Insights and Perspectives from the California Innovation Corridor: High-Wage Job Creation and Retention through Innovation Support Supply Chain Competitiveness Talent Development

Prepared for
The California Space Authority, Program Lead California Innovation Corridor WIRED Initiative

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"There will always be some country paying lower wages than the U.S. ...Some of the U.S. jobs that have been outsourced will never come back, and that's okay... What we need to do is create jobs that cannot be exported, high-wage jobs for the 21st Century.

------President Barack Obama, March 26, 2009 Online Townhall
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Inspiring Job Creation, Job Retention:  
The California Innovation Corridor WIRED Initiative

As the U.S. worker seeks to find or retain employment in a job-hungry environment, no challenge seems more important than creating meaningful, family-wage jobs and sustainable economic prosperity. The California Innovation Corridor (CIC or Corridor) partnership, guided by the California Space Authority (CSA) as program lead and with funding from the U.S. Department of Labor/Employment Training Administration (DOL/ETA) through the California Labor and Workforce Agency (CLWA)*, executed an initiative to explore how a region can become a sustainable high-wage, job-creation habitat through innovation and alignment of its workforce, economic development and education resources. Training, job placement, student and capacity-building successes in over two dozen projects make the California Innovation Corridor Initiative a national model for collaboration and leading-edge insights about regional economic prosperity and sustainable job growth in the 21st Century global environment. If developed into local action plans, these insights could foster job creation and retention while addressing California’s unemployment problem. Twenty-five projects were successfully completed with more than 300 products and deliverables in the three year period from 2006-2009. These products and deliverables are available to California regional communities, as well as those across the U.S., for replication, scaling or simply for inspiration. All are viewable at: www.InnovateCalifornia.net
California Innovation Corridor Partnering and Supporting Organizations
California Space Authority – Program Manager

ACE Clearwater Enterprises
The Aerospace Corporation
Allan Hancock College
Antelope Valley Board of Trade
Antelope Valley College
Bay Area Council Economic Institute (BACEI)/Bay Area Science Innovation Consortium (BASIC)
The Boeing Company
California Council on Science & Technology
California Labor & Workforce Development Agency, Employment Development Dept. (CLWA/EDD)
California Manufacturing Technology Consulting
California Space Education & Workforce Institute
California State Polytechnic University, San Luis Obispo
California Troops to Teachers
California Workforce Association
Cerritos College/Center for Applied Competitive Technologies
Chabin Concepts
City of Lancaster, Lancaster University Center/The Aerospace Office
City of Lompoc Economic Development Office
College of the Canyons
CONNECT
Economic Alliance of the San Fernando Valley
Economic Vitality Corporation of San Luis Obispo County
El Camino College
Employment Training Panel, CLWA/EDD
Garvey Spacecraft Corporation/California State University, Long Beach
Golden Capital Network
Greater Antelope Valley Economic Alliance
Hannover Fairs USA, Incorporated
Kelly Space & Technology, Incorporated
Kern County Workforce Investment Board
Kern Economic Development Corporation
Labor Market Information Division. CLWA/EDD
L5 Performance Systems
Lockheed Martin Space Systems Company
Los Angeles County Economic Development Corporation
Los Angeles City Workforce Investment Board
Los Angeles County Workforce Investment Board Mains Associates
Mathematics Engineering Science Achievement (MESA)
Mission Community Services Corporation/ Women's Entrepreneurial Ventures
NASA Ames Research Center
NASA Dryden Flight Research Center
NASA Jet Propulsion Laboratory
Naval Postgraduate School
Northrop Grumman Corporation
NOVA – North (Santa Clara) Valley Workforce Investment Board
Orange County Business Council
Orange County Workforce Investment Board
Private Industry Council of San Luis Obispo County
Raytheon Company
Riverside County Economic Development Agency, Workforce Division
San Bernardino County Workforce Investment Board
San Diego East County Economic Development Council/Connectory
San Diego Workforce Partnership
South Bay Economic Development Partnership
South Bay Science Foundation
South Bay Workforce Investment Board
Southern California Edison
Space Exploration Technologies
Space Information Laboratories, Incorporated
Space Systems/Loral
Stanford University/Space Systems Development Laboratory
Stauffer Communications, LLC
Strategic Innovations Group
Strategic Vitality, LLC
Supplier Excellence Alliance
University of California, Riverside/Bourns College of Engineering
University of California, Santa Cruz, Extension
University of Southern California, Viterbi School of Engineering, Western Regional Applications Center (WESRAC)
Ventura County Economic Development Association
Workforce Development Centers of Riverside County
Workforce Investment Board of Ventura County
State of California and the California Innovation Corridor

California’s capacity for innovation and entrepreneurship has served as the state’s key engine for job growth and prosperity since the early days of aviation. In the era when high-flying aviators established their companies in Southern California, few thought that those companies would evolve into today’s premier global aerospace corporations or play a key role in the Apollo Lunar Program and satellite navigation, much less spawn a manufacturing industry now representing nearly fifty percent of the U.S. industrial base. In later years, a quiet area of Northern California found itself home to some engineers with a nascent interest in computing. At the time, these electronic innovators were not yet recognized for the visionaries they were, surprising us all with the skills, innovations and entrepreneurial ventures that led to the Silicon Valley phenomenon, the rise of venture capital and today’s marvels of YouTube, FaceBook and Twitter. More recently, a similar evolution, from small innovative entrepreneurial efforts complemented by government investment in research and development, took place in San Diego, a hotbed for the biotechnology industry. What these examples have in common is that they show us a proven way to create high-wage jobs nurture innovation and entrepreneurship, support it with government investment in R&D and watch a job-creation engine self-organize.

How to nurture the job-generators of innovation and entrepreneurship was the challenge of the U.S. Department of Labor’s Employment and Training Administration’s Workforce Innovation in Regional Economic Development – WIRED Initiative. The thirteen county “California Innovation Corridor” was formed to respond to this challenge.

As the awardee of the Corridor WIRED multiple-year grant, the California Labor and Workforce Development Agency would like to recognize the Herculean efforts of the California Space Authority, the Corridor WIRED Program Management organization responsible for developing and managing one of the most ambitious WIRED initiatives in the nation. Well-deserved accolades also go to the dozens of funded partner organizations which completed the twenty-five projects within the Corridor WIRED Initiative. The training insights, projects, models and tools developed in the WIRED Corridor Initiative to educate and train California workers for 21st Century jobs can go a long way in helping to address California’s current unemployment and job loss. Congratulations to all involved!

Sincerely,

Jaime Fall
Deputy Secretary
California Labor and Workforce Development Agency
Space enterprise is a key California economic sector, providing jobs for over 71,000 space workers and creating 4.2 additional jobs for each space position. Generating a total of more than 371,000 jobs across all industries in California, with a total wage impact of $19.4 billion, the space enterprise provides the Golden State a positive trade balance, innovation at every level of the supply chain and a total economic impact in excess of $76 billion. Comprised of commercial, civil and national security space endeavors, including space services, California space enterprise represents 40% of the U.S. space market and 21% of the $146 billion space enterprise since the Space Age began a half-century ago and its impacts have been felt in a wide range of fields, from navigation to health care.¹

While dispersed throughout the state, space enterprise also enjoys numerous centers of activity statewide. The greater Los Angeles and Orange County areas, San Diego, Antelope Valley and the Inland Empire, California’s Central Coast and Silicon Valley are all key space enterprise strategic areas in California. It is not coincidentally that it is in these areas where California’s greatest innovations are born, through leading edge technology often inspired by university, government or corporate research and industry development. Technology and research partnerships are common within and across these areas, collaboration of government agencies and nonprofits are also found.

Once this is recognized, it is easy to understand how a small nonprofit representing one of California’s critical innovation sectors discovered and responded to a U.S. Department of Labor opportunity identified in late 2005 by the Governor and the California Labor and Workforce Development Agency. The opportunity to explore innovation as an avenue to job creation/retention and economic prosperity inspired the California Space Authority to issue a call to action to over sixty public and private partners and innovation, entrepreneurship stakeholders within what it described as the “California Innovation Corridor”. The stakeholder organizations on page six have accomplished the amazing successes described in the following pages. We are grateful for their efforts and resulting contributions. I would like to congratulate Judy Turner, California Innovation Corridor Program Manager, for her extraordinary efforts to bring the Corridor Initiative to a successful conclusion, and thank Victoria Conner, Strategic Vitality, for synthesizing and articulating our collective findings to the State and the ETA. We extend appreciation to the State of California and the California Labor and Workforce Development Agency, as well as the U.S. Department of Labor, Employment Training Administration for the opportunity to contribute to the national Workforce Innovation in Regional Economic Development – WIRED Initiative which holds so much promise for solutions to today’s nation-wide economic crisis. Lastly, we thank the thousands of California space enterprise workers and companies whose efforts to enhance our planet’s environment, our security, our pioneering spirit and our quality of life inspire us daily.

¹ Economic Impact of Space Enterprise, A.T. Kearney, 2008
Overview: the California Innovation Corridor
WIRED Initiative

In late 2005, the U.S. Department of Labor (DOL)/Employment Training Administration issued a challenge to each state, through the offices of governors nationwide, to submit up to three proposals in response to a new DOL initiative aligning with the nation's American Competitiveness Initiative. The DOL initiative was named: Workforce Innovation in Regional Economic Development (WIRED). In California, a statewide opportunity was announced as a prelude to determining California's three submissions. The California Space Authority's proposal, which included the California Labor and Workforce Development Agency as fiscal agent and CSA as program manager of the California Innovation Corridor initiative, was forwarded to DOL as one of the three proposals from California. On February 6, 2006, DOL announced the Corridor as one of 45 WIRED grant proposals being funded. Later it was learned that the Corridor proposal had been ranked highest of all proposals submitted.

The California Innovation Corridor initiative spanned thirteen counties and included 41 funded partners. Eighty-two scopes of work were executed for the twenty-five Corridor projects in Phase I. Funded partners included various workforce and economic development entities, training providers, community colleges, universities, nonprofits, and private-sector companies. Collaborators and stakeholder organizations not originally identified in the grant proposal included many more of each of the above, plus other government agencies, professional associations and individuals (see page 6). Dozens of collaborating organizations and hundreds of stakeholder groups ultimately participated, sharing best practices and building on diverse experiences along the way. Many times entirely new partnerships were created and are continuing to function collaboratively even after the WIRED project which brought them together has been completed (see Relationships Built, Appendix A).

Well over 300 products and deliverables have been produced through the Corridor WIRED initiative. They are available for review at www.InnovateCalifornia.net/deliverables.

“Optimize the Corridor for innovation and 21st Century workforce competitiveness” was the overarching intent of the Corridor WIRED initiative, with this being addressed initially (Phase I) through twenty-five Corridor projects (see pages 60-61) implemented via three separate, but aligned pathways during the performance period:

- Innovation Support
- Supplier Competitiveness (originally called Industrial Rejuvenation)
- Talent Development
Phase II of the Corridor initiative built on the success of Phase I, with twelve Projects implemented as follow-on efforts during 2009 (See Phase II project list, page 62).

The Corridor Initiative was unique among the nation-wide WIRED initiatives because it was led by an industry-driven stakeholder non-profit representing 21st Century employers (commercial, civil and national security space, e.g. private-sector space/aerospace companies, NASA, U.S. Air Force, etc.) The concept for the Corridor WIRED proposal was adapted from recommended projects in the California Space Enterprise Strategic Plan, so by its very nature, the Corridor WIRED Initiative began as a sectoral strategy. While it evolved to address many industries besides space/aerospace, it kept its industry focus throughout the performance period, allowing for greater engagement with industry regarding workforce and skill needs and private sector resources. The CIC Initiative fully leveraged the private/public action research model.

The diversity of partners brought to the table to determine how to better address 21st Century innovation and the jobs it can create and save served the region well. Unlike other WIRED regions led by government or education entities who sometimes found it difficult to engage industry in planning and implementation, the Corridor benefited from CSA’s unique position in the state. CSA brought to WIRED a decade of success in building bridges between the industry and public sectors, with partners statewide from workforce, education, economic development and the nonprofit community. Because of this, CSA was able to bring many partners and collaborators into the Corridor Initiative already experienced in addressing the challenges of working through diverse public and private-sector agendas or across jurisdictional lines.

The “transformational vision” of the Corridor initiative was the “integration of education, workforce and economic development systems/innovation strategies in a regional (Corridor) framework”. Alignment of these systems is seen as the key success factor in job creation/retention of the high-skill, high-wage jobs characteristic of an innovation ecosystem providing the only sustainable economic vitality model of the 21st Century. While the CIC WIRED Initiative is a great start, continued work will be needed to sustain these efforts. (For more on this, see page 302).

As Program Manager of the California Innovation Corridor Initiative, I was privileged to see the linkage and synergy among the many Corridor WIRED projects, and I can tell you that, as the Initiative draws to a close, more has been accomplished than we would have ever imagined. Project partners not only did what was asked, but saw what was needed to enhance their projects and undertook to accomplish that, as well. For that I will be forever grateful. We can truly say that we impacted the three systems most critical to supporting California jobs and innovation: the workforce system, the economic development system and the education system. This impact was brought to bear by a laser-like focus on the industries identified as the job engines for the future...those industries boasting a foothold in the only competitive field left for global success: innovation.
Sampling of Success Stories from the Corridor WIRED Initiative

With its 25 projects, 40+ funded partners and myriad of collaborators and inkind supporters, the California Innovation Corridor has more than its share of success stories. Many of these highlight the capacity-building achievements that will enable the Corridor to collectively create a sustainable regional innovation and entrepreneurship-oriented economy to drive high-wage job creation and retention. These capacity-building success stories will be featured within the elements of this document describing Innovation Support, Supply Chain Competitiveness, Talent Development, Training and Education and other key Corridor Initiative domains included.

This first “Sampling of Success Stories” focuses on those efforts that go beyond capacity-building to directly and positively impact the lives of individuals, providing them either with the skills and high-wage jobs or management capacity and 21st Century business models, to potentially change their lives forever.
L.A. County’s South Bay and Antelope Valley Implement “Innovation Driven Economic Development Model”

In 2008, the Bay Area Economic Forum/Bay Area Science and Innovation Consortium (BAEI/BASIC), a partner in Phase I of the California Innovation Corridor (Corridor) Initiative, launched the Innovation Driven Economic Development Model (Model) and an accompanying “toolkit” of products produced by other partners.

In Phase II of the Corridor Initiative, the California Space Authority guided implementation of the Model in two sub-regions of the Corridor. The Los Angeles County Economic Development Corporation (LAEDC) founded the South Bay Aerospace Consortium (Consortium) to implement the Model in the South Bay aerospace community. The Antelope Valley Board of Trade (AVBOT), another Corridor strategic partner from an aerospace area of California, engaged new stakeholders to participate in implementing the Model in the Antelope Valley. Cathy Hart, Program Manager for Southern California Edison and President of AVBOT, led the Antelope Valley implementation effort. The chairperson for the Consortium was Dr. Wanda Austin, President/CEO of The Aerospace Corporation, a federally-funded research and development center that supports all national security programs for the U.S. Air Force and the National Reconnaissance Office, as well as providing its technical, scientific and advisory services for NASA, commercial entities and other government agencies.

The South Bay Aerospace Consortium’s work in 2009 produced two outcomes:

- Identification of key occupations needed by the aerospace sector (with Production/Touch Labor ranking #1, Systems Engineering ranking #2)
- The Long-Range Economic Development Strategy for the South Bay Aerospace Industry

Antelope Valley funded the Greater Antelope Valley Economic Alliance (GAVEA) in its development of the capstone effort in the region’s implementation of the Model: A Vision Report 2010: Regional Collaboration as the Blueprint for Prosperity. A business cluster study, a strategy outlined in the Model, was also developed, as was a science, technology, engineering and math (STEM) educational collaborative building on the engineering pathway developed by Antelope Valley stakeholders in Phase I. As a result of the Corridor WIRED Initiative, a California State University Fresno engineering program, developed to help “home-grow” engineers in this high desert area, was saved, allowing 36 students involved to pursue degrees locally instead of relocating.

Using the Innovation Driven Economic Development Model as a guide for a regional collaboration among workforce, education, economic development, industry and government, the South Bay and the Antelope Valley project partners were able to implement a collaborative region-wide strategy supporting ongoing innovation. These two successful sector-centric regional initiatives align well with the State Economic Strategy Panel’s “(industry) clusters of opportunity” and emerging “(industry) sector strategy” approaches to economic development and serve as replicable demonstrations for other regions statewide.
Workforce Investment Boards Transition to Meet 21st Century Worker and Employer Demands

In addition to the many California Innovation Corridor projects including Workforce Investment Board (WIB) partners or orientations, two of the Corridor WIRED projects were primarily designed to address the need for California Workforce Investment Boards to better understand and adapt to the worker and employer demands of the 21st Century global economic environment. The Workforce Investment Board (WIB) Learning Collaboratory project was led by the California Workforce Association (CWA), the voice of California’s 49 WIBs and its project partner the California Space Authority (CSA), Corridor WIRED Program Manager and an industry/employer nonprofit. Its sister project, the WIB Toolkit Racing for the Future, was led by the California Council on Science and Technology, with the CWA and the California Space Education and Workforce Institute (Institute) as project partners.

The Collaboratory was a professional development effort created to embed into statewide and local WIB planning and operations the WIRED principles of an innovation-driven economy characterized by the alignment of workforce and economic development and education in support of 21st Century worker and employer needs. The WIB Toolkit was an online resource created, in addition to others initiated by CWA and/or CSA, to assist in WIB professional development.

Through the Collaboratory-supported conferences, surveys, studies, white papers and its regular WIB and statewide workforce stakeholder interfaces, the CWA made great strides in engaging local WIBs in WIRED-related dialogue, strategy-building and planning. Between this project, the WIB Toolkit project, and other Corridor WIRED work of WIBs also supporting their growing understanding of the new worker/employer environment, much progress was made toward WIB adaptation to 21st Century innovation and evolution to a demand-driven system:

- From a WIB-produced white paper: “WIBs can enhance their contributions to the economic success of their communities by developing an understanding of the requirements and challenges of the driving industries in their regions.”
- WIB professional: “My involvement in the project provided a greater understanding of the North American Industry Classification (NAICs). The project also allowed me the opportunity to interact directly with high-technology firms to discuss their current and future skill needs…”
- WIB professional: “In my professional life, I never really engaged with economic development professionals…I wasn’t sure if WIBs should focus on economic development. This project opened my eyes to life outside the WIA and how WIBs could become more demand-driven by really listening to the needs of business. The WIRED assignments allowed me to broaden my vision about how the workforce system and the economic development approaches could link together and support each other.”
- According to the California Workforce Association, its organization and many of its local WIB members are now incorporating WIRED principles into their strategic organizational planning.
California has a wealth of innovation assets not well understood. The California Innovation Corridor (CIC) portal on Connectory.com, developed by Connectory founder, the San Diego East County Economic Development Council (ECEDC), under Phase I of the Corridor WIRED Initiative and expanded by CSA under Phase II, is a tool to support the identification of innovation assets and enhance supplier competitiveness. By linking suppliers, primes and government to potential innovation and supplier partners the CIC portal helps establish the “culture of innovation” within the Corridor and the state.

The CIC Innovation Asset Mapping project leveraged an existing online platform – Connectory.com, a buyer/supplier, searchable, capabilities-based online inventory – to build a portal identifying the Corridor’s innovation assets, public and private. The project, led jointly by the Bay Area Science Innovation Consortium, CSA and the ECEDC, implemented by teams of workforce and/or economic development entities throughout the Corridor, captured regional innovation assets in the following categories:

- Industry/small business/entrepreneurial firms
- University labs and research centers
- Military installations
- Federal labs and research institutions

Profiles of innovation assets identified include relevant facility, technology, personnel and/or equipment descriptions, as well as official designations and certifications, e.g. Woman, Veteran or Minority-Owned Business, and AS 9100. While over 1,700 Corridor innovation assets have been identified, this is only a portion of those that exist; identification of innovation assets will be ongoing.

Additional benefits to those of innovators were realized by this project:

- Some of the innovation employers identified became resources for other Corridor WIRED projects, either as project advisory group participants, innovation interviewees, innovation event participants, or industry subject matter experts; others among the innovation asset employers responded to workforce or supplier or other surveys
- Actually participating in the inventory asset mapping project enable Workforce Investment Board and economic development professionals lacking an understanding of the importance of “knowing your territory” the opportunity to see first-hand the value of not only identifying but truly understanding the employer community in order to more strategically identify worker and community development opportunities

To create and retain innovation jobs, it is essential that workforce and economic development professionals know how to leverage and address the workforce needs of their innovation-oriented industry/business clusters. Mapping the innovation assets is the first step, and now California has a tool for doing so.
Industry Mentors, Internships, and Hands-On Engineering for Over 100 Students

Working jointly with the California Space Authority to provide undergraduate and graduate payload (Stanford) and launch experience (Garvey Spacecraft) for undergraduate and graduate students, Stanford University and Garvey Spacecraft enabled hands-on learning for engineering students at Stanford, California State University Long Beach and San Jose State University.

In association with California State University Long Beach, the Garvey Spacecraft team established a rocket development and launch program to support the joint project described above. The team produced two dedicated WIRED test vehicles and conducted launches manifesting numerous academic payloads. In addition, the team arranged for multiple student secondary payloads on vehicles developed through parallel projects with the US Air Force and NASA. Nine mentors were recruited from the aerospace industry to assist, with eight students playing key roles for fabrication and launch activities, 80+ students were provided the experience of participating in the WIRED launches either in the field, in the lab, or both. Over the course of the project, fourteen mentors supported the California State University Long Beach students.

The Stanford University team established three student payload internships (two undergrad, one graduate), a variety of internships for payload launchers (one undergrad and one graduate), four graduates for a balloon launch and two undergrads and one graduate student recruited for work on the Virtual Classroom (see below). In conjunction with San Jose State University and two industry mentors, five students developed and launched an ARLISS rocket in 2008. The balloon launch program engaged over 500 students in creating “PearlSat” payloads, analyzing payload contents after return.

Also in association with San Jose State University and industry mentors, Stanford developed and demonstrated a prototype “virtual classroom” (VC) system capable of linking classrooms with a launch site, lab or real-world science, technology or engineering activity anywhere in the world. In this “control room” environment, a classroom can experience real-time interaction (audio, video, data) between students and working professionals. The system consists of a trailer and mobile cart and associated electronics enabling launch or other site communications via the internet and computer workstations over a geosynchronous satellite link. A distance learning innovation, the virtual classroom technology holds the promise of transforming classroom learning, enabling multiple classrooms simultaneously to bring students right into the workplace - to experience first-hand the activities, the trouble-shooting, the actual work of today’s 21st Century professionals.

The Garvey/Stanford project gave students the opportunity to experience the entire life cycle of a launch vehicle or payload development effort, engaging them in hands-on engineering/aerospace work from a holistic approach, allowing them to apply their classroom learning to real-life situations including problem-solving, innovating, streamlining processes and providing them a true systems engineering experience.
Capacity Building: Supplier Transformation Strategy

The WIRED Project 2.2 team, led by the California Space Authority (CSA), beginning with a comprehensive survey of 288 suppliers, identified the common supplier learning outcomes required needed for 21st Century success, developed four training modules and piloted the four modules in two-day training courses. Over 100 suppliers were instructed on the Supply Chain Management principles that have been identified as critical to supplier training and success in the 21st Century global market.

In addition, a white paper was developed, enlightening local Workforce Investment Boards as to their potential role in supplier transformation (Supply Chain Transformation: The Role of Workforce Investment Boards).

In Phase II of the Corridor Initiative, CSA developed an online supplier company assessment and a web-based, self-paced version of the Supply Chain Principles course developed in Phase I, including a supplier pre and post test. International outreach to assist suppliers in their global marketing efforts included the coordination of a trade mission and information exchange between California suppliers and the French Aerospace Valley.

Throughout the four-year “Smart Supplier” effort, an annual Supplier Transformation Forum was held, engaging dozens of prime contractors, government organizations, suppliers, training providers and nonprofits in panels, presentations and roundtables designed to educate suppliers about 21st Century competitiveness issues and solutions. Key topics from these forums were selected for follow-on workshops and seminars, which often included tours, student participation and networking.

An estimated 400 suppliers, as well as WIBs, economic development and education entities and government organizations have participated in these events over the course of the Corridor WIRED Initiative. The Smart Supplier Initiative has made large strides in increasing awareness and understanding of the 21st Century Supply Chain Transformation and what it means to employers and workers in key California and U.S. industries.
A Small Supplier Transformation
Earns Top Recognition from a Prime,
Increases Business 15% ¹

Omega Precision (Omega) was founded more than 40 years ago, and has earned a reputation for quality and machining expertise by performing close-tolerance machining on a wide variety of materials. Omega employs thirty highly-skilled craftsmen and professionals using state-of-the-art manufacturing technology at its Santa Fe Springs facility.

Introducing Omega to the “Smart Supplier” success factors identified early in the development of the Supplier Transformation Strategy (see p. 112, Supply Chain Competitiveness project), and leveraging the WIRED Supplier Transformation Survey as well as a benchmarking tool from the Department of Defense Mentor Protégé program, supply chain training provider California Manufacturing Technology Consultants (CMTC) enabled Omega to greatly increase its capacity as an aerospace supplier.

CMTC used the results of the assessments to work with Omega to examine both internal and sub-tier capabilities and respond to the primes looking for higher levels of value and integrated solutions. By developing a broader range of subcontractors, as well as the ability to manage them, Omega was able to garner 2008 Boeing “Supplier of the Year” honors. The same improvements enabled Omega to win a large program requiring the use and management of several sub-tier contractors, this growth in its supply chain management capability earning a business increase of more than 15% over the previous year.

¹ California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness, California Space Authority, Antelope Valley College, 2008 (see Corridor WIRED Deliverables at www.InnovateCalifornia.net)
Twenty Dislocated Software Workers Obtain New Aerospace Software Engineering Certification, High-Wage Jobs

The Dislocated Software Specialists project was an industry-driven pilot training program to retrain dislocated software engineers for space-related information technology (IT) positions. This California Innovation Corridor project was born out of an early 2000 joint effort between the California Space Authority and NOVA, the North (Santa Clara) Valley Workforce Investment Board, to perform a skills assessment for the software/computer engineering skills needed within the space industry. It was recognized that, in the Silicon Valley area which NOVA serves, thousands of IT workers had been laid off after the dot com crash, but were not being picked up readily by the space community hungry for software engineers. CSA and NOVA asked “why not?” From the early 2000 project, the two organizations determined that an industry-transition training program probably would overcome the skill and culture issues keeping unemployed IT workers from becoming valuable space/aerospace employees.

NOVA developed an industry advisory body with CSA’s support and partnered with the University of Santa Clara Extension (UCSC Extension) to hire an instructor, design a training outline and create a certification program ensuring potential employers that individuals completing the program were qualified for aerospace software positions. The collaboration of industry, workforce and education specialists proved invaluable in creating the certification program and moving the graduates from training to employment.

The UCSC Extension created the “Software Development for Aerospace/Defense Applications” certification and delivered program coursework in two cohort sessions to 27 unemployed IT industry software specialists prepared to make a career change into aerospace and defense. NOVA had completed technical pre-assessments and determined the 27 as good prospects for certification. Trainees were able to access NOVA’s job search workshops and resources, along the way. In addition, industry speakers were recruited for the training program, giving trainees insight into what company hiring priorities and processes were.

All 27 trainees completed the certification. By the end of the project, 20 had already been employed, transitioning from being unemployed IT workers to becoming qualified aero/space industry employees.

In addition, NOVA cites several benefits to its mission as a Workforce Investment Board:

- Better understanding of the aero/space industry in its jurisdiction
- Creation of a better assessment tool for technical worker assessment
- Understanding of the value of engaging HR and hiring managers early in training planning stages to ensure training meets industry needs
- That, in complex training arenas such as cross-industry training, collaboration among workforce, education and industry, is critical
Thirty-Six Incumbent/Displaced Workers Placed after Aerospace Manufacturing Technician Certification Training

Situated n the center of the aerospace industry cluster in the South Bay of Los Angeles County, El Camino College, part of the system of 122 California community colleges, is perfectly positioned to respond to a local workforce crisis impacting U.S. aerospace suppliers. Over 75% of the world’s suppliers of aerospace-related fasteners resides in this area.

The local/global fastener industry was experiencing a crucial shortage of manufacturing technicians, threatening delivery of the fasteners critical to our nation’s aircraft and other aerospace suppliers. In a community characterized by diversity, low incomes, elevated high-school drop-out rates in most areas and growing unemployment, El Camino College took on the challenge.

Supported by US DOL WIRED funding for the California Innovation Corridor through the State and the California Space Authority, El Camino developed, with industry-defined skills applied to aircraft structures assembly, a 360 hour course leading to an “Aerospace Manufacturing Technician” Certificate. The Certificate not only prepared students for existing openings in the critical fastener sector, but opened new territory for California technician training by introducing students to aircraft airframe assembly using innovative composites and composite fastening systems. Partnering with the South Bay Workforce Investment Board and ProPath, Inc. for placement assistance, tracking and recruitment of displaced workers and under-employed people with little or no experience, El Camino College trained and certified thirty-six workers, all hired by aerospace airframe manufacturers. This success was truly a collaborative effort, supported by the Small Manufacturer’s Institute, the Society of Manufacturing Engineers and Northrop Grumman Corporation, which provided training, curriculum support, training space and placement. El Camino College also partnered with Antelope Valley College on the development of a future credit program leveraging the Aerospace Manufacturing Technician certification.

In certifying and placing the thirty-six students, El Camino College provided them not only with jobs but with marketable 21st century skills in composite manufacturing, expanding their aerospace career competitiveness. This is good news for the students’ families, as recent figures show the average California aerospace wage at $96,412\(^1\), significantly above the retail and service sector wages typical for workers at entry-level.

\(^1\) The Space Report, U.S. Space Foundation, 2008, p. 89
Two New AS Degrees, Two Certifications and a STEM Pathway

Allan Hancock College’s leadership of Project 3.11 included the development and piloting of an industrial technology-based associate degree program in Mechatronics, as well as exploring with other education-related partners high school recruitment strategies to bring students into engineering and technical programs.

Allan Hancock College successfully developed curricula and monitored through approval two new degrees and two new certifications:

- Associate of Science (AS) degree in Engineering Technology with Emphasis in Mechatronics
- Certificate in Engineering Technology with Emphasis in Mechatronics
- Associate of Science (AS) degree in Electronics Technology with Emphasis in Mechatronics
- Certificate in Electronics Technology with Emphasis in Mechatronics

The College greatly exceeded its goal of enrolling 100 unduplicated students in the piloting of core coursework for the new degree/certification program. 136 unduplicated students had enrolled in the foundational “Introduction to Robotics & Mechatronics” through Fall, 2008, with 82 course completers by Spring of 2008, representing an 85.4% success rate for students. As a result of College outreach around the new degree/certification, Spring 2008 student enrollment in the course was up 87.5%, with a Fall, 2008 enrollment increase of 150%, well exceeding expectations.

In another element of Project 3.11, Lancaster University Center, an education support group in the Antelope Valley and 3.11 partner, developed demand-driven Career/Certificate Pathways (guidelines to assist local parents, students and local high schools in workforce preparation for science, technology, engineering and math – STEM careers). These Pathways have the approval of the community college and high school districts and were distributed to the high school counselors for implementation. The Pathways, which were based on industry need surveys and developed cooperatively with the community college and high school districts, are aligned with the following Antelope Valley College certificate programs, which also foster entrance into four-year engineering and other STEM degree programs:

- Aeronautical and Aviation Technology
  - Aircraft Airframe
  - Aircraft Powerplant
  - Aircraft Fabrication and Assembly
- Drafting/Computer Aided Design (CAD)
- Electronics Technology
- Engineering Technology

In addition, enrollment in the Lancaster University Center engineering program grew from 15 to 40 students; the Introduction to Engineering course for high school students attracting 31 high school students. Project Lead the Way (PLTW) high school classes had a fall 2008 enrollment of 240 students, with the first PLTW graduating class having been eligible to enter Antelope Valley College in the spring of 2009.
Student Mentoring, Fostering University Payloads to Space on U.S. Launches

Project 1.6, the University and Student Payload Demonstration, was designed to address a pressing need to enable affordable launch of university and student payloads on U.S. launch vehicles. Currently, costs to launch on U.S. boosters is prohibitive, forcing universities to launch student payloads on foreign vehicles, generally those in the former Soviet Union. Due to travel costs, this impacts student ability to participate in launches, with launch participation required to test payload design, providing a critical systems engineering learning opportunity. This project enables future student participation in launch experiences, as well as providing some of today’s graduate students mentoring and hands-on experience with real-world launch teams.

Several years ago, the university satellite community, partially funded by the California Space Authority, designed an integrated platform enabling the grouping of several student payloads. It was called the CubeSat. In Phase I of Project 1.6, the Naval Postgraduate School and the California Space Education and Workforce Institute (Institute) delivered the “Naval Postgraduate School CubeSat Launcher – NPSCuL”, a half-scale hardware prototype (mock-up) of a CubeSat launcher that would enable integration with U.S. launchers, primarily the Evolved Expendable Launch Vehicle – the “EELV” used by the U.S. Department of Defense. In addition, a student payload process/requirements document was developed to describe the current method of manifesting non-US Government DOD-relevant payloads on US government-sponsored space launches, and to introduce a new process through NPSCuL to manifest non-Government CubeSat payloads on a space-available basis on US Government space launches. The project demonstrated the feasibility of launching up to 50 individual CubeSats from a single secondary payload slot on an EELV.

Phase II again included the Institute and the NPS. For this phase, the concept slightly evolved into the NPSCuL-Lite, a structure which houses fewer CubeSats than the original design, but provides better opportunity for integration into an actual flight unit. In Phase II, the NPSCuL-Lite underwent the necessary analysis and testing to qualify it for an EELV flight.

The Naval Postgraduate School has supported Project 1.6 with over $100,000 of in-kind labor, travel, equipment and material, with the WIRED presentations around this project generating enough interest within the Government launch community that additional resources are now being addressed to make the NPSCuL capability a reality. Three university graduate students were provided project-based learning opportunities through the production of the NPSCuL, with three other summer interns performing significant work. Over 20 university contacts were made to orient relevant departments about the payload launch opportunity. The process and requirements document can be used by all universities. During the project, it was recognized that getting student access to only one U.S. secondary payload slot, on one launch, would provide more student access to space than the CubeSat community has realized on all U.S. launches to date. Thanks to the Corridor WIRED Initiative, the NPSCuL has been manifested for a 2010 launch.
STEM Collaborative Action Plan: California’s First Statewide Private/Public STEM Strategic Initiative

From 2006 - 2009, the California Space Education and Workforce Institute (Institute) has successfully led the California Innovation Corridor (CIC) project to develop a statewide private/public collaborative action plan for science, technology, engineering and math (STEM). All four California educational systems and 400 statewide STEM stakeholders from industry, education, academia, workforce entities and informal science participated. As part of the project, the Institute created California’s first statewide private/public STEM Inventory, and engaged the Alliance for Collaborations to Heighten Educational Success (ARCHES) as a partner in developing High Stakes: STEM Education, The Essential Ingredient for California Competitiveness, the nation’s first public/private collaborative STEM action plan. View the plan at http://www.innovatecalifornia.net/documents/STEMCAPDOC.pdf. Also as a part of this project, six implementation projects in various California areas were conducted by ARCHES and its Collaboratives the summer of 2008, proving the value of the STEM CAP recommendations and their accompanying suggested actions.

The organizing principle for the STEM Collaborative Action Plan was NASA’s Strategic Education Framework: Inspire, Engage, Educate, Employ. The STEM Inventory includes STEM programs from education, informal science, industry and government at all levels of this NASA/STEM CAP continuum (www.steminventory.net) In addition, the STEM Inventory now features a blog, discussion forum, live calendar, and other social networking features to foster an online STEM community.

In September of 2009, the Institute held a forum to gauge the ongoing impact of the STEM CAP and the collaboration which developed it. Speakers included a representative of the California STEM Innovation Network Planning Initiative (CSiNet) being funded by the Gates and Bechtel Foundations to raise STEM education to the “top rung of California’s policy agenda”. CSiNet is being led by former STEM CAP/CIC partners - the California Council on Science and Technology (CCST) and the California Polytechnic University San Luis Obispo (Cal Poly SLO), who used the STEM CAP as a foundation for the CSiNET Initiative.

As a result of the STEM CAP, the Institute was invited to provide feedback for the National Academy of Sciences STEM report; present STEM CAP recommendations at the joint STEM working group of the National Defense Industries Association, the Aerospace Industry Association and the American Institute of Aeronautics and Astronautics (AIAA); share findings with the national Aerospace Community of Practice; coordinate a STEM CAP implementation workshop in cooperation with leadership of California’s STEM Equity Pipeline; develop an education/workforce panel for the AIAA Space 2009 Conference and participate with the California Department of Education in ongoing dialogues around STEM and Career Technical Education.

It is clear that the development of the STEM CAP has led to a myriad of statewide STEM efforts, some with the original STEM CAP developers, some without, proving that the impacts of the STEM CAP development will have far-reaching implications.
Executive Summary

Inspiring Job Creation, Job Retention:
The California Innovation Corridor WIRED Initiative

As the U.S. worker seeks to find or retain employment in a job-hungry environment, no challenge seems more important than creating meaningful, family-wage jobs and sustainable economic prosperity. The California Innovation Corridor (CIC or Corridor) partnership, guided by the California Space Authority (CSA) as program lead and with funding from the U.S. Department of Labor/Employment Training Administration (DOL/ETA) through the California Labor and Workforce Agency (CLWA), executed an initiative to explore how a region can become a sustainable high-wage, job-creation habitat through innovation and alignment of its workforce, economic development and education resources. Training, placement, student and capacity-building successes in over two dozen projects make the California Innovation Corridor Initiative a national model for collaboration and leading-edge insights about regional economic prosperity and sustainable job growth in the 21st Century global environment. If developed into local action plans, these insights could foster job creation and retention while addressing California’s unemployment problem. Twenty-five projects were successfully completed with more than 300 products and deliverables in the four year period from 2006-2010. These products and deliverables are available to California regional communities, as well as those across the U.S., for replication, scaling or simply for inspiration. All are viewable at: www.InnovateCalifornia.net
California Innovation Corridor Partnering and Supporting Organizations

California Space Authority – Program Manager

ACE Clearwater Enterprises
The Aerospace Corporation
Allan Hancock College
Antelope Valley Board of Trade
Antelope Valley College
Bay Area Council Economic Institute
  (BACEI)/Bay Area Science Innovation Consortium (BASIC)
The Boeing Company
California Council on Science & Technology
California Labor & Workforce Development Agency, Employment Development Dept. (CLWA/EDD)
California Manufacturing Technology Consulting
California Space Education & Workforce Institute
California State Polytechnic University, San Luis Obispo
California Troops to Teachers
California Workforce Association
Cerritos College/
  Center for Applied Competitive Technologies
Chabin Concepts
City of Lancaster, Lancaster University
  Center/The Aerospace Office
City of Lompoc Economic Development Office
College of the Canyons
CONNECT
Economic Alliance of the San Fernando Valley
Economic Vitality Corporation of San Luis Obispo County
El Camino College
Employment Training Panel, CLWA/EDD
Garvey Spacecraft Corporation/California State University, Long Beach
Golden Capital Network
Greater Antelope Valley Economic Alliance
Hannover Fairs USA, Incorporated
Kelly Space & Technology, Incorporated
Kern County Workforce Investment Board
Kern Economic Development Corporation
Labor Market Information Division. CLWA/EDD
L5 Performance Systems
Lockheed Martin Space Systems Company
Los Angeles County Economic Development Corporation
Los Angeles City Workforce Investment Board
Los Angeles County Workforce Investment Board
Mains Associates
Mathematics Engineering Science Achievement (MESA)
Mission Community Services Corporation/
  Women's Entrepreneurial Ventures
NASA Ames Research Center
NASA Dryden Flight Research Center
NASA Jet Propulsion Laboratory
Naval Postgraduate School
Northrop Grumman Corporation
NOVA – North (Santa Clara) Valley Workforce Investment Board
Orange County Business Council
Orange County Workforce Investment Board
Private Industry Council of San Luis Obispo County
Raytheon Company
Riverside County Economic Development Agency, Workforce Division
San Bernardino County Workforce Investment Board
San Diego East County Economic Development Council/Connectory
San Diego Workforce Partnership
South Bay Economic Development Partnership
South Bay Science Foundation
South Bay Workforce Investment Board
Southern California Edison
Space Exploration Technologies
Space Information Laboratories, Incorporated
Space Systems/Loral
Stanford University/
  Space Systems Development Laboratory
Stauffer Communications, LLC
Strategic Innovations Group
Strategic Vitality, LLC
Supplier Excellence Alliance
University of California, Riverside/Bourns College of Engineering
University of California, Santa Cruz, Extension
University of Southern California, Viterbi School of Engineering, Western Regional Applications Center (WESRAC)
Ventura County Economic Development Association
Workforce Development Centers of Riverside County
Workforce Investment Board of Ventura County
Messages from the
California Labor and Workforce Development Agency
and the California Space Authority

Stating that California’s capacity for innovation and entrepreneurship has served as the state’s key engine for job growth and prosperity since the early days of aviation, the Deputy Secretary of the California Labor and Workforce Development Agency, Jaime Fall, applauded the work of the California Innovation Corridor partners. In a letter to the California Space Authority (CSA), he wrote:

“As the awardee of the Corridor WIRED multiple-year grant, the California Labor and Workforce Development Agency would like to recognize the Herculean efforts of the California Space Authority, the Corridor WIRED Program Management organization responsible for developing and managing one of the most ambitious WIRED initiatives in the nation. Well-deserved accolades also go to the dozens of funded partner organizations…the training, insights, projects, models and tools developed in the WIRED Corridor Initiative to educate and train California’s workers for 21st Century jobs can go a long way in helping to address California’s current unemployment and job loss. Congratulations to all involved!”

For four years (2006-2009), the California Space Authority has been driving talent development and global competitiveness through the California Innovation Corridor Workforce Innovation in Regional Economic Development – WIRED Initiative. Conceived by CSA in 2005, the Corridor Initiative, originally one of only thirteen nationwide WIRED grants, was funded by the U.S. Department of Labor/Employment Training Administration (DOL/ETA) through the California Labor and Workforce Development Agency (CLWA).

In cooperation with dozens of funded partners and collaborators, as well as hundreds of stakeholders across the thirteen Corridor counties from Alameda County north to San Diego County south, the Corridor has successfully completed the work of the California Innovation Corridor WIRED Initiative. Developing over 300 products, tools, and models ready for replication statewide and nationwide, Corridor partners are already engaged, individually and in partnerships developed during the WIRED effort, in follow-on activities to ensure that the Corridor strategic goal areas of Innovation Support, Supplier Competitiveness and Talent Development, continue to receive the attention they deserve in the global, demand-driven 21st Century economy and worker/employer environment. We applaud the work of our partners and thank both the State and DOL/ETC for their support of the California Innovation Corridor Initiative.
Overview: California Innovation Corridor Initiative

Conceived and developed by the California Space Authority (CSA), the California Innovation Corridor Initiative was created out of a strategic partnership of sixty public/private and nonprofit organizations convened on behalf of California’s most innovative region of regions, spanning thirteen counties along the coast from Alameda County in the north to San Diego in the south and east to Los Angeles County’s Antelope Valley. Submitted by the State of California for U.S. Department of Labor (DOL) funding under DOL’s Employment Training Administration’s nationwide Workforce Innovation in Regional Economic Development – WIRED Initiative, the Corridor Initiative was initially one of only thirteen national WIRED multi-year awards. Four years later, forty-five WIRED grants have been awarded to U.S. regions from Maine to California.

Support by the California Labor and Workforce Development Agency (CLWA) as fiscal agent, the California Space Authority served as Program Manager for the Corridor Initiative, executing eighty-two scopes of work with 41 funded partners in thirteen counties for the twenty-five projects proposed in the Corridor Initiative for completion between 2006 and 2008. Funded partners included various workforce and economic development entities, training providers, community colleges, universities, nonprofits, and private-sector companies. Collaborators and stakeholder organizations not originally identified in the grant proposal included many more of each of the above, plus other government agencies and professional associations (see list of partners/collaborators above). Dozens of collaborating organizations and hundreds of stakeholder groups ultimately participated, sharing best practices and building on diverse experiences along the way. Many times entirely new partnerships were created and are continuing to function collaboratively even after the WIRED project which brought them together has been completed. Phase II of the Corridor Initiative was funded with unused partner funding from Phase I of the Initiative. Well over 300 products and deliverables have been produced through the Corridor WIRED initiative. They are available for review at www.InnovateCalifornia.net/deliverables.

“Optimize the Corridor for innovation and 21st Century workforce competitiveness” was the overarching intent of the Corridor WIRED initiative, with this being addressed initially (Phase I) through twenty-five Corridor projects implemented via three separate, but aligned pathways during the performance period. Phase II efforts built on Phase I projects within three strategic goal areas of Innovation Support, Supplier Competitiveness (initially Industrial Rejuvenation) and Talent Development. Eight capacity-building sustainability projects were identified at the start as likely to have significant, long-term impact.

For full Corridor Initiative report including project detail, visit the following link:

http://www.innovatecalifornia.net/WIREDdeliverables/0.0-CIC-Final-Report.pdf

*Sustainability Projects are those projects that support both a strategic transformational goal and also the greater CIC WIRED grant effort as a whole. See Sustainability Projects, page 27.
Projects of the California Innovation Corridor Initiative

Strategic Transformational Goal 1: Create an atmosphere in which the culture, environment and systems are characterized and driven by robust innovation and flourishing entrepreneurship. 1.0 Projects:

- Innovation Driven Economic Development Model (1.1)*
- 21st Century Workforce Profile Analysis (1.2)
- Innovation Asset Mapping Inventory (1.3)*
- Innovation-Based Entrepreneurial Ventures (1.4)
- Joint University Innovation Model (1.5)
- Enabling Student Payloads on U.S. Launches (1.6)
- WIB Innovation Resource Toolkit (1.7)*

Strategic Transformational Goal 2: Ensure common “smart supplier”, competitiveness and enterprise-driven outcomes across supply chain training provider/support network. 2.0 Projects:

- Smart Supplier Initiative (2.1/2.2)*
- Outreach Plan to Supplier Contacts (2.3)
- Manufacturing Technician Training/Certification Program (2.4)

Strategic Transformational Goal 3: Integrate consideration of current and future industry enterprise needs into workforce and educational planning and policymaking. 3.0 Projects:

- Workforce Needs Analysis (3.1)
- Space Employer/University Consortium (3.2)
- Space-Related University Programs (3.3)
- Systems Engineering Orientation/Training (3.4)
- STEM Collaborative Action Plan (3.5)*
- High-School Teacher Institutes (3.6)
- Retraining of Dislocated Software Specialists (3.7)
- Aerospace Community Development Program (3.8)
- Troops to Teachers Program (3.9)
- Stanford Mentoring Model (3.10)
- Mechatronics Certification Program Development/HS Outreach (3.11)
- Science Educator Conferences (3.12)
- Space Education Center Website (3.13)
- WIB Learning Collaboratory (3.14)*

Phase II Projects (Phase I enhancements):

- Demonstration: Innovation Driven Economic Development Model (Project 1.1 follow-on)
- Innovation Asset Mapping Inventory Expansion (enhancement of Project 1.3)
- Talent Development/Innovation Webinars (follow-on to Project 1.5)
- University and Student Payload Demonstration Project (enhancement to Project 1.6)
- Smart Supplier Transformation Initiative (enhancement to Project 2.2)
- Launch-Related Industry Mentoring with Demonstration of Virtual Classroom Tool (3.3)
- STEM Collaborative Action Plan Implementation (enhancements to Project 3.5)
- Aerospace Community Development Strategy (enhancement to Project 3.8)
- Enhancement of California Space Education Center Website (follow-on to Project 3.13)
- WIB Learning Collaboratory (Bridging gap between HR and WIB professionals)
- Sustainability/Expansion of InnovateCalifornia.net
- Ongoing Sustainability in Support of California Innovation Corridor WIRED Initiative

*Sustainability projects supporting both a strategic Corridor goal and the overarching Initiative
California Innovation Corridor Sample Impact!

**Sampling of Training: Incumbents, Unemployed & Displaced Workers**

- 364 new hires/incumbents trained in new satellite manufacturing processes (Space Systems/Loral, Palo Alto)
- 27 displaced Silicon Valley IT workers were trained and certified as aerospace software engineers (NOVA WIB/University of Santa Cruz Extension)
- 36 entry-level and low-skilled workers were trained/certified as aerospace manufacturing technicians (El Camino College, Torrance/Hawthorne)
- 28 individuals completed the 14-week Vision to Venture series of classes (Mission Community Services, San Luis Obispo)
- 35 innovation-oriented business owners participated in the “Entrepreneur Boot Camp” held in conjunction with the California Tech 100 event (Golden Capital Network, Orange County)
- 96 working engineers participated in the systems engineering orientation/training offered (The Aerospace Corporation, Los Angeles; California Polytechnic State University, San Luis Obispo)

**Degrees and Certifications Developed**

- A.S. Degree, Engineering Technology with Emphasis in Mechatronics (Allan Hancock College, Santa Maria)
- A.S. Degree, Electronics Technology with Emphasis in Mechatronics (Allan Hancock College)
- “Aerospace Manufacturing Technician” Certificate (El Camino College)
- “Software Engineering for Aerospace and Defense Applications” Certificate – (UC Santa Cruz Extension)
- “Engineering Technology, Emphasis in Mechatronics” Certificate (Allan Hancock College)
- “Electronic Technology with Emphasis in Mechatronics” Certificate (Allan Hancock College)
- “Supply Chain Management” Certificate (Antelope Valley College)

**Sampling of Employment Placements**

- 36 entry-level and low-skilled workers completing the Aerospace Manufacturing Technician Certification at El Camino College – hired by Los Angeles South Bay aerospace
- 20 displaced workers completing the “Software Engineering for Aerospace and Defense Applications” Certification from UC Santa Cruz Extension hired into aerospace
- 19 entry level workers completing customized aerospace technician training facilitated by Lancaster University Center, delivered by Antelope Valley College, hired by Antelope Valley aerospace
**Guides and Blueprints Fostering Systems Alignment**

In the “Key Enablers” section beginning on page 295, California Space Authority emphasizes the importance of industry engagement, systems alignment and model practices as key enablers fostering innovation and regional prosperity. The Corridor Initiative developed numerous model practices, but the three which most directly speak to the need for systems alignment of workforce and economic development and education, with industry, as a means for addressing the challenges of the 21st Century, are those which follow. Driven as they were by the changing 21st Century workplace, these guides are completely compatible with a regional sector strategy. In outlining new roles for the workforce, economic development and education systems, identifying success factors and providing case studies or implementation pilots, these three system guides offer a collective blueprint for other regions in aligning the three systems.


Quote from the final report of an Economic Development Stakeholder
“WIRED fostered a much-improved understanding for our organization of the needed coordination and disconnects between employers, workforce agencies, economic development organizations, students, and educational institutions. The resulting insights will drive our planning and priorities for some time to come.”


Quote from the final report of an Education Stakeholder
“I discovered that it is necessary to leverage all K-U, Academia, government agencies, industry resources…to collaborate… in solving both economic and workforce development challenges for the 21st century. Developing and nurturing relationships have been extremely important to the current success of the Corridor and will become more important for future success on programs that will impact the state and nation…”


Quote from the final report of a WIB Stakeholder
“In my professional life, I never really engaged with economic development professionals or the senior members of their boards. I wasn’t sure if WIBs should focus on economic development. This project opened my eyes to life outside of the WIA and how WIBs could become more demand-driven by really listening to the needs of business. The WIRED assignments allowed me to broaden my vision about how the workforce system and the economic development approaches could link together and support each other.”
Development and Implementation of the Innovation Driven Economic Development Model and Toolkit

In 2008, the Bay Area Council Economic Institute/Bay Area Science and Innovation Consortium (BACEI/BASIC), a partner in Phase I of the California Innovation Corridor Initiative, launched the Innovation Driven Economic Development Model (Model) and an accompanying “toolkit” of products produced by other partners.

Researching innovation centers worldwide and capturing innovation insights from Silicon Valley CEOs as part of an innovation roundtable event, BACEI/BASIC had developed a blueprint for fostering regional prosperity through the creation of an innovation culture. This culture, said the Model, would be characterized by the presence of four innovation drivers: Inventors, Transformers, Financiers, Brokers.

Other Project 1.1 efforts supported the Model and were considered part of the “Toolkit” accompanying the Model.

As entrepreneurial companies are critical to the pipeline feeding an innovation economy, connecting regional entrepreneurs, venture capital, technical assistance and business resources attuned to the special needs of entrepreneurs is imperative. Through Golden Capital Network, the Corridor Initiative launched three “Venture Communities” designed to bring entrepreneurs together with investors and resources. The Corridor also hosted a statewide “California Tech 100” event to connect entrepreneurs and venture capitalists.

To support global competitiveness, the California Space Authority linked 16 California companies with nine international business firms at a business match-making session taking place during the International Satellite Communications exchange – ISCe.

The Los Angeles Economic Development Corporation (LAEDC) undertook a business climate survey, reinstated its former “Regional Business Assistance Network” (RBAN) program, and developed fact sheets for key innovation industries in the County.

In Phase II of the project, the California Space Authority guided implementation of the Model in two Corridor sub-regions.

The Los Angeles County Economic Development Corporation founded the South Bay Aerospace Consortium (Consortium) to implement the Model in the South Bay aerospace community.

“Purposeful Support” for Innovation*

- Raise the Stakes: Introduce Innovation as the Imperative
- Reassess the Region: Identify Current/Potential Sources of Innovation
- Connect the Innovators: Conduct a Disciplined, Collaborative Process
- Broker Breakthroughs: Help Innovators Take Collaborative Action
- Network the Brokers: Accelerate and Expand Innovation Development
- Redefine Success: Change the Metrics in Economic Development

Chairperson for the Consortium was Dr. Wanda Austin, President/CEO of The Aerospace Corporation, a federally-funded Research and Development center which supports the U.S. Air Force, other government agencies, and provides some technical assistance to the commercial sector.

The Antelope Valley Board of Trade (AVBOT), another Corridor strategic partner from an aerospace area of California, engaged new stakeholders to participate in implementing the Model in the Antelope Valley. Cathy Hart, Program Manager for Southern California Edison and President of AVBOT, led the Antelope Valley implementation effort.

The South Bay Aerospace Consortium’s 2009 work produced two outcomes. First was identification of key occupations needed by aerospace (Production/Touch Labor #1, Systems Engineering #2). Second was the Long-Range Economic Development Strategy for the South Bay Aerospace Industry.

AVBOT funded the Greater Antelope Valley Economic Alliance (GAVEA) in its development of the capstone effort in the region’s implementation of the Model: A Vision Report 2010: Regional Collaboration as the Blueprint for Prosperity. A business cluster study was also developed.

Using the Innovation Driven Economic Development Model as a guide for a regional collaboration among workforce, education, economic development, industry and government, the South Bay and the Antelope Valley project partners were able to implement a collaborative, region-wide sector strategy supporting ongoing innovation.
Asset Mapping Inventory Enhances Collaboration, Fosters Innovation

California has a wealth of innovation assets not always well understood. The California Innovation Corridor (CIC) portal on Connectory.com, developed by Connectory founder, the San Diego East County Economic Development Council (ECEDC), under Phase I of the Corridor WIRED Initiative and expanded by CSA under Phase II, is a tool to support the identification of innovation assets and enhance supplier competitiveness. By linking suppliers, primes and government to potential innovation and supplier partners, the CIC portal helps establish the “culture of innovation” within the Corridor and the state.

The CIC Innovation Asset Mapping project leveraged an existing online platform – Connectory.com, a buyer/supplier, searchable, capabilities-based online inventory – to build a portal identifying the Corridor’s innovation assets, public and private. The project, led jointly by the Bay Area Science Innovation Consortium, CSA and the ECEDC, implemented by teams of workforce and/or economic development entities throughout the Corridor, captured regional innovation assets in the following categories:

- Industry/small business/entrepreneurial firms
- University labs and research centers
- Military installations
- Federal labs and research institutions

Profiles of innovation assets identified include relevant facility, technology, personnel and/or equipment descriptions, as well as official designations and certifications, e.g. Woman, Veteran or Minority-Owned Business, and AS 9100. While over 1,700 Corridor innovation assets have now been identified, this is only a portion of those that exist; identification of innovation assets will be ongoing.

Additional benefits to those of innovators were realized by this project:

- Some innovation employers identified became resources for other Corridor WIRED projects; others among the innovation asset employers responded to workforce or supplier or other surveys
- Actually participating in the inventory asset mapping project enabled Workforce Investment Board and economic development professionals lacking an understanding of the importance of “knowing your territory” the opportunity to see first-hand the value of not only identifying but truly understanding the employer/worker community.

### Capacity Building: Supplier Transformation Strategy

The WIRED Project 2.2 team, led by the California Space Authority (CSA), beginning with a comprehensive survey of 288 suppliers, identified the common supplier learning outcomes required needed for 21st Century success, developed four training modules and piloted the four modules in two-day training courses. Over 100 suppliers were instructed on the Supply Chain Management principles that have been identified as critical to supplier training and success in the 21st Century global market.

In addition, a demonstration project was conducted by the California Manufacturing Technology Consultants (CMTC) with Omega Precision (Omega), a forty-year veteran of close-tolerance machining on diverse materials. Introducing Omega to the Smart Supplier Success Factors (see p. 119), as well as a benchmarking tool from the U.S. Department of Defense Mentor Protégé program, supplier training provider CMTC used assessments to examine Omega’s internal and sub-tier capabilities. Omega then developed a broader range of subcontractors and the ability to manage them, enabling Omega to win “Boeing Supplier of the Year” honors in 2008 and increase its earnings 15% over the previous year.

In Phase II of the Corridor Initiative, CSA developed an online supplier company assessment and a web-based, self-paced version of the Supply Chain Principles course developed in Phase I, including a supplier pre and post test. International outreach to assist suppliers in their global marketing efforts included the coordination of a trade mission and information exchange between California suppliers and the French Aerospace Valley. Throughout the four-year “Smart Supplier” effort, an annual Supplier Transformation Forum was held, engaging dozens of prime contractors, government organizations, suppliers, training providers and nonprofits in panels, presentations and roundtables designed to educate suppliers about 21st Century competitiveness issues and solutions. Key topics from these forums were selected for follow-on workshops and seminars, which often included tours, student participation and networking.

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**What capabilities exist in your company?**

<table>
<thead>
<tr>
<th></th>
<th>Small Companies</th>
<th>Mid-sized</th>
<th>Large Companies</th>
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<tr>
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<td>60.00%</td>
<td>50.00%</td>
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<tr>
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<td>40.00%</td>
</tr>
<tr>
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<td>30.00%</td>
</tr>
<tr>
<td>Prototyping—virtual/digital simulation</td>
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<td>20.00%</td>
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<tr>
<td>None</td>
<td>30.00%</td>
<td>20.00%</td>
<td>10.00%</td>
</tr>
</tbody>
</table>

*California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness, California Space Authority, Antelope Valley College, 2008 (see Corridor WIRED Deliverables for Project 2.2 at www.InnovateCalifornia.net)*
The fact that 80% of production now lies in the hands of suppliers, with primes often focused only on integration, means that 80% of nationwide innovation is also now required of suppliers. This has implications for the supplier workforce, which now must include design and engineering capabilities, as well as production skills.

"Integration of latest technologies" was addressed in this project through a manufacturing-for-design simulation, enabled through super-computing, typically a large company capability. The demonstration showed how the latest technologies could put small suppliers on par with larger companies. The effort had University of Southern California graduate students working with the Western Research Applications Center (WESRAC) build a supercomputer, run a manufacturing simulation for an aerospace supplier, with the pilot validating the potential value of offering innovations collectively (e.g. supercomputing) to small suppliers.

While Antelope Valley College developed a "Supply Chain Management" certificate based on learning outcomes from this project, others like the California Space Authority, developed different models to address supplier competitiveness. CSA’s Global Smart Supplier Strategy includes the now-Annual Supplier Forum, featuring “hot topics”, targeted workshops to address the topics, as well as the online supplier self-assessment and self-paced Supply Chain Management coursework. An estimated 400 suppliers, as well as WIBs, economic development and education entities and government organizations have participated in these events over the course of the Corridor WIRED Initiative. The Smart Supplier Initiative has significantly increased awareness/understanding of the 21st Century Supply Chain Transformation and what it means to employers and workers.

<table>
<thead>
<tr>
<th>Module 1</th>
<th>Module 2</th>
<th>Module 3</th>
<th>Module 4</th>
</tr>
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<tbody>
<tr>
<td>Principles of Supply Chain Management</td>
<td>Introduction to Supply Chain Relationships</td>
<td>Principles of Procurement &amp; Sourcing Management</td>
<td>Introduction to Law and Regulation of Business</td>
</tr>
<tr>
<td>Introduce the concept of global supply chain operations and the fundamentals of managing the supply chain.</td>
<td>Understand supply chains across functional and organizational boundaries and the contribution of strategic alignment of the supply chain.</td>
<td>Introduce the importance of international procurement and sourcing management to an organization.</td>
<td>Understand the key areas of law and regulations as they apply to aerospace daily operations and logistics management.</td>
</tr>
</tbody>
</table>
Training and education programs aligning with the degrees, certificates on page __

Antelope Valley Engineering Program - assures high desert residents local higher education options to obtain an engineering degree. Lancaster University Program enrollment grew from 15 to 40 students, with the Introduction to Engineering Course attracting 31 high school students. Sample impact: single mom able to stay in the area to successfully complete engineering degree and find employment as an engineer with Lockheed Martin at a healthy family wage.


El Camino College facilitated establishment of Project Lead the Way programs in five LA South Bay high schools, fostered their expansion at seven high schools.

Garvey Spacecraft Corporation, with California State University, Long Beach, conducted a rocket development and launch program, with student payload opportunities provided and nine industry mentors participating.

New Mechatronics course developed at Fremont High School.

Cerritos College created a new Pathway Programs Department to centralize Career Technical Ed initiatives, student recruitment

Space Information Labs, with JPL developed a new high school level Earth Science curriculum designed to meet science content standards and serve as a University of California-approved Lab Science course.

Six regional education demonstrations were conducted around the state to test principles and/or recommendations from the STEM Collaborative Action Plan

Space Information Labs established new STEM/engineering “Endeavour Academy” at Torrance H.S.

Aerospace Community Development Program was initiated to foster aerospace and STEM career understanding of students, professors and advisors.

A UCR business class allowed Engineering and MBA students to work in teams on an action research project characterizing corporate innovation and 21st Century skills.

Stanford University conducted a student payload program and a launch project with San Jose State as well as mentoring programs at Fremont, Saratoga High Schools, with Bloomington, Pajaro High Schools supporting

A virtual classroom technology was developed and demonstrated to foster remote mentoring, real-world student work.

College of the Canyons began a Robotics Academy for high school students.

A CubeSat Launcher designed and prototyped by graduate students at the Naval Postgraduate School in Monterey will, if successfully manifested and launched, enable more student payload launches in one year than that of all previous years.
Workforce Investment Boards Transition to Meet 21st Century Worker and Employer Demands

As the California Workforce Association (CWA), representative of California’s forty-nine statewide local Workforce Investment Boards (WIBs), states in its final partner report, “In most other states, the public workforce system was not a key player in the first generation of WIRED grants, but in California, CSA included WIBs from the beginning as key players.” CWA was included in the Corridor WIRED Leadership Team, the Project Leads Forum, and WIRED Academies. Its influence figured significantly in all of the Corridor’s signature products.

Again citing CWA’s final WIB Learning Collaboratory report:

California Workforce Association’s key accomplishments include refocusing California’s local workforce system on the importance of responding to the needs of their local employers and an emphasis on talent development. Local Boards are identifying sector policies to better help their local and regional businesses stay competitive. CWA has helped forge tighter partnerships among Local Boards to look at issues regionally instead of in isolation. California will be better served if local partnerships understand their importance in the regional landscape. The Corridor will prosper when there is a steady flow of a skilled, educated workforce.

In addition to the many California Innovation Corridor projects including Workforce Investment Board (WIB) partners or orientations, two of the Corridor WIRED projects were primarily designed to address the need for California Workforce Investment Boards to better understand and adapt to the worker and employer demands of the 21st Century global economic environment. The Workforce Investment Board (WIB) Learning Collaboratory project was led by the California Workforce Association (CWA) and its project partner the California Space Authority (CSA), Corridor WIRED Program Manager and an industry and employer nonprofit. The Collaboratory’s sister project, the WIB Toolkit: Racing for the Future, was led by the California Council on Science and Technology (CCST), with CWA and the California Space Education and Workforce Institute (Institute) as project partners.

The Toolkit provides an overview of five roles important for local WIBs:

- Convener (of community workforce stakeholders)
- Workforce Analyst (community experts regarding workforce composition, key industries, trends, etc.)
- Broker (intermediary facilitating solutions, e.g. between industry and community college for customized education)
- Community Voice (representing workforce interests)
- Capacity Builder (enhancing workforce resources)

These roles align with the Innovation Driven Economic Development Model (Model), which emphasizes importance of Brokers, and with both the Model and the Innovation Asset Mapping project, which stress the value of understanding regional innovation assets.
The Toolkit is comprised of five categories:

- Background (nature of 21st Century global workplace and skills needed)
- Five Core WIB Roles (see above)
- Industry Profiles (overview of key California high-tech industries)
- Case Studies (WIB successes)
- Resources (WIB references)

The Collaboratory was a professional development effort created to embed into statewide and local WIB planning and operations the WIRED principles of an innovation-driven economy characterized by the alignment of workforce, economic development and education in support of 21st Century worker and employer needs. The WIB Toolkit was an online resource created, in addition to others initiated by CWA and/or CSA, to assist in WIB professional development.

Five monographs informed the work of the WIB Learning Collaboratory project:

- Regional Workforce Strategies
- Youth and STEM
- WIB and Community College Collaboration

Through the Collaboratory-supported conferences, surveys, studies, white papers and its regular WIB and statewide workforce stakeholder interfaces, the CWA made great strides in engaging local WIBs in WIRED-related dialogue, strategy-building and planning. Between the Collaboratory, the WIB Toolkit project, and other Corridor WIRED work of WIBs, much progress was made in WIB adaptation to the 21st Century global innovation economy and WIB responsiveness to a demand-driven system.

An interesting element in Phase I of the Learning Collaboratory was the inclusion of a Social Networking Survey to gauge the kind and strength of working relationships between local WIBs and their community partners in education, economic development, as well as their interfaces with State agencies, some of which is mandated activity. As might be expected, State-mandated interfaces were strong, but it was interesting to see that both WIRED-funded and non-funded WIBs are
working with community partners more than are non-WIRED WIBs.

Supply Chain Transformation: Role of the Workforce Investment Boards, while developed under the Smart Supplier project, was another resource provided WIBs and the Learning Collaboratory project. Its conclusion, written by the NOVA Workforce Investment Board which developed the study, stated:

Workforce Investment Boards can contribute to supplier success by assisting with workforce recruitment, providing links to training resources, and by utilizing their many partnerships to make connections between industry, economic development, education and job seekers. WIBs can enhance their contributions to the economic success of their communities by developing an understanding of the requirements and challenges of the driving industries in their regions.

Like NOVA, the San Diego Workforce Partnership (WIB) conducted an analysis on potential WIB roles in an innovation economy. Innovating Workforce Development by Supporting Business Innovation: Case Studies from California, offered WIBs a new perspective:

WIBs were designed to provide job training opportunities to the most disadvantaged people in particular communities. The move toward economic development is very recent, and possibly at odds with the core mission of many WIBs who see their primary role as supporting low-wage or dislocated workers and disadvantaged youth. The stories presented here (WIBs and Innovation) were selected precisely because they represent a departure from the bread-and-butter activities of WIBs and demonstrate what might be the next stage of workforce development.

In Phase II of the WIB Learning Collaboratory project, CWA and its Phase II Learning Collaboratory partner, CSA, took full advantage of the WIB surveys, monographs, projects, presentations and elements it developed, as well as those developed by CSA and its Corridor partners in Phase I.

A cross orientation opportunity was designed for WIBs and employers, meant to facilitate better understanding of each other’s purpose, needs, processes and resources. The threefold purpose was described as follows:

- To enhance understanding of WIBs to Corporate Human Resource hiring, workforce development considerations, and constraints
- Acquaint HR professionals with WIBs as workforce resources
- Orient the corporate HR community to WIB job placement, dislocated worker and talent development resources through facilitation of a shared strategy

“HR 101” and “WIB 101” sessions were designed and delivered. Results of the Phase II element of the Learning Collaboratory were very positive, according to CWA:

“One of the fundamental motivators behind the Phase II project was for the Learning Collaboratory to create a strategic partnership between WIBs and HR. Through the two presentations and CWA’s participation in the Professionals in Industry Human Resources Association – PIHRA, this has truly been accomplished.”
Teacher Professional Development

31 teachers participated in two MESA summer Math Physics Technology Institutes in 2007 for a projected student impact of 4,960 (32/class x 5 classes/day)

47 teachers/administrators participated in the Lancaster University Center co-sponsored international Society of Automotive/Aerospace Engineers' "World in Motion" professional development opportunity

75 teachers participated in the Space Information Labs 2007 teacher professional development opportunity in conjunction with the NASA AIM launch – projected student impact: 12,000.

55 teachers participated in the Space Information Labs 2008 JPL 50th Anniversary teacher education opportunity for a student impact of 8,800.

Sampling: Student Experiential Learning Opportunities

2007: 30 pre-engineering students participated in the Lancaster University Center’s four-week summer program to introduce “real-world” STEM work.

2007: Stanford’s balloon launch program engaged over 500 students in creating PearlSat” payloads, analyzing return results.

Garvey Spacecraft’s rocket development and launch program involved 80+ students the experience of participating in Corridor Initiative launches either in the field, lab or both.

1200 students participated in El Camino College’s Project Lead the Way courses.

41 University of California, Riverside (UCR) MBA and Engineering students involved in the innovation action research project conducted three student-to-student workshops and designed and ran the 2-day UCR Tech Horizons Conference

2007: 20 high school students enrolled in Allan Hancock College’s fourth annual Mechatronics Institute.

130 students participated in Allan Hancock College’s Mechatronics certificate and degree courses.

24 university students used the lunar simulant testbed at NASA Ames.
From 2006 – 2009, the California Space Education and Workforce Institute (Institute) successfully led the California Innovation Corridor (Corridor) project in developing a statewide private/public collaborative action plan for science, technology, engineering and math (STEM). A STEM Collaborative Action Plan Steering Committee was established and outreach conducted to engage over 400 project participants.

Statewide STEM stakeholders engaged:
- Education
- Industry
- Workforce System
- Academia
- Economic Development
- Informal Science

Directors/executives from all California educational systems were engaged:
- Office of Public Instruction (K-12)
- California Community College
- California State University
- University of California

Three initial forums were convened to share STEM perspectives among stakeholder domains. The Institute engaged the Alliance for Collaborations to Heighten Education Success (ARCHES) in developing *High Stakes: STEM Education, The Essential Ingredient for California Competitiveness*, (the STEM Collaborative Action Plan – STEM CAP), believed to be the nation’s first private, public collaborative statewide plan addressing the STEM crisis.

View the plan at: [www.InnovateCalifornia.net/documents/STEMCAPDOC.pdf](http://www.InnovateCalifornia.net/documents/STEMCAPDOC.pdf)

ARCHES culled the recommendations of the 22 most cited National and State STEM reports down to 100 recommendations, which were further synthesized down to 25 recommendations by the STEM CAP Advisory Group. Those 25 cross-cutting recommendations were further distilled into the final ten STEM CAP recommendations through the inputs...
and feedback of 25 stakeholder focus groups engaging 273 participants from industry associations, educator and administrator professional associations, informal science, various math and science stakeholder groups.

Also as an element of the STEM Collaborative Action Plan, six regional projects implementing STEM CAP principles and recommendations were conducted by ARCHES in the summer of 2008, proving the value of STEM CAP recommendations and their accompanying suggested actions.

The organizing principle for the STEM Collaborative Action Plan was NASA’s Strategic Education Framework: Inspire, Engage, Educate, Employ. Each of the STEM CAP’s ten recommendations is aligned with one of these areas.

As part of the project, the Institute created the first statewide private/public STEM Inventory. The STEM Inventory includes STEM programs from education, informal science, industry and government at all levels of the NASA/STEM CAP continuum. www.STEMINVENTORY.net.

The STEM Inventory is an online, user-friendly, searchable database of many California and national STEM programs organized by grade level, geography and topic, targeted to students, STEM practitioners, teachers and parents.

In Phase II of the STEM Collaborative Action, the STEM Inventory was enhanced to better accommodate video and establish social networking aspects to foster a statewide STEM community of practice. Also in Phase II, the STEM CAP Forum reconvened, a STEM community environmental assessment was completed, and a Guidebook for Creating a Community STEM Pathway was developed.

### STEM CAP Recommendations

#### Inspire
- Motivate students and adults, using a variety of incentives, to study and enter STEM careers, with special effort geared to those in currently under-represented and under-served groups
- Build public support for and understanding of the value of STEM education for all students and citizens

#### Engage
- Provide rigorous, relevant Career Technical Education (CTE) that prepares students for both higher education and the workplace in order to reinforce classroom instruction and provide tangible, relevant skills for greater subject matter retention and competency
- Deliver science and math curriculum that motivates, energizes, and rewards the natural curiosity and interest students bring to the subject

#### Educate
- Align state K-12 science and math standards and assessments with post-secondary and workforce expectations of what high school graduates should know and be able to do
- Implement a comprehensive package of recruitment strategies for math and science teachers throughout grades K-12 to expand and diversify the pool of fully prepared and certified candidates
- Strengthen teacher preparation programs in math and science through inclusion of hands-on, problem-based instruction and strategies that will benefit all students including under-represented and underserved groups
- Provide ongoing, research-based professional development programs, focused on both content and pedagogy, for all math and science teachers and faculty K-higher education

#### Employ
- Create industry partnerships directly engaged with educators to deliver relevant, motivational and exciting instruction to reinforce/enhance STEM curriculum while setting the foundation for building a competitive and qualified workforce in tune with emerging work realities
- Create hands-on internships and fellowships for students, teachers and faculty with employers in industry, academia, informal science networks and civic organizations

*High Stakes: STEM Education, The Essential Ingredient for California Competitiveness, California Space Education & Workforce Institute w/support of ARCHES, 2008*
Findings: Innovation Support

Why is innovation important? One reason is its economic and job impact, as well as its wage value for workers. As stated in the Innovation Driven Economic Development Model (Model) described earlier, in a section entitled “Without An Innovative Economy, Other Community Outcomes Are Difficult to Achieve”:

An innovative economy is at the core of regional vitality and quality of life. Without an innovative economy, any gains in social inclusion, livable community, and collaborative governance are short-lived. An innovation economy is the engine that produces economic opportunity and community revenues that make possible career mobility, investment in educational systems, development of community infrastructure and amenities, investments in environmental preservation, and other critical assets for regional vitality and quality of life.

According to the Obama Administration, approximately 70% of U.S. jobs are attributable to small business. State resources show that 95% of California firms qualify as small business based on the Small Business Administration’s definition (<500 employees). Many innovation companies are well below 500 employees (most Los Angeles County Economic Development business climate high-tech innovation company surveyees had <50 employees). Small business is a critical job resource for California and the U.S.

Yet, the most important part of the story for those wishing to create and/or retain the greatest number of jobs is that all small businesses are NOT equal in terms of job generation or economic impact. Few in California question the value of the tourism industry, yet many do not understand the value of the innovation and technology sector.

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<th>Impact Type</th>
<th>Average Salary Small Hotel</th>
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<td>$4,154,000</td>
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CSA panel presentation to WIBs Sept. 7, 2009: “Impact of Companies on Local Economy and Infrastructure, Quantitative Metrics”
One element of the CIC’s Innovation Support effort was the employment of the Southern California Edison Economic Impact (Pollack) Model to analyze the economic value of a small innovative company. Data above shows that worker income in a small innovation company was more than three times that of a small service sector company, with job and economic impact four times greater.

Several Corridor partner organizations explored the nature of innovation prior to their other activities. While their exact definitions of innovation differed, consensus was: A new technology or process is innovation only when it is put into service (commercialized), producing a new or vastly improved product, service or application, one which reveals or meets a demand.

This description has great significance in terms of innovation funding and R&D tax policy. In its analysis of R&D funding for California (Overview of California State-Funded R&D, 2004-2007: Understanding the State’s Role in Shaping R&D Spending), California Council on Science and Technology (CCST) found that, in 2005, California ranked first in the nation for receiving federal R&D investment, garnering $19.4 billion. In the same year, $50 billion in R&D was conducted in California by industry. It is likely that most of the industry investment was in “development” research, as industry, according to the report, is the largest provider of development research, that supports “the final stage in preparing a product or process for public consumption”, i.e. the commercialization or innovation described above.

R&D tax credit rationale is based on the assumption, illustrated in the “Small Aerospace” tables above, that the State will receive a high return on investment for its support of innovation-oriented R&D. Unfortunately, in 2008, that rationale did not prevail. Restrictions were made to the California R&D tax credit that decreases its usefulness to companies by 50% through the 2010 tax year. Since 31 other states now offer R&D tax credits, the California R&D tax credit adjustment could become a competitive advantage to other states, probably impacting small business even more than large companies. The CCST report states, “...most tax returns with R&D claims are filed by small and medium-sized businesses; in 2002, over 60 percent of R&D credit claims were filed by businesses with gross revenues of under $1 million.”

California, according to the CCST report, leads the nation in total R&D dollars, enjoying over three and a half times that of any other state. It also points out that, in at least some of California’s R&D investments, the return is two to one from other sources. Yet, per capita, California R&D is slipping, with the state now ranking only 19th for academic R&D funding relative to GDP. To fully understand the role of California’s R&D investments in directing statewide R&D, more consistent tracking will be necessary. An R&D strategy at the state level is also advised to support California’s high-tech sector.

Support of entrepreneurs was also addressed by the three venture communities established by Golden Capital Network as part of the Corridor effort. Chabin Concepts, in its Venture Community Guidelines, provides a key insight:

To support entrepreneurs, communities can work to build and support visibility for innovators, vertical and functional networks, access to all stages of capital,
access to talent, access to customers and strategic partners, and establishment of anchor companies in the local community.

Much of this support can be provided by effective innovation asset mapping, such as that conducted by the Corridor, with Corridor innovation assets now housed in a single “California Innovation” portal for the benefit of entrepreneurs, suppliers, primes, universities and other innovation stakeholders: [http://www.connectory.com/portal_home.aspx?portalid=5](http://www.connectory.com/portal_home.aspx?portalid=5)

Insights gained in developing the Corridor’s innovation asset resource inventory included the following from the Corridor’s full final report:

- Companies residing in a certain industry sector can no longer be assumed to have capabilities, workforce needs and activities similar to those of each other
- As stated in the final report of the Corridor’s “Workforce Analysis” project: “Aerospace, bioscience and other emerging technologies reside in multiple NAICs codes and are therefore problematic to find and measure – requiring other qualitative approaches to truly gauge breadth of emerging industries in a region”
- The Corridor’s Innovation portal is the type of tool that can assist in identifying emerging regional innovation assets because it is capabilities-based rather than industry-based. It can provide the foundational data that enriches essential face-to-face contact necessary to keep up with the evolving innovation community

Early research efforts of the BACEI/BASIC to develop an economic development model to support innovation included an Innovation Networking Roundtable (Roundtable). The event provided much of the foundational information for the [Innovation Driven Economic Development Model](http://www.connectory.com/portal_home.aspx?portalid=5) described previously. The event also included insight on the importance of a new kind of public/private collaboration to support innovation.

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**John Kao on the Bay Area Innovation Networking Roundtable**

This gathering offers a glimpse of what the future of our country’s approach to innovation might look like on a grand scale. Our national agenda should not be a grand project along the lines of the old top-down five year plans, but rather a free-flowing, unencumbered dance among the private and public sectors, among academics and NGOs, entrepreneurs and individual citizens. It is neither the bureaucratic top-down of a government agency, nor the invisible hand of the private sector. What we need is a blend of the two that finds the sweet spot between the invisible and the controlling hand – in short, the helping hand.


The culminating report from the Roundtable event included the summary findings of the gathering. These findings described the “Emerging Patterns of the Next Wave of Innovation”, and workforce and economic stakeholders would be wise to study them.

Partners in the Joint University Innovation Model project also have insights of interest to innovation stakeholders.

Below are insights from both of above:
Emerging Patterns of the Next Wave of Innovation

- A networked environment – in which ideas are brokered both within and between organizations – is critical to creativity
- Regional capabilities must be connected to global networks
- Maintaining and attracting a talented workforce is a critical factor in an innovation infrastructure; businesses need to draw on the best talent from wherever it can be found, including globally
- Companies must be flexible and adaptable to changes affecting their markets and technology platforms
- Ideas come from everywhere; companies must lose any “not-invented-here” mentality
- Taking risks and not being afraid to fail are essential
- Innovation on the business side of the process can be as important as the science
- The four network roles of inventor, transformer, financier and broker are at the core of the new global innovation model, so it is important to pick the right role or roles for your particular company

Sample of Findings from Innovation Companies, Joint University Innovation Model

- The reward system is an effective parameter for innovation
- The market/customer determines the need for new products
- Financial health of the company affects R&D investment
- Benefits of innovation are measured by customer satisfaction, revenue
- Primary collaborators are in U.S., 50% are in California
- Outsourcing is done to reduce labor compensation, penetrate new markets
- Language barriers affect outsourcing
- Companies concerned those outsourced to are too far away
- R&D driven by top management, then engineering
- Only 12% of online surveyees (106 companies) partner with university labs
- California companies stay in California for the availability of highly educated professionals
- Companies hire primarily locally, with exception of employees with advanced degrees, for which they prefer to hire within U.S., locally if possible
- Outright sale is preferred exit strategy (4-6 years online surveyees)
- There is no “magic formula” for innovation in a company
- Individuals may be singularly significant, e.g. Steve Jobs, Apple
- Networking is a critical innovation factor - between those with technology needs, those with technology solutions

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1 Bay Area Innovation Network Roundtable: Identifying the Emerging Patterns of the Next Wave of Innovation, Bay Area Science Innovation Consortium, 2007


1 Partners: University of California, Riverside; Stanford University, California Space Authority. Data from innovation company interviewees and 106 surveyed companies
As part of its support to the nationwide WIRED partners, the U.S. Department of Labor offered regions technical assistance from a variety of sources. One such source was the company called New Economy Strategies, which BACEI/BASIC called upon early in the Corridor effort to characterize global best practices in innovation support.

Innovation Success Factors/Global Best Practices

Lightening Bolt Challenges: Obstacles and Opportunities

Unearthed in the Global Benchmarking of Regional Innovation Capacity

-----New Economy Strategies

- **Economic development planning supported by innovation metrics**
  *Best Practice: John Adams Innovation Institute – Greater Boston* Editions of the annual "Index of the Massachusetts Innovation Economy" provide valuable innovation metrics for MA, CA, NY, other key innovation states (e.g. SBIR awards, Patents, Corp R&D expenditures, innovation cluster employment, etc.)

- **Robust adult/continuing education programs**
  *Best Practice: Dipoli – Finland* "Dipoli, the Lifelong Learning Institute of Helsinki University of Technology, is one of the premier continuing education institutes for engineering in Europe. It works with companies to provide specifically designed programs for training in engineering and management and may serve as a model for bridging the gap between formal academic programs and training within firms”

- **Promotion of a variety of advanced certification programs**
  *Best Practice: Technical Education in India* A National Skills Standards Act was passed in India in 1994 by the "All India Council for Technical Education, the central body responsible for India’s 1,346 engineering colleges, to facilitate development of voluntary skills and certification standards. India’s Department of Higher Education cites 357 Industrial Training Institutes with a capacity to serve 1.5M people in over 200 industries. Mid-level professionals requiring advanced applications training are served by 290 polytechnics nationwide.

- **Leveraging of public/private technology parks, infrastructure, collaboratories**
  *Best Practice: Singapore Science Park* A set of Singapore technology parks founded co-locating academic institutions and industrial facilities has created a particularly strong infrastructure for technology transfer. Singapore Science Park consists of three different parks with a "vast array of customized facilities created to support work in a variety of fields from medicine to media” and also contains Asia’s first R&D facility dedicated to telecommunications

- **Endorsement of a globally networked business model, leveraging global outsourcing to ensure its companies/workforce are more competitive**
  *Best Practice: Outsource Competitor/Partner – India* The country has defined itself as a hub for IT software and consulting services, employing its vast technically educated workforce in the service of growing India’s IT industry by means of leveraging its talents first on low transnational telecom cost work outsourced from other countries

- **Proactive Federal and State policies toward technology competitiveness**
  *Best Practices: Singapore and Korea* Despite its small size, Singapore recently devoted $5B USD on R&D, both public and private, in key industry sectors, acknowledging thereby the advancement of its innovation policy. Korea is moving towards a knowledge-based economy through its Vision 2025, setting a goal of achieving competitiveness with G-7 nations. Both Singapore and Korea have developed and are implementing aggressive innovation policy

*Best Practice: Many of the above-mentioned players* "It was evident from our review of global best practices in innovation capacity that challenger nations have developed more formalized networks. Often these networks are government-led and have resulted in industries and firms that have benefited from strong alignment between government policies and firm success. This organized dialogue amongst industry, academia and government over policies for the successful development of innovation capacity has often resulted in success for all three sectors of society."
Findings: Supplier Competitiveness

The single most important insight gleaned from the Corridor Supplier effort was articulated in the Supplier project final report, learned in relation to aerospace, but is applicable more broadly:

*As prime contractors have become focused on final integration, with 80% of systems development now moved out to the supply network, the result is that 80% of product and process innovation is now expected from suppliers.*

Thus, for the U.S. to remain competitive globally, the challenge to quickly bring California and U.S. suppliers up to 21st Century expectations cannot be overstated. It is primarily the manufacturing sector which offers workers and small business owners pathways out of poverty and into work promising long term family wage incomes. Since California is home to about 50% of U.S. manufacturing, failure to keep our California industrial base globally competitive would threaten not only our national security but our very quality of life.

First, it was important to review what had happened to the supplier environment:

**A Changing Landscape for Aerospace Suppliers**

- Suppliers are working in a global “flat world”
- They are doing business in a digital, socially networked world
- Supplier work is changing from “Stable & Certain” to “Sense & Respond”
- Collaboration and competition are coming from more places
- 6 Sigma and Lean are standard, not exceptional
- Marketplace is moving from “Make & Sell” to “Sense & Respond”
- Suppliers exist in an E-Commerce, E-Process global marketplace
- Data, information and communication are more critical
- Pace of change is accelerating

**Key Messages for Suppliers**

- Nearly 80% of former “prime” manufacturing/assembly work had moved down to suppliers, with most primes now focused on final integration
- Impact: 80% of the innovation and engineering falls to suppliers
- Suppliers unlikely to remain competitive simply providing components
- Supplier transformation and training are only competitive options

**The Best Companies Are Adjusting to Stay Successful**

Other conclusions were drawn from comparison of findings of the Supplier project with other CIC projects. The following were conclusions cited in the Supplier project final report:
Supply chains have evolved into dynamic complex supplier networks requiring significant change, trust, collaboration and communication, with clearly defined technical and business requirements, balanced accountability, responsibilities and reward

Need for balance of innovation and risk

Need for Innovation metrics
Early collaboration with customers and suppliers, innovators and markets is critical
Interdisciplinary skills and teams, ad hoc teams are required
Expectation of the shared risk, investment, reward of innovation
Common assessment processes are needed across the supply chain network

Smart Supplier Success Factors

Successfully managing supplier relationships (upstream, downstream)
Successfully managing process and quality performance demands in an environment of both vertically integrated chains of companies as well as dynamic, distributed networks of companies
Remaining flexible, agile, to deal rapidly with changes/disruptions in one layer or node of the supply system
Expanding capacity to take on new functions, e.g. design, engineering, quality assurance formerly a responsibility higher up the chain
Engaging earlier in the product development cycle with both customers, suppliers, i.e. requirements definition, design
Real-time, open sharing of more data, earlier, more often, i.e. schedule, quality (open systems)
Digital modeling and simulation capabilities (utilization of high performance computing if possible)
Full understanding of customer requirements
Performing to industry standards
Aligning research/development
Software engineering and systems engineering capabilities
Solid planning, process, risk, LTS management (schedule, cost, quality control)
Recruitment and retention of quality-conscious workers (technicians, engineers)
Effective inventory, logistics, materials management
Effective sub-contract, intellectual property management
Development of long-term strategic relationships (customers, suppliers)
Reputation management
Incorporate foreign content to assure foreign market access; control counterfeits
Ongoing training in latest technologies, basic skills, business practices
Lean practices
Willingness/ability to expand to meet customer needs (e.g. equipment, facilities)
Customer and supplier collaboration (process streamlining, cost/risk reduction, product design, development, etc.)
Regulatory compliance (e.g. ITAR), regulatory flowdown management
Product lifecycle management
Forecasting
Rapidly introduce new technologies
Focus on core competencies
Capture and proposal strategies
Supplier diversity
Understanding program pricing targets and company’s contribution
Obtain/maintain appropriate certifications
Utilize internal audits
Market solutions providing differentiation (technology, cost, speed)

1 From presentations, handouts provided at the October, 2007 Supplier Transformation Forum, October 2008 Forum
Findings: Talent Development

According to a U.S. Department of Education, Office of Vocational and Adult Education report (Adult Basic Education to Community College Transition Symposium Report), 90 percent of the country’s fastest-growing jobs require post-secondary education or training, yet 60 percent of Americans have no post-secondary credentials.

Most of the fastest-growing jobs require science, technology, engineering and math (STEM) skills and with baby-boomer retirements, fewer STEM professionals and technicians are available now than ever before. It is a "perfect storm" for a country (and a state) committed to global competitiveness.

Part of the solution lies with the U.S. workforce system, part with the state’s educational systems and the rest is distributed among industry, nonprofits, community stakeholders and parents.

The California Workforce Association (CWA), the voice of California’s 49 Workforce Investment Boards (WIBs), identified some of the barriers to implementing an innovation agenda at the local level from the WIB perspective:

- Issue #1: Workforce Investment Act (WIA) Performance Measures (which exhibit a "significant disconnect" between WIA and a collaborative regional innovation agenda)
- Issue #2: Demand-Driven Design ("WIA is largely silent on the WIB role, local authority and responsibility in responding to business needs")
- Issue #3: Role of the WIB (Need for collaboration with local entities "constrained by a lack of clear policy direction and of dedicated strategic planning resources" to achieve workforce system transformation)
- Issue #4: Access to Resources

CWA outlined Federal, State and Local recommendations to address the above. See the CSA full Corridor final report (Key Findings) for detail.

In developing the Science, Technology, Engineering and Math Collaborative Action Plan (STEM CAP), project participants identified four key challenges facing California STEM education:

- Fewer high school students are interested in preparing for and obtaining a college degree in STEM
- Too many of California’s students do not have access to high-quality science and mathematics instruction or quality materials
- Large percentages of California students, especially those in low performing schools, receive instruction from under-performing teachers
- California lacks state-level leadership to make high-quality science and mathematics education for all students a priority

All of the above are quite real and significant. Through other CIC Talent Development projects, however, other challenges were identified, some of which can be addressed through the STEM CAP, some of which are beyond its scope:

- Recognition of education’s role in preparing the 21st Century workforce does not seem widely accepted within the education community.
- Lack of mechanisms within the four systems for student, parent, teacher career awareness, career relevancy
and career preparation pathways, which especially impacts students without college educated parents

- Willingness to see industry, industry associations and employers as partners and subject matter experts, as well as outside funders

- Less educator accountability than necessary for assuring a quality, relevant learning experience for all students

- Systemic education issues that do not seem resolved by additional funding

- Critical importance of educators remaining current with the educational needs of today’s workers

- Importance of inquiry and project-based learning in today’s global environment. As it is now impossible to learn everything in school needed for success in the 21st Century career marketplace, it is increasingly important for students to engage and succeed in real-world scenarios to prepare them for the ever changing environment in which they will work

- Broader recognition of the value of Career Technical Education (CTE) as a pathway to success and family wage jobs for students not interested or able to pursue four-year college after high school graduation

- Importance of an interdisciplinary approach to career preparation. Nearly all of today’s careers, as will be seen below, require cross-disciplinary skills and competencies. The strict departmental structure of our universities and the single focus of many of our degrees does not lend itself to the relevancy required to keep our universities cutting edge.

- Perceived or real lack of articulation in STEM disciplines among segments of education K-University

- There is also recognition of the need for more hybrid degrees which would address the domain understanding needed by a professional managing a technology firm doing scientific or high-tech work. Such a degree, exemplified by the new California State University “Professional Science Masters” degree, addresses the competencies needed to manage or market a domain-based high technology business, for someone who does not plan to actually engage in domain-based (e.g. biotech) work itself.

Industry surveys were conducted as part of several Corridor projects, with surprising consistency in the results.

Probably the most significant, though not surprising, insight, is that across nearly all industry sectors surveyed in sub-regions of the California Innovation Corridor, two occupations emerge as the top careers critical to 21st Century industries:

- Engineers
- Technicians

While the order of the two changes from sub-region to sub-region (Engineering #1 in some areas, #2 in others), it is clear that the need for these two occupations is uppermost in employer minds. Notes to the above:

- Need for systems engineers seems to be growing as technologies become more complex

- In heavy biotech-oriented sub-regions, scientists and technicians may appear as numbers one and two (e.g. Bay Area)

Also similar across several projects was the finding that, in addition to domain competency, today’s workers need a set of additional skills to be competitive.

The 21st Century Workforce Skills illustration below, featured on the WIB...
Toolkit, is fairly representative of the aggregated skills identified by most projects with a skills analysis element.

Two notes to the above: UCR found that business knowledge was also an expectation, and numerous partners identified “systems” understanding as important, as well.

An interesting data point in the STEM conversation about the importance of engineers and technicians is that findings of the Worker Profile project and Workforce Needs Analysis projects both indicate that industry is facing a critical skills shortage of technicians, meaning they are hard to find. In the scientist/technician dialogue in the Bay Area, it was indicated that it is easier to find PhDs than bio-technicians. This could be a good news story for California workers, if community colleges can accelerate technician training programs, as it was indicated that most of the STEM technician training positions require a two-year degree or technician certification.

While only featuring aggregated findings of the Workforce Profile Analysis and Workforce Needs Analysis projects, the following is representative of findings of numerous Talent Development projects.

Common Findings: Talent Development

- Engineers, technicians most critical occupations for innovation, also map to critical skills shortages
- STEM education/training is key
- Greater levels of education or certification are anticipated for STEM workers, except perhaps for the doctoral level
- Most critical occupations fall into high-wage categories ($60-over $105,000)
- Technical knowledge, communications and workplace skills all rank among top three skillsets needed
- Problem-solving and business skills also a key need
- No educational preparation of level exceeds employer expectations
- Industry-relevant, real-world experience is critical and sorely lacking in 21st Century workforce development

Common areas of recommendations:

- Build better linkage between education, academia and industry to ensure relevant knowledge, skill-building
- Educate policymakers about issues, recommendations, resources
- Develop more “real-world”, hands-on opportunities for STEM students
- Develop communications and problem-solving, business and workplace skills alongside technical knowledge
- Increase awareness of STEM career attractiveness among parents, educators and students
- Re STEM: Link educational levels
- Align workforce and economic development and education to address industry workforce needs
Key Enablers of an Innovation Ecosystem:
Industry Engagement, Systems Alignment and Model Practices

Regional collaboration, as anticipated, was indeed a success factor of the Corridor Initiative and an identified success factor for supporting an innovation culture beyond the Corridor Initiative. But regional collaboration alone, without the other enablers listed below, would not be enough to foster innovation and drive regional prosperity.

The Corridor Initiative, in its three pathways of activity and in its 25 discrete projects, especially those that from the start were labeled “sustainability projects”, again and again discovered that project and/or Corridor success was dependent upon these three factors:

- **Industry Engagement**
- **Systems Alignment**
- **Model Practices**

Distilled from across the CIC WIRED pathways and 25 projects, across the broad-based accomplishments of the 42 funded partners and across the 82 scopes of work making up the California Innovation Corridor Initiative, these three factors offer valuable insight to the rest of California and the nation in how to bring about the transformational change necessary to ensure California and U.S. global competitiveness.

The economic vitality necessary for high employment requires job creation and/or retention. Because workers are dependent upon thriving industries for long-term opportunity, it is critical to include the industry perspective as early as possible. It is perhaps a Corridor WIRED success factor that the CIC Initiative itself was conceived and managed by the California Space Authority, which represents the private and government space community (employers) throughout the state. Many of the 25 projects included in the Corridor’s original WIRED proposal, while featuring cross-industry applicability, were derived from objectives in CSA’s eight years of space enterprise (employer) strategic planning. Because CSA as an association of employers understood the value of engaging industry and employers or their representative associations at the outset as well as throughout, nearly every Corridor project did so.

While conducting a sector strategy was not the purpose of the Corridor Initiative, the Initiative’s success, based on its early and frequent engagement of key industry sectors and its call for systems alignment on behalf of workplace sector needs, lends credence to the cluster-driven, sector strategy model that California has been attempting to implement through its “Industry Clusters of Opportunity” Initiative.

**Industry Engagement**

There is no better way to articulate the value of early engagement of industry than what was said in the *Innovation Driven Economic Development Model*:

*Brokers should start at the source. The drivers of innovation will primarily come from the private sector.*
Without early and ongoing industry/employer engagement, the likelihood of designing effective worker, student or community programs addressing 21st Century workforce needs is slim. Numerous CIC projects engaged industry in both predictable and unique ways, supporting the drive to transform the education, workforce and economic development systems to respond to 21st Century innovation era needs.

Industry/employers were engaged in the 25 projects in the California Innovation Corridor Initiative to:

- help define innovation
- characterize the new supply chain network environment
- partner in demonstrations
- respond to workforce surveys
- sit on panels, committees
- make presentations
- grant interviews
- participate in STEM career awareness activities
- sponsor events, activities
- share industry programs, models
- provide facilities
- offer use of equipment
- lend subject matter expertise
- provide projects for real-world student work
- support teacher professional development
- work technology issues
- serve as program advisors
- mentor young people
- offer classroom instruction
- test theories
- design or refine curriculum
- make recommendations

In implementing industry engagement as a principle, clarification and articulation of the role of industry is important. Communication of such to all partners keeps them aware and respectful of industry’s role and time contributed. Meetings to which industry/employers are invited should have outcomes requiring them to be there, or there is risk of losing their participation. The single biggest “take-away” regarding industry engagement:

Engage industry/employers at the beginning, not the middle or end of an initiative and retain their involvement throughout the effort to ensure real-world relevance and sustainability.

**Systems Alignment**

A principle challenge to the creation of successful regional collaboration in support of job creators and workers is that of aligning the public education, workforce and economic development systems. Some Corridor partners recognized this from the start, others learned it in attempting regional or sub-regional collaboration. Several factors characterize this challenge:

- Funding streams and accompanying mandates are different among the three systems
- Disparate goals and sometimes mandated metrics determine system priorities, seldom with an eye for addressing the demand-driven workplace
- Jurisdictional boundaries of the systems are not aligned, and none of the system boundaries are aligned with governance boundaries

Building a regional collaborative in such an environment requires creativity, trust and a willingness to value the regional economy perspective. Stakeholders must recognize that the industries generating jobs and regional prosperity through their investments in people and facilities and product/service development do not recognize or care about the varying boundaries of public systems or governance that have nothing to do with the flow of commerce. If anything, this perspective of industry...
has been exacerbated by the global economy where products and services can be sourced from around the globe.

The alignment of systems behind Corridor Initiative objectives was a continual focus of the CIC Project Leads and partner meetings, and there were numerous occasions for collectively exploring how actual project practice demonstrated systems alignment or was hindered by its difficulty.

- In several projects or pathways, economic development and workforce partners were asked to jointly pursue project objectives:
  - In the Workforce Needs Analysis projects ED and WIB project partners were asked to agree on industry cluster targets, develop/disseminate/analyze employer surveys and collaboratively articulate conclusions
  - In addressing unique needs of entrepreneurs, one project asked its ED and WIB partners to approach the entrepreneur development and workforce issues from a regional economy (collaborative) perspective
- In the Supplier Transformation project and pathway, it was the systems representatives themselves that integrated their research and developed their individual project elements accordingly
- Systems alignment in development of the STEM CAP was assured by all three systems participating on the Steering Committee
- The Learning Collaboratory included findings, perspective of education and ED systems in their work throughout the performance period
- The WIB Toolkit featured the benefits of collaboration with ED and education

The Innovation Driven Economic Development Model recognizes the need for alignment of systems without mentioning the three system “players”:

Regional innovation is the product of economic, social, environmental, and other place-based factors. It requires innovative companies, but also talent with education, skills and creativity, and livable communities that provide a quality environment, one that is attractive and supportive for people and commerce. It also requires effective regional governance, the ability of public and private entities to work together across boundaries to strengthen economic, social, and environmental assets that are the key to regional vitality and quality of life.

The Learning Collaboratory’s final monograph How Workforce Boards Connect to WIRED Projects lists five strategies intended to allow WIBs to continue moving to a talent development system by capitalizing on the work done through the Corridor Initiative:

- Develop Strategy Design Using the 5 Roles of the WIBs
- Collaborate with Economic Development
- Collaborate with Education
- Know Everything About Your Labor Market and Supply and Demand
- Cultivate Networks

The Corridor Initiative made huge inroads in fostering working relationships across and within the Corridor among workforce and economic development and education entities, all encouraged to collaborate for the benefit of the region. This built new trust, new relationships and new opportunities to align and leverage the three key public systems supporting regional innovation.
Model Practices

The utilization of model practices or actual proven models is included as an important innovation enabler because it has the potential to accelerate the creation of a regional innovation ecosystem.

The CIC WIRED Initiative produced hundreds of deliverables. What follows is just a sampling of what the Corridor produced in the way of model practices or working models. For others, see “Deliverables” under www.InnovateCalifornia.net

- The Innovation Driven Economic Development Model
  http://www.innovatecalifornia.net/WIREddeliverables/Innovation%20Driven%20Economic%20Development.pdf

- Innovation Asset Mapping Inventory

- WIB Toolkit  http://www.wibtoolkit.net/

- Supplier Transformation Requirements for 21st Century

- STEM Collaborative Action Plan
  http://www.innovatecalifornia.net/WIREddeliverables/STEMCAPDOC.pdf

- WIB Learning Collaboratory/Primer for WIBs (monograph #3)
  http://www.innovatecalifornia.net/WIREddeliverables/Primer%20for%20WIBS-Monograph%203.pdf

- “WIB/WIA 101” training course – for employer Human Resource professionals
  http://www.innovatecalifornia.net/WIREddeliverables/3.14-WIB-info-for-HR-departments.ppt

- “HR Fundamentals and Strategies for WIBs” - orienting WIBs to industry/employer (HR) perspective, how WIBs/HR departments might interface
  http://www.innovatecalifornia.net/WIREddeliverables/3.14-HR-issues-for-WIBs.ppt

- (California Community College-approved) “21st Century Aerospace Manufacturing Technician” Certificate
  http://www.innovatecalifornia.net/WIREddeliverables/Certification%20Manufacturing%20Tech%20Body%20of%20Knowledge.pdf

- (California Community College-approved) Associate of Science (AS) degree/Certificate in Engineering Technology with Emphasis in Mechatronics

- Distributed Curriculum: Systems Engineering Course for Working Engineers

- High School Earth Science Curriculum for University of California approval
  http://www.innovatecalifornia.net/WIREddeliverables/MTPES%20UC%20Approval%20Course%20Description.pdf

- Venture Communities Guidelines – blueprint for creating venture communities according to Golden Capital Network model
  http://www.innovatecalifornia.net/WIREddeliverables/Venture%20Communities%20Guidelines.pdf
Program Management • Leverage • Sustainability

Program Management

As Program Manager for the California Innovation Corridor WIRED Initiative, the California Space Authority employed a variety of strategies to bring the Initiative to a successful close. Several of these were called out as “Best Practices” by DOL/ETA. Key success factors in Corridor program management included:

- Public/private Leadership Team including workforce and economic development, education and industry
- Project (CSA staff) liaisons facilitating communication among program management, project partners and related projects
- Project Leads Forum fostering integration across all projects
- All Partner Meetings encouraging greater cross-talk and leverage
- Common reporting templates
- Use of webinars to reduce costs
- Constant fostering of cross-sector, public-private activities and relationship-building across jurisdictional, geographical, functional and domain lines

Four task forces established in early stages launched cooperative efforts across the partnership: Data, Policy/Issue Identification, Media/External Communications, Resource Development.

Development of an online presence for the partnership and its achievements (InnovateCalifornia.net) ensured continuity and fostered sustainability.

Leveraged Resources

In fall of 2009, CSA was requested by the State to query partners as to leveraged amounts they could report in support of their Corridor WIRED contracts. CSA received a 73% response rate to its request for information related to leveraged resources using the ETA guidance provided. This was considered to be quite good considering nearly all partner contracts had ended November 30, 2008. On its financial quarterly report for October – December, 2009, CSA reported $2,355,469.96 in Federal leverage, $1,381,569.74 in Non-Federal leverage, for a total reported Corridor Leverage amount of $3,737,039.70. In addition to the Leverage reported, many partners indicated, but were not able to quantify for auditing purposes, thousands more of in-kind support to Corridor projects.

Sustainability

A key element of success in the CSA methodology was the early identification of “sustainability projects”. Six projects within the CIC WIRED Initiative were identified as having potentially more impact and longevity than the other 19 (see “Overview”, above)

These projects were seen as most likely to drive transformation in the three thematic areas, as well as within the three systems (workforce and economic development, education). Project Leads and All Partner meetings consistently featured findings of
these projects, with the intention being to expand Sustainability Project findings and insights throughout the Initiative.

Sustainability was also a frequent feature of Project Leads and Partner Meetings, with many new partnerships and strategic relationships developed. Partner capabilities and competencies were inventoried and uploaded to InnovateCalifornia.net to foster partnering even after the Initiative.

Phase II actually called out sustainability efforts in specific sustainability projects.

In addition to the replicable models listed above, sustainability of Corridor efforts throughout the nation was facilitated by numerous Corridor presentations at DOL Academies, where CSA shared Corridor strategies and lessons learned on:

- Developing statements of work
- Developing project metrics
- Enhancing STEM education
- Engaging industry
- Driving sustainability

CSA was also asked to present at two Workforce Innovation Conferences (2007 and 2008), sharing its WIRED program management experience. The greatest sustainability successes, however, grew out of the natural evolution of partnerships and institutionalization of WIRED principles. Examples include:

- WIB Learning Collaboratory support in transitioning WIBs to a demand-driven system has led to WIBs now using the WIB Toolkit and the five roles of WIBs in strategic planning
- Collaborative WIB/ED research on employer needs, leveraging Labor Market Information data as done in the 21st Century Workforce Profiles and Workforce Needs Analysis projects, is now standard practice in some areas
- California Innovation Corridor (Asset Mapping) Portal has been designated by the State as its new iHub repository
- The Innovation Driven Economic Development Model has been implemented in two Los Angeles County aerospace sub-regions, with their cluster and strategy work likely to have a decade of impact
- The CIC STEM Inventory is likely to be linked with a similar national Time-Warner effort, as well as being adopted by the Orange County Engineering Council representing over 40 Affiliated Professional Societies in Orange County
- Corridor partners believe it was the STEM Collaborative Action Plan that perhaps inspired the State Office of Education to start a STEM Task Force
- Online supplier assessment and Supply Chain Management Course will continue as a supplier resource
- IC.net provides a platform for retrieval of CIC models
- STEM Collaborative Action Plan served as foundation for a Gates/Bechtel grant establishing the California STEM Innovation Network

California Space Authority is proud of all the many projects, initiatives and programs that will continue and potentially expand as a result of the seeds planted with the California Innovation Corridor Initiative.
California Innovation Corridor WIRED Initiative: Methodology, Program Management, Leverage, and Sustainability

Methodology

In the California Innovation Corridor WIRED Initiative developed by the California Space Authority and submitted by the Governor’s Office of the State of California to the U.S. Department of Labor/Employment Training Association, there were initially 25 projects within three separate, but complementary tracks of activity. These thematic tracks included “Innovation Support”, “Industrial Rejuvenation” and “Talent Development”. Upon the DOL award, it became clear to the California Space Authority that it would be necessary to develop a program management methodology that would ensure integration of the 25 separate projects in both understanding and implementation. The first order of business was to recruit a Leadership Team representative of key CIC partners, and State and DOL stakeholders. Sustainability Project (see below) Leads represented Corridor project partners; key workforce and economic development State officials represented State stakeholders. DOL was represented by the DOL/ETA WIRED region liaison. Then, in order to better articulate the linkage and complementary nature of the 25 discrete Corridor projects, CSA developed a draft “Project Integration Protocol” (PIP), which was refined by the Corridor Leadership Team prior to the drafting of the partner scopes of work (see CIC WIRED Project Integration Protocol (PIP) with Scope of Work within PIP document below):

Project Integration Protocol (PIP)

California Innovation Corridor

Workforce Innovation in Regional Economic Development (WIRED) Initiative

“Innovation will be the single most important factor in determining America’s success through the 21st century”.

Council on Competitiveness, “Innovate America”, 2005

Overarching Goal/Intention of the CIC WIRED Initiative

Optimize the entire Corridor for innovation and 21st Century workforce competitiveness.¹

Transformation Vision:
Integration of education, workforce and economic development systems and innovation strategies in a regional (California Innovation Corridor) framework

¹ Regional adaptation of national intention, from “America’s Task”, page 7 of Innovate America
Transformation will be institutional, organizational, and behavioral and will addresses resource alignment, barriers and unintended consequences.

Characteristics of the integrated transformation will be:

- Purposeful innovation and innovation support
- Regional continuity
- Business-driven approach, business engagement
- Anticipation of market trends
- Enhancement of relationships and interfaces that
  - Define a common language
  - Set a vocabulary for innovation
- Relevant data knowledge collection and dissemination

**Introduction to CIC WIRED Initiative Project Integration**

The WIRED Initiative serves as a catalyst to accelerate momentum of a decade of transformation in what is now known as the California Innovation Corridor. Information technologies, biotech, nanotechnology, space technology and advanced manufacturing have all contributed to this transformational environment.

The driving inspiration behind the projects outlined in the California Innovation Corridor (CIC) WIRED Initiative was threefold: industry and stakeholder inputs to the 2004 California Space Enterprise Strategic Plan; the National Innovation Initiative as articulated in *Innovate America*, a 2005 call to action by the Council on Competitiveness; and the principles and recommendations outlined in *Rising Above the Gathering Storm*, a 2005 Congressionally-commissioned study by The National Academies. Other relevant studies, materials, inputs were also considered in designing the final portfolio of Initiative projects.

In the California Innovation Corridor proposal, three strategic goals were identified – some more focused on economic development with a workforce element, some workforce with an economic development element, some educational with both a workforce and economic development aspect. The strategic goals were related to: Innovation Support, Industrial Rejuvenation and Talent Development. These three goals or “centers of gravity” are all characterized by the transformational integration of workforce and economic development and education.
CIC WIRED “Centers of Gravity”

- Innovation Support – “Create new companies and high-skill, high-wage jobs by designing a replicable and sustainable “innovation support architecture” to increase innovation and entrepreneurship” – CIC WIRED Proposal

 Strategic Transformational Goal (1.0):
 Create an atmosphere in which the culture, environment and systems are characterized and driven by robust innovation and flourishing entrepreneurship.

 Current State:
 Ad hoc innovation and entrepreneurship

 Desired State:
 Purposeful support for innovation and entrepreneurship, where an innovation-driven ecosystem aligns resources, enhances knowledge, accelerates linkages and integrates programs and support across domains and jurisdictions throughout the Innovation Corridor.

 Projects in 1.0 (See p. 102)
 o Innovation Driven Economic Development Model (1.1)
 o 21st Century Worker Profiles (1.2)
 o Innovation Asset Mapping Inventory (1.3)
 o Innovation-Based Entrepreneurial Ventures (1.4)
 o Joint University Innovation Model (1.5)
 o Enabling Student Payloads on U.S. Launches (1.6)
 o WIB Innovation Resource Toolkit (1.7)

- Industrial Rejuvenation – “Improve the international competitiveness of the region’s supply chain by developing and executing a “Smart Supplier Strategy” that supports manufacturers, small businesses and entrepreneurs in adapting to the global manufacturing transformation” – CIC WIRED Proposal

 Strategic Transformational Goal (2.0):
 Ensure common “smart supplier”, competitiveness and enterprise-driven outcomes across supply chain training provider/support network.

 Current State:
 Lack of continuity in program/service outcomes across Corridor’s supplier provider/support system

 Desired State:
 Continuity of program/service outcomes across Corridor’s supplier provider/support system

1Outcomes for transformational goals will be relational, transactional, or both
Projects in 2.0 (See p. 142)
  o Smart Supplier Initiative (2.1/2.2)
  o Outreach Plan to Supplier Contacts (2.3)
  o Manufacturing Technician Training/Certification Program (2.4)

- Talent Development – “Accelerate development of a highly skilled 21st Century talent pool by creating pilot projects and activities capable of supporting a continuum of math, science and engineering education (K-U), and lifelong learning relevant to the 21st Century worker.” – CIC WIRED Proposal

Strategic Transformational Goal (3.0):
Integrate consideration of current and future industry enterprise needs into workforce and educational planning and policymaking.

Current State:
Systems not aligned with “real world” needs, or pro-active in responding to global change; system/enterprise metrics not aligned, lack of continuity across systems

Desired State:
Responsive, flexible education/workforce systems which anticipate and respond to global market changes, workforce needs with continuity across systems

Projects in 3.0 (See page 226)
  o Workforce Needs Analysis (3.1)
  o Space Employer/University Consortium (3.2)
  o Space-Related University Programs (3.3)
  o Systems Engineering Orientation/Training (3.4)
  o STEM Collaborative Action Plan (3.5)
  o High-School Teacher Institutes (3.6)
  o Retraining of Dislocated Software Specialists (3.7)
  o Aerospace Community Development Program (3.8)
  o Troops to Teachers Program (3.9)
  o Stanford Mentoring Model (3.10)
  o Mechatronics Certification Program/HS Outreach (3.11)
  o Science Educator Conferences (3.12)
  o Space Education Center Website (3.13)
  o WIB Learning Collaboratory (3.14)
**CIC WIRED Transformation Sustainment**

Transformation fostered through the CIC WIRED grant award will be driven and sustained through the execution of six key “**Sustainability Projects**”. Each Sustainability Project, while subordinate to one of the strategic transformational goals above, also links to projects/outcomes in other strategic transformational goals, thereby providing continuity and sustainable change across the WIRED grant activity:

- Innovation Driven Economic Development Model (1.1)
- Innovation Asset Mapping Inventory (1.3)
- WIB Toolkit (1.7)
- Supply Chain Competitiveness/Smart Supplier Initiative (2.2)
- STEM Collaborative Action Plan (3.5)
- WIB Learning Collaboratory (3.14)

**CIC WIRED Project Integration Protocol (PIP) with Scope of Work**

The Project Integration Protocol (PIP) was meant to serve as a background and California Innovation Corridor WIRED grant “big picture” orientation for development and execution of the CIC WIRED partners’ scopes of work.

Each of the 25 project teams within the CIC WIRED grant was asked to articulate a “project goal” to align with the Strategic Transformational Goal under which the project lay.

Each partner organization was asked to articulate and implement specific objectives aligned with the project goal for which it serves as a project team member. (Some CIC WIRED partners are on more than one project team).

To support the development and implementation of the scopes of work of CSA’s WIRED partners, the partner role is shown in context in the illustration in Figure 1 below.

Projects in Phase II of the CIC WIRED Initiative were led by CSA staff and included the following, which performed follow-on or value-added activity to Phase I efforts:

- Demonstration of *Innovation-Driven Economic Development Model* (focused on the aerospace sectors of two geographically distinct regions – implementation of Project 1.1)
- Innovation Asset Mapping Inventory Expansion (enhancement of Project 1.3)
- Talent Development/Innovation Webinars (follow-on to Project 1.5)
- University and Student Payload Demonstration Project (enhancement to Project 1.6)
- Smart Supplier Transformation Initiative (enhancement to Project 2.2)
- Launch-Related Industry Mentoring with Demonstration of Virtual Classroom Tool (follow-on to Project 3.3)
- STEM Collaborative Action Plan Implementation (enhancements to Project 3.5)
- Aerospace Community Development Strategy (enhancement to Project 3.8)
- Enhancement of California Space Education Center Website (follow-on to Project 3.13)
- WIB Learning Collaboratory (Bridging the gap between industry human resources and WIB professionals – enhancement to Project 3.14)
- Sustainability/Expansion of InnovateCalifornia.net (Corridor Program Management enhancement)
- Ongoing Sustainability in Support of California Innovation Corridor WIRED Initiative (Corridor Program Management enhancement)

**CIC WIRED PROGRAM**

**TRANSFORMATIONAL INTENTION:**
Optimize the Corridor for Innovation

### Strategic Goals

1.0 Innovation Support

2.0 Industrial Rejuvenation

3.0 Talent Development

**SUSTAINABILITY PROJECTS**

**PARTNER OBJECTIVE(S)**
Tasks/Activities

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Figure 1 Corridor Goals and Project Alignment

*Sustainability Projects are those projects that support both a strategic transformational goal and also the greater CIC WIRED grant effort as a whole. Sustainability projects include: 1.1 (Economic Development Model), 1.3 (Innovation Asset Inventory), 1.7 (WIB Toolkit), 2.2 (Supply Chain Competitiveness/Smart Supplier Initiative), 3.5 (STEM Collaborative Action Plan), 3.14 (Learning Collaboratory)

Note: Some of the above project names evolved throughout the performance period and may appear throughout this report in slightly different forms. Projects applicable to more than one strategic goal may be reported on in more than one section of this report.*
**Program Management**

Besides formation of a Corridor Leadership Team and integrating each partner’s scope of work with the Protocol above, the California Space Authority, as program management lead, established a CSA *staff liaison* for each project. The job of the liaison was to ensure that each project partner’s role was well understood and implemented, to facilitate information exchange among the project partners, to provide guidance for the Project Lead’s participation on the Project Leads Forum (see below), and to serve as a resource for project implementation, reporting and invoicing. CSA’s Corridor Program Manager held a monthly meeting with all staff liaisons to address collective issues, collaboration and leveraging of effort. In between, individual meetings or telecons were held with staff liaisons as needed by either the Program Manager or the liaison. *This design was designated a “best practice” by the ETA evaluation team in the June 2008 evaluation review.*

Additionally, a “Project Leads Forum”, comprised of each project’s lead partner was formed. This group became the coordinating link fostering information exchange across projects and integration of regular projects with sustainability projects (see below), as well as integration of projects with the over-riding WIRED region intention to “Optimize the Corridor for innovation and 21st Century workforce competitiveness”. In addition to the strategies mentioned above, CSA convened regular “All Partner Meetings” in which presentations, challenges, new information, project findings and opportunities were addressed. The Project Leads Forum would be convened prior to the Partner meetings, either as an in-person meeting or as a webinar, with all-project issues being aired for consideration in developing the draft Partner Meeting agendas. Project Leads were generally asked to provide updates of their projects as part of the Forum meetings, to give other Leads a chance to share interfaces that could be articulated at the All Partner Meetings. In retrospect, greater emphasis on interactive sessions with less project “report outs” would have generated greater cross-pollination of project work and more thoughtful consideration of collective goals. But the All Partner Meetings served to foster both continuity and networking as the Corridor projects progressed.

An online presence for the Corridor effort was created to assist partners, Corridor stakeholders and the general public in understanding the various projects and over-riding goals of the California Innovation Corridor WIRED Initiative. Established at [www.InnovateCalifornia.net](http://www.InnovateCalifornia.net), this electronic overview of the Corridor effort included a description of the three thematic strategic goal areas, the projects within them, partner profiles for those involved, and the activities carried out. Ultimately, the website carried deliverables of the Corridor projects. A user-friendly tool to researching the Corridor Initiative status, history or activity, “IC.net” was searchable by project, by strategic pathway, by partner, or by deliverable.
Finally, reporting for quarterly submissions as well as Project Leads Forums and All Partner Meetings was standardized, with partners given templates through which to submit their reports. Templates requested input not only on activities, but on integration with other projects and on progress in meeting both the project and pathway goals established under the Project Integration Protocol above.

The program management model developed by CSA was a great success and is recommended for replication by any large-scale effort comprised of numerous “moving parts” and dozens of partners dispersed over a large geographical area. The benefits of the CSA methodology developed in cooperation with the Leadership Team for the Corridor Initiative were as follows:

- The Leadership Team provided guidance from both public (State and Federal) and private sectors, as well as from the perspectives of economic development, workforce, education, and private enterprise on design and implementation of key Initiative strategies
- The project liaisons facilitated communication between program management representatives and partners, among project partners and across project teams
- The Project Leads Forum provided a means of identifying key findings contributing to the overall objectives of the Corridor Initiative, fostered project-to-project interface, and created an important set of social networking nodes across which Corridor Initiative dialogue could travel.
- The All-Partner Meetings fostered even greater cross-talk and interface across projects and partners, helping to build a set of common assumptions about the Corridor, the new global economy and what it takes to compete within it.
- The common reporting templates designed for quarterly and final reports as well as Project Leads Forum and All Partner Meetings allowed for much easier integration of inputs.
- The use of webinars as a means of cost-savings and ensuring greater partner participation for important meetings proved also a means of introducing some organizations to online technologies useful for their own network dialogues with internal and external customers.
- The constant fostering of cross-sector, public-private activities and partner relationships across jurisdictional, geographical, functional, and domain lines – in both administrative and project-related work – supported communication, leveraging and idea-sharing across boundaries, enabling through the process the trust-building and effective partnering that only comes with time and energy invested collaboratively behind a mutually important project or goal.

In addition to the Project Leads Forum, CSA, after consultation with some Leadership Team members, in September 2006 issued a memo to the Corridor Leadership Team that it was establishing four task forces to support the WIRED grant implementation process:
- **Data Task Force** (Jamie Foster, CSA COO, Lead) Responsible for coordinating the Corridor’s interface with the Workforce Innovation and Technical Solution (WITs) tool, in conjunction with project asset mapping efforts.

- **Policy/Issue Identification Task Force**: (Andrea Seastrand, CSA Executive Director, Lead, with CSA’s Janice Dunn, Deputy Director and Director of Federal Government Relations and Eric Daniels, Director of State and Local Government Relations, supporting) Responsible for interfacing with Corridor partners to identify issues and/or external obstacles affecting at least one WIRED project. Task Force was told to develop background on the issues with recommendations where appropriate.

- **Media/External Communications Task Force** (Chris Taranto, CSA Public Relations Director, first Lead, Will Simon, his replacement, second Lead) Responsible for crafting and conveying messages about WIRED, also will oversee collection and dissemination of success stories.

- **Resource Development Task Force** (Deborah Hirsch, Executive Director, California Space Education and Workforce Institute, first Lead, later Co-Leads were LeeAnn Hutchinson and Jeff Martin.) Responsible for researching, identifying, evaluating opportunities to leverage WIRED partnership work and pass on information regarding the same to the partnership.

The first two task forces were more active in the early stages of WIRED. Most of the policy issues were identified by the first year. The asset data mapping project was only a one year effort. Communications and WIRED outreach was a topic at several Partner Meetings, with InnovateCalifornia.net growing out of those discussions. The Resource Development Task Force also presented and facilitated discussion at All Partner Meetings, with one of the final Partner Meetings featuring an exercise using IC.net to find grant or funding partners.

One of the most significant benefits of the above program management methodology was that CSA “began with the end in mind”, allowing for continuity and building in sustainability and institutionalization of WIRED principles at the outset.

**Program Management Issues**

On November 30, 2007, CSA along with all WIRED regions, received an email dated November 19, 2007 from then- DOL Assistant Secretary Emily DeRocco providing guidance on new and retroactive policies related to STEM education activities for WIRED participants under 16 years of age. The guidance indicated that further instruction would be provided at a webinar on January 16, 2008. The California Labor and Workforce Development Agency, in concert with DOL, followed up with CSA in a conference call on January 23, 2008 regarding which projects would be impacted. This necessitated CSA to advise all partners on 11 projects to cease all project activities until the appropriate justifications could be...
presented to DOL and continued project work was approved. Clarifying information was developed and provided for approval to DOL for four projects. Seven additional projects required CSA to justify the project activities and gain special approval from DOL for continuation with stipulated changes to the statements of work. This not only required an enormous amount of time and resources by CSA but also resulted in up to six months of lost project activity in the final year for multiple partners. In one instance a partner was no longer able to complete the work and the contract was terminated. In May 2008, approval for the last project was finally received. This not only negatively impacted CSA, but all of the partners and the work to be accomplished across the 11 impacted projects, resulting in a greater than anticipated reimbursement of partner funds to CSA at the end of Phase I, resulting in the need for development and approval of a strategy for use of these funds into a fourth grant year. This reallocation process also took over four months for approval and resulted in less than six months to finish the Phase II project work.

**Leveraged Resources**

At the start of the WIRED Initiative, reporting on In-Kind contributions or Leverage was encouraged, but not required. WIRED regions were first told that Leverage reported would not be subject to audit. The issue of leveraged resources first surfaced as an issue as a part of the second DOL/ETA monitoring review process in June 2008. The report was issued on July 28, 2008 with continuous discussions between the CA EDD and the ETA continuing thought November 2009. At that point, ETA lead Carol Padovan strongly advised CSA to take whatever steps were necessary to resolve the outstanding issue of leveraged resources using the guidance provided by ETA to the CA EDD. At that time, CSA was requested by the State to query partners as to leveraged amounts they could report in support of their Corridor WIRED contracts. Following multiple requests, CSA received a 73% response rate to their requests for information related to leveraged resources using the ETA guidance provided. This was considered to be quite good considering nearly all partner contracts had ended November 30, 2008. On its financial quarterly report for October – December, 2009, CSA reported $2,355,469.96 in Federal leverage, $1,381,569.74 in Non-Federal leverage, for a total reported Corridor Leverage amount of $3,737,039.70. In addition to the Leverage reported, many partners indicated, but were not able to quantify for auditing purposes, thousands more of in-kind support to Corridor projects.

**Sustainability**

A key element of success in the CSA methodology was the early identification of “sustainability projects”. Six projects within the CIC WIRED initiative were identified potentially having more impact and longevity than the other 19 (see PIP above: **CIC WIRED Transformation Sustainment**). These projects were recognized as those most likely to drive transformation in the three thematic
areas, as well as within the three systems (workforce and economic development, education). Much of the work in Phase I of the Project Leads Forum and the All Partner Meetings was intended to drive home to partners the purpose and findings of these sustainability projects.

The CSA thinking was that, the more partners who were convinced of the relevance of the sustainability project findings, the more those findings would find their way into the institutions and best practices of Corridor stakeholders, thus ensuring sustainability even without targeted funding for such.

The Corridor Initiative also supported sustainability through the fostering of new thinking and new relationships between and among partners. Sustainability was a frequent topic on All Partner Meeting agendas, with Partners suggesting in one session that their competencies and capabilities be inventoried and displayed on IC.net so partners could do self-matches when looking for grant or initiative partners in the future. This was done at the end of Phase I.

Phase II actually called out sustainability efforts by including the “Sustainability/Expansion of InnovateCalifornia.net (IC.net)” and “Ongoing Sustainability…” as Phase II projects.

To fulfill the purposes of the above-mentioned sustainability projects, CSA continued uploading project deliverables to IC.net, fostering review and replication of innovation blueprints, models and guidelines created, as well as conducting a variety of activities related to sustainability:

- Identification and research of numerous NSF grants aligning with Corridor projects
- Purchase of access to and use of a foundation directory to use as a resource in researching foundation missions and priorities in possible alignment with follow-on efforts to WIRED projects
- Tracking of opportunities through various grant directories
- CSA retreat regarding sustainability opportunities to research, create strategies around the WIRED initiatives and products.

While the Corridor Initiative was frequently referred to as the most complex of the WIRED Initiatives, it was also frequently applauded as having successfully achieved both the content and program management objectives initially intended.

On numerous occasions, the Corridor design, template or model for a program management activity was used or adapted by DOL for consideration by other WIRED regions. This also supported sustainability across the WIRED regions. Several CSA program management efforts were featured at the DOL WIRED Academies:
- CSA participated in an ETA panel on the development of statements of work
- CSA participated in an ETA panel on how to engage industry in WIRED
- Joint ETA/State of California/CSA panel on project metrics
- CSA participated on an ETA panel presentation on STEM
- CSA panel presentation on an ETA panel on sustainability

CSA and CSEWI staff were also requested to present at two Workforce Innovation Conferences in 2007 and 2008, a Driving Transformation Conference for WIBs, EDOs and State LMID entities in 2008, and the at the Recovery and Re-employment Research Conference in September 2009.

Perhaps the greatest successes in Sustainability, however, grew out of the natural evolution of partnerships or institutionalization of WIRED principles developed in Phase I of the Corridor Initiative. Great examples include:

- As a result of the WIB Learning Collaboratory effort to help WIBs transition to a demand-driven system, many WIBs are now using the WIB Toolkit and the five roles of the WIBs in their strategic planning; the collaboration between WIBs and community colleges encouraged in the WIB Learning Collaboratory white paper is now taking place on the ground, in some areas where such collaboration did not previously exist
- The collaborative researching of regional employer needs by WIBs and economic development entities together, accomplished in projects like 1.2 and 3.1 using LMID data provided by the State, is now becoming a standard practice in some areas
- The California Innovation Corridor (Asset Mapping Inventory) Portal has been designated by the State as its new iHub repository
- The Innovation Driven Economic Development Model created in Project 1.1, which aligns with the CA Economic Strategy Panel's Industry Cluster sector strategy, has been implemented in two Los Angeles County regions, with their cluster and strategy work likely to have a decade of impact
- The CIC STEM Inventory is likely to be linked with a national STEM inventory being funded by Time-Warner. Efforts are also under way to integrate it with the Orange County Engineering Council (OCEC), which represents over 40 Affiliated Professional Societies in Orange County
- Corridor partners believe that it was the STEM Collaborative Action Plan that inspired the State office of education to start a STEM Task Force. The Plan was also the inspiration for a statewide public/private STEM network being supported by the Gates and Bechtel foundations
- On-line Smart Supplier Capabilities Assessment and Supply Chain Management Course will continue to be available for public use on IC.Net
- IC.Net will continue to be a resource compilation of all CIC WIRED deliverables and products
- The Aerospace Community of Practice will continue with anticipated broader involvement to share best practices and be utilized by the Aerospace Revitalization Task Force and a vetting entity for proposed products and policies.

Numerous sustainability strategies were outlined for various projects in Phase II, but the two stand-out examples include:

- A proposed “Global Smart Supplier Initiative” outlining how CSA might build on the fine work done in Project 2.2
- *Jump Starting a California Manufacturing Sector Strategy through Leveraging of California Innovation Corridor-Developed Tools, A Concept Paper for California Innovation Corridor Sustainability*

Presented to the California Labor and Workforce Development Agency at the end of 2009, the concept paper outlines a sector-strategy effort focused on manufacturing that could incorporate numerous industry sectors, building on the Corridor work of those projects focused on regional collaboration, supplier competitiveness and asset mapping, all being those projects also designated in the original Corridor project planning as Sustainability Projects.

Again, by “beginning with the end in mind”, CSA was able to assure that the good work of the many partners lives on in the Corridor and beyond.
High-Wage Job Creation through Innovation Support

According to the Obama Administration, approximately 70% of U.S. jobs are attributable to small businesses. State resources show that 95% of California firms quality as small business, based on the Small Business Administration’s definition of less than 500 employees. Hence, small business is important to the U.S. and California economies. Yet the most relevant part of the story for those wishing to create and/or retain the greatest number of jobs is that all small businesses are NOT equal in terms of job generation. One of the California Innovation Corridor projects under the “Innovation Support” Initiative was to identify an economic impact model and resulting data that would inform economic developers and workforce professionals about the importance of supporting and growing jobs in innovative industries as a means of job creation/retention in a regional economy. With the support of the Southern California Edison company, which developed the Southern California Edison Economic Impact Model\(^1\), the following tables from Corridor WIRED Project 1.4 (see p. 108) show why:

**Personnel Placement - Multipliers/Effort: Small Hotel (Retail/Service) vs Small Aerospace Company (Innovation/Technology)**

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Average Salary Small Hotel</th>
<th>Average Salary Small Aerospace Co</th>
<th>Impact Sm Hotel Multiplier</th>
<th>Impact Sm Aero Multiplier</th>
<th>Hiring Impact Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>$33,400</td>
<td>$103,450</td>
<td>$45,090</td>
<td>$305,177</td>
<td>6.8</td>
</tr>
<tr>
<td>Indirect</td>
<td>$47,000</td>
<td>$68,529</td>
<td>$63,450</td>
<td>$202,160</td>
<td>3.2</td>
</tr>
<tr>
<td>Induced</td>
<td>$43,800</td>
<td>$41,818</td>
<td>$59,130</td>
<td>$123,363</td>
<td>2.1</td>
</tr>
<tr>
<td>Multiplier Total</td>
<td>1.35</td>
<td>2.95</td>
<td>$167,670</td>
<td>$630,701</td>
<td>3.8</td>
</tr>
</tbody>
</table>

The Project 1.4 analysis showed that worker income in a small innovation manufacturing company was more than three times that of those working in a small service sector hotel (see above), that the job impact and economic impact of the innovation company were four times greater than those of the hotel (see below). **By focusing job creation efforts on innovation, the U.S. can produce more family-wage jobs resulting in a better quality of life for more workers.**

The importance of technology and innovation to the U.S. cannot be over-estimated. It has been reported that “Scientific innovation has produced roughly half of all U.S. economic growth in the last 50 years.”\(^2\)

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\(^1\) Sometimes in the Corridor Initiative called “The Pollack Model”

\(^2\) National Science Foundation, 2004
The quality of life that has drawn immigrants from around the world has traditionally been attributed to the U.S. innovation/technology edge. But, as Corridor partners engaged in the Innovation Support Initiative recognized, the U.S. is no longer the only player on the world technology/innovation stage. We are all now engaged in a global innovation race to discover and exploit the new technologies that will guarantee competitiveness in the 21st Century. In Part I of The Innovation Driven Economic Development Model (Model) produced for the Bay Area Council Economic Institute, a Corridor WIRED partner (see Project 1.1, p. 102), the Collaborative Economics authors emphasize the changing nature of globalization, quoting Dr. William F. Miller, Stanford University, who has articulated a “new world business paradigm” that began emerging at the end of the 20th Century.

“OLD GLOBALISM based on the search for low factor costs where international businesses invested in regions with low-cost land and labor to serve as export platforms to produce high-volume commodity products

NEW GLOBALISM based on the search for the best locations to host high-value, specialized, and innovation-related activities where businesses invest in regions to gain access to specialized workforces, research and development and commercialization capacity, innovation networks, and unique business infrastructure.”

The impact of this “new globalism” on American jobs is significant, as the Model points out quoting a 2003 statement by Intel CEO Craig Barrett:

“The United States now has to compete for every job going forward. That has not been on the table before. It has been assumed we had a lock on white-collar jobs and high-tech jobs. This is no longer the case.”
Also cited in the Model: “other regions, from Beijing to Bangalore, are rapidly increasing their capabilities to perform value-added activities and compete in the global market place.”

Corridor WIRED Project 1.7 (see p. 264) developed by a team including the California Council on Science and Technology (CCST) and the California Workforce Association (CWA) with the support of the California Space Education and Workforce Institute (Institute), also had important findings about globalization.

In the “Background” section of its Racing for the Future web-based toolkit (WIB Toolkit) for Workforce Investment Boards and workforce stakeholders, team members cite a Standard and Poor’s study anticipating that 500 companies from its benchmark index were expected to have more than half of their 2007 sales in foreign countries.

An even more staggering statistic articulated in the WIB Toolkit is that

“By 2050, 65% of the global market will be dominated by emerging economies”:

In the new global economy, where ideas and innovation drive competitiveness, the traditional infrastructure of more mature economies such as that of the U.S. is less important, allowing new players to compete more easily (see table below, p. 5 of the Innovation-Driven Economic Development Model):

**IDEAS DRIVE ECONOMIC GROWTH**

<table>
<thead>
<tr>
<th>RAW MATERIALS</th>
<th>INDUSTRIAL ECONOMY</th>
<th>IDEA ECONOMY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Natural Resources, Labor,</td>
<td>Ideas</td>
</tr>
<tr>
<td></td>
<td>Capital</td>
<td></td>
</tr>
<tr>
<td>CUSTOMER FOCUS</td>
<td>Mass Production</td>
<td>Mass customization</td>
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<td></td>
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<td>based on information</td>
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<td>technology and</td>
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<td></td>
<td></td>
<td>product design</td>
</tr>
<tr>
<td>ORGANIZATION</td>
<td>Large Corporations, Economies on Scale</td>
<td>Entrepreneurs, Small Scale, Free Agents, Networks</td>
</tr>
<tr>
<td>SUCCESS FACTOR</td>
<td>Labor, Quantity, Low Cost</td>
<td>Talent Speed, Innovation</td>
</tr>
<tr>
<td></td>
<td>Stability, Control</td>
<td>Flexibility, Customization</td>
</tr>
</tbody>
</table>

The Model sums it up this way:
“What is emerging is a global innovation economy that both opens up new opportunities for prosperity and raises the stakes for participation. As some regions of China and India will attest, this kind of globalization is bringing a burst of prosperity to regions that can add value to the innovation process. It is also creating both growth and disruption in regions in advanced economies like the United States – rewarding those that are strong innovators and causing hardship in regions that are, for a variety of reasons, more bystanders than contributors to global innovation.”

The ability to compete on ideas and innovation rather than low-cost labor and established infrastructure is creating high-consumption middle classes around the world, as described in the online WIB Toolkit “Background”:

“China’s middle class is already about twice the size of Canada’s entire population. They will become global trendsetters and are expected to buy, for example, 4.5 million cars by 2010. India’s and Latin America’s middle classes are growing rapidly, too. India’s middle class is expected to represent 50% of its population by 2025.”

To keep this fact front and center in the minds of partners, CSA introduced its Project Integration Protocol (see above page 62) with the following quote:

“Innovation will be the single most important factor in determining America’s success through the 21st century”. 
Council on Competitiveness, “Innovate America”, 2005

The focus of the Innovation Support Initiative projects (see descriptions of Innovation Support Projects 1.1-1.7 beginning on p. 102) was to explore California/Corridor innovation and entrepreneurship and recommend ways to expand it. That began with a partner exploration of both the nature of innovation and today’s global innovation landscape.

**The Nature of Innovation and Its Success Factors**

Several of the Innovation Support projects contributed to an understanding of the nature of innovation and the success factors driving it within the global landscape.

Under Project 1.1, which was assigned the task of creating an economic development model to support innovation, one of the first steps of the Bay Area Economic Institute (BAEI, formerly the Bay Area Economic Forum)/Bay Area Science and Innovation Consortium (BASIC) was to coordinate the Bay Area Innovation Network Roundtable which was designed to foster a dialogue among legendary and emerging Bay Area innovators and innovation stakeholders about the “drivers” of innovation. Chaired by the Hewlett Packard Vice President of
Worldwide University Relations, with the support of BASIC’s board chairman, the executive director of QB3, the California Institute for Quantitative Biosciences and the BASIC board of directors, the Roundtable served as a full day inquiry culminating in a report entitled: *Bay Area Innovation Network Roundtable, Identifying Emerging Patterns of the Next Wave of Innovation* (see Deliverables, [www.InnovateCalifornia.net](http://www.InnovateCalifornia.net)).

A key acknowledgement of the symposium was that the current Bay Area technology innovation, while “alive and well”, was taking a different form than that which spawned the dot-com boom. “Emerging Patterns” of the next wave of innovation (see [InnovateCalifornia.net](http://www.InnovateCalifornia.net) – Deliverables: *Bay Area Innovation Network Roundtable*, page 19) were identified by BASIC after presentations in the “Living Studies” segment of the program.

Defining innovation itself proved challenging for several projects, although a worthwhile effort at both the project level and the overall broader partner interface level.

The Project 1.1 participation of the California Science and Technology Council (CCST) identified a definition for innovation as part of its *Overview of California State-Funded R&D, 2004-2007: Understanding the State’s Role in Shaping R&D Spending*, (see [InnovateCalifornia.net](http://www.InnovateCalifornia.net)). In citing the definition of innovation put forth by the Alliance for Science and Technology Research in America (ASTRA) for the U.S. Department of Commerce in 2007, CCST states that *innovation is “a process by which value is created for customers through public and private organizations that transform new knowledge and technologies into profitable products and services for national and global markets”.*
The Corridor’s Innovative Asset Mapping Inventory Project (see p. 88), sought to leverage regional innovation-oriented public and private sector assets in the Corridor to create jobs, increase competitiveness and commercial innovation, enhance innovation and entrepreneurship, and increase economic growth. To do this, it became obvious that a consensus-based definition of “innovative” needed to be found. Rounds of emails and dialogue and submissions of candidate definitions both of partners and innovation “experts” resulted in the following definition being adopted for “the immediate purpose of this effort” (project):

“the term ‘innovative’ is intended to mean efforts to develop and expand technologies and capabilities to increase value to the end user”

The purpose of Project 1.5 was to foster a better understanding of innovation within academic institutions and determine how academic institutions could better prepare graduates to succeed in an innovation-driven environment. The Project’s findings regarding the latter will be discussed later in the Training and Education for 21st Century Innovation segment. The former, fostering a better understanding of innovation within academic institutions, was enabled through the use of two different models, one designed and implemented by University of California, Riverside (UCR), another by Stanford University (Stanford). Each contributed to an ultimate understanding, if not an absolute definition, of innovation.

In the Stanford University’s white paper - Creating Innovation: No Magic Formula – the Stanford partner first describes innovation as “a mystical process that is producing new things”. Later in the paper, referencing results of the Seminar - Webinar sessions it developed around innovation, it documents other definitions:

- **Plato**
  “Necessity…the mother of invention”
- **Professor Stan Weiss**
  “The introduction of something new; effecting a change”

The Stanford partner also identified two types of innovation. “Evolutionary” innovation represents incremental change; “revolutionary” innovation represents paradigm change.

The UCR project role was to develop an action research model to study innovation through student/faculty team visits to “innovative” Corridor companies. The evolution of the model resulted in a typical team being comprised of an engineering faculty member teamed with two engineering graduate students and one or two business school graduate students. In all, eighteen engineering faculty members and forty-two graduate students from Engineering and Business participated in some phase of the project, with twenty-three cross-disciplinary site visits conducted from March 2007 – June 2008 (see description of Project 1.5/UCR student work under Talent Development, page 193). Prior to the site visits to study innovation, UCR undertook the effort of creating a working
definition of the term “innovation”. In its literature review, UCR identified four definitions (see InnovateCalifornia.net/deliverables: Pilot Program for Professional and Graduate Student Internship to Explore Innovation and Entrepreneur Environment, page 5):

- **The National Council on Competitiveness**
  
  *Innovation is “the intersection of invention and insight, leading to the creation of social and economic value.”*

- **Andrew & Sirkin (2006)**
  
  *Innovation is “the entire process of developing ideas with the goal of achieving payback.”*

- **National Science Foundation Innovation & Discovery Workshop**
  
  “Creativity involves the introduction of new variables, significant leaps, and novel connections. A subset of creativity, innovation, involves the creation of a new idea but also involves its implementation, adoption and transfer. Innovation and discovery transform insight and technology into novel products, processes and services that create value for stakeholders and society. Innovations and discovery processes should be formal processes that harness creativity to those ends.”

- **Peter F. Drucker**
  
  *Innovation is “change that creates a new dimension of performance.”*

Working with the California Space Authority to validate the context within which a definition needed to be understood, UCR ultimately crafted its own working definition of innovation for the 1.5 project. UCR used this definition as a touchstone for its corporate site visits:

> “Innovation is the vortex of successful business where strategic capability, competence, process, and design converge to provide significant, measurable, long term value to validated stakeholders.”

Like the Project 1.1 partners, Bay Area Council Economic Institute (BACEI) sub-contractor Collaborative Economics explores the nature of innovation, claiming that **innovation is about “ideas and recipes”**. Referencing Stanford economist Paul Romer, the Model explains that in Romer’s “new growth theory”, “the ingredients (natural, human capital, capital resources) are not as important as the recipes (the ideas about how to put the ingredients together). The recipes are the product of the innovation process.” The Model goes on to quote the Pew Center and the National Governor’s Association which states that “*innovation is the recipe that is composed of four major ingredients*: expertise, interaction, diversity and application.

Expressing a view slightly different than the Stanford perspective above that states that innovation can be evolutionary (incremental) or revolutionary (paradigm-changing), the Model is emphatic:
Innovation seldom appears according to script and is often disruptive – creating an unpredictable impact. This reality makes nurturing the “habitat” for innovation that much more important than somehow trying to predict and pick “winners and losers” in the innovation race.

Supporting Regional Innovation

The first thrust of the Corridor WIRED initiative (Corridor WIRED projects 1.1 – 1.7) was “Innovation Support”. Its purpose, as outlined in the Corridor’s Project Integration Protocol was to:

*Create new companies and high-skill, high-wage jobs by designing a replicable and sustainable “innovation support architecture” to increase innovation and entrepreneurship*

Strategic Goal #1 from the same document reads:

*Create an atmosphere in which the culture, environment and systems are characterized and driven by robust innovation and flourishing entrepreneurship.*

The “Current State” was described as:

*Ad hoc innovation and entrepreneurship*

with the “Desired State” being:

*Purposeful support for innovation and entrepreneurship, where an innovation-driven ecosystem aligns resources, enhances knowledge, accelerates linkages and integrates programs and support across domains and jurisdictions throughout the Innovation Corridor.*

Under one Project 1.1 element, research was conducted by technical assistance provider New Economy Strategies on regional innovation globally, with the intent of “benchmarking” innovation support strategies through identification of global best practices, mapping them to California/Corridor innovation challenges and opportunities (see “Innovation Success Factors/Global Best Practices” below).

*Lightening Bolt Challenges: Obstacles and Opportunities Unearthed in the Global Benchmarking of Regional Innovation Capacity* was a report produced by WIRED consultant New Economy Strategies as foundational information for Project 1.1 partners (see page 103, Project 1.1) led by the Bay Area Council Economic Institute (BACEI - formerly the Bay Area Economic Forum).
Innovation Success Factors/Global Best Practices
Lightening Bolt Challenges: Obstacles and Opportunities
Unearthed in the Global Benchmarking of Regional Innovation Capacity

- **Economic development planning supported by innovation metrics**
  *Best Practice: John Adams Innovation Institute – Greater Boston* Editions of the annual “Index of the Massachusetts Innovation Economy” provide valuable innovation metrics for MA, CA, NY, other key innovation states (e.g. SBIR awards, Patents, Corp R&D expenditures, innovation cluster employment, etc.)

- **Robust adult/continuing education programs**
  *Best Practice: Dipoli – Finland* “Dipoli, the Lifelong Learning Institute of Helsinki University of Technology, is one of the premier continuing education institutes for engineering in Europe. It works with companies to provide specifically designed programs for training in engineering and management and may serve as a model for bridging the gap between formal academic programs and training within firms”

- **Promotion of a variety of advanced certification programs**
  *Best Practice: Technical Education in India* A National Skills Standards Act was passed in India in 1994 by the “All India Council for Technical Education, the central body responsible for India’s 1,346 engineering colleges, to facilitate development of voluntary skills and certification standards. India’s Department of Higher Education cites 357 Industrial Training Institutes with a capacity to serve 1.5M people in over 200 industries. Mid-level professionals requiring advanced applications training are served by 290 polytechnics nationwide.

- **Leveraging of public/private technology parks, infrastructure, collaboratories**
  *Best Practice: Singapore Science Park* A set of Singapore technology parks founded co-locating academic institutions and industrial facilities has created a particularly strong infrastructure for technology transfer. Singapore Science Park consists of three different parks with a “vast array of customized facilities created to support work in a variety of fields from medicine to media” and also contains Asia’s first R&D facility dedicated to telecommunications

- **Endorsement of a globally networked business model, leveraging global outsourcing to ensure its companies/workforce are more competitive**
  *Best Practice: Outsource Competitor/Partner – India* The country has defined itself as a hub for IT software and consulting services, employing its vast technically educated workforce in the service of growing India’s IT industry by means of leveraging its talents first on low transnational telecom cost work outsourced from other countries

- **Proactive Federal and State policies toward technology competitiveness**
  *Best Practices: Singapore and Korea* Despite its small size, Singapore recently devoted $5B USD on R&D, both public and private, in key industry sectors, acknowledging thereby the advancement of its innovation policy. Korea is moving towards a knowledge-based economy through its Vision 2025, setting a goal of achieving competitiveness with G-7 nations. Both Singapore and Korea have developed and are implementing aggressive innovation policy

- **Formalized innovation networks and organized dialogue: industry/academic/government**
  *Best Practice: Many of the above-mentioned players* “It was evident from our review of global best practices in innovation capacity that challenger nations have developed more formalized networks. Often these networks are government-led and have resulted in industries and firms that have benefited from strong alignment between government policies and firm success. This organized dialogue amongst industry, academia and government over policies for the successful development of innovation capacity has often resulted in success for all three sectors of society.”
The report culminated in seven innovation success factors being identified, with these factors articulated through recommendations for California/Corridor implementation. Each was supported by a best practice identified in the global innovation arena.

While results from this report were not included in the *Innovation Driven Economic Development Model*, the report provided a valuable early perspective on global innovation centers and the success factors which support them. As a stand-alone piece, the report is in significant alignment with the findings and recommendations of the Model.

Another element of Project 1.1 shedding light on the subject of innovation was the study referenced above conducted by the California Council on Science and Technology. *Overview of California State-Funded R&D, 2004-2007: Understanding the State's Role in Shaping R&D Spending* was meant to serve as an update of a CCST 1999 study of California R&D spending, assessing the “present status and long-term trends affecting California’s science and technology infrastructure”. It explores available data on the state’s R&D spending, R&D knowledge gaps in current data supplied by state and federal sources and recommendations for more comprehensive data gathering on California’s R&D spending.

As the report states, “R&D is a contributing factor to the innovation process, but only one component of the process.” As such, “Government R&D funding has the ability to impact scientific direction, support the innovation infrastructure of universities and research centers, and support pre-competitive collaboration on basic research outside the bounds of industry.” While 66% of R&D nationwide is performed by private industry, most basic (or pre-competitive) research (59%) is conducted by universities and federal research centers, with California boasting a wealth of these kinds of assets.

California receives significant federal funding for R&D. The CCST report cites, “federal R&D spending per capita in California is over 50% higher than the national average. According to the National Science Foundation (NSF) 2005-7 State S&E Profiles, in 2006 California ranked first in the nation for federal R&D obligations, receiving over $19 billion.” California’s average percentage of the total federal R&D allocation to academic institutions varies little, with 2006 seeing California receiving 13.6% of the national investment.

The CCST R&D study points out that states have become more engaged in R&D support, primarily to foster more innovation, as “innovation has become a focus of how states perceive high-tech competitiveness”. Because federal R&D funding in real terms, had declined for several consecutive years, and because industry funds “narrowly”, state support of R&D, both in policymaking and investment, has become more significant, allowing states to “spur innovations that serve
economic and social needs within their own borders” according to the National Governors’ Association and the Pew Center for the States.

State investment in R&D also attracts new dollars. In California, according to CCST, “every dollar spent by the state on R&D brings in up to two dollars from other sources”. While slipping per capita on R&D spending, now ranking “19th in the nation for academic R&D funding relative to its GDP”, California is still a national leader in state R&D funding. It enjoys over three and a half times the total R&D dollars of any other state.

California is also one of the 31 states nationally that has supported innovation with a research and development tax credit (RDC). First enacted in 1986, the state’s RDC was increased from 8% to 11% and the basic research credit was increased from 12% to 24% in 1996. According to the CCST study, over 60% of returns with RDC claims “were filed by businesses with gross revenues of under 1 million.” This emphasizes the importance of California’s small and medium-sized businesses to the state’s innovation capacity.

Unfortunately, in 2008, California R&D tax restrictions made as part of state budget negotiations, according to CCST, limits claims by up to 50% over the next two years. All the while, other states are recognizing the value of RDCs. CCST cites an Arizona push for expansion of its RDC, specifically mentioning its need to remain competitive with California credits.

At best, according to CCST, the state has only a “fragmented understanding” of the state’s overall R&D investment, due to the need to collect R&D data in a consistent and centralized manner. As the study points out, the state R&D investment has significant value to innovation, supporting research and development areas of special interest to the state, although perhaps outside federal or industry priorities. State R&D investment also “fosters collaboration and provides essential input into the innovation process”.

But without a comprehensive R&D statewide strategy, and without the means to gather and analyze critical state R&D funding data consistently, says CCST, it is impossible to understand the impact of state-funded R&D or the tax credits meant to encourage innovation. The CCST made a significant contribution to U.S. as well as California innovation through its interface during the development of this report. By discussing its approach and seeking information from the National Science Foundation (NSF), the CCST was able to point out areas where information gathering regarding R&D fell short, enlightening the NSF about the types of State needs existing for its data.

Some might ask “Why support innovation?” The answer to this question is contained in Part I of The Innovation Driven Economic Development Model, a signature product of the Corridor WIRED initiative.
It is addressed in a section entitled: “Without an Innovative Economy, Other Community Outcomes Are Difficult to Achieve”. Collaborative Economics, authors of the Model for the Bay Area Council Economic Institute, state:

“…it is not possible to sustain regional vitality and quality of life over the long term without an innovative economy...An innovative economy helps create the conditions for a healthy economy.”

The Model then quotes Benjamin M. Friedamin’s *The Moral Consequences of Economic Growth*:

“Economic growth – meaning a rising standard of living for the majority of citizens – more often than not fosters greater opportunity, tolerance of diversity, social mobility, commitment to fairness, and dedication to democracy.”

In the section which follows “Why Is Innovation Central to Rising Living Standards?”, the Model states:

“The key to prosperity is increasing productivity. Productivity growth is the basis for rising real wages for workers, increasing returns to shareholders, and increasing per capita income for a region and the nation. The basis for increasing productivity is innovation. In the long term, an advanced economy like that of the United States cannot compete by just lowering costs or increasing inputs. The only way to compete and raise our standard of living is to find new and better ways to use natural, human, and capital resources to increase productivity.”

**Why Support Innovation?**

“Without an Innovative Economy, Other Community Outcomes Are Difficult to Achieve”.
--- Innovation Driven Economic Development Model

“…it is not possible to sustain regional vitality and quality of life over the long term without an innovative economy...An innovative economy helps create the conditions for a healthy economy.”

“Economic growth – meaning a rising standard of living for the majority of citizens – more often than not fosters greater opportunity, tolerance of diversity, social mobility, commitment to fairness, and dedication to democracy.”
The Model cites research by both the McKinsey Global Institute and the Boston Consulting Group showing that innovation is critical to both productivity and economic growth.

In a key highlight of its discussion on “How Innovation Works in Today’s Economy and Communities”, the Model emphasizes the need for every region and industry to “become more innovative”, pointing out that “there is no such thing as ‘high tech or low tech’ industry anymore, only innovative and non-innovative.” For economic and community success, says the Model, “regions must understand the nature of innovation”.

According to the Model, the top global competitors and collaborators are not cities, states or countries, per se, but regions. Defined by economic assets, workforce capabilities and common infrastructure, regions like those in Bangalore in India, Shanghai or Guangzhou in China, or Silicon Valley or the Research Triangle in the U.S. represent “spikes” (Tom Friedman, Flat World) of innovation and high-tech mastery. With new innovative regions now sprouting all over the world, a global network of innovation regions exists. Savvy regions can support their innovation economies by partnering rather than competing with these global colleagues:

*The perceived zero-sum game between regions vying to out-compete each other can be transformed into the pursuit of integration for the purpose of mutual gain. While competing for talent, technology and capital, regions can also benefit from sharing these assets across national boundaries in order to grow the economy in each region. (2007 Index of Silicon Valley, pp. 5-6)*

In an expansive region-of-regions such as the California Innovation Corridor, this is perhaps the most significant piece of advice found to maximize California’s competitiveness: encourage economic development entities to cooperate on their strengths, compensate for their weaknesses, through cooperation with other innovative regions. The Model concludes the section on why regions are the key to the innovation challenge with this quote from the Report of the Strengthening America’s Communities Advisory Committee, July 2005:

*In the 21st Century, America’s communities will derive economic strength by acting regionally to compete globally. Innovation and entrepreneurship are the new engines of job creation, productivity, growth, economic prosperity and healthy communities.*

The Model states that we have entered the “open innovation era”, which is much different than the closed innovation era (see Figure 2).
The Model quotes Wayne Johnson of Hewlett Packard as emphasizing that we are now in an “Innovation 3.0” era, where innovation support can no longer be ad hoc and fragmented. Collaborative Economics contrasts the traditional economy, “where ideas were held tightly within institutions” with the new economy where “ideas flow more freely within networks. The unit of innovation has become the network, not simply the firm…networks organize the sharing and distribution of knowledge.” This ties to the importance of the Innovation Asset Mapping Inventory, which facilitates networking across California and/or the U.S.

![Figure 2 Model: Open/Closed Innovation Logic](source_url)

Citing a framework presented by Navi Radjou of Forrester Research at the Bay Area Innovation Network Roundtable (see above Emerging Waves of Innovation from that event), the Model introduces Radjou’s concept of the “global innovation networks model” as a best practice for innovation support. Characterizing this networks model are four types of collaborators: inventors, transformers, financiers and brokers. (see description, page 85)

Claiming that, even in the knowledge age “Innovation is Place-Based and Regional”, the Innovation Driven Economic Development Model cites a report called Investing in Innovation by the Pew Center published by the National Governors’ Association, which states that companies “jockeying for advantage” (innovation companies as opposed to those searching for just lower costs) look for places where ingredients for innovation reside (smart people, research sites, professional networks and the like).
The Model affirms that, “despite the strong and growing body of evidence about its importance, regional innovation is not at the core of many economic development strategies”, and the purpose of the Model is to change and facilitate that. Under “open innovation”, says the Model

> the role of economic development is to intervene at appropriate times to help firms achieve higher value and productivity by gaining access to appropriate innovation assets at each stage of the business development process – start-up, expansion, production and marketing.

Claiming that many economic development practitioners falsely operate under “the expectations and metrics of a cost-driven economic development model”, Collaborative Economics points out that “having more of something that does not improve your competitive prospects in the global economy can provide a false sense of progress and security.”

> The cost-driven model creates a set of incentives that actually undermine the innovation-driven model of economic development...Having more of something that does not improve your competitive prospects in the global economy

The Model outlines the “broker” role so important to innovation-driven economic development:

> …inventors, transformers and financiers are typically very focused on individual innovations, while brokers are more likely to be able to focus on the broader climate for innovation. Without a strong broker function, innovation can still happen, but likely in a more isolated, fragmented and fleeting ways.
Since the “Desired State” for creating an innovation ecosystem in the Corridor (see above page 61, citing from the Project Integration Protocol, page 60) involves “purposeful support” for innovation, the Model outlines six steps to do so (see box at right).

By giving economic development practitioners a “way forward” in approaching innovation support, the Innovation Driven Economic Development Model: A Practical Guide for the Regional Innovation Broker provides a replicable template for regions seeking economic vitality. As the Model points out:

**Success in economic development today is about increasing innovation to produce higher living standards for people and growing prosperity for communities.**

Following the detail on the six steps to innovation support listed above, the Model presents several regions already implementing innovation best practices (see Part III of the Innovation Driven Economic Development Model).

**A Sampling from the Innovation Driven Economic Development Model “Toolbox”**

To supplement the Model, a set of Innovation Driven Economic Development tools was identified to serve as a resource supporting the Model. Many of these tools were developed as part of the Corridor WIRED Initiative, either as other projects or other elements of Project 1.1.

Well aligned with the Model’s second step in supporting innovation through identification of a region’s current and potential innovation assets was Project 1.3 and an element of Project 1.1, both involving Innovation Asset Mapping Inventory housed on the California Connectory. Project 1.3 Phase I, led by BACEI/BASIC and the East County Economic Development Council/Connectory, and Phase II led by the California Space Authority, fostered enhancement of innovation support by facilitating a better understanding of the innovation assets resident in
the California Innovation Corridor (see Project 1.3 reference under Nature of Innovation above).

As the Model states, "Regional capabilities matter – especially to companies that are innovation-based". Project 1.3 activities included engaging various economic development (see below, Project 1.3) in obtaining the innovative asset information related to the capabilities of assets in their Corridor sub-regions. As stated in its final report, Project 1.3 partners, by contributing innovation information to the existing California Connectory platform, “not only helped to create a self-organizing environment where cross-pollination and leveraging of resources is encouraged, but, through the asset mapping process, also became increasingly knowledgeable about the innovative assets of their regions”, enabling their ability to leverage capabilities for economic growth and job creation.

California has a wealth of innovative assets not always well understood. The California Innovation Corridor (CIC) portal on Connectory.com is a tool to enhance Corridor supplier competitiveness by linking suppliers, primes, and government to innovation and supplier partners. Project 1.3 was designed to support the goal of leveraging innovation assets to create jobs and foster economic vitality “by developing an inventory of key innovative assets in the Corridor and designing a tool to readily access and maintain the asset capability information.” It was believed by Project 1.3 lead CSA and its key 1.3 partner, the (San Diego) East County Economic Development Council (ECEDC) that “the identification, characterization and consolidation of the innovation assets and capabilities within the Corridor” would help develop and sustain an innovation atmosphere and culture of entrepreneurship.

In Project 1.3, the CIC Innovation Asset Mapping project leveraged an existing online platform – Connectory.com, a buyer-supplier, searchable, capabilities-based online inventory – to build a portal identifying the Corridor’s innovation assets, public and private. The project, implemented by teams of economic development and/or workforce development entities throughout the Corridor, captured key regional innovation assets in the following categories:
- Industry/Small business/entrepreneurial firms
- Federal labs and research institutions
- Military installations
- University labs and research centers

At the start of Project 1.3, the Innovation Driven Economic Development Model was also just in the concept stage. One benefit that can be seen from now having the Model available is that of facilitating understanding of economic and workforce entities about the importance of regional capabilities to innovation companies. An early stumbling block to Project 1.3 progress was the lack of understanding of the value of the innovation asset mapping inventorying effort by the economic and workforce partners participating, yet nearly every organization
in its final report cited the value of profiling its regional innovation assets after the fact.

As a result of Project 1.3 and 1.1, the California Innovation Corridor now has a portal within the California Connectory showing cross-cutting Corridor innovation assets and their capabilities mapped across the Corridor. (See Phase II Innovation Asset Mapping below)

Profiles of innovation assets identified include relevant facility, technology, personnel and/or equipment descriptions, as well as official designations and certifications, e.g. Woman, Veteran or Minority-Owned Business. While over 1,500 Corridor innovation assets were identified by the end of Phase I, this is only a portion of those that exist. Identification of innovation assets will be ongoing.

It should perhaps be noted that, while the submission of profiles for inclusion as innovation assets was conducted under Project 1.3, part of the Innovation Asset Mapping Inventory was conducted under Project 1.1. ECEDC, founder and manager of the Connectory platform, worked to create a California Innovation Corridor portal within the Connectory to support the Innovation Driven Economic Development Model’s accompanying toolkit.

The Los Angeles Economic Development Corporation (LAEDC), was a Project 1.1 partner providing resources for the Innovation-Driven Economic Development “Toolkit” meant to accompany the Innovation-Driven Economic Model described below. LAEDC undertook four strategies to support the toolkit:

- Reinstatement of the Regional Business Assistance Network (RBAN)
- A Business Climate Survey of Innovators
- Targeted Innovator Outreach
- A Communication/Implementation Plan (to “saturate” the market with information on the importance and value of “innovation” in LA County

The Business Climate survey was a key deliverable of LAEDC’s effort, providing valuable feedback from manufacturing, wholesale trade and innovation-oriented companies:
“The companies surveyed were randomly selected from the 88 cities and more than 100 unincorporated areas in Los Angeles County. Of the 23,073 businesses in the target population (ten or more employees), 5,000 were interviewed using a Computer Aided Telephone Interview system for an overall response rate of 21.7 percent. Of the 5,000 businesses surveyed, approximately 2 percent were identified as innovative companies that would benefit from both the LAEDC Business Assistance Program and future WIRED programs and initiatives…

As the largest manufacturing center in the United States, it is not surprising that the manufacturing industry sector composed the highest overall percentage of respondents (22 percent) with over 450,000 workers employed in this sector throughout Los Angeles County. Similarly, the high volume of trade that passes through the ports of Los Angeles and Long Beach as well as Los Angeles International Airport accounts for the high response rate for the wholesale trade industry of 16 percent. These two ports are the busiest in the nation and, in combination with LA International Airport, provide the nation’s #1 gateway to the global economy.”

---Exchanging the LA County Business Climate: Challenges and Opportunities for the Business Community and the High-Tech/Innovative Sector

One of the survey’s most interesting insights validates the importance of small business to our 21st Century economy. One caveat is that the survey was taken in fall 2007 prior to the economic downturn, which may have impacted results:

“…businesses with less than 25 employees comprised almost half (45 percent) of the total survey respondents while large companies of 100 or more employees accounted for only 15 percent. These results were also true of the high-tech/innovative companies where 43 percent of the companies had less than 24 employees and only 18% had 100 or more employees. These results verify the fact that not only does "small" business play a significant role in Los Angeles County’s economy but also a large percentage (65 percent) of high-tech/innovative companies in the County are small with less than 50 employees…This analysis could create a paradigm shift in the way business assistance has traditionally been focused, which has been almost exclusively toward medium to larger employers. **With companies of fewer than 50 employers now playing such a significant role in the County’s economy, it would behoove economic development organizations and policy makers to recognize and support the growth of these companies within the region.**”

---Exchanging the LA Business Climate
While real estate, construction and manufacturing reported less profitability, 88 percent of the high-tech/innovative companies in the transportation sector, 78 percent of those innovative companies in scientific research and development services and 71 percent of those in the innovative transportation equipment manufacturing sector reported profitability.

*The top five barriers to future expansion reported by surveyees, both the general survey population and the high tech/innovative companies, include:*

- recruiting and retaining key employees (18% of respondents),
- workers compensation costs 15% (innovative companies at 16%)
- cost of energy (14%, with 15% reported by innovative companies)
- taxes (13%, with 17% reported by innovative companies)
- availability of qualified labor (12%, with 17% indicated by innovative companies).

More than half of all businesses surveyed in the LAEDC effort reported some or great difficulty in hiring critical occupations, with Skilled Production, Sales/Marketing and Unskilled Labor being in the most demand.

**CRITICAL OCCUPATION GROUPS**

<table>
<thead>
<tr>
<th>Innovative Occupation Groups</th>
<th>Total Percent</th>
<th>High-Tech Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled Line/Production</td>
<td>20%</td>
<td>17%</td>
</tr>
<tr>
<td>Sales/Marketing</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td>Unskilled Labor</td>
<td>16%</td>
<td>15%</td>
</tr>
<tr>
<td>Management</td>
<td>13%</td>
<td>12%</td>
</tr>
<tr>
<td>Administrative/Clerical</td>
<td>12%</td>
<td>7%</td>
</tr>
<tr>
<td>Information Technology</td>
<td>8%</td>
<td>7%</td>
</tr>
<tr>
<td>Line/Operations Supervisor</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td>Quality Control</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>30%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Source: Rose Institute of State and Local Government

**Figure 3 Critical Occupation Groups-LAEDC Survey**
Value of the survey is conveyed by the following statement:

“This system should also be used as an ‘alert’ system for regular follow-up on all high-tech/innovative companies...The high-tech/innovative companies are the high-growth companies in the County and are the companies that should receive consistent follow-up....”

---Examining the LA County Business Climate

Another product created by the LAEDC under its 1.1 effort was a regional Los Angeles County resource guide comprised of over 127 conferences and events, educational institutions, business service providers and technical assistance providers. To be used by economic development entities, WIBs, and those in professional business support roles, as well as companies, the guide can direct companies and organizations to resources that might otherwise be off their “radar screen”. This guide will also support the effort to create a support network for regional businesses.

This guide supplemented the survey and white paper conducted / provided by LAEDC, focusing on:

- Profitability
- Growth and expansion
- Relocation
- Closing/downsizing
- Barriers to expansion
- Workforce
- Revenue
- Cost of doing business in LA
- Local economic conditions
- Local government

A key outcome of LAEDC’s work on Project 1.1 was the reinstatement of the Regional Business Assistance Network. Armed with a better understanding of the fact that small business played a more important role in LA’s economy than previously thought, the LAEDC reflected on strategies to support small business and realized that one resource had previously been developed, but had been allowed to languish. By reinstituting the Regional Business Assistance Network, RBAN, the LAEDC re-established a regional resource for small business that supported networking, referral and technical assistance, which became vital at the end of 2008 as the U.S. economy took a nosedive.

The LAEDC also created an “Innovation Outreach” white paper describing how the LAEDC has integrated dynamic business database instruments to provide targeted outreach to innovative and high-tech companies, ensuring the continued economic vitality of Los Angeles County. “Fact Sheets” for three innovation sectors (aerospace, high-tech, biotech) promote LA County as an innovation hub
and serve as a template for future high-growth industry cluster fact sheets. They will be used for international trade missions in conjunction with the World Trade Center in Los Angeles, as well as to acquaint countywide economic and workforce professionals and policymakers about the county’s innovation focus and key innovation clusters. A Communication Plan Implementation White Paper highlights the key assets of Los Angeles County and incorporates internal and external communication tools to be used to provide continuous updating of stakeholders about important business issues, achievement of strategic benchmarks, and the positive changes impacting the area.

Interconnected and complementary, the LAEDC deliverables set the foundation for LAEDC’s design of its Economic Development/Workforce Development component to the strategic plan being implemented in 2009. The first-ever Los Angeles County Strategic Plan benefits significantly from the WIRED effort.

As quoted above, the Model emphasizes that the role of economic development is to “intervene” at pivotal times to support firms in achieving higher value and productivity, ensuring access to regional innovation assets. One of the most pivotal times is at the start-up of a high technology or innovation-oriented company. Entrepreneurial support, as we saw above, involves not only the “inventor”, but also the “transformer”, “financier” and “broker”.

The Corridor WIRED initiative showed how brokering interfaces with transformers and financiers could benefit entrepreneurial firms and rewicker the economic development focus to support an innovation economy.

The California Space Authority, as a partner in Project 1.1, leveraged its relationship with the El Camino College Center for International Trade Development, among others, to create an international program designed to enable small- to medium-sized aerospace entrepreneurs in the Corridor to navigate the challenges of globalization by exporting, entering global supply chains and/or expanding markets to the international stage.

CSA served on the advisory committee of the “Aerospace Export Training and Enabler Program (AETEP)” and also helped market the program for El Camino College, which had received funding from the State of California for the AETEP effort. Leveraging its work on the AETEP and its sponsorship of the International Satellite and Communications exchange (ISCe), CSA recruited 16 California companies, 9 international companies for an international business matchmaking session held in San Diego around the ISCe conference. The California firms of Seaspace (Poway, CA – provider of satellite ground stations, processing software and antenna systems), Cristek Interconnects (Anaheim, CA – manufacturer of electronic connectors) and Newpoint Technologies (Sacramento, CA – manufacturer of communications management products/services) all met with the Canadian aerospace prime MacDonald Dettwiler and Associates June 5-7, 2007. Sixteen other introductions were made via email, with one resulting in a
request for quote. This well surpassed the Corridor WIRED metric of linking five companies to potential international partners.

CSA summarized information obtained in its Project 1.1 work on connecting California firms to the international market with International Aerospace Market Briefs for India, the UK, Italy, France, Hungary and Mexico.

The international component of Project 1.1 was developed to improve linkage between Corridor companies and the international community, enhance their global business opportunities and increase the level of small- to medium-sized business entrepreneurs in the global market. To assure competitiveness in the 21st Century and benefit from the exports likely to ensue from a robust globally-savvy industry sector, workforce and economic stakeholders need to leverage the expertise of appropriate industry sectors. California has a healthy aerospace region in the California Innovation Corridor. Other such regions are being created internationally – in the southeast of England through the Government of the United Kingdom and the Farnborough Aerospace Consortium, in the Midi-Pyrenees and Aquitane region of France calling itself the Aerospace Valley, and in the region served by the Hungarian Aerospace Cluster. California’s economy and job base is critically tied to exports and if this project enabled international business partnerships and regional understanding of globalization, there is a good chance that international business will follow, enhancing both the State and U.S. balance of trade.

In beginning this Innovation Support section, we indicated that, while 70% of U.S. jobs come from small business, the economic and quality-of-life value of jobs in innovation is greater than that of other jobs. By fostering innovation, workforce and economic stakeholders can ensure not only economic vitality, but family-wage jobs that keep California and the U.S. competitive and save social service costs associated with the working poor.

Entrepreneurial companies are critical to the pipeline feeding an innovation-oriented economy and so identification of regional entrepreneurs, venture capital, technical assistance and business resources attuned to the special needs of entrepreneurs is imperative. Identification of entrepreneurs took place in Project 1.3 as part of the Innovation Asset Mapping effort and in Projects 1.1 and 1.4 as part of entrepreneur outreach and support.

The Golden Capital Network (GCN), a WIRED 1.1 and 1.4 partner, described on its website its role to stimulate economic vitality through “early stage private equity investment, connecting intrepid entrepreneurs, active investors, service providers, and policymakers to share the insights, risks and rewards of innovative collaboration.” Its purpose is to introduce innovative entrepreneurs to capital, expertise, and resources for building world-class companies. Golden Capital Network “provides communities with the capabilities to integrate their own social capital networks for accelerating their homegrown entrepreneurs.” Since 1999,
Golden Capital Network’s 1000+ alumni companies have raised more than $1.3 billion in capital.

The Venture Communities, as run by Golden Capital and captured and reported by Chabin Concepts, provides a framework for creating an event to bring companies, (start up and existing), investors (VC and Angel), and service providers and business professionals together to begin dialogue and encourage investment in technology companies and ventures. If an organized investor network is not established, this framework provides the opportunity to develop the initial impetus needed to create one along with the visibility to draw in the other resources that are necessary for the development and support of businesses.

This is important as the venture community overcomes three main challenges ED professionals have in trying to bring investors, service providers and businesses together for a common purpose.

- The business or start-up needs to generate revenue to succeed but does not have the visibility or skills needed to identify and attract qualified investors to the venture or company. A venture community provides them with a platform to pitch their proposition in front of several or many qualified investors what have been pre-qualified.
- Investors experience challenges in finding qualified companies to invest in. This venue allows them to see many potential investment opportunities that have been screened and prepped to present the relevant information that the investor may need to move forward.
- Banks, accounting firms, technologists, industry professionals, service providers and consultants require sufficient visibility and potential deal-flow to justify involvement and / or sponsoring of conferences and events.

By bringing together a critical mass of companies, investors and audience, services providers can justify sponsorship of an event.

The Venture Community provides a venue and a reason for all to be involved, and additionally provides visibility to the organization (many times an Economic Development professional), which can lend leverage to other projects and initiatives that they are moving forward.

As part of the Corridor WIRED effort, GCN mentored three Corridor communities – Monterey, San Luis Obispo, Davis - in becoming “venture communities”, that is communities supporting entrepreneurship ventures in a hands-on way, with proven strategies to ensure innovation support and competitive success. GCN has identified eight components necessary to build and sustain a venture community:

1. Convene and Engage a Venture Stakeholder Community
2. Plan, Promote, Execute a Kick-Off Event
3. Survey, Outreach, Classify, Capture
4. Create a Growth Company and Entrepreneur Impact Plan  
5. Create an Angel Investor Impact Plan  
6. Conduct Evaluation, Benchmarking, Reporting  
7. Continue to Build “High Impact” Network  
8. Change the Policy and Cultural Paradigm

Demonstration communities were supported in implementing these steps. To foster replication of these venture community demonstrations, Chabin Concepts, also a Project 1.1 partner, documented the GCN strategy for implementing a Venture Communities Program, highlighted lessons learned from the three demos and provided an overview of the alternative Venture Island™ GCN format. The document is entitled: Venture Communities Guidelines and is available at http://www.innovatecalifornia.net/WIREDDeliverables/Venture%20Communities%20Guidelines.pdf. See insights from this report in Key Findings of Innovation Support, Supplier Competitiveness and Talent Development, page 269 below.

In addition, the San Luis Obispo Economic Vitality Corporation organized a Venture Community event. This was important as it showed that an economic development entity who had not previously done so, could coordinate a successful event around technology and investment, using the Golden Capital framework and that the framework developed by GCN and Chabin is operative through their process. This validated the GCN/Chabin deliverable.

Another demonstration project directly fostering entrepreneurship and the communities supporting entrepreneurs, was Project 1.4, an effort to help innovative companies, including SBIR Phase II awardees, in commercializing their technologies to ensure 21st Century competitiveness and create jobs. Partners on this project included the California Space Authority, the East (San Diego) County Economic Development Consortium (ECEDC), GCN, LAEDC, Chabin Concepts and the San Diego Workforce Partnership (SDWP). Highlight of this project the “California Tech 100” event (CATech 100) in April of 2007, with a second venture community event taking place in 2008. CATech 100 was a two day conference event serving as a model for the “kick-off” event described as one of eight steps in creating a venture community (see above). Designed to allow for entrepreneurs and technology businesses to “pitch” their goods and/or services to panels of Angel and VC investors, the event consisted of primer classes for entrepreneurs, several keynotes, and six investor panels populated by 37 investors being pitched by 35 technology companies. Capping the first day event was the California Innovation Awards, with the State recognizing 15 top California innovation companies. Also unveiled that evening was a new California innovation video funded by the California Business, Transportation and Housing Agency, produced as an inkind contribution by the State. A venture capital inaugural event template (Holding A Venture Capital Pitching Event, Starting an Angel Investor Network) was produced by Project 1.1 partner San Luis Obispo Economic Vitality Corporation to serve as a guide for those wishing to replicate the event as a venture community kick-off:
The San Diego Workforce Partnership focused its 1.4 effort on the interface between WIBs and innovation as a job creation engine. The organization developed a scope of work to engage the California WIBs who have successfully supported community innovation, then developed monographs on WIA regions with innovation programs with industry. Monographs were developed on innovation best practices and how WIBs could meet the education and training needs of entrepreneurial companies. Data was included from the following WIBS: SDWP, NOVA, North Central California, Sacramento – all combined into a 28 page compendium of interviews. (See page 267 for overview).

Supplier competitiveness and talent development are important aspects of innovation support, so much so that they were treated in the Corridor WIRED initiative as separate pathways of activity. A few of the projects completed under Phase I of Innovation Support are best understood in the context of Talent Development, so the following will be found in the summary of that pathway, which begins on page 146:

- Project 1.2, 21st Century Job Profiles (page 206)
- Project 1.5, Joint University Innovation Model (page 191)
- Project 1.6, Enabling Affordable Student Payloads (page 199)
- Project 1.7, WIB Toolkit: Racing for the Future (page 147 and 264)

**Phase II Innovation Support Projects**

**Collaboration: Underpinning of Innovation and Workforce Development Support**

As mentioned above, the Innovation-Driven Economic Development Model guides economic development and workforce professionals in how to customize a plan to collect, direct and energize local resources in support of the regional, state, national and global competitiveness that is dependent upon continual innovation. Representing a significant departure from traditional economic development focus on attraction of new companies, the Model aligns well with the California Economic Strategy Panel’s “(industry) clusters of opportunity”, and emerging “(industry) sector strategy” approach.

In 2009, under the CIC Phase II effort, CSA undertook demonstrations showcasing implementation of the *Innovation Driven Economic Development Model* in two regions. Demonstrations served as sectoral initiatives inspired by Phase I work done in Projects 1.2 and 3.1 expanding on Labor Market Information data to identify regional industry clusters. Partnering with the Los Angeles Economic Development Corporation and the Antelope Valley Board of Trade, CSA oversaw the implementation of the Model in the South Bay and
Antelope Valley regions of Los Angeles County. Both implementation efforts focused on the support of an aerospace sectoral approach and aerospace workforce development in the region. The California Space Authority facilitated cross-learning between the organizations, brought CIC-developed resources to the table and shared its experience in collaborative aerospace planning and skill-building.

**South Bay (LA County) Workforce Development Effort**

As part of the implementation of the *Innovation-Driven Economic Development Model* in southern California, the Los Angeles Economic Development Corporation (LAEDC), a CSA partner in the CIC Initiative, led the initiative to found the South Bay Aerospace Consortium (Consortium). The Consortium is comprised of industry, workforce and economic development representatives and academia. Dr. Wanda Austin of The Aerospace Corporation was recruited to chair the Consortium. This was a significant achievement, as Dr. Austin is a high-profile industry executive whose involvement resulted in participation of many aerospace companies, including The Boeing Company, Raytheon and Northrop Grumman.

Two key outcomes of the Consortium’s work lay the groundwork for ongoing economic vitality collaboration among industry, academia, economic developers and the public workforce system.

The first was identification of key occupations needed by the aerospace industry represented – both currently and in the future. The top ten aerospace occupations were distributed to industry representatives. Industry was asked to rank those of most importance to their South Bay operations (see ranking under Talent Development, page 185). Three working groups were then organized around those occupations found to be most critical: production/touch labor, systems engineering and program management. Beyond the scope of the WIRED grant, but evidence of the sustainability of this project, working groups plan to develop strategic and tactical plans to address the challenges of education, training and recruitment around these occupations.

The “Long-Range Economic Development Strategy for the South Bay Aerospace Industry” was the key product coming out of the implementation of the Model in the South Bay. The Strategy lays out the goal of the ongoing Consortium as being to “create a formal link between the aerospace industry and education and workforce development resources to provide the South Bay aerospace industry a sustainable long-term competitive advantage” using an innovation strategy. A further benefit of the Strategy is that, because the South Bay Economic Development Partnership (SBEDP) and the Los Angeles County Economic Development Corporation are now both members of the South Bay Aerospace Consortium, the strategic planning of the two organizations are aligned. In the past, each developed its strategic efforts independently, resulting in missed
leveraging opportunities and lack of alignment of efforts and resources. For its 2009-2010 work plan, the SBEDP chose four LAEDC initiatives on which to focus: promotion of a business-friendly environment, creation of a world-class ground transportation network, expediting of green growth and development of an educated workforce relevant to South Bay industries.

Other laudable products of the implementation of the Model in the South Bay included two prototype Career/Education Pathway models - for the Quality Profession occupation and the Aerospace Fasterner Industry. These Pathway models articulate possible worker routes from entry level to executive management and map to appropriate educational programs, certifications, degrees approved by industry. To anchor these products in data-driven decisionmaking, the Consortium engaged the state’s Employment Development Department (EDD)/Labor Market Information (LMI) Division to conduct a Cluster of Opportunity analysis. The analysis identified aerospace industry segments by size, growth rate and wage level. This analysis, resulting in a “Cluster Briefing Paper” is also a strategy advised in the Model as a key tool for laying the foundation for future decisions of a collaborative. While not providing the total picture of the region’s aerospace industry and cascading supply base, the analysis, paired with other tools and direct industry input, was helpful in determining industries and occupations on which to focus.

The diverse, broad-based Steering Committee of the South Bay Consortium included:

- **Employers**
  - Ace Clearwater
  - The Aerospace Corporation
  - COM DEV
  - Dasco Engineering
  - Northrop Grumman
  - Raytheon

- **Workforce Development**
  - South Bay Workforce Investment Board

- **Economic Development**
  - South Bay Economic Development Partnership
  - Los Angeles County Economic Development Corporation

- **Government**
  - City of El Segundo
  - City of Hawthorne
CSA is convinced that sustaining The South Bay Aerospace Consortium and the collaborative strategic planning it has begun under the California Innovation Corridor will go a long way in fostering economic vitality and job-generation not only in the South Bay, but in the entire southern California area.

**Antelope Valley Talent Development**

The Antelope Valley has a long history of collaboration in support of aerospace, yet the implementation of the *Innovation-Driven Economic Development Model* in the region allowed CSA’s CIC Initiative partner, the Antelope Valley Board of Trade (AVBOT), to engage new stakeholders in a collaborative to address the region’s economic and workforce challenges. It also funded the Greater Antelope Valley Economic Alliance (GAVEA) in its development of the capstone effort in the region’s implementation of the Model: *A Vision Report 2010: Regional Collaboration as the Blueprint for Prosperity* – a collaborative strategic plan for long-range regional collaboration and economic prosperity in the Antelope Valley. As part of this effort, GAVEA re-envisioned its role in the region, assigning itself the task of using the aerospace model and applying it to the renewable energy sector, aligning resources where possible to meet cross-industry needs.

Implementation funding also put in place a science, technology, engineering and mathematics (STEM) collaborative building on the seamless engineering pathway developed in Phase I of the CIC Initiative. This pathway “homegrows” the engineers needed for aerospace and other industries, as the Antelope Valley’s high desert location makes it difficult to attract engineering talent from outside the area. The engineering pathway is designed to reduce the industry’s current average cost of $70,000 to attract an engineer to the region. Also as a result of the CIC Initiative and implementation of the Model, a California State University (CSU) Fresno engineering degree extension program was saved from termination, allowing 36 students involved to study locally, instead of moving to Fresno to complete their coursework.
GAVEA also developed a business cluster study for the region, a strategy outlined in the Model to assure that a region strategically targeted its industry support. Together, AVBOT and GAVEA developed a searchable business directory focused on the Antelope Valley suppliers and also produced a 2009 update to the Antelope Valley Industry Base and Vacancy Report.

Monthly Aerospace/Defense Industry Task Force meetings organized by AVBOT included representatives of Lockheed Martin Corporation, Northrop Grumman Corporation and The Boeing Company, as well as Edwards Air Force Base and NASA-Dryden Flight Research Center. Public sector stakeholders were: the City of Lancaster; the City of Palmdale; the Small Business Administration; Los Angeles County and the Rosamond Community Services District. The Aerospace Office, a nonprofit industry/education liaison; Antelope Valley College, CSU Bakersfield, The Lancaster University Center and CSU Fresno comprised the education/academia component of the collaborative.

ABVOT’s implementation of the *Innovation-Driven Economic Development Model* proved the value of creating a common vision and foundation around key industry sectors for the pursuit of economic vitality, industry retention and expansion and talent development. Through its development of this common vision, the creation of common data sets, reference materials and resource tools, in conjunction with its established collaborative of industry, workforce and economic development and education/academia, the Antelope Valley is poised to support its primary industry sectors in their drive toward global competitiveness.

**Innovation Asset Mapping - Asset Inventory Enhances Supplier Opportunity**

While over 1500 innovation assets were compiled into the California Innovation Corridor In Phase II, 30 assets from San Bernardino and Riverside Counties were added to the Innovation Asset Mapping Inventory, as well as another 150+ added as an inkind contribution by the Connectory, bringing the total number of assets in the Portal at the end of 2009 to about 1700.

Companies or agencies seeking suppliers can visit [www.Connectory.com](http://www.Connectory.com) and, under “Portals”, click on “California Innovation Corridor” to search by geographical area, industry, capability, and other criteria. For more complex searches on relevant supplier designations, staff expertise or equipment/capacity, or other unique needs, companies may contact the California Space Authority at (805) 349-2633 or submit an appropriate profile for inclusion into the Connectory at [www.Connectory.com](http://www.Connectory.com).

**Innovation Webinars and University Payload Demonstration Projects**

Two other Phase II Innovation Support projects performed in 2009 were:
- “Innovation for the Aerospace, Space and High-Tech Industries” Talent Development/Innovation Webinars (Project 1.5)
- University and Student Payload Demonstration Project (Project 1.6)

The above Phase II projects are more appropriately discussed in the Talent Development pathway section, which begins on page 146.
Corridor WIRED Initiative 1.0 Projects

WIRED Initiative 1.0 focused on the creation of an Economic Development Model (Project 1.1) that would feature an innovation support methodology that could be utilized as a resource or template by regions in the California Innovation Corridor (CIC or “the Corridor”) and beyond to increase economic competitiveness. This model would be a free-standing, underlying framework whereby the tools, models, reports and various deliverables that were produced by the California Space Authority’s (CSA) partners under the WIRED grant could be utilized under the Economic Development Model framework to address growth, sustainability and competitiveness in regions throughout and outside of the Corridor and support innovative technology and businesses. The end product Economic Development Model would be an effective, user-oriented framework that would allow for the utilization of other tools and project deliverables and act as a foundation and avenue for their deployment.

In addition, on a separate but parallel track under initiative 1.0, a virtual Innovation Economic Development Toolkit was designed, built and launched (see www.InnovateCalifornia.net), which allows for the individual innovation projects, tools and resources developed under the WIRED initiative to be showcased and accessed by others. The toolkit allows for the replication of these projects by others for their own region’s growth, sustainability and competitiveness.

1.1 - Create an economic development innovation model and accompanying “tool kit” which features “innovation support” elements which can be used by economic development professionals interested in leveraging regional innovation assets through: Innovator Skill Building, Technology Commercialization, Entrepreneurship Growth. Project included some preliminary activities/products which contributed to the Model.

New Economy Strategies (NES): NES is an economic development / workforce development think tank based out of Washington DC. NES’s services were made available to CSA by the Department of Labor (DOL) under the WIRED grant. Through its engagement with CSA, NES collected economic data and characteristics from world technology centers, the US and California. This data was used to provide the foundational basis for a comparison of California innovation centers and clusters within the Innovation Corridor to selected current global innovation centers.

Title of Deliverable: Analysis of the California Innovation Corridor
http://www.innovatecalifornia.net/WIREDdeliverables/Analysis%20of%20the%20California%20Innovation%20Corridor.pdf

The Bay Area Economic Forum (BASIC / BACEI) conducted an Innovation Roundtable that was designed to identify emerging patterns of the next wave of innovation needed for global competitiveness for California. Industry executives
from leading technology corporations (Google, Nanostellar, IBM, etc) comprised
the panels that were focused on California’s ability to stay competitive in the
global market. One panelist, John Kao, (author of Jamming, included mention of
the Corridor WIRED project in his new book Innovation Nation, which was
published in October 2007. This early project formed the foundation for CSA and
BASIC / BACEI to engage Doug Henton of Collaborative Economics to develop
the framework Economic Development Model under which the various
deliverables in the tool kit could be utilized in a consolidated economic /
workforce / educational development program. The Model allows a region to
design and develop its own framework by assessing its specific challenges,
resources and goals. With its own framework in place tailored to its unique
needs, the region can pick and choose specific deliverables from a “toolkit” (see
components below) that will help design and implement the outcome that will
best serve a region’s specific needs and goals across a much larger economic,
workforce and educational platform.

**Deliverable References:**
Innovation Round Table Report
http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Round
table%20Report.pdf

Innovation-Driven Economic Development Model
http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Driven
Economic%20Development.pdf

**California Council on Science and Technology** – Developed a 34 page study
on R&D expenditures and support in CA ranging from 2004 – 2007. This project
explores:
- Available data on R&D spending by California
- What is not possible to know and understand with the current data being
gathered at the State and Federal level
- Suggested approaches for California to collect additional data needed for
  a more comprehensive overview of the state's R&D spending

**Title of Deliverable:** Overview of California State-Funded R&D, 2004-
2007: - Understanding the State’s Role in Shaping R&D Spending
http://www.innovatecalifornia.net/WIREDdeliverables/CCST%20Final%20
Project%202011-25-08%20%-20%-20%201.1.pdf

**Chabin Concepts / Golden Capital Network** – Venture Communities is a
program offered by Golden Capital Network (GCN) to help communities identify
and assist innovation entrepreneurs. Three venture communities were created
under Project 1.1, with Chabin Concepts providing guidelines for implementing a
Venture Communities program and describing lessons learned from three pilot
programs and the alternative Venture Island™ format, as conducted by Golden Capital Networks. It is accompanied by an appendix.

**Deliverable References:** Venture Communities Guidelines  
http://www.innovatecalifornia.net/WIREDdeliverables/Venture%20Communities%20Guidelines.pdf

Venture Communities Guidelines Appendix  
http://www.innovatecalifornia.net/WIREDdeliverables/Venture%20Communities%20Guidelines%20Appendix.pdf

San Luis Obispo Economic Vitality Corporation – Producer of a 39 page handbook that leads the reader through the process it takes to organize and hold a Capital Pitch Event in a community.

**Title of Deliverable:** Holding a Venture Capital Pitching Event – Starting an Angel Investor Network  

East County Economic Development Council (ECEDC) – ECEDC’s work centered around development and deployment of a Corridor portal on the California Connectory, which is an in-depth listing of over 15,000 technology and manufacturing companies within California. This portal will host the “Innovation Asset Inventory” resources that were collected under project 1.3.

**Title of Key Deliverable:** California Innovation Corridor Asset Portal  

Los Angeles Economic Development Corporation (LAEDC) – Focus of LAEDC within the project was to stimulate an innovation network throughout Los Angeles County region. The Los Angeles County Regional Business Assistance Network (RBAN), which had all but disappeared as a resource for business, was re-instituted under the Corridor WIRED initiative to support this effort. LAEDC also created a comprehensive, web-based, Innovation Resource Guide (IRG), which is a compilation of service providers, educational institutions, venture capital sources, and annual conferences dedicated to the support of businesses in the emerging technologies. A comprehensive Communication Plan (white paper) highlighting the key assets of the most populous County in the United States, Los Angeles County, was produced, with information elements of the Plan incorporating both internal and external communication “tools.” LAEDC also created three innovation fact sheets aligned with the County’s key innovation sectors: the high-tech industry, the aerospace industry and biotechnology. The resources created above are also being used to support
elements in LA County’s first-ever economic strategic plan. In Phase II, LAEDC formed the South Bay Aerospace Consortium, which implemented the *Innovation Driven Economic Development Model* in the Los Angeles County South Bay.

**Deliverable References:**

*Innovation Resource Guide*
http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Resource%20Guide.pdf

*Business Survey White Paper*

*Communication Plan White Paper*

(Phase II) *South Bay Cluster Briefing Paper*
http://www.innovatecalifornia.net/WIREDdeliverables/1.1-LAEDC-Ph2-Cluster-Briefing-Paper-11-13-09.doc

(Phase II) *South Bay Strategic Plan Outline*
http://www.innovatecalifornia.net/WIREDdeliverables/1.1-LAEDC-Ph2-South-Bay-Aerospace-Strategic-Plan-Outline.doc

**California Space Authority** – Understanding that international trade and investment are used as economic development tools, CSA incorporated elements into the 1.1 project to raise the level and participation of small to medium-sized aerospace companies in the global market through the implementation of an International Business Matchmaking program, representing California aerospace at the Berlin Air Show and creating six international aerospace market briefs. CSA also of course oversaw Project 1.1 and facilitated coordination of partner project elements. In Phase II, CSA facilitated demonstrations of the *Innovation Driven Economic Development Model* in two regions, continued some of its international work by establishing a relationship on behalf of California suppliers with the French Aerospace Valley, and established a lunar testbed for future university research at NASA Ames.

**Deliverable References:**

*International Business Matchmaking White Paper*
Berlin Air Show White Paper

(Phase II): Lunar Regolith Test Bed Final Report
http://www.innovatecalifornia.net/WIREDDeliverables/1.1-Ph2-Testbed-Final-Report.doc

(Phase II): Project 1.1 Phase II Final Write-up
http://www.innovatecalifornia.net/WIREDDeliverables/091120-Phase-II-1.1-Final-Writeup.doc

1.2 Project Goal – Develop 21st Century job profiles based on a cooperative effort with R&D labs in federal, non-profit, and private sector companies and organizations focusing on high technology, high impact, future innovation career pathways in selected innovative industries. Project was designed to define future workforce skills to enable workforce training providers and develop quantitative projections in key skill areas to support an education and training strategy for recommendation to funders and policy makers. It was to include recommendations to ensure that educational institutions in the California Innovation Corridor are able to prepare corridor residents with the skills needed for these jobs. Included skills profiles targeted the following industries:

- 3254 Pharmaceutical and medicine manufacturing,
- 3344 Semiconductor and electronic component manufacturing,
- 3345 Electronic instrument manufacturing, and
- 5417 Scientific research and development services.

Bay Area Science and Innovation Consortium (BASIC)

Deliverable References:

Biotech and Life Sciences Summary Report
http://www.innovatecalifornia.net/WIREDDeliverables/BASIC_1.2_Rpt_Findings.9SEP08.pdf

QB³ Model Biotech and Life Sciences
http://www.innovatecalifornia.net/WIREDDeliverables/BASIC_1.2_Rpt_TheQB3Model.pdf

California Council on Science and Technology/ California Space Authority

Title of Key Deliverable: 21st Century Worker Profile Analysis
http://www.innovatecalifornia.net/WIREDDeliverables/21st%20Century%20Worker%20Profile%20Analysis.pdf
1.3 - Develop and sustain an entrepreneurship culture, by identifying, characterizing, and consolidating the innovation assets and capabilities within the California Innovation Corridor, aligning government, university and private sector assets in order to accelerate technology commercialization in the private sector and mission success in the public sector. In Phase II, 30 additional San Bernardino/Riverside profiles were added to the total of 272 asset profiles from universities, government labs, federal installations and private sector assets submitted for the Corridor by the following partners (with portal launch under Project 1.1):

- California Space Authority (WIRED Lead)
- Bay Area Economic Forum/Bay Area Science Infrastructure Consortium (Project Lead)
- Antelope Valley Board of Trade
- City of Lompoc
- Greater Antelope Valley Economic Alliance
- Inland Empire Economic Partnership (Withdrew)
- Kern Economic Development Corporation
- Los Angeles County Economic Development Corporation
- Orange County Workforce Investment Board
- San Diego East County Economic Development Council
- San Luis Obispo Economic Vitality Corporation
- Santa Maria Valley Economic Development Association (Withdrew)
- South Bay Economic Development Partnership
- Ventura County Economic Development Association
- Stauffer Communications

**Deliverable References:**

*Templates for Identification of Innovation Assets*  
[http://www.innovatecalifornia.net/WIREDdeliverables/1.3-Innovation-Asset-Mapping-Profiles-Templates.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/1.3-Innovation-Asset-Mapping-Profiles-Templates.pdf)

*(Phase II) Orientation to CIC Portal*  
[http://www.innovatecalifornia.net/WIREDdeliverables/1.3-090630-meeting-Innovation-Asset-Mapping.doc](http://www.innovatecalifornia.net/WIREDdeliverables/1.3-090630-meeting-Innovation-Asset-Mapping.doc)

[http://www.innovatecalifornia.net/WIREDdeliverables/1.3-090825-2nd-meeting-Innovation-Asset-Mapping.doc](http://www.innovatecalifornia.net/WIREDdeliverables/1.3-090825-2nd-meeting-Innovation-Asset-Mapping.doc)

1.4 - **Demonstration project with Entrepreneurial companies, including SBIR Phase II awardees, to identify best practices in helping innovative companies to commercialize technology and create jobs.**

**Global Capital Network (GCN), Los Angeles Economic Development Corporation (LAEDC), East County Economic Development Council (ECEDC), Chabin Concepts (Chabin) and the CATech 100 Conference –**  
Entrepreneurial ventures demonstration project with entrepreneurial companies including Small Business Innovation Research (SBIR) Phase II awardees to identify best practices in helping innovative companies to commercialize technology and create jobs. A two day conference event was designed, focused on entrepreneurs being trained on venture capital topics (35 companies trained) and technology businesses “pitching” to panels of Angel and VC investors. The two day event consisted of primer classes, several key note speakers, and six investor panels populated by 37 investors being pitched by 35 technology companies. Companies and panels represented 1 and 2) Emerging
Technologies, 3) Software / IT, 4) Biotech / Pharma and Medical Devices, 5) Communications Technologies, 6) New Media / Web Internet Content. The evening concluded by the top 15 companies in California being recognized to receive the California Innovation Awards. Additionally produced for the event was a 20 minute video outlining California as the premier State for R&D and technology business and entrepreneurship. This was funded by the California Business, Transportation and Housing Agency (BTH). A 41 page template was produced, outlining the processes and procedures needed to create an entrepreneurial conference. Event deliverables were the successful conference, the Video and the event template.

**Title of Deliverable:** California Tech 100 Write-Up

[http://www.innovatecalifornia.net/WIREDdeliverables/1.4-CA-Tech-100Writeup.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/1.4-CA-Tech-100Writeup.pdf)

**San Diego Workforce Partnership**

SDPW developed an interviewing plan, questionnaire, and schedule to determine the best practices among California WIBs in supporting business innovation. SDPW developed a “how-to manual” on WIB support for innovation in emerging industries and hold a conference workshop on how WIBs can meet the education and training needs of entrepreneurial companies. Delivered was a 28 page compendium of interviews conducted with 5 innovative WIBs from across California, and the best practices and impacts from each.

**Title of Deliverable:** Innovating Workforce Development by Supporting Business Innovation: Case Studies from California

[http://www.innovatecalifornia.net/WIREDdeliverables/WIB%20Tool%20Piece-Final.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/WIB%20Tool%20Piece-Final.pdf)

**1.5 – Create pilot programs for professorial and graduate student internships to explore innovation and entrepreneurial environment, providing seminars on results.** Goal was to facilitate better understanding of innovation by professors and graduate students by exposing them to highly innovative environments such as those found in labs, R&D facilities and innovative companies. Stanford and UCR were to appoint small teams of faculty, industry professionals and students to spend a short internship (3-5 days) as observers in the R&D environment. Teams would put a seminar or seminar sessions together to present in both the public and academic community to highlight findings. Seminars would be presented in Northern and Southern California to disseminate findings and formulate recommendations on best practices and steps that could accelerate the pace of commercializing innovation. The objective was to build an understanding of effective practices for how innovation is encouraged and commercialized. Stanford’s process evolved midway in project to incorporate webinar courses featuring innovators discussing innovation. In Phase II, the Innovation Webinar concept created by Stanford was
continued, with CSA conducting two Innovation Webinars to include findings regarding workforce needs of innovative technologies, practices.

**Project partners:**
- Stanford University
- University of California at Riverside
- California Space Authority (Phase II only)

**Deliverable References:**  
*Joint University Interdisciplinary Innovation Project Summary (UCR)*

*Innovation in Aerospace Webinar Series (Stanford)*
http://www.innovatecalifornia.net/innovationase

*Innovation in Aerospace Webinar Findings Whitepaper (Stanford)*
http://www.innovatecalifornia.net/WIREDDeliverables/Creating%20Innovation.pdf

(Phase II): *Recap-Global Telecom Innovation Webinar*
http://www.innovatecalifornia.net/WIREDDeliverables/1.5-RECAP-080609-Global-Telecom-Innovation-Webinar.doc

(Phase II): *Oppenheim Lean to the Rescue*
http://www.innovatecalifornia.net/WIREDDeliverables/1.5-Oppenheim-Lean-to-the-Rescue.ppt

(Phase II): *Whitepaper - Technology Talent Needs, Aerospace and High Tech*
http://www.innovatecalifornia.net/WIREDDeliverables/1.5-Ph2-whitepaper-Technology-Talent-Needs-Aerospace-High-Tech.doc

1.6 – **Develop a half-scale prototype CubeSat launcher and a process-requirements document to facilitate student payloads on military launches**

Meant to leverage the existing CubeSat, which was designed as a means of accommodating multiple small payloads typical of university research, the CubeSat launcher project developed a prototype launcher aligned with military protocols intended to support the CubeSat payload model in order to facilitate U.S. launch of university payloads currently launched overseas. Successful deployment of the CubeSat launcher on military payloads would enable more hands-on experience of university students not burdened with the need for overseas travel to participate in the launch and payload processing experience. Phase II was intended to deliver two primary products; (1) a flight-qualified NPSCuL structure capable of improving the availability of student and university
payload space on DoD launches, and (2) a document that describes how students and universities can gain access to DoD launches.

**Project Partners:**
- Naval Postgraduate School
- California Space Authority

**Deliverable References:**

NPSCuL Presentation  
http://www.innovatecalifornia.net/WAREDdeliverables/1.6-NPSCuL.ppt

NPS Cubesat Launcher  
http://www.innovatecalifornia.net/WAREDdeliverables/1.6-NPS-CubeSat-Launcher.pdf

Student Payload Launcher Report  
http://www.innovatecalifornia.net/WAREDdeliverables/1.6-Ph2-student-payload-launcher-report.doc

**1.7 – Development and distribution of a WIB Tool Kit to Workforce Investment Boards across the Corridor and the State to enable them to identify and support entrepreneurial companies in an innovation ecosystem.** Primary audiences will be WIB Directors, local elected officials, ED groups and civic and educational leaders. The Toolkit is divided into five sections:

- Background: What’s changing in California and how it affects workforce development
- Five Core WIB Roles: Important functions and their relation to preparing the workforce of the future.
- Industry Profiles: Overviews of key high-tech industries in California
- Case Studies: Six programs that are making a difference
- Resources: Useful publications and links

**Project Partners:**
- California Council on Science and Technology
- California Workforce Association
- California Space Education and Workforce Institute

**Title of Deliverable:** Workforce Investment Board Toolkit – Racing for the Future (a website accessible by visiting www.wibtoolkit.net)
High-Wage Job Creation through Supply Chain Competitiveness (Industrial Rejuvenation)

It is no secret that over the last two decades, globalization and the ever-more-competitive manufacturing/supplier landscape resulting from this “flattening world”, has drawn thousands of U.S. manufacturing and supplier jobs offshore. Eighty percent of manufacturing jobs are now outside the U.S., yet eighty percent of the value-added manufacturing still happens in the U.S. Impact on the Golden State is significant, as California is the country’s powerhouse of manufacturing, still boasting 30,000 manufacturing, processing and technology companies, according to the California Manufacturing and Technology Association. Most of California’s manufacturing sector lies within the California Innovation Corridor. In its 2005 proposal to DOL on behalf of the State and the Corridor for WIRED funding, the California Space Authority cited a California Innovation Corridor regional manufacturing job loss from 1990-2004 of 400,000, virtually all of California’s manufacturing decline. These jobs also represented 13% of the national manufacturing job loss for the 1990-2004 timeframe. Corridor manufacturers/suppliers are critical to both California and U.S. manufacturing, especially in terms of retention. It is worth noting that much of the “value-added” manufacturing in the U.S. is Corridor-based, derived from California’s 21st Century aerospace and information technology sectors or other high-value sectors such as biotechnology. Also of note is the importance of “value-added” manufacturing jobs in terms of quality of life. Today’s California space worker, for example, earns over $96,000 a year, which enables a much higher standard of living than salaries of the average retail or service industry worker, and thus ensures a pathway from poverty to the middle class.

California is home to approximately 50% of the U.S. aerospace suppliers and globalization has seemed to take many California suppliers by surprise. While a single large California manufacturer has 6,000 California companies as suppliers and a direct job impact of 60,000 jobs, 80% of the aerospace workforce is in companies with fewer than 100 employees. With today’s suppliers responsible for up to 80% of final product content and innovation, “requirements for both supplier company capability and workforce have changed, requiring integrated life-cycle systems support, and the ability to compete in a global, dynamic, complex supplier network”.

1 Friedman, Thomas, The World Is Flat: A Brief History of the Twenty-First Century, Farrar Straus Giroux, NY, 2005
4 California Space Enterprise Strategic Plan, 2007-2010
5 California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness, California Space Authority, Antelope Valley College, 2008 (see Corridor WIRED Deliverables at www.InnovateCalifornia.net)
As illustrated in CSA’s original WIRED proposal, a better, more strategic understanding of globalization’s impact on the supply chain environment, as well as an articulation of competitiveness success factors needed to be forged and assimilated by the Corridor’s supply chain stakeholders. California needed “smart suppliers”. Without an understanding of the competencies and skills needed to compete in this new global environment, as well as development of resources to assist them, suppliers faced a gradual, if not accelerated decline.

Thus was born the second thrust of the California Innovation Corridor WIRED Initiative (Industrial Rejuvenation - to be led by CSA), which, as the effort evolved, also came to be known as the Supplier Transformation Strategy.

Supplier Transformation Strategy

Improve the international competitiveness of the region’s supply chain by developing and executing a “smart supplier strategy” that supports manufacturers, small business and entrepreneurs in adapting to the global manufacturing transformation.

Strategic Transformational Goal #2 from the same document was to:

Ensure common “smart supplier” competitiveness and enterprise-driven outcomes across the supply chain training provider/support network

The “current state” as described in 2006, was “lack of continuity in program and service outcomes across the training provider/support system”. The “desired state” was described as “continuity of program and service outcomes across the Corridor’s training provider/support system”.

Supplier Transformation Strategy Projects

Project 2.1
Identification of High Priority Supplier Training Needs

Project 2.2
Characterization of “Smart Supplier” Competitiveness Skills (Supply Chain Training Provider Common Learning Outcomes)

Project 2.3
“Smart Supplier” Resource Awareness (Outreach to 3000 California Suppliers regarding ETP Funding, etc.)

Project 2.4
Development of Industry-Driven Community College Manufacturing Technician Program (see page 178)
Four serial projects were originally designated under the Industrial Rejuvenation/Supply Chain Competitiveness thrust. Initially, Project 2.1 (Supplier Transformation Survey) and 2.2 (Common Learning Outcomes, Supplier Transformation findings, Pilot Design and Implementation, Supply Chain Management courses), as well as 2.3 (Supply Chain Outreach/Employment Training Panel funding availability) and 2.4 (Aerospace Manufacturing Technician Certification) were designed as stand-alones to be accomplished sequentially. As the project evolved, however, an advantage was seen in managing the programs concurrently to leverage findings, industry volunteers, collaborative opportunities, etc. The 2.1-2.3 projects were further leveraged by the fact that the Supply Chain advisory group (see below) worked closely with the California Space Industrial Base Vitality (CSIBV) Collaborative and its sub-committee, the Space Manufacturing Group. Both consortia served under CSA’s Space Enterprise Advisory Council, which was responsible for statewide California space enterprise strategic planning. It was in the 2004 California Space Enterprise Strategic Plan that the need for a “smart supplier” strategy and many other Corridor WIRED initiatives first surfaced.

First on the agenda to accomplish the above was to reach a common understanding of the supply chain environment within the global market in which it found itself.

How could the transformation to a global supply chain environment be characterized? What changes had occurred that left so many suppliers bewildered about how to compete? What common attributes of this new environment could be identified and where did Corridor suppliers fall in understanding/responding to this new environment?
The Supply Chain Environment in a Global Market

To address the questions above, the "smart supplier strategy" partners first took on a set of four activities:

1. Convene a statewide advisory committee of key supply chain stakeholders
2. Establish an annual “supply chain transformation” forum
3. Characterize the transformational supply chain landscape
4. Conduct a supply chain capabilities survey built upon steering committee and other supply chain stakeholder inputs

The steering committee developed was named the “Supply Chain Industry Advisory Group – SCIAG”. It was populated with diverse stakeholders, growing in number and diversity as the project evolved. It included industry – primes, subs, small business, entrepreneurs – as well as representatives of major government supply chain stakeholders such as the Space & Missile Systems Center (SMC), involved with procurement and deployment of all USAF space programs, and NASA. In addition, it included supply chain training providers and supplier system representatives who were partners on the WIRED smart supplier initiative: the California Space Authority, Strategic Vitality LLC (2006 only), the Santa Clara Valley Workforce Investment Board (NOVA), the California Manufacturing Technology Consultants (CMTC - a NIST MEP), Antelope Valley Community College (AVC) and the Western Research Applications Center (WESRAC) out of the University of Southern California (USC). Chair of the SCIAG was Dina Hyde, then Vice President of Supply Chain Management, Raytheon Space and Airborne Systems. For a list of the initial Supply Chain Industry Group (which ultimately included public sector supply chain stakeholders, as well as members of CSA’s California Space Industrial Base Vitality Collaborative and the Small Manufacturing Group), please see link on page 144.
Annual Supplier Transformation Forums Held – Phase I

November 9, 2006
http://www.innovatecalifornia.net/WIREDdeliverables/REC
ap-Nov%2006%20Supply%20Chain%20Forum-
FINAL.pdf

October 5, 2007
InnovateCalifornia.net/2_2_forum_details/

October 7, 2008
InnovateCalifornia.net/Supplier Forum 2008

The 2006, 2007 and 2008 Supply Chain Transformation Forums were key activities to the Supplier Transformation Strategy. In conjunction with the joint SCIAG/CSIBV/SMG meetings, they contributed to stakeholder understanding of the 21st Century supply chain environment, how it had changed over the past decade, what capabilities suppliers needed to develop to stay competitive, how to assess their level of competency as “smart suppliers” and how best to address training gaps uncovered.

The 2006 Supplier Transformation Forum “Accelerating Supply Chain Integration: Supplier Training Impacts in Real Time” focused on the changing supplier landscape, as well as introducing the idea that it was not a little training around the edges that was needed, but transformation of supplier behavior if they were to survive and succeed. The number of changes occurring in the global arena, the depth and scope of those changes, as well as the accelerated pace at which they were occurring, called for wholesale reform of supplier practices.

Friedman, Thomas, The World Is Flat: A Brief History of the Twenty-First Century, Farrar Straus Giroux, NY, 2005

A Changing Landscape for Aerospace Suppliers¹

- Suppliers are working in a global “flat world”
- They are doing business in a digital, socially networked world
- Supplier work is changing from “Stable & Certain” to “Sense & Respond”
- Collaboration and competition are coming from more places
- 6 Sigma and Lean are standard, not exceptional
- Marketplace is moving from “Make & Sell” to “Sense & Respond”
- Suppliers exist in an E-Commerce, E-Process global marketplace
- Data, information and communication are more critical
- Pace of change is accelerating

Key Messages for Suppliers
1. Nearly 80% of former “prime” manufacturing/assembly work had moved down to suppliers, with most primes now focused on final integration
2. Impact: 80% of the innovation and engineering falls to suppliers
3. Suppliers unlikely to remain competitive simply providing components
4. Supplier transformation and training the only competitive option

The Best Companies Are Adjusting to Stay Successful

¹ From Presentations, Handouts, Supplier Transformation Forum, November 9, 2006
In addition to evolution of the supply chain role (see “Supply Evolution” graphic below), changing requirements specific to Aerospace Suppliers are developing, as well. Those highlighted in this first forum included:
- System Complexity – Magnitude/Scope of Parts, Hardware, Software, Interfaces
- Greater Test Challenges Related to Changes in Technology, Manufacturing, Materials
- Specifications and standards announced as integral to SMC acquisition
- Contractual compliance through the supply chain (requirements flow-down)

While developing, distributing and analyzing The 21st Century Supply Chain Transformation Survey described below on page 120, Project 2.2 partners also conducted two more annual forums, in 2007 and 2008. See Industrial Rejuvenation/Supplier Competitiveness, Phase II below for 2009 Forum information.

In addition to laying out information regarding the WIRED Industrial Rejuvenation and Supplier Transformation Strategy project and sharing preliminary results of the Transformation Survey completed in September, the October 5, 2007 Forum focused on Smart Supplier and U.S. supply chain success factors. The October 7, 2008 Forum continued the dialogue and also featured best practices.

Supply Chain Success Factors: Government Perspective
- Cooperation and collaboration across government domains, agencies, acquisition arms
- Industry collaboration
- Sharing lessons learned/best practices
- Uniformity and consistency across customers/primes/programs:
  - specifications and standards
  - subcontract management
  - technical practices
  - requirements flowdown
  - supplier metrics and assessments
  - contracting and decisions
- Tighter integration of product design/development and supply chain functions
- Improved competency of supply chain functions
- Improved supply chain visibility; insight
- Evolution of primes’ “Make/Buy” paradigm to more strategic approach to customer solutions
- Participative governance structures that also provide clear responsibilities, accountabilities and integrated performance metrics
- Risk management and mitigation tools and capabilities that provide early alerts

1 From presentations, handouts and information provided at the October, 2007 Supplier Transformation Forum, October 2008 Forum
Smart Supplier Success Factors

- Successfully managing supplier relationships (upstream, downstream)
- Successfully managing process and quality performance demands in an environment of both vertically integrated chains of companies as well as dynamic, distributed networks of companies
- Remaining flexible, agile, to deal rapidly with changes/disruptions in one layer or node of the supply system
- Expanding capacity to take on new functions, e.g. design, engineering, quality assurance formerly a responsibility higher up the chain
- Engaging earlier in the product development cycle with both customers, suppliers, i.e. requirements definition, design
- Real-time, open sharing of more data, earlier, more often, i.e. schedule, quality (open systems)
- Digital modeling and simulation capabilities (utilization of high performance computing if possible)
- Full understanding of customer requirements
- Performing to industry standards
- Aligning research/development
- Software engineering and systems engineering capabilities
- Solid planning, process, risk, LTS management (schedule, cost, quality control)
- Recruitment and retention of quality-conscious workers (technicians, engineers)
- Effective inventory, logistics, materials management
- Effective sub-contract, intellectual property management
- Development of long-term strategic relationships (customers, suppliers)
- Reputation management
- Incorporate foreign content to assure foreign market access; control counterfeits
- Ongoing training in latest technologies, basic skills, business practices
- Lean practices
- Willingness/ability to expand to meet customer needs (e.g. equipment, facilities)
- Customer and supplier collaboration (process streamlining, cost/risk reduction, product design, development, etc.)
- Regulatory compliance (e.g. ITAR), regulatory flowdown management
- Product lifecycle management
- Forecasting
- Rapidly introduce new technologies
- Focus on core competencies
- Capture and proposal strategies
- Supplier diversity
- Understanding program pricing targets and company’s contribution
- Obtain/maintain appropriate certifications
- Utilize internal audits
- Market solutions providing differentiation (technology, cost, speed)

¹ From presentations, handouts and information provided at the October, 2007 Supplier Transformation Forum; October 2008 Forum
**Transformation Survey**

In 2006, work began with Project 2.1/2.2 partners and the SCIAG on development of a supplier survey (Project 2.1) to help inform the identification of the common learning outcomes required in Project 2.2.

The 21st Century Supply Chain Transformation Survey was designed to serve as a comprehensive assessment of supplier understanding of the role of the successful global supplier. With the survey development led by the California Space Authority and executed by Antelope Valley College, the survey was supported by the following Supplier Transformation Strategy WIRED funded partners: the California Manufacturing Technology Consulting (CMTC); the NOVA Workforce Investment Board; the Western Research Applications Center (WESRAC), Viterbi School of Engineering, University of Southern California. Unfunded supporters included prime contractors - The Boeing Company, Lockheed Martin, Raytheon, Northrop Grumman Corporation – as well as multi-tier contractors and small suppliers (e.g. Aerojet and ACE Clearwater); government supporters such as the U.S. Air Force, The Aerospace Corporation and NASA; other educational partners including El Camino College; professional associations such as the Society of Manufacturing Engineers (SME) and the Supplier Excellence Alliance (SEA), workforce investment boards (WIBs) and economic development entities (EDCs).

**SUPPLY EVOLUTION**

![Supply Chain Network Diagram]

**Figure 4 Supplier Survey Report: Supply Evolution**

“Collaboratively, these groups worked to identify priority supplier training needs and changing training needs driven by supply chain transformation...Additionally, the survey sought to capture statistics on California’s current supply base,
common requirements, and identify foundational ‘smart supplier’ competitiveness skills.

For survey data collection, member and stakeholder databases of multiple WIRED partners, aerospace membership organizations and primes were used for distribution.”¹

Data represent supplier capability requirements and gaps broadly across California aerospace manufacturing. Survey distribution began April 1, 2007 and closed September 15, 2007. Surveys were emailed in batches by CSA, prime and multi-tier contractors, government agencies, professional associations and workforce and economic development entities, with approximately 8000 aerospace manufacturers invited to participate. **Two hundred eighty-eight survey responses were received for a response rate of 3.6%.**

![The 21st Century Supply Chain Transformation Survey](image)

**Nearly 75% of companies responding to the Transformation Survey earn 50% or more of their annual revenue from aerospace.**

“We believe that these data are suggestive of developments and trends in core supplier capability requirements and gaps and the research findings will help to optimize a California supplier development and training strategy”¹ designed to assist California suppliers in competing in the global economy.

¹ *California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness, California Space Authority, Antelope Valley College, 2008*

Forty-nine percent of respondents completing the survey were from senior company management or executive levels (*Figure 5*), indicating a high level of support for the survey. The 59% of respondents representing small companies (*Figure 6*) is consistent with the fact that 80% of California aerospace manufacturing employees work for companies with less than 100 employees. For the survey, companies having 1-100 employees were classified as small, 101 to 1000 as medium, and more than 1000 large.

Approximately what percentage of your company revenue is sales to the Aerospace industry annually?

Nearly 75% of respondents indicated that their companies earned 50% or more of their annual revenues from aerospace, with a balance between government, commercial work. The importance of the 2.2 project findings to support the evolution of 20th Century suppliers into global 21st Century suppliers can be seen by Figure 9 in which survey developers asked about the supply chain integration impact on customer and/or supplier efficiency. While nearly 40% of small companies described their current level of supply chain integration as efficient, less than 30% of mid-sized companies did so, and less than 20% of large companies saw their supply chain integration as efficient.
In addition, only about 40% of small companies hold their current level of supply chain integration to be negatively impacting their customers/suppliers, while over 50% of large companies generally believe this to be the case.

“These results show that the level of satisfaction with the current state of the supply chain decreases as the size of the corporation increases.”¹ (See Figure 9 below). Since smaller companies are generally suppliers to larger, and since the integration of the supply chain is one of the first keys to success in this new era, supplier orientation to the transformational 21st Century Supply Chain environment and the skills and/or management training to deal with this environment are critical to the success of suppliers.

A key finding in reviewing the supplier satisfaction level of current supply chain integration was that “67% of the supplier value network believes that supplier network integration does affect productivity and profits. However (see Figure 10), leading drivers affecting profits and productivity are not as high a priority as trailing indicator metrics. As an example, inventory turns can decrease overall production costs; order fulfillment time will affect on-time delivery to customers,”² the responding suppliers’ highest priority metric.

¹ California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness, California Space Authority, Antelope Valley College, 2008
² Final Partner Project Report, 2.1, 2.2, 2.3, California Space Authority, 2008
Similarly, while small and mid-sized firms exhibit some of the capabilities required as 80% of supply chain innovation moves to their roles “farther down the chain” (early phase design and test), **they use these capabilities less than 25% of the time with their suppliers or customers, indicating a significant productivity gap.** (See Figure 12)

Another potential indicator of global competitiveness is the breadth and scope of a supplier’s partnering. As one might expect, survey results showed that **the smaller the company, the more likely the customers and suppliers were located in California, the larger the company, the greater the partnering outside the U.S.** While national and international opportunities exist, small supplier survey respondees appear not willing or able to take advantage of them (See Figure 13)
Approximately how many active suppliers/vendors does your company have globally outside of the United States?

It also does not appear that the California suppliers polled are active in the international market. Over 90% of small suppliers and over 80% of medium-sized suppliers have less than 50 suppliers/vendors outside the country. For the 44% of their work that is government-based, and for the 50% of their work that is aerospace-related, some of this might be explained by government business restrictions on foreign parts, and also by export licensing constraints for sensitive technologies, potentially negatively impacting supplier ability to gain access to world markets. Still, for the portion of their work not government or aerospace-related, the partnering, in the context of a 21st Century global marketplace, appears limited.

Lastly, another worrisome element in regard to competitiveness of California suppliers is shown in their rankings of several elements of “three-year importance to your company’s success” – while “highly trained workforce” and “lowering production costs” rank one and two for all sized companies, again, supply chain integration ranks as important only to large companies and product innovation is in the bottom quartile for all company segments. Workforce concerns were at the top of the importance scale for 69% of the companies surveyed.
The types of employees needed by survey respondees points once again to the shortage of California and U.S. science, technology, engineering and math (STEM) workers and the need for work-ready skilled production workers, highlighting the need for career technical education (CTE) support. Engineers and scientists were most in demand for the larger companies, skilled technicians being the most critical for small companies. The fact that mid-sized companies had almost an equal need for engineers and scientists and skilled technicians perhaps illustrates how much of the work formerly done by primes (innovation, new product development, sophisticated processing) now falls to suppliers. In other data reported, all three segments of suppliers (small, medium, large) indicated that “some negative impact” was expected in their company’s ability to meet customer needs due to the skilled employee shortage.

**Where do you anticipate a shortage of employees to occur within your company in the next five years?**

![Employee Shortage Graph](image)

**Figure 15 Supplier Survey Report: Projected Employee Shortages**

Training data from the survey is being covered in the “Training and Education” section of this report, and the survey’s impact on identification of Common Learning Requirements (Outcomes) is covered in a segment below (see page 128).

Recommendations from the Project 2.2 team included:

1. Utilize low-cost training options delivered through traditional resources and emerging alternative methods to best meet 21st Century supplier training needs, increasing understanding of supply chain, systems, product life cycle and functional best practices.
2. Foster tighter integration of industry with education to meet 21st Century needs for contextual learning combining technical, workplace scenario, systems and problem-solving capabilities. Addressing common basic skills through common training resources allows industry to focus on specific training relative to proprietary knowledge.
3. Establish a Career Readiness Certification (CRC) and assessment to address basic and technical interdisciplinary skills including mechanical, electrical, fluid and thermal engineering basic contextually.

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1 California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness, California Space Authority, Antelope Valley College, 2008.
- Leverage California’s Employment Training Panel (ETP) funding to enable more integrated work/study
- Implement I-BEST (Integrated Basic Education and Skills Training)
- Establish “Industry in Residence” Program
- Standardize supply chain practices that create consistent, balanced contract flow-down from the customer through the suppliers, to reduce costs
- Standardize supply chain practices that include customer support for balancing risk and innovation
- Foster standardization of common supplier assessment process and Supply Chain Management practices
- Accelerate an RFID global aerospace standard for process streamlining, cost reduction
- Consider a Human Capital Development Tax Credit
- Establish a California collaboration among government, universities and industry to enable high performance computing for suppliers

The 21st Century Supply Chain Transformation Survey was a complete capacities maturity survey consolidating first level supplier assessments from all major primes and agencies and was deliberately aligned to the SAE International Capabilities Maturity Model (CMM). The Society for Automotive Engineering (SAE) also include Aerospace and other “mobility engineering” disciplines and defines industry quality standards such as AS9100. The Transformation Survey also covered all ten functional areas of the “Supply Chain Management Handbook” put out by the International Aerospace Quality Group. Informed not only by industry, but also by the Space Quality Improvement Council (SQIC), the Space Supplier Council (SSC) and the NASA Quality Leadership Forum (QLF) as well as the Society for Manufacturing Engineers (SME), the Transformation Survey, with slight redesign, was the basis for the development in Phase II of a valuable capabilities maturity assessment tool to assess supplier company capabilities.

Note: Company capability requirements drive workforce requirements, and the WIRED Project 2.2 team did provide input to the U.S. Department of Labor Advanced Manufacturing Competency Model regarding workforce skill-sets. See the Training, Education and Needs Assessing for the 21st Century Worker, page 174.
Common Learning Outcomes (Requirements)

A primary deliverable under Project 2.2, the desired common learning outcomes regarding 21st Century supply chain transformation are meant to provide some continuity across the Corridor’s supplier training provider network. As Supply Chain changes and impacts increase, the traditional training on manufacturing and logistics or “lean” simply no longer suffices.

<table>
<thead>
<tr>
<th>The Change</th>
<th>The Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEM operations are increasingly dependent on highly processed purchased material instead of commodity products.</td>
<td>Sourcing of OEM purchases cannot be quickly redirected as it could for commodity products.</td>
</tr>
<tr>
<td>Purchased content of OEM’s products has risen significantly.</td>
<td>OEM operational effectiveness increasingly depends on supply chain order fulfillment capability.</td>
</tr>
<tr>
<td>Suppliers are no longer located near customers, as assumed in TPS.</td>
<td>Distance increases supply interruption risk and decreases supply flexibility.</td>
</tr>
<tr>
<td>Asset reduction initiatives have led OEMs to adopt build-to-demand strategies.</td>
<td>Suppliers must support higher magnitudes of OEM order variability.</td>
</tr>
<tr>
<td>The market is more demanding. Mass customization is replacing inventory-based product offerings.</td>
<td>Obsolescence is accelerating. Building ahead carries significant market and financial risk.</td>
</tr>
<tr>
<td>Competition in greater. Customers expect instant gratification.</td>
<td>Alternate Products are available. Companies that cannot provide products in a timely manner will lose sales.</td>
</tr>
</tbody>
</table>

Figure 16 Supplier Survey Report: Supply Chain Changes & Impacts

From information garnered through the Supplier Transformation Forums and Survey described above, two areas of specific learning requirements were identified:

- Supply Chain Management and functional best practices, including such functions as design for manufacturability, engineering analysis, quality, procurement, regulations, etc.
- Technical Capabilities, the interdisciplinary basics of electronics, mechanical, fluid and thermal dynamics, digital modeling and digital simulation and the need for suppliers to be able to understand where and how their product and processes fit into the entire integrated system and the lifecycle they support

The successful case study done by Project 2.2 partners California Manufacturing Technology Consulting (CMTC) with Omega Precision (Omega) described on page 18 began with a look, informed by CMTC internal studies and the WIRED 2.2 project at:
Smart Supplier Requirements
Looking Upstream in the Supply Chain – (What does my customer want?)

• International Traffic in Arms (ITAR) or “export controls” compliance
• Capabilities for involvement with design collaboration – New product design, Design for Manufacturing & Assembly (DFMA), Engineering Analysis, Non-Destructive Testing (NDT), Prototyping, Design for Six Sigma (DFSS)
• Metrics in place for On Time Delivery
• Risk analysis and mitigation planning
• Establish cooperative relationships and effective coordination
• Maximize flexibility and responsiveness
• A workforce development plan in place
• Pursue supplier-integrated product and process development

Looking Within the Enterprise – (What are my capabilities?)

• A Culture of Improvement - Management commitment, Infrastructure
• Visual Workplace - Value Stream Mapping, 6S, Visual Controls
• Lean Product Development - DFMA, Flattened Bill of Materials (BOM)
• Process Focus - Continuous Flow, Parts Presentation, Cellular Mfg, Right-sized equipment, Operator versatility
• Just In Time - Inventory Levels, Pull Systems, Load Leveling, Single Piece Flow, Setup
  Time Reduction, Takt Time
• Control of Processes - Mistake Proofing, Six Sigma, Self-Verification, Root-Cause Analysis, Total Product Management (TPM)
• Standard Work - Defining, Cycle Time, Sequencing, Standard Work in Progress (WIP)
• Continuous Improvement - Kaizen, Performance Measures, Quality Management System, Six-Sigma, Statistical Process Control (SPC)

Looking Downstream in the Supply Chain – (What do I need from my suppliers?)

• Design of the supplier network architecture
• Development of complimentary supplier capabilities
• Creation of flow and pull throughout the supplier network
• Cooperative relationships and effective coordination throughout the supplier network
• Maximize flexibility and responsiveness
• Pursue supplier-integrated product and process development
• Integrate knowledge and foster innovation
• Demonstrate continuous performance improvement

Results of the assessments completed by Omega Precision will be used to structure additional training and provision of resources to continue the company’s growth and strengthen their position in the Aerospace and Defense supply chain.
This basic list of requirements (or desired learning outcomes) formed the basis for the successful training that led Omega to become The Boeing Company’s Supplier of the Year (2007) and increase its business 15%.

Concurrently, the California Space Authority, Project 2.2 lead, and Antelope Valley College, which developed the Transformation Survey, had begun developing, in cooperation with other team members, a four-module two-day course around smart supplier needs identified in the Forums and Survey and around the CMTC-identified desired supplier learning outcomes.

### Supply Chain Management Course Modules

<table>
<thead>
<tr>
<th>Module 1</th>
<th>Module 2</th>
<th>Module 3</th>
<th>Module 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Principles of Supply Chain Management</strong></td>
<td><strong>Introduction to Supply Chain Relationships</strong></td>
<td><strong>Principles of Procurement &amp; Sourcing Management</strong></td>
<td><strong>Introduction to Law and Regulation of Business</strong></td>
</tr>
<tr>
<td>Introduce the concept of global supply chain operations and the fundamentals of managing the supply chain</td>
<td>Understand supply chains across functional and organizational boundaries and the contribution of strategic alignment of the supply chain</td>
<td>Introduce the importance of international procurement and sourcing management to an organization</td>
<td>Understand the key areas of law and regulations as they apply to aerospace daily operations and logistics management.</td>
</tr>
</tbody>
</table>

- Strategic Framework of Supply Chain Management
- Evolution of Supply Chain
- System Engineering to Aerospace Supply Chain
- Business Models of Supply Chain
- Network Structure of Supply Chain
- Supply Chain Integration
- Coordination in a Supply Chain
- Outsourcing, Make or Buy Decision
- Procurement Strategies
- Project Management
- Quality and Compliance Management Systems
- International Trade
- Domestic and International Regulatory Requirements

Sub-topics within these four modules serve as an enhanced version of the Supply Chain Management and functional best practices category of training mentioned above. The modules do not address other interdisciplinary company requirements of a technical nature. Based on a “supplier company capabilities model”, the focus is on improving company capabilities. (For skill-building of individual supply chain workers, see Training and Education segment). Sub-topics can be considered the “common learning outcomes” for the Supply Chain Management focus:
**Introduction to Supply Chain Relationships**

I.1. Network structure of Supply Chain
I.1.1. Vertical Collaboration
I.1.2. Horizontal Collaboration
I.1.3. Upstream Partnership
I.1.4. Downstream Partnership
I.2. Supply Chain Integration
I.2.1. Push-Based Supply Chain
I.2.2. Pull-Based Supply Chain
I.2.3. Push-Pull Supply Chain
I.3. Coordination in Supply Chain
I.3.1. 3rd Party Logistics Partnership
I.3.2. 4th Party Logistics Partnership
I.3.3. Lead Logistics Partnership (LLP)

**Principles of Supply Chain Management**

I.1. What is Supply Chain versus Logistics Management?
I.1.1. Definition
I.1.2. Business Objective
I.1.3. Scope of Responsibilities
I.2. Evolution of Supply Chain Management
I.2.1. Development Process
(how the discipline started and where it is headed)
I.3. System Engineering to Aerospace Supply Chain
I.3.1. Dynamic Alignment Framework
(DNA of business and enterprise supply chains)
I.4. Supply Chain Business Models
I.4.1. Continuous Replenishment Supply Chains (where relationships matter most)
I.4.2. Lean Supply Chains (Focusing on efficiency and lowest cost-to-serve)
I.4.3. Agile Supply Chains (where quick response is paramount)
I.4.4. Fully Flexible Supply Chains (where nothing is impossible)

**Principles of Procurement and Sourcing Management**

III.1. Outsource, Make or Buy Decision
III.1.1. Decision Making Process
III.1.2. Risk and Benefits Analysis
III.1.3. Differential Analysis
III.1.4. Break-even Analysis
III.2. Procurement Strategies
III.2.1. Kraljic’s Supply Matrix
III.2.2. E-Procurement
III.2.3. RFI / RFP / RFQ
III.3. Project Management
III.3.1. Project Life Cycles
III.3.2. Supply Chain Projects
III.3.3. Project Process Groups
III.3.4. Project Management Techniques

**Introduction to Law and Regulation of Business**

IV.1. Quality and Compliance Management Systems
IV.1.1. AS9100 & ISO 9001:2000
IV.1.2. Ethical & Social Responsibility
IV.1.3. Mission Assurance
IV.2. International Trade
IV.2.1. Supply Contracts for Aerospace Industry
IV.2.2. Trade Risks & Incoterms
IV.2.3. Trade & Customs Issues across the Global Supply Chain
IV.3. Domestic and International Regulatory Requirements
IV.3.1. Uniform Commercial Code
IV.3.2. Antitrust and Trade Regulation
IV.3.3. Regulation of U.S. federal procurement
IV.3.4. Regulation of International Commerce

**The Simulation Game**

V.1. Introducing the Role-Play Game
V.1.1. Background
V.1.2. Rules of the Game
V.1.3. Steps of the Game
V.2. Post-game Discussion
V.2.1. Results of the Game
V.2.2. Experience
V.2.3. Human Behavior
Two 21st Century Supply Chain Management principles three-day courses were held as part of Project 2.2. Lockheed Martin in Antelope Valley hosted the September, 2008 session and The Boeing Company in Huntington Beach hosted the October, 2008 session. In addition to the two-day Supply Chain Management modules described above, each session featured a company-specific course the third day, plus a company tour and expert dialogue around supply chain topics.

**High Performance Computing – Supplier Network Simulation**

Because a dynamic complex supplier network is difficult to manage, high performance computing can help with the understanding of this concept and with dynamic supplier network simulation demonstrating how a change in any node can cause oscillations.

“One collaborative business form, the manufacturing supply chain is particularly vulnerable to disruptive perturbations generated from the dogmatic application of outdated static techniques to complex dynamic systems. A manufacturing supply chain needs to utilize enhanced High Performance Information Sharing (HPIS) to orchestrate an optimal flow of materials, information and money from a company’s suppliers to customers and create innovative harmonies with internal systems. In reality, the adherence to old control centric management practices is denying supply chain practitioners the ability to integrate modern innovative theories and technologies into a business environment capable of eliminating the destructive waste of uncontrolled perturbations. There is ample evidence that a new dynamic approach is needed. . . .

- **Development of a Web Based Simulation Artifact**

  “In this project a Web based simulation applet was developed to demonstrate the management challenges of a managing a multiple tier supply chain. The applet resides on a virtual “Supply Chain Campus” in the “Simulation Center”. This center is designed to provide a “Learning to Be” experience. The simulation applet allows interaction with virtual supply chain learning. This simulation is based on the research results contained in the classic Sterman board game “The Beer Game” (Sterman 1992). It will also build on simulation work used in the NetLogo simulation of the “Beer Game” created by Densmore (Densmore 2004).
"This kernel simulation is an adaptation of a NetLogo simulation by Densmore available on the NetLogo site. His simulation added several concepts not demonstrated in the Sterman board game through the manipulation of GUI buttons, switches and faders. Densmore demonstrated additional parameters such as the ability of RFID between adjacent tiers in a supply chain to dampen unwanted oscillations through a property he called 'Vis'.

"It has been determined that the four tiers of Sterman’s Beer Game can be approximated using 24 state variables. These 24 state variables and all their permutations would generate a state space that contains roughly $1.74 \times 10^{39}$ different states. It is beyond the capability of human cognition to deal with this level of complexity and innovation without the assistance of HPIS.

- Implications for Practice

"Popular virtual world games are influencing capitalism and its business forms (Boellstorff 2008) into a new post-information age. The new age is being called the Creativity age. Many business theories and models are being explored in online economies without the gate keepers and mediators of traditional global economics. The static dimensions of highly controlled systems stifle innovation and prevent the formation of self organizing systems that foster a high innovative and creative business environment. New dynamic business systems should move in a laminar fashion through tens of thousand of potential stable product states and be able to capture new markets in a near chaotic pace. This laminar perpetual
evolution needs to occur in the context of dynamic models that more accurately portray the global economy. The adoption of HPIS by small agile firms, allows the expansion the scope of business horizons at a rate that will exceed the abilities of traditional small suppliers business and logistic systems to keep pace. A digital divide caused by the slow adoption of innovative theories will render many industries and their complimenting research disciplines irrelevant. Existing virtual worlds have demonstrated an ability to create massive persistent on-line societies with provide indirect professional benefits to the gamer/learner. The creation of learning objects in this virtual world designed to accelerate competitive advantage would give direct benefit to real world fields of practice would be important and significant.\(^1\)

The powerpoint found in the link at the end of this paragraph illustrates the nature of the simulation project demonstrated to show that enabling High Perfomance Computing at a small supplier company through a local university can increase competitiveness of California and U.S. suppliers. A demonstration of virtual metal form prototyping using High Performance Computing shows that the supplier can reduce the number of physical prototypes used and shorten the manufacturing cycle. Demonstration is meant to show the value that small suppliers can derive from some of the virtual and simulation tools already in use by larger companies, decreasing costs and saving time, making quality improvements, etc.

http://www.innovatecalifornia.net/WIREDdeliverables/High%20Performance%20Computing-ACE.pdf

\(^1\) A Supply Chain Simulation Artifact In a Virtual Campus Context, Ken Dozier, Executive Director, Western Research Application Center, Feb 15, 2008
**Supply Chain Transformation: The Role of Workforce Investment Boards (includes Supply Chain Resource Guide)**

The Project 2.2 NOVA white paper on the role of WIBs in supply chain transformation, with its Supply Chain Resource Guide element, will be discussed in the section on WIB roles (see p. 265).

**Outreach to Supplier Contacts, Project 2.3**

Project 2.3, which features not only development of an outreach plan regarding potential training funding available through the State, but also a significant training effort completed as part of the WIRED Corridor Initiative, will be covered in the section on *Training, Education and Needs Assessing for the 21st Century Workforce*, p. 174.

**Industry-Driven Community College Manufacturing Technician Certification**

While workforce capacity-building is critical to supplier competitiveness, it is so important to innovation support overall, that we have included a summary of Project 2.4 in the section on *Training, Education and Needs Assessing for the 21st Century Workforce*, p. 174.

**Phase II Industrial Rejuvenation/Supplier Competitiveness Projects**

**Key deliverables** in Phase II of the Supplier Competitiveness themed area built solidly on the work performed in Phase I.

1. **Online “21st Century Supplier Network Capabilities and Maturity (Self) Assessment** To enhance supplier understanding of competitiveness factors against company capabilities/capacities and to identify gaps in the organization’s competitiveness against a 21st Century supplier competency model, an online version of the Supplier assessment developed in Phase I was created. This company self-assessment can also serve as the basis for deciding which modules of the four-module Supply Chain Management Course would be most worthwhile for company needs.

2. **Online pre-(self)assessment** for individuals. Helps determine staff capabilities and skills needed by suppliers, determine skill gaps for individual training needs.
3. **Online self-paced version of the 21st Century Supply Chain Principles Course** was also created to facilitate supplier access to training materials and key learning outcomes identified in Phase I.

4. A “Training Funding Strategy”

In addition, again building upon the Phase I development of the Annual Supplier Transformation Forum and the Supply Chain Management Course, the California Space Authority offered several additional half-day or full-day forums and workshops during 2009's Phase II. The following events fulfilled the two deliverables indicated:

1. Three Industry Outreach Events
   a. Design for Electronics Manufacturability/Tour of Qual Pro, Department of Defense Nunn-Perry Award Facility, May
   b. Industry Hot Topics Event, June
      i. Numerous panels, including “How to Do Business with Government”, “Standards: What is Important, What is Changing?”, “Green Initiatives and Sustainable Manufacturing”, “Supplier Resources”
   c. Introduction to 21st Century Supply Chain Management, June

2. Two On-Site Customized Training Courses
   a. Space-Enabled Global Communications and Electronic Systems Industry Update, August
   b. Counterfeit Detection, Avoidance and Mitigation, December

CSA additional activities included:

- 4th Annual Supplier Innovation Forum, October (see Agenda, p. 138) [http://www.innovatecalifornia.net/WIREDDeliverables/2.2-4th-Supplier-Forum-091007-Agenda.doc](http://www.innovatecalifornia.net/WIREDDeliverables/2.2-4th-Supplier-Forum-091007-Agenda.doc)

- Development of Space 101 course (Space/Aerospace Fundamentals: “Rocket Science for Non-Scientists” course was delivered in July under Project 3.8, see Talent Development section)

- Relationship built with French Aerospace Valley (FAV) to support global aspirations of California suppliers. See Figure 13, page 125 above, showing limited number of California supplier global partnerships, which are necessary to ensure 21st Century competitiveness. In late February, 2009, the French Aerospace Valley was referred to CSA by the Office of the Governor, in regard to creating an itinerary for a visiting delegation representing FAV’s

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1 The French Aerospace Valley is comprised of aerospace stakeholders in the regions of Aquitane and Midi-Pyrenees in the southwestern region of France.
competitive cluster of companies. As a result, CSA facilitated coordination/execution of 19 statewide meetings and networking events in support of the FAV trade mission to California, March 15 – 20, 2009. Meetings facilitated outreach for and supported manufacturer/supplier new contacts with large French multi-national aerospace firms (Thales; Thales Alenia Space; SAFRAN; Spot Image) and with small, medium-sized French enterprises (Helilio; Boostec; Epsilon), all of whom are engaging in the California space enterprise community. Numerous California space enterprise stakeholders were engaged as partners providing in-kind support to the trade mission, including: Aerojet; NASA Ames; United State Research Association (USRA); Trimble Navigation; Stellar Solutions; Space Systems/Loral; Caltech; JPL; Wyle Labs; Quintron; United Paradyne; SpaceX; Antelope Valley Board of Trade; Antelope Valley College; El Camino College; Southern California Edison; and the Santa Ana District Office of the Small Business Administration. As a follow-on activity, CSA organized and helped plan a meeting with French Foreign Trade Minister Anne-Marie Idrac and members of the California space enterprise community. California company participation included: Aerojet, The Boeing Company, California Manufacturers and Technology Association, California Business, Transportation and Housing Agency, Lockheed Martin, New World Consulting.

Discussions centered on supplier international work and the WIRED goals of building better bridges among academia, workforce development and economic development entities. Follow-on activities were conducted under Project 3.8 (see Talent Development, (p. 171), as they emphasized workforce development partnering, STEM curriculum and development of STEM Pathways (see Project 3.11, p.179). A white paper on the French Aerospace Valley support project was drawn up under the title:

First Steps: California Space Authority’s Global Space Enterprise Outreach, Support for Potential Supplier Transformation and New Market Development in Cooperation with the French Aerospace Valley, August 2009 (see p.237)

- Other international interfaces were also conducted in Phase II:
  - Supplier international outreach support vis a vis Chile in cooperation with the California Governor’s Office
  - Outreach to suppliers regarding potential European Union (EU) opportunities surrounding the EU’s “Galileo” project
  - Supplier international business development support regarding opportunities in India
Development of a “Training Funding Strategy” for supplier training

http://www.innovatecalifornia.net/WIREDdeliverables/2.2-Smart-Supplier-Sustainability-Strategy.doc

The CSA “Global Smart Supplier Program Concept Paper” serves as a potential strategy to continue the work begun in the Corridor WIRED Project 2.2. It includes

- Program rationale
- Suggested 2010 program schedule
- Projected Income/Expense Data
California Innovation Corridor Sample Supplier Forum Agenda:

Supplier Transformation Annual Forum
Co-Hosted by
California Space Authority, Boeing Satellite Systems
October 7, 2009
Location: Boeing Satellite Systems, Event Center S24 E
2020 E. Imperial Highway, El Segundo, CA

AGENDA Presenters/Topics

Welcome
Judy Turner, Director, Programs and Partnerships, California Space Authority

Executive Welcome
Stephen O’Neill, President, Boeing Satellite Systems, Int’l; Vice President, Boeing S&IS Commercial/Civil Satellite Programs

Forum Agenda Objectives
Christine Purcell, Assoc. Director, Supplier Network, Industry Workforce and Manufacturing Development, California Space Authority

Keynote Presentation: Manufacturing 2.0 – The Milken Institute Study
Jack Stewart, President, California Manufacturers & Technology Assn. (CMTA)

Legislative Update from Capitol Hill and Sacramento: Discussion
California Update: Jack Stewart, CMTA
AB 32 – California Global Warming Solutions Act of 2006 Status & Implications:
Ray Wells, Assoc. Director, Technology Commercialization and Business Development, CSA
Federal Update:
Janice Dunn, Deputy Director, General Counsel and Federal Government Relations Director, CSA
Status of Federal R&D Incentives:
Randy Eickhoff, President, Acena Consulting, LLC

Industry Requirements and Business Outlook – Panel & Discussion
Jim Schultz, Director, Quality & Supplier Quality, Boeing Satellite Systems
Michael Gross, VP, Subcontracts, Aerospace Systems, Northrop Grumman
Daniella Picciotti, ASQ CQE, CMQ/OE, Sr. Mgr., Supplier Quality, Supply Chain Management, Space & Airborne Systems, Raytheon
Gary Bartmann, VP, Procurement, Lockheed Martin Company
Preggy Medina, Director, Supplier Mgmt, C3 Networks Div., The Boeing Company
Williard Strozier, Deputy Director, Small Business, LAAFB/SMC
October 7, 2009 Supplier Transformation Forum Agenda (cont’d)

Industry Realities: Challenges and Successes – Panel & Discussion
21st Century Supplier Network Competitiveness: Christine Purcell
High Performance Computing, Design for Manufacturability,
Complex Supply Network Dynamics:
Gary Johnson, VP, Ace Clearwater Enterprises
Ken Dozier, Executive Director, USC Engineering Technology Transfer Center, and
Western Research Applications Center
Dr. Keith Moo-Young, Dean of Engineering, California State University, LA

Department of Defense Common Supplier Requirements – Update on
Space Quality Improvement Council (SQIC) & Space Suppliers Council (SSC)
Gary Schipper, Space Quality Improvement, The Aerospace Corporation

Configuration Management for the World’s Largest Laser –
Serial Tracking and Site Registration
Ed Krieger, Team Lead, Controls/Information Systems, National Ignition Facility,
Lawrence Livermore National Laboratory, Department of Energy
Mike Smith, Director, Professional Services, Globia International

Lunch/Networking, Boeing Satellite Systems Production Tour

Industry Success via Leveraged Resources: Innovative Opportunities
Cost Accounting, Finance and Contract Management for Gov’t Contractors
Michael Tinsley, President; Tom Hernandez, VP, NeoSystems Corp.
Risk Management, Decision Support and Analysis Innovation
Joe Zino, The Goyak Group
Standards – What is Important and What is Changing – AS 9100 Update
Sidney Vianna, Det Norske Veritas Certification, Inc.
RFID as Counterfeit Parts Mitigation
Robert Vermillion, Certified, ESD and Product Safety Engineer-iNARTE,
RMV Technology Group, LLC
Tax Incentives – Manufacturing and R&D
Randy Eickhoff,
Government Resources for Suppliers
Dept. of Commerce’s Manufacturing Extension Partnership
Dept. of Defense Mentor-Protégé Program
California Community College – Centers for Applied Competitive Technologies -
Terry Weiner, Sr. Consultant, California Manufacturing Technology Assn.
Small Business Administration – Paul Smith, Orange County SBA
California Dept. of Labor and Workforce Development’s
Employment Training Panel (ETP) –
Jason Sakamoto, Economic Development Analyst, ETP
Supplier Transformation Strategy Capacity-Building Success

The WIRED Project 2.2 team, led by the California Space Authority, beginning with a comprehensive survey of 288 suppliers, identified the common supplier training requirements needed for 21st Century Smart Supplier success, developed four training modules and piloted the two day courses. Over 100 suppliers were instructed on the Supply Chain Management principles that have been identified as critical to supplier success in the 21st Century global market.

In addition, a white paper was developed, enlightening local Workforce Investment Boards as to their potential role in supplier transformation (Supply Chain Transformation: The Role of Workforce Investment Boards)

In Phase II of the Corridor Initiative, CSA developed an online version of the supplier company assessment and a web-based, self-paced version of the Supply Chain Principles course developed in Phase I, including a pre/post test. International outreach to assist suppliers in their global marketing efforts included the coordination of a trade mission and information exchange between California suppliers and the French Aerospace Valley.

Throughout the four-year Smart Supplier effort, an annual Supplier Transformation Forum was held, engaging dozens of prime contractors, government organizations, suppliers, training providers and nonprofits in panels, presentations and roundtables designed to educate suppliers about 21st Century competitiveness issues and solutions. Key topics from these forums were selected for follow-on workshops and seminars, which often included tours, student participation and networking.

An estimated 300 suppliers, as well as WIBs, economic development and education entities and government organizations have participated in these events over the course of the WIRED Corridor Initiative. The Smart Supplier Initiative has made strong strides in increasing awareness and understanding of the 21st Century Supply Chain Transformation and what it means to employers and workers in key California and U.S. industries.
Corridor WIRED Initiative 2.0 Projects

WIRED Initiative 2.0 focused on improving the international competitiveness of the California Innovation Corridor supply chain through design and execution of a “Smart Supplier Strategy” supporting manufacturers, small businesses, and entrepreneurs in adapting to the global manufacturing transformation. Numerous products and tools were developed to accomplish this, including the identification of common learning outcomes necessary for supplier success in the global environment, a four-module “Supply Chain Management” course and self-assessments for both companies and workers. Training of suppliers and new satellite manufacturing workers took place, as well, with a manufacturing technician certification program developed and implemented to address the need for training programs for entry-level workers. Additional tools and products delivered are described below.

Project 2.1/2.2 - Through surveys and other means, characterize “smart supplier” competitiveness skills and articulate a set of common smart supplier program requirements and learning outcomes across the supply chain training provider network. In addition to the above and other products shown below, a Supply Chain Management course was developed, and piloted at two venues.

Antelope Valley College (AVC): AVC is a community college located in the Antelope Valley, an aerospace center of Los Angeles County. With guidance and collaboration from the California Space Authority, AVC served as the developer of the supplier survey and the survey analysis provided in a report published in 2008.

Deliverable References:

Supplier Transformation Survey (foundation for all of 2.2)

Supplier Transformation 21st Century Supply Chain Management at Lockheed Martin Palmdale (Pilot of Course - Antelope Valley)
http://www.innovatecalifornia.net/WIREDdeliverables/SupplyChainSeminar_LM.pdf

Supplier Transformation 21st Century Supply Chain Management at Boeing Huntington Beach (Pilot of Course – Los Angeles Metro area)
http://www.innovatecalifornia.net/WIREDdeliverables/SupplyChainSeminar_Boeing.pdf

California Space Authority (CSA): CSA served as project lead for the 2.1/2.2 projects. As the California Innovation Corridor Initiative program manager and a
nonprofit representing the interests of space employers in California, closely affiliated with aerospace and other high-tech industries as well as space, CSA was well-positioned to guide the important supplier element of the Corridor Initiative. CSA’s expertise, and that it recruited through the Supply Chain Industry Advisory Group (SCIAG) that it established, served for four years as a body of institutional knowledge about both the traditional and the transformational nature of the supply chain environment. While CSA’s deliverables were few, its influence was significant on every product and deliverable created under 2.1/2.2.

**Deliverable References:**

*California Aerospace Supplier Transformation Requirements for the 21st Century* (Key 2.2 report on survey findings, overview of 2.2)

2007 Smart Supplier Forum
[http://www.innovatecalifornia.net/2_2_forum_details/](http://www.innovatecalifornia.net/2_2_forum_details/)

2008 Smart Supplier Forum

2009 Smart Supplier Forum
[http://www.innovatecalifornia.net/WIREDdeliverables/2.2-4th-Supplier-Forum-091007-Agenda.doc](http://www.innovatecalifornia.net/WIREDdeliverables/2.2-4th-Supplier-Forum-091007-Agenda.doc)

**California Manufacturing Technology Consulting (CMTC):** CMTC provides professional management consulting services to assist manufacturers in achieving and sustaining world-class performance. CMTC is the largest member of the National Institute of Standards and Technology (NIST) Manufacturing Excellence Partnership (MEP). In cooperation with CSA, CMTC identified the common learning outcomes necessary for suppliers to succeed in the 21st Century environment. CMTC also piloted a training program based on these learning outcomes, which garnered the company trainee Boeing’s Supplier of the Year honors and a one year business volume increase of 15% (See Success Story, page 17)

**Deliverable References:**

*The Development of A Smart Supplier – 20080901*
[http://www.innovatecalifornia.net/WIREDdeliverables/The%20Development%20of%20A%20Smart%20Supplier-20080901.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/The%20Development%20of%20A%20Smart%20Supplier-20080901.pdf)
The Development of A Smart Supplier – A Case Study
http://www.innovatecalifornia.net/WIREDdeliverables/The%20Development%20of%20a%20CSA%20Smart%20Supplier%20A%20Case%20Study.pdf

Strategic Vitality LLC: Strategic Vitality LLC (SVLLC) was a one-year partner in the 2.1/2.2 project. A consulting firm which also served as strategic planning consultant for the California Space Authority’s statewide space enterprise strategic planning, SVLLC had established CSA’s Space Manufacturing Group, the recommendations of which led to the Smart Supplier element of the California Innovation Corridor Initiative proposal, which SVLLC developed for CSA.

Deliverable References:

SCIAG Roster (Initial advisory group recruited for Project 2.1/2.2)
http://www.innovatecalifornia.net/WIREDdeliverables/2.1-SCIAG-Roster-9-30-06.doc

Supplier Projects Overview SCIAG
http://www.innovatecalifornia.net/WIREDdeliverables/092806-Supplier-Projects-Overview-SCIAG.pdf

RECAP – Nov 9 06 Supply Chain Forum-FINAL
http://www.innovatecalifornia.net/WIREDdeliverables/RECAP-Nov%209-06%20Supply%20Chain%20Forum-FINAL.pdf

NOVA (North Santa Clara Valley) Workforce Investment Board: NOVA serves the Silicon Valley community with job placement, dislocated worker and training resources and other workforce system services. It was included in the 2.1/2.2 project to help articulate what role the WIBs had in relation to Supplier Competitiveness.

Key Deliverable: Supply Chain Transformation – Role of the Workforce Investment Boards + Appendix (Supplier Training Resource Guide)
http://www.innovatecalifornia.net/WIREDdeliverables/SupplyChainTransformation%20-%2ORole%20of%20Workforce%20Investment%20Boards%20Appendix.pdf

USC Viterbi School of Engineering Western Research Applications Center (WESRAC/USC): WESRAC is exploring High Performance Information Sharing (HPIS) as a competitive advantage for suppliers in adapting to the complexity and accelerated pace of the 21st Century Supply Chain environment. A computer simulation was created demonstrating the oscillations of a negative feedback system in a small supply chain (case study), meant to document value of accelerated information-sharing throughout supply chain network.
Deliverable Reference:

High Performance Computing – Ace Clearwater Example
http://www.innovatecalifornia.net/WIREDDeliverables/High%20Performance%20Computing-ACE.pdf

Project 2.3 - Train 1000 new satellite manufacturing workers and develop and implement an outreach strategy targeting 3000 California suppliers, 50 economic development entities, 25 WIBs with “smart supplier” information, training provider resources, training funding support information to employers, acquainting them with the availability of California Employment Training Funds through the State’s Employment Development Department. (See detail on training segment of this project under Training, Education and Needs Assessing for the 21st Century Workforce, p. 174)

California Space Authority: CSA worked in partnership with the State’s Employment Training Panel to assure dissemination of ETP and other supplier training information throughout the three years of the 2.3 project. Part of that effort was CSA’s development of the Outreach Strategy. CSA also facilitated the relationship between Space Systems/Loral, a space manufacturer in Silicon Valley faced with 1000 new hires for several new international satellite building contracts, and ETP, resulting in the projected training of 1000 new satellite manufacturing industry workers.

Key Deliverable: CSA ETP Outreach Plan

Project 2.4 – Create an Industry-driven sequential certification process in manufacturing, including an articulation agreement with minimum of two high schools.

El Camino College is in the heart of the Los Angeles County South Bay aerospace industry, the largest concentration of aerospace in the country. The College has for several years been working with CSA and the aerospace employers locally to enhance workforce development and provide family-wage jobs for local residents.

Deliverable Reference:
Certification Manufacturing Technical Body of Knowledge
High-Wage Job Creation through Talent Development

As mentioned previously, each of the 25 projects in the California Innovation Corridor Initiative has interfaces with each of the three Initiative pathways: Innovation Support, Industrial Rejuvenation/Supplier Competitiveness and Talent Development, no matter under which theme the project actually follows in the original organizational structure. But the Talent Development pathway, originally featuring fourteen projects, was hands-down the richest area of involvement, drawing activity not only from the original fourteen projects within its purview, but from nearly every project within the Innovation Support and Supplier Competitiveness areas, as well.

The transformation goal laid out for the Talent Development pathway in the Corridor’s Project Integration Protocol (see page 61) was to:

*Integrate consideration of current and future industry enterprise needs into workforce and educational planning and policymaking.*

You will see below just how much Corridor WIRED partners took undertook to achieve this goal. Job creation and retention is much more robust when all job stakeholders are aligned behind the real-world needs of the global workplace.

As the nature of the new 21st Century has unfolded, we have found interrelationships and interconnectedness at its core. This is also the essence of talent development, as illustrated by the scope and the interfaces of the Corridor projects involving talent development, the number of which goes well beyond the original fourteen.

There are three sub-sections to our segment on Talent Development. In the first, we will discuss the projects or project segments focusing on the principles, policies and professional development necessary for effective talent development. In the second part (*Training, Education and Skills Assessing for the 21st Century*) will be featured projects involving students and/or incumbent worker trainees and/or employer needs assessments. And finally, in the third section, we will list the Corridor training or education-related products and deliverables such as curriculum, instructional materials, etc.

**Principles, Policies and Professional Development**

While all of the projects addressing Talent Development are important, there are a few signature Corridor projects that need top mention because they serve as blueprints for systemic, transformational change and address the professional development and policy aspects needed to succeed. They also outline principles that characterize the ideal state. Two of these projects were in the original Talent
Development 3.0 pathway, one was actually a project within the Innovation Support pathway, but has great talent development significance. All three are among what the Corridor Leadership Team identified as “Sustainability Projects”, meant to have a life after WIRED. One of these, Project 3.5 - the Science, Technology, Engineering and Math Collaborative Action Plan (STEM CAP) – will be described in detail in this section. But first, it is advisable to offer a brief description of the two workforce system-related talent development projects that will be described more fully elsewhere.

In regard to the workforce system, two projects were of greatest value in terms of talent development/professional development. Both are covered in depth in the section of this report entitled “Workforce Investment Boards: Existing and Potential Roles in the Innovation Economy”, beginning on page 243.

**WIB Learning Collaboratory**

Professional development and resource development are touchstones for the California Workforce Association (CWA), Lead on the WIB Learning Collaboratory, Project 3.14. CWA worked with the California Space Authority and the California Space Education and Workforce Institute (Institute) on the workforce system-related talent development project which will also be described in the Role of the Workforce Investment Boards section mentioned above.

Through a myriad of activities (numerous conferences and workshops), development of five monographs, interface with other WIRED project partners and a host of other activities, the California Workforce Association used its normal schedule of activities, hosted new activities and leveraged the Project 1.7 WIB Toolkit described briefly below to help transition WIB members, through professional development, to adapt to the new global innovation and supplier environment. CWA also identified four key barriers/issues and made recommendations to address them (recommendations CWA developed are covered in the section entitled Key Findings in Innovation Support, Supplier Competitiveness and Talent Development, beginning on page 269). Barriers identified:

- Performance Measures
- Demand-driven Design
- Role of the WIB
- Access to Resources

Aligned closely with Project 3.14, Project 1.7 was conceived to be a “toolkit” for WIBs and a resource for the Learning Collaboratory in dealing with the transformational change necessary to meet the demands of the 21st Century worker and workplace. This “Racing for the Future” online sourcebook, produced in partnership by the California Council on Science and Technology (CCST), the California Workforce Association (CWA) and the California Space Education and
Workforce Institute (Institute), offers 150 pages of support to WIBS in understanding the environment and their role in supporting and sustaining the innovation economy that has made California a global leader (http://wibtoolkit.net/main.php). The five sections of the toolkit that provide the WIBs welcome information and engender focus in regard to the 21st Century workplace transformation that has occurred will be described more fully in the WIB section mentioned above. But they include:

- Background
- Five Core WIB Roles
- Industry Profiles
- Case Studies
- Resources

The WIB Toolkit serves as a foundation for professional development of WIB staff and board members, as well as other workforce stakeholders in adjusting to the new global workplace, addressing both its challenges and opportunities for workers and workforce professionals. The Toolkit is a much-needed professional development resource in acquainting workforce system employees and executives to the demands which must be met in order to ensure the California and U.S. talent development necessary for workers to enjoy the benefits of the 21st Century innovation economy.

While the Phase II aspect of the WIB Learning Collaboratory project will also be covered in the Role of the Workforce Investment Boards section referenced above, it is worth noting that a major public/private professional development effort was at its core. As you will see from the overview in the section on WIB roles, in Phase II of the WIB Learning Collaboratory, the California Workforce Association developed an orientation on the Workforce Investment System for California space enterprise human resource directors and the California Space Authority developed an orientation to the priorities and practices of industry HR professionals for presentation to the WIBs.

*Science, Technology, Engineering and Math Collaborative Action Plan (STEM CAP)*

The STEM CAP Project 3.5 effort was both a sustainability project of the Corridor Initiative and a signature project of the Talent Development pathway. It is believed to have created the first statewide private/public STEM collaboration in the country and the first private/public statewide STEM inventory.

While industry had recognized the STEM workforce crisis for over a decade, public sector recognition of the STEM issue began in earnest with the publication in 2005 of *Rising Above the Gathering Storm, Energizing and Employing America for a Brighter Economic Future*. The report was produced by the National Academies. It described the nature of the “perfect storm” striking the U.S. -
21\textsuperscript{st} Century technology-based economy demanding a technically-skilled workforce and the number of workers possessing technical skills or STEM degrees declining to a pitiful few. In California, this report and others had led to one important initiative, a collective effort by the state’s two public university systems to double the number of math and science teachers produced in a decade by the two systems (the lack of an adequate number of math and science teachers was an issue identified in the \textit{Rising Above the Gathering Storm}). This initiative, which aligned with the STEM CAP effort, was charged with helping to address the projected shortage of 33,000 math and science teachers.

While this initiative powerful and as we will see is having great success, it still only united two of California’s four education systems behind a unified STEM enhancement effort, although outreach to community colleges and some outreach to high schools was a part of some elements of the joint university system initiative.

Since the strategic goal for the Talent Development pathway of the Corridor Initiative called for the Corridor to \textit{“Integrate consideration of current and future industry enterprise needs into workforce and educational planning and policymaking”}, the math and science teacher initiative was clearly not enough. In developing its proposal first to the State and then to DOL, CSA, familiar with the joint university system initiative, recognized that a broader approach would accelerate California’s statewide ability to prepare workers for 21\textsuperscript{st} Century employment. It must be said that the challenge was daunting.

While it was understood, at least in some higher education circles, that there were not enough math and science teachers and that not enough students were entering the difficult science and math degree programs, the larger understanding, especially at the community college and K-12 levels, that the STEM crisis required systemic changes in all four systems, had not yet been recognized at the beginning of the Corridor WIRED Initiative. Many educators and education policymakers still did not know what “STEM” was, did not recognize how much the current and future workplace would require technical skills and technology-savvy workers. In fact, there was an underlying bias toward liberal arts education as opposed to technical education because so many more of California’s educators at all levels possess liberal arts rather than technical degrees. In addition, under the mandated “No Child Left Behind”, students were tested in reading and math, but not in science at that point, resulting of course in a de-emphasis if not total dropping of science from classroom study.

\textit{“Eighty percent of K-5 teachers report spending less than 60 minutes each week on science, and 16\% of teachers are spending no time at all on science.”}

----Bay Area Science Study, \textit{Lawrence Hall of Science}
On top of that, research had already shown that many elementary teachers are completely uncomfortable teaching math and science and fewer math and science graduates go into teaching because of their lucrative private sector career options.

CSA and its sister organization, Project 3.5 Lead the California Space Education and Workforce Institute recognized that it was only by including all four educational systems (K-12, Community College, California State University and University of California), as well as industry and the informal science community in a dialogue to identify common values and principle-based recommendations that California would truly be ready to meet the huge STEM challenge it faced.

The original funded partners of Project 3.5 represented only a small fraction of the 400+ participants eventually involved in the STEM CAP:

- California Space Education and Workforce Institute (Institute) – 3.5 Lead
- California Polytechnic University, San Luis Obispo (Cal Poly SLO)
- Mathematics Engineering Science Achievement (MESA)
  
  As the STEM CAP evolved, MESA withdrew from its funded role in the STEM CAP project, but continued with inkind support
- California Council on Science and Technology (CCST)
- El Camino College (El Camino)
- Strategic Vitality LLC (SVLLC)

Representatives from these entities, plus key education system executives from the California State University and the California Community College serving as in-kind advisers, acted as a formation committee to launch Project 3.5. They assisted in articulating the Project 3.5 goal:

_Develop a partnership and a strategic action plan to increase the number and support the development of science, technology, engineering and math (STEM) students, graduates, teachers, professors, mentors (K-University) within the California Innovation Corridor and the State, leveraging resources of not only education and academia, but also of industry and informal science._

The start of the project’s larger collaboration was a June, 2006 STEM CAP Forum, with CSA sharing information about the WIRED effort, CCST presenting on *Rising Above the Gathering Storm*, and with two important panels setting the stage for the massive collaboration which was to follow. One panel engaged executive level participants from all four educational systems to share what they were doing in STEM or math and science; another featured industry STEM perspective, programs and projects; a third highlighted STEM-related informal science efforts. The Forum closed with an introduction to the new statewide STEM Inventory that CSEWI would develop, believed to target the most broad-based private/public group of STEM stakeholders in the country. Two STEM
teachers served as luncheon speakers on their classroom experiences, with three workshops rounding out the day (Access and Equity, A Successful STEM Partnership: Barriers, Opportunities and Outcomes; and Transition Points and Strategies).

Around the same time, a broader STEM Steering Committee was recruited to guide the Project 3.5 project. The Steering Committee was comprised of about 25 STEM stakeholders, an education system executive from each of California’s four educational systems, industry STEM points of contact, informal science representatives, government education and workforce stakeholders and nonprofits.

After the initial forum and Steering Committee meeting, the Institute engaged the services of the Alliance for Collaborations to Heighten Educational Success (ARCHES) as a partner in developing the STEM Collaborative Action Plan, *High Stakes: STEM Education, The Essential Ingredient for California Competitiveness* ([www.innovatecalifornia.net/documents/STEMCAPDOC.pdf](http://www.innovatecalifornia.net/documents/STEMCAPDOC.pdf)).

There were several steps in the development of the actual STEM CAP:

- The Coalition was expanded, with several forums held for STEM stakeholders from the education, academia, industry, informal science, workforce and economic development and other government communities
- ARCHES convened an Advisory Committee just for the development of the Plan (the Steering Committee also oversaw all Project 3.5 activities)
- An in-depth inquiry was performed, with ARCHES and its Advisory Group reviewing the recommendations of 22 national studies on the STEM crisis
- Twenty-five stakeholder focus sessions were held with 273 statewide participants representing the University of California, California State University, California Community College, Federal Research Centers and Laboratories, Industry Associations, and K-12, e.g. groups of School District Superintendents, groups of principals, groups of School Board members, etc. Stanford Research International (SRI) assisted in the design of the focus sessions, the protocols and the rating scales, with digital recordings and transcriptions of focus session dialogue produced
- Additional forums were held, engaging the broader stakeholder group to provide input, and hear updates and ancillary STEM information
- Forum and focus group analysis – the multi-year input was distilled to 10 recommendations and accompanying action items

In all, four forums were held. In addition to the panels on system and industry/informal science activity, each Forum featured different highlights and breakout sessions.
STEM CAP FORUMS

June, 2006 Forum
  ▪ Highlights
    o Overview of STEM crisis
    o Panel of California’s four educational systems
    o Industry panel
    o Informal Science panel
    o Teacher testimonials
  ▪ Breakouts
    o Access and Equity
    o STEM Partnering Success
    o Transition Points/Strategies

December, 2006 Forum
  ▪ Highlights
    o Overview of Riverside/San Bernardino STEP Conference
    o STEM Inventory progress
    o Presentation by STEM Manager, Office of the Secretary of Defense
  ▪ Breakouts
    o Recruitment/Retention of STEM Students, Graduates, Teachers, Professors and Mentors
    o STEM Academic Curriculum and Industry/Workforce Relevance
    o Seamless STEM Transitioning, Elementary – Workforce

May, 2007 Forum
  ▪ Highlights
    o Moderator dialogue between industry, K-12 education executives (Rick Stephens, Sr. Vice President, HR, The Boeing Company; Jack O’Connell, California Superintendent of Public Instruction)
  ▪ Breakouts
    o K-12
    o Industry
    o Higher Education
    o Informal Science

April, 2008 STEM CAP Preview Forum
  ▪ Highlights
    o Preview of final STEM CAP
    o Presentation: Dr. Anthony Monreal, Deputy Superintendent of Curriculum and Instruction, California State Office of the Superintendent of Public Instruction
  ▪ Workshop on Collaborative Implementation of the STEM CAP
A set of Guiding Principles was established by the Advisory Group to provide continuity of thinking across the public/private sectors and across California’s four education systems:

- Shared Vision by Leaders
- New Relationships to Leverage Resources
- Sustained Commitment with a Policy of R&D and Ability to Scale
- Regional Approach
- Inspire and Engage

As one can see, WIRED principles of a demand-driven system - consideration of industry needs in education and workforce planning, regional strategies, collaboration and public/private partnering were embedded in both the Forum agendas and the Guiding Principles.

The organizing principle that was suggested in the December, 2006 Forum, and adopted by the Advisory Group in developing the STEM CAP recommendations, was based on NASA’s Strategic Education Framework (NASA Framework):


Each of the ten final STEM CAP recommendations falls under one of the four categories of the NASA Framework.
STEM CAP\textsuperscript{1} Recommendations

\textbf{Inspire}
- Motivate students and adults, using a variety of incentives, to study and enter STEM careers, with a special effort geared to those in currently underrepresented and underserved groups
- Build public support for and understanding of the value of STEM education for all students and citizens

\textbf{Engage}
- Provide rigorous, relevant Career Technical Education (CTE) that prepares students for both higher education and the workplace in order to reinforce classroom instruction and provide tangible relevant skills for greater subject matter retention and competency
- Deliver science and math curriculum that motivates, energizes, reinforces and rewards the natural curiosity and interest students bring to the subject

\textbf{Educate}
- Align state K-12 science and mathematics standards and assessments with postsecondary and workforce expectations of what high school graduates should know and be able to do
- Implement a comprehensive package of recruitment strategies for mathematics and science teachers throughout grades K-12 to expand and diversify the pool of fully prepared and certified candidates
- Strengthen teacher preparation programs in mathematics and science through inclusion of hands-on, problem-based instruction and strategies that will benefit all students, including underrepresented and underserved students
- Provide ongoing, research-based professional development programs, focused on both content and pedagogy, for all mathematics and science teachers and faculty K-Higher Education

\textbf{Employ}
- Create Industry partnerships directly engaged with educators to deliver relevant, motivational and exciting instruction to reinforce and enhance STEM curriculum while setting the foundation for building a competitive and qualified workforce in tune with emerging work realities.
- Create hands-on internships and fellowships for students, teachers and faculty with employers in industry, academia, informal science networks and civic organizations

\textsuperscript{1} High Stakes: STEM Education, 2008
www.InnovateCalifornia.net/documents/STEMCAPDOC.pdf
Among the sixteen Actions mapped to the recommendations above (see STEM CAP at previous link), one seeks to address is feared to be a collaborative, but perhaps “fractured” approach to implementing the STEM recommendations. The Plan states:

California is lacking a central mechanism for business and industry to focus their efforts on a common agenda that will have a statewide impact.

----STEM CAP, page 32

For this reason, the Plan’s final action item recommended is for the “launching of a new, independent, non-governmental State STEM Council.”

One sustainability note is that, following the release of the STEM CAP, two STEM council-like groups have emerged, albeit neither “independent, non-governmental”. One is a State K-12 initiative, one the collaborative California STEM Innovation Network Planning Initiative put together by the California State Polytechnic University, San Luis Obispo (Cal Poly SLO) and the California Council on Science and Technology (CCST), funded by the Gates and Bechtel Foundations.

In the summer of 2008, the STEM CAP was field tested with six regional STEM CAP implementation pilots being conducted. Regional educational/community alliances competed for ARCHES funding to allow demonstrations of how STEM CAP recommendations, actions can be implemented:

- Alliance for Education: San Bernardino Superintendent of Schools “Making the Connection”, Applications by Business and Labor for Educators (ABLE) – increasing student engagement with math through online resources, including video vignettes
- The Aurora Project – California-wide project to support community college freshmen and sophomores in pursuing math or science teaching careers
- Monterey Bay Educational Consortium/University of California Santa Cruz (UCSC) Educational Partnership Supporting STEM Education – Hiring of five community college students as academic interns exposed to teaching of math or science as possible career
- Sacramento Collaborative for Regional Education and Workforce (CREW) STEM Teacher Recruitment at Sacramento State University – Internal Sacramento State University project to increase pool of qualified teacher applicants in STEM fields
- San Luis Obispo County P-16 Council’s Cal Poly State University Learn By Doing Lab – Leveraging the goal of the Lab, which is to recruit/train new science teachers, support professional development of in-service science teachers, inspire/engage middle students in science, this project provided “teaching” opportunities for Cal Poly science students, connecting them with middle schoolers studying science
- Southern Alameda County Regional Alliance – Funded strategic actions to address alarming standardized test rates of math, supporting the 2008 Summer Algebra Academies, pre-algebra and algebra refresher courses for 7th – 9th graders

In addition to the STEM CAP, Project 3.5 featured development of the STEM Inventory [http://www.steminventory.net/](http://www.steminventory.net/). It was discovered that there was no one place that all California STEM programs could use to share their work. The STEM Inventory was launched to serve as that place. As the project evolved, it was learned that some industry associations such as the National Defense Industry Association (NDIA) had begun collecting STEM programs, but their reach was mostly within the industry sector or to regional education partners. NDIA submitted its programs to the Institute for incorporation into the STEM Inventory.

The STEM Inventory is an on-line, user-friendly, searchable database of many California and national STEM programs organized by grade level, geography, and topic. It targets students, STEM practitioners, teachers and parents. It is envisioned as “the place” to go to find and research existing STEM programs. At the end of Phase I, the development of a STEM community of practice emerged as an opportunity to expand the usefulness of the STEM Inventory.

Another aspect of Project 3.5 was that done by an adjunct professor in the Cal Poly SLO Electrical Engineering Department. This 3.5 partner developed a white paper presenting results of a study conducted on the California State University (CSU)-NASA/JPL Collaborative Teacher Professional Development Institutes located at Cal Poly SLO, CSU Fresno and CSU Bakersfield. The promising practices and “collective wisdom of their directors” are highlighted in the white paper, with a potential model proposed as a framework for other campuses and institutes to consider implementing. The paper compares and contrasts the three CSU campus STEM-related professional development institutes, concluding with the identification of critical elements and best practices of a “high quality collaborative teacher professional development institute model as found from this study”:

- High quality curriculum (such as that of the CSU/NASA Institutes)
- Sustained professional development
- Materials support
- Administrator support (K-12 and institutes of higher education – IHE)
- Assessment and evaluation

The paper also creates an illustrated Collaborative Model that articulates the
important components and best practices that become a system (the Collaborative Model) when all are implemented. The beauty of the Collaborative Model is in its ability to be replicated anywhere, with NASA or other informal science partners, anywhere in the CSU system, or even outside of the CSU system if quality alternatives to some of the resources unique to CSU can be found.

The El Camino College (ECC) role in Project 3.5 was three-fold:

- To establish more partnerships between El Camino College and local high schools
- Expand ECC’s Project Lead the Way (PLTW) and Robotics camps activities
- Support the development of the STEM CAP

The College’s key accomplishments under Project 3.5 included the following:

- The number of PLTW and Robotics Camp teachers expanded from 2 to 21
- Hundreds of students were recruited for PLTW and Robotics camps from local high schools
- Added five PLTW high schools and expanded the programs at seven high schools
- Obtained an additional $565,000 in funding to sustain the programs
- Offered 1,200 high school students PLTW courses through El Camino College since the inception of the program
- Established Concurrent Enrollment Agreements with three local high schools for the PLTW courses through El Camino College since inception of the program

In addition, ECC performed a case study “to assess (PLTW) program benefit to technical student recruitment”, garnering input along the lines of the following from educators and students alike:

- “After PLTW, the California Academy of Math and Science (CAMS) offers a vertically aligned curriculum that gives students a pathway to prepare for engineering….The impact of this curricular change was felt almost immediately. The strong interest in engineering was bolstered and student extracurricular choices demonstrated increased focus on engineering-based challenges. The robotics club grew from 65 students to 105 students.” – Ted Harder, Director of Engineering Programs, CAMS
- “Sandra came to the Lennox Academy in her freshman year planning to find a career where she could use her communication skills. She had no plans related to engineering. However, due to her high math skills, she was paced into Principles of Engineering. In this first semester, she showed herself as a capable student...As a sophomore, in the second
**PLTW class of Introduction to Engineering Design, Sandra is blossoming, creating designs, coming up with innovative ideas for projects, and thinking out of the box. She has indicated that she now wants to major in Engineering.** ---Jose Rivas, Instructor, Lennox Math, Science and Technology Academy

- **“Matt had a hard time his freshman year. His GPA was 1.7 and his ambition was to be a drummer in a rock and roll band or a martial arts instructor.”** Matt came to the Engineering Academy just “going along” with a friend, but got really excited about the program. “He went from having a blasé attitude about school to being the top student in the Academy with close to a semester GPA of 4.0. Matt is the president of the Engineering Academy in this his senior year…In his spare time he designs models with the Inventor software. He created the 3D model of the robot built last year for the FIRST competition. After presentations on his robot, employers began asking when he would graduate from high school, expressing an interest in paying for his education. “Next year, he is heading to El Camino College, and planning to transfer from there to CSU Long Beach as an engineering student.” ---Jeff Ordway, PLTW Instructor, Hawthorne High School Engineering Academy

- **Juan’s freshman GPA was 1.266. “But within the Engineering Academy, two weeks after the kids start, they know each other and the teachers know the kids by name. When the kids realize they matter, they also start caring. Juan started EA as a sophomore and his GPA was 3.6 for that year. His CSU cumulative GPA is now 3.4. This quarter, as a junior, his cum is 3.6.”** --- Jeff Ordway, PLTW Instructor, Hawthorne High School Engineering Academy

The conclusion of the case studies is the Project Lead the Way program is a successful program in inspiring, engaging and educating STEM students. Dr. Ralph Mills, of the Small Manufacturers’ Institute, is the PLTW liaison with El Camino College. He believes that the PLTW model in place at Hawthorne High School/El Camino College is one of the most successful programs ever, worthy of replication nationwide.

**Phase II – Project 3.5 STEM CAP**
The California Space Education and Workforce Institute was the Lead on Project 3.5 Phase II, with the California Space Authority partnering. The purpose of the Phase II STEM CAP project was multi-faceted. One key element was to provide “an ongoing forum for the STEM CAP network to sustain STEM/Career Technical Education (CTE – outgrowth of former vocational education) enhancement dialogue and action across government, education, academia, industry and informal science boundaries as a means of implementing the STEM Collaborative Action Plan developed by the California Space Education and Workforce Institute and its diverse statewide stakeholders. Other Phase II 3.5 purposes included:
Performing an analyses and fostering STEM/CTE solutions being discussed statewide

Outlining a concept for a community-based pathway/continuum of STEM/CTE programs and activities aligning with recommendations and/or actions identified in the STEM CAP.

Evaluating industry support for an Industry and/or statewide Career Readiness Certificate (CRC)

Expanding usefulness of the STEM Inventory website supporting STEM CAP implementation

On September 26, 2009, the Institute and many of its original STEM CAP partners re-convened, revisiting how to best collaboratively implement the STEM CAP, and advance STEM and CTE education and workforce development. [http://www.innovatecalifornia.net/WIREDdeliverables/STEM%20CAP%20Forum%20Presentations%209-26-09.zip](http://www.innovatecalifornia.net/WIREDdeliverables/STEM%20CAP%20Forum%20Presentations%209-26-09.zip). One of the six STEM CAP pilot implementation project leads reported on progress made after the pilot, the CSU Chancellor’s office spokesperson applauded the collaborative cross-sector approach of the development of the STEM CAP and on a sustainability note, the CSU now uses it in all of its grant applications to show STEM continuity across systems. In another panel, a presenter shared details about the launching and operations of an entire school focused on STEM and the positive math scores resulting.

The keynote speaker at the Phase II STEM CAP Forum was Jay B. Labov, PhD, Senior Advisor for Education and Communications for the National Academies. His message was that the STEM CAP was timely, as it was completed just as national attention was moving more towards STEM competency. The Forum ended with a workshop conducted by Ivan Cheng, Professor of Secondary Education at California State University Northridge. Professor Cheng shared a successful model of an algebra-readiness summer program.

Enhancement of the STEM Inventory was another focus of the STEM follow-on Phase II effort. New content was developed, expanding the usefulness of the site, STEM outreach was enabled by new social networking features enhancing the site, general STEM Inventory maintenance was conducted on a daily basis. The new program metric for the STEM Inventory was the addition of 30 programs, which unfortunately was not achieved. Ten new programs were added, with numerous inquiries fielded regarding other programs which are expected to self-upload after the performance period. As a result of outreach efforts conducted through social networking sites and local events, the STEM Inventory as of November 30, 2009, was receiving 60 hits/day, not bad for a relatively new resource, but not quite at the 100 hits/day level projected.

Outreach to policymakers and other STEM stakeholders regarding Career Technical Education continued during 3.5 Phase II. In quarter one, CSA attended weekly meetings of the Get REAL Coalition established to increase public and
policymaker awareness of STEM-related CTE. In Quarter two, CTE as an important worker employment opportunity was featured during California Space Day and California Space Week in Washington DC. Both events featured STEM and CTE policymaker education teams. Quarter three include one meeting with the STEM Education Coalition, five meetings with state Assembly members and one CTE meeting held with the Department of Education. While after the close of Phase II activity November 30th, a CTE strategic planning session was held in December in Sacramento with the California Department of Education.

Outreach to state and federal policymakers regarding STEM, like that of CTE mentioned above, was mandated under the Phase II proposal. STEM outreach took place in an integrated manner across all the activities of the Institute, within the Phase II WIRED effort and in regular CSEWI and CSA work. The following represent merely a sampling of how STEM outreach was accomplished:

- STEM/CTE teams for California Space Day in Sacramento/California Space Week in Washington DC
- Participated in the National Academy of Science (NAS) STEM Education Convocation to develop STEM-related recommendations; helped distribute final report within California STEM stakeholder network
- Participated in K-8 STEM Reform Task Force meetings sponsored by the California State University and University of California
- Engaged in dialogues with the University of Southern California Professional and Graduate programs to negotiate collaboration for STEM-related workforce development programs
- Planned and conducted small group teleconference focused on Continuity of Education in the Aerospace Sector, for the Aerospace Community of Practice for Workforce Development
- Met with leadership of Youth Science Center and Youth Science Camp to brainstorm methods for expanding or replicating their program regionally and statewide
- Attended STEM Education forum and workshop of STEM Working Group, National Defense Industry Association and Aerospace Industries Association – presented suggestions for implementing STEM CAP recommendations
- Designed and organized (with California STEM Equity Pipeline and STEM Education Work Group leadership) a special workshop (December, 2009) to develop implementation plans for the STEM CAP recommendations in California. Became a designated member of California STEM Education Leadership Council.
- Worked with Education leadership of International Council on Systems Engineering (INCOSE) to develop pathways for improving STEM education in the U.S., and joined INCOSE Education leadership.

One outgrowth of the Smart Supplier effort under Project 2.2 in Phase I was an apparent need for entry-level readiness for technician positions. As a result, Project 3.5 Phase II included research on the Career Readiness Certificate
(CRC) now being embraced by some states to address this need. A CRC survey was developed in Phase II of Project 3.5 targeting employers, assessing the level of need/interest of employers in seeing a CRC-like certification that would be a statewide standard. The surveying was completed in Quarter three, with the analysis and report completed in Quarter four. Support for such a certification was indicated, but not with the overwhelming demand expected from dialogue during the Smart Supplier effort. The full CRC Certificate analysis may be viewed on InnovateCalifornia.net.

In another Project 3.5 Phase II deliverable, CSEWI performed an environmental assessment of STEM programs in the target community of the El Segundo High School District in Los Angeles County: http://www.innovatecalifornia.net/WIREDDeliverables/3.05-Ph2-STEM-Environmental-Assessment-CSEWI.doc

Additionally, a guidebook to developing a STEM community pathway in a given community was developed. This guidebook acts as a blueprint for designing a local STEM strategy in a target area. A Practical Guidebook for Developing A Community STEM Pathway may be viewed at the following link: http://www.innovatecalifornia.net/WIREDDeliverables/3.05-Ph2-Guidebook-Developing-STEM-Community-Pathway-SVLCC.doc

While more analysis of the key findings and insights of the STEM CAP project will be included in this report in its Conclusion (see page 269-316), suffice it to say that the STEM CAP was among the Corridor projects likely to have the most impact over the long-term. This is due to several factors:

- California education systems are using it to validate proposed grant efforts
- STEM CAP principles and recommendations are being institutionalized across systems
- ARCHES, the statewide facilitator of regional collaborations and STEM CAP development contractee is embedding STEM CAP principles into its frequent solicitations to regional collaboratives
- A new STEM statewide network of stakeholders led by STEM CAP key partners is being funded to leverage the STEM CAP into statewide STEM progress (the Gates/Bechtel-funded effort)
- CSA has internalized STEM CAP principles and has presented such at numerous industry-related forums and conferences, assuring that industry as well as the education systems are implementing STEM CAP recommendations

The common principles agreed to by a significant number of California’s key education stakeholders and policymakers makes sustainability of the STEM CAP effort promising. The policies on CTE now being considered by the Legislature and the STEM-related advisory committees being established through the Office
of the Superintendent of Schools makes institutionalization of STEM CAP recommendations actually feasible.

California Aerospace University-Industry Consortium

The purpose of the California Aerospace University-Industry Consortium, Project 3.2, which was led by the California Space Education and Workforce Institute and included CSA as a partner, was to develop and initially implement a consortium model of space science and research, university/industry communities to support affordable space opportunities for small satellite and university payloads, enabling real-world experience for future space workers. The Consortium was to be a mechanism for existing Corridor aerospace-focused university programs, and student organizations, to gain technical and career development by involving them in programs and events sponsored or supported by the aerospace industry. It is believed that involvement in such activities improves the technical workforce’s ability to meet the 21st Century aerospace needs.

The two specific of the Consortium, once established, were to:

- Increase the technical workforce capable of meeting the state's aerospace needs
- Enhance the California academic community’s ability to address aerospace industry requirements

The initial work on Project 3.2 was to recruit a consortium comprised of representatives of space science and research and university communities, with a minimum of three universities, three companies involved. The Consortium kicked off December 2007, with the following membership:

- Aerospace Industry
  - Garvey Spacecraft Corporation
  - Northrop Grumman Corporation
  - The Aerospace Corporation
  - Space Exploration Technologies
  - SpaceDev

- Universities
  - Cal Poly San Luis Obispo
  - Naval Postgraduate School
  - University of Southern California
  - California State University, Long Beach

Once recruited, the Consortium’s university and industry partners were to help identify opportunities to improve access to space for student projects. As stated in the project white paper, “The Consortium was intended to actively seek
aerospace industry support to improve the value of student involvement in aerospace development efforts….It was intended that the industry Consortium members would inform these university programs and student groups about existing projects they can join or support, and provide them with access to existing industry contacts to pursue potential activities such as project partnerships, “career seminars”, “field trips” and other career development support.”

A list of current small satellite and payload conferences normally attended jointly by university faculty and students as well as industry was produced, with a suggested participation schedule. A collaborative workspace allowing members to document capabilities, interests and partnership opportunities was also established for consortium members. Again from the white paper, “The idea of the collaborative workspace was to initiate an online dialogue that is similar to what normally happens at the workshops and conferences.” It was hoped that the collaborative workspace would serve as an “effective and responsive tool” facilitating the development of new industry/university partnerships. With universities listing their students’ capabilities and industry listing its project needs and potential funding sources and student project work opportunities, it was even thought that perhaps prize competitions for students could be arranged.

Besides seeing each other at the conferences and forums suggested, it was believed to be beneficial for the Consortium to gather twice a year, either electronically or face-to-face, to discuss Consortium priority topics and process improvements to the Consortium.

Unfortunately, due to several of the project risk factors covered in the project white paper, the original benefits expected of the Consortium were never realized.

While two of the universities and three of the four companies established a presence on the collaborative workspace, none added significant content. Nearly all Consortium members attended the suggested conferences:

- CubeSat Workshop, Cal Poly San Luis Obispo, April 2008
- Small Sat Conference and CubeSat Workshop, Logan, UT, August, 2008

Conference attendance was used to attempt to recruit new Consortium members and inquire as to why current members did not seem to be using the collaborative workspace. Impacted work schedules seemed to be the consensus answer.

Two other factors regarding the lackluster participation in both the Consortium and the collaborative workspace were mentioned enough by Consortium members to be cited in the white paper:
• Collaboration seemed to be occurring at the conferences and workshops without the need for the Consortium; several university/industry partnership projects were in progress; existing opportunities for face-to-face networking seemed to be enough, without the need for a collective electronic interface
• Some industry members expressed concerns about proprietary issues in regard to the use of an open platform for collaboration
• Industry also mentioned that most university/industry relationships were longstanding, built not at seminars and conferences, but primarily through alumni relationships

To better understand how more successful consortia are created, the Institute undertook a study of both space-related and other technology-oriented consortia. Attributes were analyzed, additional risks identified and recommendations made in the final project white paper.

While three moderated dialogues were projected to meet the project metrics, only one was actually held (December 2008), due to lack of active involvement/interest by the Consortium membership.

One key insight from Project 3.2 may very well make it a valuable project despite its lack of success in addressing its original goal. It identified the importance of “the credibility assigned to student projects by potential industry partners. Currently, (aerospace) industry partners experience a lack of motivation by their customers (DoD, NASA) to include student elements into existing projects. In addition, the industry partners are unlikely to advocate for it due to valid concern for the reliability of student projects as compared to their industry counterparts.” In other words, until the government and industry see more benefit than risk to university partnering, the best approach might well be to engage student participation in existing consortia or new consortia built upon traditional consortia models, rather than focusing on student work as the nexus for the consortium.

See the full white paper for Project 3.2 Final Report, University-Industry Consortium Development on InnovateCalifornia.net at http://www.innovatecalifornia.net/WIREDdeliverables/3-2_White%20Paper%20final.pdf

**MESA Academies**

Just as professional development for WIBs focused on innovation and the global knowledge economy was a critical factor for transforming the workforce system, professional development of teachers on teaching 21st Century skills is critical to transform the education system. Mathematics, Engineering, Science Achievement (MESA) has, since 1970, supported educationally disadvantaged students so they can excel in math and science studies and graduate with STEM
degrees. MESA was engaged as a Corridor WIRED partner and Project Lead of 3.6 to conduct six “Mathematics Physics Technology Institutes (MPTI)” summer STEM-related middle and high school teacher professional development academies (two annually) on university campuses, summer of 2007 and 2008. The Academies were meant to provide teachers a STEM-related professional development experience that fosters innovation by pairing middle and high school teachers, introducing new uses of technology and focusing on space and other applications relevant to math and science content. Their purpose was to:

- Improve teachers’ content knowledge of the relationship between math and the sciences, and to draw connections with space-based applications of the content
- To expose teachers to advanced hand-held technology to stimulate student interest in math and science. (Unlike many teachers, students have grown up with the latest in technology readily available to them. By training teachers to employ technology as a normal part of classroom pedagogy, teachers are more likely to respond to student desire to learn using technology). To produce in three years a cadre of 150-225 teachers who will employ the skills learned to improve the teaching of math and science for the 20 – 30,000 students this cadre will teach each year.

A relationship with Texas Instruments (TI) facilitated the use of TI handheld devices (the Nspire tool) built on a traditional calculator by adding complex functions of real-time graphing capabilities for math functions. Connected to scientific probing instruments, data was downloaded to handhelds for analysis, with teachers challenged to determine how the technology could be incorporated into the classroom.

Two two-week summer teacher professional development institutes (space and technology academies) for middle and high school teachers took place in July and August of 2007, one at the University of Southern California (USC) and one at the University of California Riverside (UCR). Thirty-one teachers participated, with Saturday follow-ups being planned for the school year following. A estimated minimum number of 4,960 students were impacted that first year alone by the professional development of the 31 teachers (31 teachers x 32 students per class x 5 classes/day).

Planning began for the 2008 professional development academies, with a series of meetings held between MESA and Texas Instruments regarding the provision of equipment for the four sessions planned for 2008. Two of the four institutes were to feature at least one Texas Instruments instructor from the TI T3 program. Curriculum was finalized, with an extra day of TI training being included. Sites selected for the 2008 academies included USC, UCR, San Diego State University and Cal Poly San Luis Obispo, with each site goal being 20 teachers.
Planning continued for the 2008 MESA teacher professional development academies in early 2008, with MESA finalizing the 2008 curriculum, placing equipment orders, coordinating logistics and beginning to recruit teachers. MESA’s contract was terminated by CSA with an effective date of June 4, 2008. This advisory, to quote from CSA’s Corridor quarterly report from Q2/08, was made “following agreement by both the State and DOL/ETA that CSA had taken appropriate steps to elicit needed financial and programmatic reporting documentation but that MESA had not complied appropriately as required” by its contract. The State EDD subsequently met with MESA to work together to gather sufficient financial and programmatic documentation to allow for reimbursement for services provided. MESA was paid for all invoiced expenses incurred.

It is believed by CSA and the State that the four 2008 MESA teacher professional academies may have taken place as planned, but outside of the WIRED Initiative.

Key deliverables for the MESA teacher academies for professional development included:

- Curriculum for 2007 Math Physics Technology Institute
- Curriculum for 2008 Math Physics Technology Institute

**Science/STEM Educator Conferences**

Project 3.12, the Science/STEM Educator Conferences, like the MESA Academies project above, was focused on teacher professional development to address the critical California education issue of inadequately prepared STEM teachers and students. Project 3.12 was led by Space Information Laboratories (SIL), Inc. California Space Authority served as a 3.12 project partner. As stated in its website, “SIL is a nonprofit 501 (c) (3) educational and scientific corporation with operating divisions to improve education and develop innovative products in the field of science and engineering through such efforts as school-to-career pathways, public outreach, and research and development.” Its Endeavour Center promotes STEM disciplines using space-related curriculum and activities to inspire teachers and youth. Its Endeavour Institute implements an advanced engineering and applied science school to career pathway at the high school level (Endeavour Academy). Its Endeavour Labs conduct research and develops state-of-the-art aerospace hardware/software, including university graduate students in these endeavors.

Targeting middle and high school science and other STEM teachers, the Space Information Labs, Inc., industry WIRED partner and 3.12 Project Lead, conducted three “Educator Launch Conferences” 2006-2008, with an additional conference providing STEM professional development just after the WIRED performance period in January of 2009. SIL also coordinated a teacher conference in coordination with JPL’s 50th Space Anniversary celebration held in January,
2009. Planning for the two January conferences took place during the 2006-2008 performance period.

The Educator Launch Conferences provided educators with relevant science curriculum and activities tied to NASA satellite missions launched from Vandenberg Air Force Base on California’s Central Coast. Educator Launch Conferences, often featuring actual NASA mission specialists as presenters, orient teachers to using real-world curriculum and activities in the classroom, on project-based activities that build innovator skills early.

The Space Information Lab conferences, supported by the California Space Authority, aligned with the following earth/science NASA missions:

- Calipso-Cloudsat
- AIM
- OSTM/Jason-2
- JPL Orbiting Carbon Observation Satellite

Two of SIL’s mission-related principles are in perfect synch with recommendations in the STEM CAP: promotion of STEM teacher professional development, incorporation of experiential, project-based learning to inspire students and ensure relevance to real-world careers.

It was learned through the STEM CAP and other avenues that there was no existing curriculum to meet California’s State Earth Science Standards. Because it is believed by many that high school student interest in Earth Science can foster recruitment into STEM career pathways, creating a University of California-approved Earth Science curriculum to enable the high school offering of Earth Science to fulfill college entrance requirements was deemed extremely important.

A valuable contribution of SIL, with CSA support and JPL, an inkind SIL Project 3.12 partner, was the development of the ninth grade Mission to Planet Earth Systems (MTPES) STEM course. The course, which has been submitted to the University of California for approval, meets California State Earth Science Standards with a rigorous “hands-on” laboratory component. [http://www.innovatecalifornia.net/WIREDdeliverables/MTPES%20UC%20Approval%20Course%20Description.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/MTPES%20UC%20Approval%20Course%20Description.pdf)

The MTPES course was piloted at West High School, Torrance Unified School District and at Orcutt Academy High School, Orcutt Unified School District, in the 2008-2009 school year. Both school districts have signed a five year contract for an Endeavour Academy program through SIL’s Endeavour Institute, garnering a $600,000 inkind contribution enhancing the WIRED investment.
As SIL stated in its final Corridor WIRED Partner Meeting report:

*Excellence in STEM education at the middle and high school levels are critical to sustain California’s aerospace/innovation Corridor and workforce.*

**Transition to Teaching Assistance/SEARCH Troops to Teachers Program**

As important as professional development is for those already teaching in STEM positions, it is equally important to recruit new STEM teachers. The Corridor WIRED Initiative chose to address this aspect of STEM through Project 3.9. This two and a half year pilot program addressed the shortage of STEM subject teachers in Corridor schools which must be overcome to meet the significant long-term technical workforce development challenge. It was believed that the attraction into 7th – 12th grade teaching of STEM professionals leaving STEM employment could have a powerful impact on the STEM pipeline. The project (3.9) was led by the California Troops to Teachers organization, a federal program funded through the Department of Defense to help military service men and women transition from military service into classroom teaching.

As Project 3.9 Lead, Project Pipeline/Troops to Teachers developed the “Scientists and Engineers Alternative Routes to Certification and Hiring – SEARCH” program with the support of its project partner the California Space Education and Workforce Institute (Institute) to provide outreach and career counseling to STEM professionals interested in finding an accelerated pathway to enter the classroom as teachers. The program included the design, development and production of outreach materials; construction and maintenance of a specific program website; the establishment of a computer-based lead and participant tracking system; development of detailed information packets for participants; leveraged links to a network of state approved teacher preparation programs; and trained and experienced counselors to assist SEARCH participants. Access to industry partners’ transitioning personnel was to be gained through CSEWI efforts.

Through the development of a system to provide detailed counseling to career changers interested in giving back to the community through helping student achievement in STEM subjects, the project partners learned hard lessons about how to best tap into the great pool of potential teachers. While the metric for the number of career changers becoming teachers was not met within the performance period, the number of contacts recruited was triple the target and the number of presentations and outreach events exceeded those targeted in the metrics.

Through this career-changer recruitment effort, SEARCH discovered some key lessons learned that were ultimately described in a white paper summarizing pilot program findings:
http://www.innovatecalifornia.net/WIREDdeliverables/Transition%20to%20Teaching%203.9%20SEARCH.pdf. The following represents highlights from that paper:

- Recruitment of career-changers takes longer than expected for candidates to work through the process to become STEM teachers. Start the recruitment process at least two years before the individual desires to transition into teaching. There is a longer than expected lead time required to identify, motivate, train and transition industry professionals to become STEM teachers.
- Provide financial assistance for the costs incurred in meeting mandatory professional teacher preparation standards
- Expand the opportunities for STEM professionals to contribute to student math and science achievement in other than full-time teaching roles (tutoring, part-time teaching, serving as industry liaison, helping with teacher technical professional development, etc.). Many new retirees do not want a full-time commitment.

The pipeline of potential teachers SEARCH developed will not dissolve with the end of the WIRED performance period. Teachers recruited into the career changer process but not having yet completed it will be served by another organization found to carry on the work of SEARCH. The SEARCH program under the WIRED Initiative ended with a merger with an organization working toward the same goals of attracting STEM industry retirees into teaching. This organization, EnCorps, Inc., was conceived and implemented by PrimeTime, the flagship program of the Sherry Lansing Foundation, through guidance of the Governor's Committee on Education Excellence, to recruit industry retirees into teaching math and science. It is now serving as an integral element in the Governor's broader teacher recruitment effort. Introduced to each other by the California Space Education and Workforce Institute, which assisted with development of a Memo of Understanding (MOU) between the two organizations, the California Troops to Teachers' executive director will serve as an advisor to EnCorps, and the materials and findings of the SEARCH program will assist EnCorps in its ongoing recruiting efforts. See the full MOU at: http://www.innovatecalifornia.net/WIREDdeliverables/SEARCH%20Memorandum%20of%20Understanding%20with%20Encorps.pdf

The merger of the SEARCH program with EnCorps California has established sustainability of the pilot project and increased the number of future STEM teachers in what is now a sustainable pipeline. A table provided Corridor WIRED program management at the end of Project 3.9 lists 35 individuals committed to the teacher transition process as the direct result of the combined SEARCH/EnCorps project. Although not every person listed in the table will complete all the requirements to reach their teaching or part-time substitute goals, it is a reasonable expectation that the great majority will enter the classroom as STEM teachers to make a true difference in the academic achievements of their students. When the long path between identification of
potential candidates and fully certified teachers is taken into consideration with this list of individuals now on the path, the SEARCH pilot can be seen as quite successful in filling the pipeline with future STEM teachers.

**California Space Education Center Website**

The California Space Education Center (CSEC) is a web-based research, education and workforce collaboratory meant to increase interest in and show relevance of science, technology, engineering and math (STEM) disciplines. Its aim is to expose students to steps in the STEM career path and provide opportunities for students to become involved in a participatory learning community focused around STEM careers.

The California Space Education and Workforce Institute (Institute) was the lead organization in the development of the California Space Center (CSC), which is pending lease approval by the US Air Force for land located currently on Vandenberg Air Force Base. While construction of the CSC will not occur until well after the WIRED grant period, educational program and facility planning is beginning and Project 3.13, led by the Institute, is affiliated with this effort. Providing a “virtual” space education platform giving the CSC team a research and outreach tool to build excitement around space-related STEM careers, the CSEC allows its creators to inspire and engage young people about STEM careers through space enterprise-related participatory activities. It also allows for exploration of potential CSC content and increases awareness of the ultimate Center’s educational components, to both students and educators.

Supported not only by the Institute, but also by CSA as a project partner, the virtual CSEC features content and outreach for STEM programs unique because of its online “participatory” approach and connection to real world projects, allowing students a glimpse into the space enterprise community of activity. The space-related Speaker’s Bureau described as part of the Aerospace Community Development Strategy below is also housed on the CSEC site. The Institute anticipates that the CSEC will leverage the interest in current WIRED STEM programs which may later reside in the physical California Space Center. The site was completed and launched in September of 2008. Visit the CSEC site at: [http://www.csewi.org/csec/](http://www.csewi.org/csec/)

STEM career pathways, “consecutive steps” to a STEM career and career ladders for STEM are illustrated on the CSEC through linkage with the U.S. DOL’s CareerVoyages.gov website.

Metrics associated with the CSEC site included not only the online site development and maintenance, but also activities supporting or precursors to the development of the physical California Space Center.
Three “internships” were developed in support of the virtual CSEC and the eventual physical CSC, through the launching of a course in Cal Poly San Luis Obispo’s School of Landscape and Environmental Design. The course supports development of design concepts for the physical California Space Center. Students enrolled in the course participated in a variety of activities, including conducting a topographical survey of the site using the Leica Geosystems survey equipment, with the assistance of licensed survey personnel, acquainting them with the latest state-of-the-art survey tools in the STEM work of surveying.

Several outreach efforts around garnering student interest in space enterprise and the CSEC site were conducted, including the attraction of 15 educational exhibits as part of outreach to a minimum of 400 attendees of the NASA Centennial Challenges. Eighteen exhibitors participated in 2007, eight in 2008.

Inspirational STEM career professionals were recruited to speak at NASA Centennial Challenge events, sharing the excitement of STEM careers. While the metric was five speakers, project partners recruited eight speakers total for the 2007 and 2008 events. CSA and the Institute far exceeded the metric of attracting 150 students to the NASA Challenges to expose them to STEM work and STEM careers. Over 450 students were in attendance in 2007, over 300 in 2008.

Phase II California Space Education Center Website Project 3.13

In Phase II of the CSEC effort, the Institute and CSA continued the evolution of the CSEC virtual site, working on the interactive component to the website and building a social networking component. The Cal Poly student work continued in support of the CSEC and the eventual physical Center, the NASA/Institute/CSA outreach effort expanded and a sustainability strategies were explored.

Key deliverables included the completion of:

- Eighty-one profiles for the Space Education Center social networking section
- Site capability was enhanced to enable showing of live space vehicle launches through the site, fostering classroom viewing/participation in real-world space activities
- Final report on internship activities of Project 3.13

Aerospace Community Development Strategy

CSEWI’s role as Project Lead in the Aerospace Community Development Strategy Project 3.8 was to act as a community builder and facilitator of relationships between the partnering universities and industry. By orienting the university students, staff and faculty to the Corridor innovation industry assets (see Project 1.3 detail on innovation assets), synergies between the university
and companies can be formed more efficiently. Providing tools for cross-communication and career-oriented relationship-building between the universities and the industry have enabled better understanding on both sides about what it takes to prepare career-ready students for STEM positions in the real world. Activities of Project 3.8 in Phase I included:

- Project groundwork: inventory of student clubs at each of the three participating universities, listing of industry mentors/advocates, outreach materials to encourage university student exploration of innovation asset companies as career opportunities. Relationships were built with all three universities and with one academic program within each, as well as with the advisors/advocates that direct those programs.
- Creation of an “Aerospace Community Development” (ACD) program to create a sense of community and partnership between industry and the three universities. This program fosters an atmosphere of networking opportunity and perspective sharing, opening lines of communication among industry, students and the university students’ advisors/advocates and university staff. The program consists of company innovation tours, forums/surveys, open communication via a blog and mentorship. There were three specific programs developed under the ACD program (see Project 3.8 deliverables, page 238 for links):
  - The California Space Enterprise Speaker’s Bureau
    - Seasoned professionals recruited for presentations to education/public audiences
  - Mentor Match
    - E-mentoring facilitated with support of ICouldBe.org: university student/working professional in space industry
  - Space Space Blog
    - Opportunity for university students and new space professionals to network
  - Other ACD efforts included
    - New Space Professional Survey (to inquire about what attracted these new professionals to STEM/space careers
      - New Space Professionals are those employed in the space industry – in companies, civil (NASA) or national security space (Aerospace Corp., Space and Missile Systems Center, etc.)
    - High-tech career/ACD orientation session for target university advisors, students
    - Development of outreach materials on space-related STEM careers
    - Facilitation of meetings between industry mentors/university advisors
    - Innovation Tours –
- May 23, 2008 – 5 UC Irvine students to Northrop Grumman Space Technology (University Relations & Recruiting Manager led tour)
- May 28, 2008 – 11 Cal Poly Pomona students to Kelly Space & Technology (Program Managers led tour)
- October 24, 2008 – 5 students from Cal Poly SLO to Lockheed Martin, Sunnyvale (LM young professionals led tour) Director of Cal Poly SLO MESA program also attended innovation tour (see Project 3.6)

- Presentations about the ACD to industry conferences, forums

**Phase II – Project 3.8 Aerospace Community Development**

Phase II of the ACD effort continued to build on Phase I activity. Student outreach was conducted in regard to a Student Career Forum and innovation tour. Student “Space 101” class was held at an innovation tour provided by Space Exploration Technologies (SpaceX) July 16, 2009. Twenty-one students were onsite, twelve completed Space 101 course via live web streaming – 33 total Space 101 students. Student Aerospace Career Forum and was held October 7, 2009 as an element of the Project 2.2 Supplier Forum hosted by The Boeing Company.

Outreach for the virtual mentoring program (Mentor Match – see above) continued, with a Phase II mentoring meeting held with ICouldBe.org. Also in Phase II, three companies were added to the ACD program. Boeing supported the Phase II innovation tour, Lockheed Martin and Space Systems/Loral provided virtual mentor recruitment support.

Guidelines for ACD activities and a sustainability strategy was completed for the ICouldBe.org site.

Also included under the Phase II Project 3.8 effort was the production of a white paper on CSA’s work with the French Aerospace Valley. Primary topic of the white paper was establishing a more formal dialogue between CSA and the French Aerospace Valley with an articulated intention for significant joint organization university and education partnering effort.

While Project 3.8 did work with students and could have been therefore included in the following section focusing on projects with students and/or employers, we saw its value more in the model it created. A very creative multi-faceted approach to supporting students in their career exploration efforts, Project 3.8 shows how STEM-related industries might go about establishing more than one-off interfaces with university students, student advisors and universities. Its value is in that it is a replicable model for industries and/or the regions that support them in assuring an adequate pool of next generation STEM industry workers.
**Training, Education and Needs Assessing for the 21st Century Workforce**

Several Corridor projects were conducted either to train workers, educate students, or comprehend more fully the 21st Century competitive issues facing today’s workforce and to better assess the needs and the concerns of Corridor employers with hiring challenges. These projects spanned all three of the CIC WIRED Initiative pathways of Innovation Support, Supplier Competitiveness and Talent Development. The projects focused on one or more of the following: assessing regional skill needs in target industries, articulating education/training gaps in preparing workers, creating learning resources and/or curriculum, identifying or developing training resources, designing or delivering training. In order to bring the results of these efforts to the forefront, as well as facilitate understanding of commonalities across these projects, we are considering the results of these projects in this special section on “Training, Education and Needs Assessing for the 21st Century Worker”.

The project overviews which follow will be arranged not in numerical order, but in order of the following categories, keeping in mind that some projects have several features:

- Workforce training for incumbent workers, entrepreneurs or those in certification programs
- Education projects featuring direct work with students, projects that feature mentoring and/or development of instructional materials, training resource guides, etc.
- Projects that feature employer needs assessing

Two other important notes to this section:

- Some projects (or elements of projects) covered in this section also appear in Innovation Support, Industrial Rejuvenation/Supplier Competitiveness, or Talent Development, so it is advisable to watch for references to other project mentions.
- Projects featuring professional development (training) of teachers is being covered above “Principles, Policies and Professional Development” section of this report, which began on page 146

**Training and Placement of Dislocated Software Specialists**

The Dislocated Software Specialists project (3.7) was an industry-driven pilot training program to retrain dislocated software engineers for space-related information technology (IT) positions. This California Innovation Corridor project was born out of an early 2000 joint effort between the California Space Authority and NOVA, the North (Santa Clara) Valley Workforce Investment Board, to perform a skills assessment for the software/computer engineering skills needed within the space industry. It was recognized that, in the Silicon Valley area which
NOVA serves, thousands of IT workers had been laid off after the dot com crash, but were not being picked up readily by the space community hungry for software engineers. CSA and NOVA asked “why not?” From the early 2000 project, the two organizations determined that an industry-transition training program probably would overcome the skill and culture issues keeping unemployed IT workers from becoming valuable space/aerospace employees.

NOVA developed an industry advisory body with CSA’s support and partnered with the University of Santa Clara Extension (UCSC Extension) to hire an instructor, develop a training outline and create a certification program ensuring potential employers that individuals completing the program were qualified for aerospace software positions. The collaboration of industry, workforce and education specialists proved invaluable in creating the certification program and moving the graduates from training to employment.

The UCSC Extension created the “Software Development for Aerospace/Defense Applications” certification and delivered program coursework in two cohort sessions to 27 unemployed IT industry software specialists prepared to make a career change into aerospace and defense. NOVA had completed technical pre-assessments and determined the 27 as good prospects for certification. Trainees were able to access NOVA’s job search workshops and resources, along the way. In addition, industry speakers were recruited for the training program, giving trainees insight into what company hiring priorities and processes were.

All 27 trainees completed the certification. By the end of the project, 22 had completed services and 20 had already been employed, transitioning from being unemployed IT workers to becoming qualified aero/space industry employees.

In addition, NOVA cites several benefits to its mission as a Workforce Investment Board:

- Better understanding of the aero/space industry in its jurisdiction
- Creation of a better assessment tool for technical worker assessment
- Understanding of the value of engaging HR and hiring managers early in training planning stages to ensure training meets industry needs
- That, in complex training arenas such as cross-industry training, collaboration among workforce, education and industry, is critical

**ETP Training Resource Outreach to Suppliers/Resulting Training of Satellite Manufacturing Workers**

The objective of the Project 2.3 Outreach Plan to Supplier Contacts is to educate 3,000 supply companies in the California Innovation Corridor about the "smart supplier" resources available to them, focusing especially on potential funding for training through the State’s Employment Training Panel (ETP –
The purpose is to foster utilization of these resources to ensure 21st Century training, which is the story of Project 2.3. Space Systems/Loral, faced with training of new hires and current staff due to the winning of several contracts, was introduced to the ETP training funding resources through CSA and pursued an ETP contract to accomplish the training. The Project 2.3 effort provides materials and executes an outreach plan, leveraging distribution via other Corridor outreach efforts, also leveraging ETP investments, part of the State’s pledged in-kind contribution to the Corridor WIRED Initiative as articulated in the original WIRED Corridor proposal. California Space Authority was the lead and sole partner on this project, although the ETP staff within the State’s Labor and Workforce Development Agency contributed significant in-kind support to the outreach effort during the performance period. Access the Project 2.3 Outreach Plan Employment Training Panel Outreach Plan at: www.innovatecalifornia.net/WIREDdeliverables/CSA%20ETP%20Outreach%20Plan.pdf

It is important to note that CSA undertook to implement outreach efforts at CSA events and meetings immediately upon WIRED start-up, even before the Outreach Plan was developed. In so doing, CSA learned of the urgent training need of Space Systems/Loral (SS/L), which had just won more than one global satellite-building contract and was in the position of hiring hundreds of new workers who would need training on 21st Century satellite manufacturing. By connecting SS/L with ETP, which resulted in an ETP training contract for the space company, CSA was able to leverage State training dollars in support of WIRED objectives. Ultimately under Project 2.3, 364 SS/L workers were documented by the State Job Training Administration (JTA) system as having completed training and maintained employment to meet ETP guidelines. While the number beginning training was much higher (1370), many of whom we believe completed the company training program, the smaller percentage of documented completions points up the challenges in the cumbersome employer record-keeping necessary for companies to benefit from government programs, a common complaint of participating companies.

Supplier resource and ETP outreach briefings and/or materials distribution was included in all of the following:

- **SpaceBound!** – CSA newsletter, distribution: 14,000
- **SpotBeam** – electronic newsletter of CSA, circulation 9,000
- Press Releases re: Supplier events – CSA Media List, 500 contacts
- Collateral Event Materials re: Supplier events, estimated distribution >1000 suppliers
- CSA website – primary portal for California space/aerospace suppliers

In addition, Project 2.3 outreach was a part of each of the four Supplier Transformation Forums held as part of Project 2.1/2.2’s WIRED activities.
Inclusive of primes, suppliers, government programs and agencies, the Forums were a perfect venue for supplier resource information distribution. Forums featured supplier resource panels which included WIBs, California community colleges, California State universities, education and an ETP presentation on program and application information, as well as successful case studies, results and unique approaches on how to use ETP funding productively:

- November 9, 2006
- October 5, 2007
- October 7, 2008
- October 7, 2009

Outreach regarding supplier resources was also accomplished as part of the two piloted Supply Chain Management Classes delivered as part of Project 2.2. One class was held in the Antelope Valley at Lockheed Martin, one at The Boeing Company in Huntington Beach, with an estimated 30 suppliers attending each class.

CSA also distributed supplier resource and training funding information at the following events, in which it participated in or attended:

- Raytheon SAS Supplier Conference – outreach to 300+
- NASA JPL High Tech Conferences – outreach to 500+ attendees at each event
- NASA JPL Small Business Conference – outreach to 30+
- Northrop Grumman Small Business Conference – outreach to 300+
- Boeing Small Business Supplier Conference - outreach to 300+
- NASA Quality Leadership Conference – outreach to 90+
- CSA Annual Membership Meetings – outreach to 50+ annually
- CSA Space Enterprise Advisory Council (SEAC) Meetings, three annually – 30+ each meeting
- NDIA Gold Coast Small Business Conference outreach to 500+
- Marketplace Small Business Conference (co-hosts: Northrop Grumman, Boeing, Lockheed Martin and Raytheon) outreach to 300+ each/3 conferences

One ETP training contract directly resulting from this outreach (in addition to the SS/L contract) was to ComDev. Thirteen other aerospace companies were awarded ETP training contracts during the WIRED performance period, but it is impossible to do a direct correlation between the CSA Supplier outreach project and these contracts, as some of the companies were already aware of ETP and other resources, some also hear CSA supplier information at events not under the WIRED contract but from within the space community itself, etc. Yet it is more than likely that several of the following contracts (in addition to SS/L and ComDev) resulted from supplier information distributed in Project 2.3:
- Northrop Grumman $1,499,000
- Reid Products $31,200
- B/E Aerospace $64,152
- CIRCOR $360,000
- General Dynamics $612,000
- Goodrich Aerostructures $720,000
- Hi-Shear $898,560
- Keeley Aerospace $59,280
- Lockheed Martin Bay Area $508,950
- Lockheed Martin $1,262,008
- Orcon $230,040
- Scaled Composites $28,350
- Winslow Automation $49,400

Aerospace Manufacturing Technician Certification and Placement

Situated in the center of the aerospace industry cluster in the South Bay of Los Angeles County, El Camino College, part of the system of 122 California community colleges, is perfectly positioned to respond to a local workforce crisis impacting U.S. aerospace companies. Over 75% of the world’s suppliers of aerospace-related fasteners resides in this area alone.

The local/global fastener industry was experiencing a crucial shortage of manufacturing technicians, threatening delivery of the fasteners critical to our nation’s aircraft and other aerospace suppliers. In a community characterized by diversity, low incomes, elevated high-school drop-out rates in most areas and growing unemployment, El Camino College took on the challenge of Project 2.4.

Supported by US DOL WIRED funding for the California Innovation Corridor through the State and the California Space Authority, El Camino developed, with industry-defined skills applied to aircraft structures assembly, a 360 hour course leading to an “Aerospace Manufacturing Technician” Certificate. The Certificate not only prepared students for existing openings in the critical fastener sector, but opened new territory for California technician training by introducing students to aircraft airframe assembly using innovative composites and composite fastening systems. Partnering with the South Bay Workforce Investment Board and ProPath, Inc. for placement assistance, tracking and recruitment of displaced workers and under-employed people with little or no experience, El Camino College trained and certified thirty-six incumbent/displaced workers, all hired by aerospace airframe manufacturers.

This success was truly a collaborative effort, supported by the Small Manufacturer’s Institute, the Society of Manufacturing Engineers and Northrop Grumman Corporation, which provided training, curriculum support, training space and placement. El Camino College also partnered with Antelope Valley
College on the development of a future credit program leveraging the Aerospace Manufacturing Technician certification.

In certifying and placing the thirty-six students, El Camino College provided them not only with jobs but with marketable 21st century skills in composite manufacturing, expanding their aerospace career competitiveness. This is good news for the students’ families, as recent figures show the average California aerospace wage at $96,412¹, significantly above the retail and service sector wages typical for workers at entry-level.

**STEM Pathway and Two New AS Degrees and Certifications with Emphasis in Mechatronics Facilitate Student Entry into STEM Careers**

Allan Hancock College’s leadership of Project 3.11 included the development and piloting of an industrial technology-based associate degree program in Mechatronics, as well as exploring with other education-related partners high school recruitment strategies to bring students into engineering and technical programs.

Allan Hancock College successfully developed curricula and monitored through approval two new degrees and two new certifications:

- Associate of Science (AS) degree in Engineering Technology with Emphasis in Mechatronics
- Certificate in Engineering Technology with Emphasis in Mechatronics
- Associate of Science (AS) degree in Electronics Technology with Emphasis in Mechatronics
- Certificate in Electronics Technology with Emphasis in Mechatronics

The College greatly exceeded its goal of enrolling 100 unduplicated students in the piloting of core coursework for the new degree/certification program. 136 unduplicated students had enrolled in the foundational “Introduction to Robotics & Mechatronics” through Fall, 2008, with 82 course completers by Spring of 2008, representing an 85.4% success rate for students. As a result of College outreach around the new degree/certification, Spring 2008 student enrollment in the course was up 87.5%, with a Fall, 2008 enrollment increase of 150%, well exceeding expectations. In addition, 2500+ high school and college students and 540 educators and industry representatives participated in STEM curriculum and career outreach efforts.

Also in Project 3.11, Lancaster University Center, an education support group in the Antelope Valley and 3.11 partner, completed Career Pathway guidelines to assist local parents, students and local high schools in workforce preparation for science, technology, engineering and math (STEM) careers.

¹ *The Space Report, U.S. Space Foundation, 2008, p. 89*
College of the Canyons, under Project 3.11, produced a “Coaches Guide” to robotics programs and began a Robotics Academy for High School Students, in partnership with the William S. Hart District.

Cerritos College created a new Pathway Programs Department, providing centralization of all career technical education high school initiatives and allowing enhanced partnerships among high school districts, Regional Occupation Programs (ROP) and the WIB.

**Systems Engineering Training/Orientation**

Corridor Project 3.4 was a cooperative effort between The Aerospace Corporation (Aerospace Corp.), California Polytechnic State University, San Luis Obispo (Cal Poly), and the California Space Education and Workforce Institute (Institute), with The Aerospace Corporation serving as Project Lead. The primary objective of this project was to deliver an introductory Systems Engineering (SE) course to 100 working engineers and provide an online SE training resource guide. To accomplish this, the project team had to meet several sub-objectives:

- Design and conduct an employer needs assessment
- Inventory current SE offerings
- Define SE introductory needs and design introductory course curriculum
- Develop and deliver the pilot introductory course curriculum
- Refine introductory course curriculum and deliver the introductory SE course

Partner roles were as follows:

- The Aerospace Corporation served as lead partner, articulating the overall project concept, implementing the needs assessment (survey), defining SE introductory needs and designing introductory course curriculum, developing and delivering the pilot introductory course curriculum, developing the SE training resource guide, supporting recruitment of cohorts for the two course deliveries
- Cal Poly’s role was to identify and evaluate existing SE curricular programs (academic, industrial in-house, and commercial offerings) to determine SE training opportunities available to working engineers across multiple industries in California; assist in the definition and development of a distributed SE curricula, with the intention of developing a “roadmap” to provide working engineers a menu of SE specialization tracks, methods and flexible timelines to obtain additional meaningful SE training at the professional level; host delivery of the refined curriculum for a second cohort of working engineers; serve as the interface between the academic community and The Aerospace Corporation and develop, plan and serve as host venue for a variety of Project 3.4 meetings and ancillary events
The California Space Education and Workforce Institute role was to recruit participation in the survey, provide administrative support to all project partners, provide recruitment outreach for both the pilot and the final Project 3.4 courses, host the online version of the Systems Engineering Resource Catalog, review and approve all project reports, invoices.

Products and deliverables for Project 3.4 were numerous and included:

- Systems Engineering Industrial Survey and Results
- Survey Analysis – 44 Key Systems Engineering Competencies
- List of California SE Instructional Resources
- SE Curricular Guidelines
- SE Training Resources Catalog – produced in hard copy, uploaded online
- Two Peer-Reviewed Publications:
  - A Distributed Systems Engineering Curriculum for Working Engineers in California, American Society of Engineering Educators (published and presented at both the Pacific Southwest Regional Conference and the National Conference)
  - Systems Engineering Education: Addressing the Needs of Working Engineers via a Distributed Curriculum, American Society of Engineering Management (published and presented at the National Conference)
- List of outreach targets for potential course participants
- Student enrollment and completion lists for pilot and final courses
- Videos of systems engineering course elements
- A distributed systems engineering curriculum for working engineers

Both the online training resource catalog deliverable and the video course content products are available at http://www.innovatecalifornia.net/systemsEngineeringResourceCatalog

At the end of the project, 105 incumbent workers had entered training, with 96 having completed the courses. As far as we know, Project 3.4 was the first attempt to inventory and catalog available Systems Engineering training resources in California. Sixty-two were registered into the JTA system without complete registration information, once again pointing out the difficulty of obtaining certain kinds of information from trainees. The two papers presented above, plus the development of an abstract for a paper to be delivered after the Project 3.4 partner performance period (Systems Engineering Continuing Education Opportunities in California: “State of the State”, for the American Society of Engineering Educators, June 2009), in addition to presentations to corporations, space community stakeholders (e.g. CSA’s Space Enterprise Advisory Council), NASA and the IEEE, have done much to increase the urgency of addressing significant and growing need for systems engineers (See also Project 1.5, page 198) among both the private sector and the academic community.
The project succeeded contributing some thought leadership to the issue of presenting introductory Systems Engineering coursework across industries to working professionals, as it was found in the research stage of the project that SE terminology and concepts differed from industry to industry. Identifying commonalities to present as a foundation to SE students was a challenge.

An electronic survey of over 60 users of systems engineers covering a broad cross-section of industries were provided the survey link. They represented various technology sectors and included a range of positions (senior management, technical management, program management and chief/lead engineers). Results were analyzed and articulated in terms of priorities in the identification of a common set of 44 Systems Engineering Competencies – skills most critical to California employers. Gaps between industry SE needs and current course offerings were identified and a replicable methodology was provided to develop distributed curricula for continuing education. During the performance period, over 100 incumbent working engineers were introduced to Systems Engineering with introductory short courses. In addition, the infrastructure and course material created for potential ongoing education and symposium offerings.

Perhaps most importantly, working engineers now have the tools they need to develop their own individual path of continuing Systems Engineering education.

**Creation of An Innovation Driven Economic Development Model**

Project 1.1 was primarily covered in the Innovation Support section beginning on page 72, but one aspect of the project carried with it a training metric, and one aspect dealt with student experiential opportunities, so we will cover those portions here.

Because it is not useful to create something without introducing it to the stakeholders expected to put it to use, part of Project 1.1 included orientation of economic development organizations (EDOs) and Workforce Investment Boards (WIBs) to the Innovation Driven Economic Development Model (Model). The project team was committed to introducing the Model to 25 EDOs and 25 WIBs. The training/orientation of the WIBs to the Model took place in March of 2008 at a California Workforce Association (CWA) meeting in San Diego with over 40 WIBs in attendance, with CSA’s Ray Wells presenting. Approximately 50 economic development organizations (EDOs) were in attendance for the orientation/training on the Model given again by Ray Wells May 1, 2008 at the CALED (California Local Economic Development) meeting. Numerous other WIB and EDO presentations around other Corridor projects referenced the Model, as well. In addition, CWA executive director Virginia Hamilton worked with 1.1 Project Lead Sally DiDomenico, to better understand the Model in support of the Learning Collaboratory activities in Project 3.14.
Included in Phase II of Project 1.1 because of its obvious support of innovation in addition to its purpose to provide a platform for student experiential learning, was a lunar testbed developed for university and other student use and installed at the NASA Ames Lunar Institute. The lunar testbed, featuring a surface comprised of lunar simulant (regolith), provides a test surface replicating the unique surface of the moon. The Lunar Regolith Simulant Testbed housed at NASA Ames in the heart of Silicon Valley was developed as part of 1.1 and brought to operational capability for the express purpose of offering university students a capability to test rover, excavation and other robotic systems on surfaces not typical of earth-bound operations. The testbed offers students, future innovators in space systems, a state-of-the-art platform for gaining engineering and exploration experience in a simulated off-earth environment.

A major effort was undertaken to develop the lunar testbed lab and get it approved through NASA processes. But California Space Authority, the partner leading this portion of the Project 1.1 effort, succeeded in getting the testbed approved and operational in time to surpass the metric of engaging at least 20 students in its use. The following universities and schools fielded student teams comprised of a total of 24 students to utilize the testbed in a national lunar simulant competition in 2009:

- Cal Poly, San Luis Obispo – one student
- Colorado School of Mines – five students
- Florida Institute of Technology – one student
- Brevard Community College – one student
- Palm Bay Senior High School – one student
- Carnegie Mellon University – eight students
- Worcester Polytechnic Institute – five students
- Purdue University – one student
- University of California, San Diego – one student

Outreach regarding the experiential learning opportunities offered by the lunar testbed was conducted even while the testbed was being developed and operationalized, with the following outreach contacts a sampling of those contacted, all of which house active robotics programs under their domain and expressed interest in future collaboration:

- Stanford University Department of Aeronautics/Astronautics (Professor Farhat)
- Santa Clara University Robotic Systems Laboratory (Kitts)

One of CSA’s last project tasks was sending an information letter about the lunar testbed to all universities in its database.
Establishment of the operational lunar regolith simulant testbed is an innovative solution to education and workforce development challenges. While the project’s white paper describes some specific “lessons learned" about the challenges of creating a research testbed on a NASA campus, the project enjoyed much success. The combination of open access, co-location with a NASA Research Center building strategic partnerships with local universities, and the testbed’s proximity to several university campuses foster the accessibility necessary for engaging student participation in engineering and technology innovation challenges. An educational experience enhancing employability, the lunar testbed project is of great benefit to students interested in careers with employers involved in off-Earth operations.

Other Project 1.1 data worth noting, although it applies more to the “education/needs assessing” aspect of this section, than training, is that contributed by the Los Angeles County Economic Development Corporation from its Project 1.1 Business Climate Survey. Identifying 103 of its total survey respondents as “High Tech/Innovative Companies”, drawn from Health Services, Manufacturing or Transportation (including aerospace) sectors, it produces comparisons of responses from these surveyees from those of the general business community. Forty-seven percent of High Tech/Innovative Company respondents reported “some” or “great” difficulty in hiring critical occupations, with the five top hiring challenges of both the general business community and that of the High Tech/Innovative Company group aligning fairly well:

<table>
<thead>
<tr>
<th>Occupations</th>
<th>General Survey Population</th>
<th>High-Tech/Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled Line/Production</td>
<td>20%</td>
<td>17%</td>
</tr>
<tr>
<td>Sales/Marketing</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td>Unskilled Labor</td>
<td>16%</td>
<td>15%</td>
</tr>
<tr>
<td>Management</td>
<td>13%</td>
<td>12%</td>
</tr>
<tr>
<td>Administrative/Clerical</td>
<td>12%</td>
<td>7%</td>
</tr>
</tbody>
</table>

1 Examining the LA County Business Climate: Challenges and Opportunities for the Business Community and the High-Tech Innovative Sector, Los Angeles Economic Development Corporation, 2008

In Phase II of Project 1.1, in which two communities implemented the Innovation Driven Economic Development Model, the South Bay Aerospace Consortium (Consortium) polled the South Bay aerospace industry to identify the key occupations it needed, both currently and in the future. The top ten national aerospace occupations were given industry surveyees, who were asked to rank those of most importance to their South Bay operations.
The top three occupations in demand were production/touch labor, systems engineering, with computer software engineering tied with program management for third.

### Demonstration Project with Entrepreneurial Companies

Much of Project 1.4’s work was covered in the Innovation Support section, but the training element of the project is more relevant in this section on Training, Education and Needs Assessing:

Recruit and select the California Innovation Corridor’s “Innovation All-Stars” – a group of at least 40 innovation-based entrepreneurial ventures (may include SBIR Phase II candidates) to provide kick-off forum training, benchmark their collective economic activity and ongoing business services, and insert needed training from CIC resources over a three-year period. The 1.4 project team will coordinate its efforts to integrate into the WIRED CIC Economic Development Model (1.1) a sustainable entrepreneurial infrastructure among the Corridor’s workforce investment and economic development community that supports knowledge of and responsiveness to the distinct needs of technology entrepreneurs.

Sixty-three individuals were trained as part of Project 1.4. Twenty-eight of these were graduates of the Vision to Venture program of the Mission Community Services Corporation in San Luis Obispo. Vision to Venture is a 14 week evening class hosted at Mission Community Services in San Luis Obispo. It is a business fundamentals course designed to build the foundation allowing people to transition to the role of business owner. Three modules make up the program: Marketing, Financials and Operations. The goal is to make sure Vision to Venture students learn the of what it takes to run a business and where to learn more about business topics.

Thirty-five of the trainees were leaders of companies participating in the “Entrepreneur Boot Camp” segment of the California Tech 100 event held in April 24 and 25, 2007. For the first time, according to Project partners, both government and commercial resources were brought together in support of entrepreneurship training. A sampling of the topics covered:

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**Aerospace Workforce Hires 2009 South Bay Ranking**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>SoBay Ranking</th>
<th>Nat’l Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prod/Touch Labor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Systems Engineering</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Comp/Software Engineering</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Program Management</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Aerospace Engineering</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Operations Rsch/Process</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>
- Leveraging Government R&D Investment Resources to Grow Your Venture
- SBIR Grants and Contracts
- Accessing Government IP for Innovation
- Navigating SBA Funding
- Entrepreneur’s Guide to Angling to Angel Investors and Venture Capitalists
- Valuation: Real-World Tips for Your Term Sheet Negotiations

Unfortunately, because the metrics for the Corridor Initiative were not established before training was completed, the Vision to Venture graduates had finished their training and were heavily involved in their new businesses, with little incentive to respond to tracking requests. Likewise, none of the California Tech 100 participants were willing to participate in the ongoing tracking originally envisioned as part of Project 1.4 to document entrepreneurship impact (see above text from 1.4 scope of work). This is one “lesson learned”...commitment to participate in ongoing tracking of trainees needs to be agreed to as part of training delivery. Once training is completed, there is no longer incentive for the companies or individuals to cooperate, especially if the company information being requested is perceived competitive information.

A new strategy was devised to accomplish the goal tracking entrepreneurial ventures. Leveraging mutual interest in training/tracking entrepreneurial companies with a neighbor organization, Project 1.4 Lead San Diego East County Economic Development Council (ECEDC) contacted San Diego CONNECT, an entrepreneurship training and support resource with an established program (Springboard) for supporting entrepreneurship companies. CSA and ECEDC worked with CONNECT to identify innovation entrepreneurs who could be for their economic impact.

The Springboard program offers entrepreneurship clients step-by-step business development consulting driven by both a mentor and a panel of entrepreneurship experts, with milestone-oriented inputs/recommendations/evaluation at various points in the development process:

- Concept
- Technology Transfer
- Product Development
- Commercialization
- Inflection Point

Fifty-one of the companies receiving the Springboard training from CONNECT from 2006 – 2008 participated in the Southern California Edison economic impact (Pollack) model survey. This validates the “Lesson Learned” above, which recognizes the difficulty of garnering tracking cooperation from companies with which a longterm relationship has not been established. Springboard clients, as
opposed to Entrepreneur Boot Camp participants, commit to a lengthy mentoring relationship with CONNECT venture experts and have more time to see the benefits of venture coaching and a vested interest in sustaining the innovation culture in which they are participating.

Twenty-three different NAICs codes represented those reported by the companies and verified by Project 1.4 partners. Included were those for Testing Labs (541380); Biological Product Manufacturing (325414); R&D in Physical, Engineering, Life Sciences (541710); Semiconductor and Related Device Manufacturing (334413); Electromedical and Electrotherapeutic Apparatus Manufacturing (334510); Analytical Laboratory Instrument Manufacturing (334516); Pharmaceutical Preparation Manufacturing (32512); Data Processing, Hosting, and Related Services (518210) and several others. A sampling of technology/products/services represented among the companies trained included:

- Nanoparticles assisting in drug recovery
- On-line learning software
- Secure data acquisition software
- Soil toxicity testing
- Low-powered cell phone chips
- Fuel cells
- Software tools for data management
- Real-time warehouse automation software
- HDAC inhibitors for cancer
- Network appliance enabling sharing of notes, documents, media
- Flourescent antibodies for tumor detection
- Digital stethoscope
- Surface engineering and advanced material technologies
- Web-based solutions for automotive industry
- Pod casting

By using the Southern California Edison Economic Impact (Pollack) Model applied to the 51 companies from the twenty-three different NAICs codes, it was possible to compute the average economic impact of an entrepreneurial company’s first year of activity (see below).
Economic and Fiscal Impact – First Year Entrepreneurial Company

<table>
<thead>
<tr>
<th>Facility Operations</th>
<th>Program Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic Impact – Year One</strong></td>
<td></td>
</tr>
<tr>
<td>Direct Jobs</td>
<td>267</td>
</tr>
<tr>
<td>Indirect Jobs</td>
<td>105</td>
</tr>
<tr>
<td>Induced Jobs</td>
<td>146</td>
</tr>
<tr>
<td>Annual Jobs</td>
<td>516</td>
</tr>
<tr>
<td>Annual Population</td>
<td>988</td>
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<tr>
<td>Annual Personal Income ($000)</td>
<td>$28,720</td>
</tr>
<tr>
<td>Annual Output ($000)</td>
<td>$67,016</td>
</tr>
<tr>
<td><strong>Fiscal Impact – Year One</strong></td>
<td></td>
</tr>
<tr>
<td>Annual State Taxes and Fees ($000)</td>
<td>$1,571</td>
</tr>
<tr>
<td>Annual County Taxes and Fees ($000)</td>
<td>$227</td>
</tr>
<tr>
<td>Annual City Taxes and Fees ($000)</td>
<td>$17</td>
</tr>
</tbody>
</table>

**Notes:**

- a) All assumptions for input were provided by and/or discussed with and agreed to by CSA and CONNECT
- b) The City of Brea, CA was used as a proxy city for all San Diego companies
- c) Orange County was used as a proxy county for all companies
- d) Annual values were used for Direct, Indirect and Induced

Considering the 50%+ first year failure rate of most start-ups, the data above prove that, by nurturing entrepreneurial ventures with relevant professional entrepreneurship resources and a comprehensive program, regions can foster new business growth and support the high-tech job engines required for establishing and sustaining a knowledge-based globally competitive economy.

**Space-Related University Experiential Learning Program**

Working jointly with the California Space Authority to provide undergraduate and graduate payload (Stanford) and launch experience (Garvey Spacecraft) for undergraduate and graduate students, Stanford University and Garvey Spacecraft enabled hands-on learning for engineering students at Stanford, California State University Long Beach and San Jose State University.

In association with California State University Long Beach, the Garvey Spacecraft team established a rocket development and launch program to support the joint project described above. The team produced two dedicated
WIRED test vehicles and conducted launches manifesting numerous academic payloads. In addition, the team arranged for multiple student secondary payloads on vehicles developed through parallel projects with the US Air Force and NASA. Nine mentors were recruited from the aerospace industry to assist, with eight students playing key roles for fabrication and launch activities, 80+ students were provided the experience of participating in the WIRED launches either in the field, in the lab, or both. Over the course of the project, fourteen mentors supported the California State University Long Beach students.

The Stanford University team established student payload project opportunities for three students (two undergrad, one graduate), a variety of internships for payload launchers (one undergrad and one graduate), four graduates for a balloon launch and two undergrads and one graduate student recruited for work on the Virtual Classroom (see below). In conjunction with San Jose State University and two industry mentors, five students developed and launched an ARLISS rocket in 2008. In 2007, the balloon launch program engaged over 500 students in creating “PearlSat” payloads, analyzing payload contents after return.

Also in association with San Jose State University and industry mentors, Stanford developed and demonstrated a prototype “virtual classroom” (VC) system capable of linking classrooms with a launch site, lab or real-world science, technology or engineering activity anywhere in the world. In this “control room” environment, a classroom can experience real-time interaction (audio, video, data) between students and working professionals. The system consists of a trailer and mobile cart and associated electronics enabling launch or other site communications via the internet and computer workstations over a geosynchronous satellite link. A distance learning innovation, the virtual classroom technology holds the promise of transforming classroom learning, enabling multiple classrooms simultaneously to bring students right into the workplace - to experience first-hand the activities, the trouble-shooting, the actual work of today’s 21st Century professionals.

The Garvey/Stanford project gave students the opportunity to experience the entire life cycle of a launch vehicle or payload development effort, engaging them in hands-on engineering/aerospace work from a holistic approach, allowing them to apply their classroom learning to real-life situations including program management, problem-solving, innovating, streamlining processes and providing them a true systems engineering experience.

*Phase II Project 3.3 - Demonstration of A Virtual Classroom Tool*

In Phase II of Project 3.3, the California Space Authority and its sub-contractor, the Association of Experimental Rocketry of the Pacific (AeroPac), executed (as a primary deliverable) a demonstration of an enhanced Virtual Classroom (VC) capability, building on the tool originally developed by Stanford University, San Jose State University and industry mentors which provided a remote learning
platform enabling capture and transmission of real-time voice, video and data over the internet. Originally intended for use by classroom students to experience a “mission control” environment as they connected with real-time launches at remote launch sites, the VC has a myriad of other distance learning capabilities. It could be useful for remote mentoring of K-12 students, training of dislocated workers, experiential, project-based work of university engineering students, as well as other applications.

Key accomplishments of Phase II Project 3.3 included enhancement of the prototype VC system, improving internet connectivity and mobility as well as the ability of users to easily interface with the system and with each other. In September of 2009, CSA and AeroPac organized and conducted a demonstration of the VC capability with groups of students utilizing the capability. The transformational value of these accomplishments is to enable access by a multitude of students to remote, experiential learning opportunities, such as those of participating in launch activities at a distant location.

**University and High School Mentoring**

Establishing a program for K-University participation in projects demonstrating technical capability in the design, assembly, testing and operation of electronics applications was the key objective for Project 3.10, with students working under technical mentors to experience hands-on activities to build interest and capability for science, technology, engineering and math (STEM) careers. Development of a set of mentoring guidelines was an additional outcome. The central accomplishment of this project was the active engagement of several schools and numerous students in scientific projects that provided a relevant, experiential learning experience.

Key metrics achieved in this effort included:

- Establishment of high school mentoring program serving approximately 20 students (Two high school mentoring programs were established: Fremont High School and Saratoga High School, with two others supporting the mentoring effort: Bloomington and Pajaro high schools)
- Recruitment of at least six industry engineers for student mentoring (15 industry engineers were recruited for student mentoring)
- Establishment of mentoring relationships with minimum of six employers (nine employer mentoring relationships were established: Lockheed Martin, Space Systems/Loral, NASA Ames, NASA JPL, The Aerospace Corporation, Northrop Grumman, The Boeing Company, SpaceX, and the Los Angeles Air Force Base Space and Missile Systems Center (LAAFB/SMC)
For high school and university students, the Garvey Spacecraft/CSU Long Beach P8 and P12 rockets were used to fly student-developed experiments (see Project 3.3 above)

Initially, considerable effort was expanded at the elementary level, as research shows that is a STEM decision point for many students. DOL's new H1B funding guidance midway through the WIRED performance period, however, imposed a new minimum age for mentees. The new minimum of 16 years old for mentees of the WIRED Initiative meant that many of the initial metrics related to elementary student mentoring were no longer achievable. Prior to that, however, nearly 500 elementary students were participants in the PongSat balloon launch, receiving instruction from an industry-recruited mentor. Well over 250 of those students were from the Latino community. In addition, models for elementary-level “robots” and “satellites” were developed (BuzzBots and CricketSates, respectively), to provide elementary students experience in hands-on assembly of electronic devices.

An important data point for sustainability of the WIRED Initiative effort is that Fremont High School, a Project 3.10 student mentoring participant, has now developed a “mechatronics-type” class as a regular part of the student curriculum.

**Joint University Innovation Model**

The purpose of Project 1.5, Phase I, was to build an understanding of how academic institutions can better prepare students to succeed in the 21st Century innovation-driven environment. The original role of both the University of California, Riverside (UCR) and Stanford University (Stanford) was to develop an action research model through which student/faculty teams would conduct multiple site visits with a variety of innovation-oriented companies in the California Innovation Corridor to foster better understanding of the innovation-driven workplace and the student skills needed to succeed. As shown below, UCR activities supported this role, while Stanford’s role evolved in a different, but very worthwhile, direction. The UCR information below is captured in a report entitled *Pilot Program for Professional and Graduate Student Internship to Explore Innovation and Entrepreneur Environment*, viewable at InnovateCalifornia.net: [http://www.innovatecalifornia.net/WIREDdeliverables/UCR_Project%20Summary_Joint%20University%20Innovation%20Finalreport_112608f1.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/UCR_Project%20Summary_Joint%20University%20Innovation%20Finalreport_112608f1.pdf), while the Stanford conclusions are covered in its Project 1.5 white paper: *Creating Innovation: No Magic Formula*, [http://www.innovatecalifornia.net/WIREDdeliverables/Creating%20Innovation.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/Creating%20Innovation.pdf)

**Stanford University Participation**

Stanford University first set out to do company executive interviews surrounding corporate innovation culture similar to those done by UCR (see below). Results
were to be reported in at least one seminar to be open to students and the general public. The Stanford team was composed of students, faculty and outside executives. Four executives, each an executive or retiree from a different type of innovation-oriented company, were interviewed. Companies included:

- A technical service provider for aerospace companies
- A start-up recently sold to a division of Hewlett Packard
- An early video game maker
- Apple Computer (Steve Wozniak, co-founder, interviewee)

After only these four interviews, Stanford’s conclusion was that the conditions and practices fostering innovation were so unique to each company that few conclusions could be drawn as to a common approach. “There is no ‘magic formula’” was the conclusion. Several noteworthy points, however, emerged from these initial interviews:

- Innovation is accepted and fostered at different levels in different companies
- Innovations that do not lead to products are of limited value
- Connecting people/companies with problems to people/companies with solutions (facilitating networking) is a key element for innovation
- Since the Silicon Valley innovation explosion in the 1950s, no other region has been able to reproduce the volume and uniqueness of Silicon Valley innovation
- Hiring is key
  - Are managers secure enough to hire innovative people that may threaten their jobs?
  - How much is one individual a key ingredient for innovation?
    - At Apple, Steve Jobs was a major innovation influence – when he was fired, no significant products were released; when he was rehired, new innovative products once again appeared, products so innovative they were not even in the same product line
  - Impact of young, uninitiated employees should not be underestimated
    - Bill Gates states that most of the innovation coming out of MicroSoft comes from employees 25 years old or younger

Because the attempt of Stanford to discover commonalities among corporate innovation cultures was not bearing fruit, Stanford’s role in Project 1.5 evolved. A demonstration was designed to enable online linkage of innovators to innovation seekers through a web-based forum (webinar) series that would be delivered as an actual course.
University of California, Riverside Participation

UCR’s qualitative, on-site visits began with comprising each interview team of at least two PhD Engineering candidates, one MBA candidate and one Engineering faculty member. For each company visit, attempt was made to include company representatives from three functional areas: strategic management, marketing, and research and/or production, with actual company participation varying from visit to visit.

Five innovation-area subsets were identified as a means of organizing the company interviews: idea generation process, decision-making process, financing and budgeting process, innovation development process and production/outsourcing process. Technology-based industries from which company interviews were drawn included: semiconductor, communications, databases, entertainment, industrial manufacturing, aerospace and biotechnology. Anonymity was promised to participating companies to facilitate recruitment of interviewees.

UCR interviews found few links with higher level educational institutions to assist with determining what kind of entry-level operational skill sets would be considered essential for priority hiring. Higher education linkage found was not within core academic units such as Engineering or Business. This suggests an opportunity for greater business/university interfaces to ensure relevancy and currency of university programs and openings for joint university/industry hands-on, integrated educational experiences

Before discussing the education enhancements planned by UCR as a result of Project 1.5, it is worth mentioning that some of these enhancements were conceived not only as a result of the site visits and online survey analysis, but also as a result of the project activities themselves, which pointed out positive learning opportunities as the project advanced.

In addition to the on-site visits and online survey, other UCR Project 1.5 activities included:

- (Spring, 2007) Engineering students joining MBA students in a formal business class to study innovation and business planning. Interdisciplinary teams developed the initial innovation model and qualitative interview, a business plan was developed and presented for an on-campus technology transfer consulting business.
UCR’s research identified the following broad-based skill needs for technical employees, based on its innovation research with companies (23 site visits and 106 online survey responses):

- Good technical research skills
- Ability to communicate effectively with all levels, internally, externally
- Managerial skills, including ability to delegate work, organize teams, monitor progress
- Knowledge of the regulatory and economic environment in which organization works
- A good grasp of ethics
- Ability to work in teams

In addition to the technical skills expected, it was found that innovation companies demanded the following skill sets in their employees:

- Functional business knowledge, including basic principles of management, budgeting and financial analysis, systems analysis, project management, marketing, law as pertains to intellectual property and contracts
- General political/social/economic awareness of global issues
- Written and oral communications skills, negotiation/organizational skills

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1. Pilot Program for Professional and Graduate Student Internship to Explore Innovation and Entrepreneur Environment, University of California, Riverside, Bourns College of Engineering, 2009

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- Students were trained in presentation skills and presented the potential market impacts of engineering research at UCR’s annual TechHorizons conference (Spring, 2008) Same formal business class offered, with new MBA participants and many returning Engineering participants. Two real businesses were created based upon engineering lab research results. Students developed and filed patent materials and entered an intercollegiate inventor competition.

- They created a business and a business plan, presenting it to the business community at large at a formal screening. One of the businesses has gone on to be funded by the angel investment community and has obtained an NSF SBIR award.

- (Fall, 2008) Two workshops were held with faculty and graduate students from the Bourne College of Engineering (BCOE). Brief review of findings from UCR’s participation in Project 1.5 was presented, with participants asked for strategies to address the findings and enhance the education experience at UCR, avoiding solutions requiring curriculum changes due to existing heavy curriculum burden on engineering students and also the “long and expensive processes” of implementing new curriculum.

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Workshop recommendations:
• **Integrating innovation into new undergraduate breadth requirements**  
  (required courses outside a student’s major)

• **Master of Engineering**  
  BCOE is developing a Master of Engineering (M.Eng) degree for mid-career professionals desiring an advanced degree. Unlike the Master’s degree in Engineering, the M.Eng will have a broad focus and will include business and societal topics. The M.Eng is being developed with significant online elements so that traditional MS and PhD students can review the training materials and lectures on industry-relevant topics.

• **Certificate Programs in the Business of Engineering and Science**  
  Incorporating business awareness into existing academic STEM disciplines is being piloted as part of the development of various campus certificate programs.

• **Expanding the Teacher Assistant Development Program (TADP)**  
  The UCR TADP fulfills the California state mandate that all people in charge of classroom education be properly trained. UCR envisions building on this mandatory framework with several optional models, such as perhaps weekly “brownbag” workshops for not only students, but faculty and staff. Topics could include those aligned with important skills identified by companies in the on-site visits and online survey.

• **Expanding programs required under the America COMPETES Act**  
  This Act requires that mentoring is provided any organization employing postdoctoral researchers under funding from the National Science Foundation. Aim is to build researcher skills to assist them in becoming independent researchers. Skill-sets identified in Project 1.5 will be integrated into this, with perhaps the expanded TADP and the postdoc training program converging at some point into a broad-based program addressing themes identified in 1.5.

• **Weekend business “boot camp” for engineering students**  
  Day-long business topic “boot camps” to enhance the understanding of real-world applications for engineering students are being evaluated as a potential replacement for one week of regular courses per each academic year, emphasizing the importance of engineers being “business savvy”.

• **Broadening weekly graduate seminar series**  
  Expanding the types of topics covered by the current BCOE departmental seminar series could address education needs identified in Project 1.5

• **Technical writing course**  
  A required course in written and spoken technical communication, if required by more than the two departments currently requiring such a course, could improve skills of undergraduates and especially the many foreign students entering the BCOE programs. Project 1.5 piloted a program that could also improve technical communication skills. In the BCOE annual “industry day” style workshop to highlight UCR research for industry partnering, engineering and business grad students in 2008 held two workshops to build communication and presentation skills.


- **Continue site visits**
  Real-world interfaces with companies, such as those conducted through the company interviews in Project 1.5, help both students and faculty in understanding innovation culture and skills requirements, as well as stay relevant with national research priorities, product commercialization, legal, economic and social impacts.

- **Internships**
  BCOE is now considering industry or agency internships as a means of providing valuable applied experience.

- **The business card effect**
  It was discovered that just having a business card fostered interest in finding opportunities to pass them out, facilitating interest in students’ attending other business forums to learn about business topics, meet prospective colleagues and exchange cards (!).

**Phase II Project 1.5 “Innovation for the Aerospace, Space & High-Tech Industries” Talent Development/Innovation Webinars**

Phase II of Project 1.5 took a page from the Stanford playbook in using webinars featuring industry-related speakers to assess technology and workforce needs for emerging or key industry sectors. Phase I of Project 1.5 focused on innovation and student mentoring, but Phase II focused on innovative technologies and the skills needed to produce them. The purpose of this phase was to provide a cost-effective forum for key players in aerospace to share their insights about innovation, the technologies driving it, the current and future talent needed and the workforce development resources required to help it flourish.

One Key deliverable for this phase included a white paper produced by Strategic Vitality LLC documenting information from the two CSA Innovation Webinars about the innovative technologies and talent development/skills requirements anticipated, as well as workforce and economic environmental factors contributing to innovation.

The two webinars held included:

- **“Space-Enabled Global Communications and Electronic Systems Industry Update”**
  Co-Sponsored by the California Space Authority and Cisco

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1. From information presented at the August 6, 2009 webinar/event “Space-Enabled Global Communications and Electronic Systems Industry Update”
August 6, 2009 (this webinar in conjunction with an onsite meeting at Cisco, in an effort to expand participation)

http://www.innovatecalifornia.net/WIREDdeliverables/1.5-RECAP-080609-Global-Telecom-Innovation-Webinar.doc

- “Innovation in Aerospace: Frustrations in the Supply Chain and Lean to the Rescue”
  Sponsored by the California Space Authority
  November 3, 2009
  http://www.innovatecalifornia.net/WIREDdeliverables/1.5-Oppenheim-Lean-to-the-Rescue.ppt

Identified in the two webinars were key current, emerging or desirable innovations required to maintain global technology and supplier competitiveness:

- Broadband (two-way) capacity increase
  - Standards-based, IT Network-oriented
  - Direct-to-Home Broadband for consumer applications, “smart” homes

- Responsive, flexible, reprogrammable, upgradable satellites, satellite services
  - Better integration with other telecom for asset leveraging
  - Bandwidth increase by factor of 10 for satellites with 15-year lives
  - Interaction on demand; smooth interface with legacy systems
  - Integration of communication/navigation applications
  - Analog to digital
  - Specific military applications: secure com, anytime, anywhere, with access to regular consumer applications as well; anti-jamming capability; apps without need for power; frequency management technologies for mobility of user; battlefield robustness, but user friendly

- Systems quality and operational efficiency, effectiveness
  - Anti-counterfeiting technologies, processes
  - Radio Frequency Identification applications to mitigate occurrence of counterfeit parts
  - Technology, innovation processes supporting lean operations, lean systems engineering and lean product development

As in other projects, need for both engineers and technicians was clear, with worker benefits in the high-wage arenas of communications and advanced manufacturing making an investment in the appropriate education very worthwhile.

Webinar information pointed out that, in addition to the electrical and electronic engineers, software and manufacturing engineers, there is a greater need today for other specialized engineering expertise: communications engineering, packaging engineering. According to webinar presenters and the white paper cited above, there is in perhaps even greater demand, due to ever-increasing
complexity of high-tech communications and lean-enabled solutions, a growing demand for systems engineers. (See Project 3.4, Systems Engineering Training) Also mentioned in the white paper: “training opportunities in innovation and lean are advised, as expertise in these areas is a cross-industry benefit to both the worker and the economy”.

Skill-building for both engineers and technicians in global communications and the advanced manufacturing supporting it, as in most high-technology fields, is characterized by similar priorities:\footnote{Target Innovation Technologies and Talent Needs for Aerospace, Space and High-Tech Industry Suppliers, Strategic Vitality LLC, November, 2009 (white paper documenting findings from Project 1.5 Phase II webinars)}:

- Domain skill (production, engineering, etc.)
- Systems understanding
- Understanding of today’s technology and its applications
- Communications skills (verbal, written)
- Presentation skills
- Collaboration/teaming skills
- Problem-solving skills
- Real world experience relevant to field

While the white paper validates the need for field training or “on the job”, “hands-on” and “internship experience”, it mentions one caveat: the need for having experienced mentors providing guidance and oversight. As Lean to the Rescue presenter Dr. Oppenheim put it: “On the job training without a mentor is no training at all.” Portable skills development such as that of “process” training, or “leaning”, can create more options for worker mobility.

Training and education resources for engineers and technicians in the global communications and advanced manufacturing sectors include:

- California’s wealth of engineering colleges and universities
  - www.universityofcalifornia.edu
  - www.calstate.edu
- Systems Engineering Learning Resource Catalog:
  - www.InnovateCalifornia.net/WIREDdeliverables/SysEngrgCatalog.pdf
- Technician training through community colleges
  - www.cccco.edu
- Potential future certification development organizations
  - International Radio and Telecom organization (packaging, counterfeit avoidance)
  - International Association of Electrical and Electronics Engineers (IEEE – innovation, cutting-edge communications)
University and Student Payload Demonstration Project

Project 1.6, the University and Student Payload Demonstration, was designed to address a pressing need to enable affordable launch of university and student payloads on U.S. launch vehicles. Currently, costs to launch on U.S. boosters is prohibitive, forcing universities to launch student payloads on foreign vehicles, generally those in the former Soviet Union. Due to travel costs, this impacts student ability to participate in launches, with launch participation required to test payload design, providing a critical systems engineering learning opportunity. This project enables future student participation in launch experiences, as well as providing some of today’s graduate students mentoring and hands-on experience with real-world launch teams.

Several years ago, members of the university satellite community, partially funded by the California Space Authority, designed an integrated platform enabling the grouping of several student payloads. It was called the CubeSat. In Phase I of Project 1.6, the Naval Postgraduate School and the California Space Education and Workforce Institute (Institute) delivered the “Naval Postgraduate School CubeSat Launcher – NPSCuL” half-scale hardware prototype (mock-up) of a CubeSat launcher that would enable integration with U.S. launchers (the Evolved Expendable Launch Vehicle – EELV used by the DOD). In addition, a student payload process/requirements document (NPSCuL Space-Available Manifesting Process and Requirements) was developed to describe the current method of manifesting non-US Government DOD-relevant payloads on US government-sponsored space launches, and to introduce a new process through NPSCuL to manifest non-Government CubeSat payloads on a space-available basis on US Government space launches. The project demonstrated the feasibility of launching up to 50 individual CubeSats from a single secondary payload slot on an EELV.

Throughout the project’s performance period, the project team engaged frequently with the university and small payload community to publicize the concept and gain support for improving affordable university access to space.

A student at NPS selected the development of the NPSCuL mock-up as the thesis for his Master’s degree, developing the requirements, analyzing trade studies on the design, creating the prototype. The prototype was used by the graduate student to present the NPSCuL concept to the stakeholder and launch community. The project provided him not only hands-on hardware experience, but valuable project management experience, as well.

Phase II Project 1.6 University and Student Payload Demonstration Project

Building on the development of the process/requirements document and Naval Postgraduate School CubeSat Launcher (NPSCuL) prototype developed in Phase I, Phase II deliverables included: (1) a flight-qualified NPSCuL structure
capable of improving the availability of student and university payload space on DOD launches and (2) a document that describes how students and universities can gain access to DOD launches. Again in Phase II, the Institute and the NPS comprised the project team.

For this phase, the NPSCuL concept slightly evolved into the NPSCuL-Lite. The NPSCuL-Lite structure houses fewer CubeSats than the original design, but provides a better opportunity for integration into an actual flight unit. Under Phase II, the NPSCuL-Lite was to undergo the necessary analysis and testing to qualify it for an EELV flight. In addition, the process/requirements document produced in Phase I was reviewed and updated to address the new design concept. Again, a graduate student intern from NPS, was engaged in the entire project, creating and performing assembly procedures, designing and conducting tests, evaluating and analyzing test results, interfacing with launch and payload experts from across the real-world stakeholder community.

The Naval Postgraduate School supported Project 1.6 with over $100,000 of in-kind labor, travel, equipment and material, with the WIRED presentations around this project generating enough interest within the Government launch community that additional resources are now being addressed to make the NPSCuL capability a reality.

Three university students were provided project-based learning opportunities through the production of the NPSCuL, with three other summer interns performing significant work. Over 20 university contacts were made to orient relevant departments about the payload launch opportunity. The process and requirements document can be used by all students and universities.

The transformational aspect of this project is that, if the NPSCuL can get manifested on just one of several EELV launches per year, the potential exists to get up to 24 student and university CubeSats into orbit annually. Getting access to just one secondary payload slot, on one launch, would provide more student access to space than the CubeSat community has realized on all U.S. launches to date. If more than one slot per year could be obtained, unprecedented routine access to space for students and universities could be achieved at minimal cost, enhancing the workforce preparation of technical graduates considerably. The NPSCuL has been manifested for a 2010 launch, which should drive Government investment in the integration of the capability, making it much more likely that NPSCuL can obtain routine access on EELV launches. This capability would likely not have developed were it not for the WIRED 1.6 project. Enabling lower cost and more access to space improves the innovation culture by allowing more students and universities to experiment with space-related technologies, better preparing them for the high-tech workplace surrounding the aerospace industry.
The 21st Century Supplier Transformation Project, Project 2.1/2.2, which defined common learning requirements, developed training materials and trained over 100 suppliers in Supply Chain Management Principles, was primarily covered in the Industrial Rejuvenation/Supplier Competitiveness section above (See page 113). In this section, however, we would like to share information about the needs elements of the 288 suppliers surveyed as part of Project 2.1/2.2.

In reviewing the following supplier responses, it is worth noting that of the 288 companies surveyed, small companies (100 or less) made up 59% of the respondents, with mid-sized companies (101 – 1000 employees) at 29% and large companies (>1000) at 12%. Thirty-nine percent of surveys were completed by the CEO/President, 18% by VPs/Management, 14% by Manufacturing/Operations officers, with remaining survey respondents including Supply Chain/Procurement, HR, Quality Assurance, Communications, Lean, Sales or other employees of the companies.

The first chart (a repeat of Figure 11, p. 123) indicates responses to the question “What capabilities exist in your company?” Physical prototyping is listed in the top three responses of all companies – small to large, validating an ongoing refrain heard from industry that hands-on experience is important. Also interesting is that, the four capabilities ranking at the top of each company’s capabilities are the same, ranking simply in different order. The fact that both small and mid-sized suppliers representing 88% of the respondents now list “new product design” and “design for manufacturability” among their top capabilities emphasizes the point that 80% of innovation work has now moved down into the supply chain. This points to more hiring opportunities at higher levels of technical and professional work at both small and mid-sized companies.

The workforce shortage issue was addressed by two survey questions, with results paralleling those of other Corridor initiative findings that technicians and engineers are the most difficult positions to fill (Figure 15 from p. 125, and Figure 16 on p. 126).
18 below). It also underlines the need for greater science, technology, engineering and math (STEM) and Career Technical Education (CTE) focus in the educational systems.

Where do you anticipate a shortage of employees to occur within your company in the next five years?

At what level does the shortage of skilled employees affect your company's ability to meet customer needs?

The importance of future workforce needs compared to other success factors is explored in the following chart, which points out that a “highly trained workforce” is tied or barely behind “lowering production costs” as a key success factor, with “integration of new technologies” ranking third in both small and mid-sized companies (graph below is Figure 14 from page 124).

Which of the following are the most important to your company’s success in the next three years?
That “integration of new technologies” ranked high among small and mid-sized companies is not surprising, considering the following chart, in which companies responded to a question regarding principal reasons they offered training. The number one response for all sizes of companies was to “keep current workforce skilled in latest technologies”.

The need for and growing cost of training incumbent employees is illustrated in the following two charts. As illustrated below, a trained workforce impacts two of the success factors above: need for a trained workforce, lowering costs of production.

Does your company spend more, less or about the same on training as it did five years ago.

Approximately what percent of your employees receive training provided by your company each year?
Training developed internally seems to be far and away the preferred avenue for meeting training needs. Unfortunately, survey did not explore whether that was a necessity because of inadequate community education resources, or simply a preference of industry.

How does your company currently meet training needs?

![Figure 22 Supplier Survey Report: Training Resources Used](image)

Training methods were consistent across large and mid-sized companies, with classroom training the predominate method, on-the-job training a close second. As would be expected, over 90% of small companies, in which physical prototyping was a key capability indicated above, predominantly use on-the-job training.

In the final portion of the survey, respondents were given:

- A set of training areas, to rank in terms of their importance for the next three years
- A set of space-related training areas to rank in terms of three-year importance

Choices were determined after extensive review by multiple primes and industry partners. A “principal components analysis” (Principal Components Analysis, G.H. Dunteman, Sage University Press, 1989) was used to group the training areas by how companies responded. Four groupings were identified within the two sets of training areas.

As seen by the illustration below, Logistics and Transportation Best Practices were independent of the other interests. But companies interested in one topic of each of the three other training areas (Functional Best Practices, Modeling, Space-Specific Technology) were also likely to express an interest for the others. Those companies indicating an interest in “crimping, cabling and harnessing” training (not part of space-related training options), were also likely to be interested in the set of space-related training choices.
Groupings below indicate training areas likely to attract interest as program offerings (program offerings color coded)\(^1\).

<table>
<thead>
<tr>
<th>LOGISTICS AND TRANSPORTATION BEST PRACTICES</th>
<th>MODELING</th>
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<tbody>
<tr>
<td><strong>FUNCTIONAL BEST PRACTICES</strong></td>
<td></td>
</tr>
<tr>
<td>• Purchasing and Procurement</td>
<td>• Forecasting and Time Series Analysis</td>
</tr>
<tr>
<td>• Manufacturing</td>
<td>• Engineering Modeling and Testing</td>
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<tr>
<td>• Finance and Accounting Management</td>
<td>• Design Modeling</td>
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<td>• Sales and Marketing</td>
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<tr>
<td>• Information Technology</td>
<td></td>
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<tr>
<td><strong>SPACE-SPECIFIC TECHNOLOGY</strong></td>
<td></td>
</tr>
<tr>
<td>• Crimping, Cabling, and Harnessing</td>
<td>• Space Environment—Implications for Spacecraft Design</td>
</tr>
<tr>
<td>(not part of the space-related training questions)</td>
<td>• Space Environment and Spacecraft Environmental Hazards</td>
</tr>
<tr>
<td>• Designing Systems for Space Radiation Environments</td>
<td>• Space Systems Fundamentals</td>
</tr>
<tr>
<td>• Initial General Space Hardware Training</td>
<td>• Space Vehicle Mechanisms: Elements of Successful Design</td>
</tr>
<tr>
<td>• Launch Vehicle Environments, Loads and Testing</td>
<td>• Spacecraft Connector Mate and Demate</td>
</tr>
<tr>
<td>• Performance, Reliability, Redundancy for Space Products</td>
<td>• Spacecraft Thermal Control</td>
</tr>
<tr>
<td>• Remote Sensing for Earth Science Applications</td>
<td></td>
</tr>
</tbody>
</table>

Respondents also suggested additional areas of training:

- Systems engineering
- Root cause analysis
- Advanced machining
- Electronics
- Six Sigma
- Thermal design
- Multi-axis lathe operation and programming
- Supplier management
- Geometric tolerancing
- Automation
- Materials engineering
- Lean
- High speed machining
- Change management
- Blueprint reading
- Electrical engineering
- Material development
- Safety
- Parts inspection

The information gleaned from the survey was used to develop the Supply Chain Management modules developed as part of Project 2.2 (see page 130). It also helped inform the Aerospace Competency Model.

\(^1\)California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness, California Space Authority, Antelope Valley College, 2008
In October of 2007, DOL’s Employment Training Administration (ETA), the U.S. Department of Energy, NASA and the Aerospace Industries Association hosted a daylong round table in which Corridor Program Manager Judy Turner co-chaired a panel focused on industry employment issues. Subsequent to that, ETA staff worked with the Aerospace Community of Practice and CSA contributed industry input in support of the development of an “Aerospace Competency Model” which would articulate the types of capabilities required for competency at various levels of aerospace.

**21st Century Workforce Profile Analysis; Workforce Skills Analysis for 100 Key Entities**

Project 1.2, “21st Century Workforce Profile Analysis” and Project 3.1, “Workforce Skills Analysis for 100 Key Entities” had many of the same partners, utilized similar methodology, and had several findings in common.
A key deliverable of Project 1.2 was a report\(^1\) compiled by the California Council on Science and Technology (CCST), a 1.2 partner, which detailed project purpose, methodology and findings of the entire project team. Project 3.1 featured a similar report\(^2\) compiling the work of the myriad of partners on the 3.1 project team led by the California Space Authority. Report author for the CSA 3.1 summary report was Paul Oliva, Oliva Global Communications. The information which follows is primarily drawn from these two project summary reports.

The approach used in Projects 1.2 and 3.1 is at least as significant as the project findings for future skills and industry analyses. Two innovative strategies were facilitated by the California Space Authority in both projects that are worth mentioning for their potential usefulness in future cross-regional industry and workforce analysis efforts:

- Projects 1.2 and 3.1 both began by engaging the California Employment Development Department’s Labor Market Information Division (LMID) to handle initial data gathering and analysis for later use by “on-the-ground” project team participants. This process of providing LMID data to economic development entities and WIBs ensures sustainability of their collaboration going forward. Utilization of LMID for cross-region data gathering and analysis ensured an “apples-to-apples” approach to identification of key industries and/or workforce characterization surveying and leveraged the WIRED investment with State in-kind support. It was found early in the work of these projects that neither WIBs nor economic development entities were taking full advantage of the LMID’s data gathering and analysis capabilities and considerable expertise. While localized data gathering was determined still to be necessary to better interpret or supplement LMID data, the value of using LMID analysis for cross-regional efforts ensures the State and funders that regional information is aligned with state findings.

In both projects, WIB and economic development (ED) partners hailing from the same region were encouraged to partner up for the data gathering and analysis, to ensure that in the particular geographical area served by both there would be consistency in data reporting and conclusions drawn. Surprising to some, joint data gathering and analysis by WIBs and economic development in the same areas is not that common. This, of course, creates problems for the region, which must try to align two sets of unaligned if not conflicting data.

\(^1\) 21st Century Workforce Profile Analysis, California Council on Science and Technology, 2008 (CIC WIRED Deliverable)
\(^2\) Technology Workforce Issues and Opportunities in the California Innovation Corridor, Workforce Skills Analysis for 100 Key Entities, California Space Authority, 2008
Project 3.1 involved a workforce skills analysis of 200 employers in a seven-county area of Southern California. The assessment’s purpose was to gather data about the skills needed for crucial positions and to identify future workforce gaps. It was thought this would enable strategies to be developed to address CIC future employer needs. As suggested by the State’s Economic Strategy Panel’s Regional Economies Project, the focus of the assessment was on key space and information technology companies, government employers, space entrepreneurial and small business and manufacturing companies. LMID provided workforce and ED partners county-level datasets created from 3-dig NAICs (North American Industry Classification Standard) code. Datasets featured information on employment, wage, growth, industry concentration and other data. By reviewing the LMID data, partners were able to identify
employment trends by county and target companies for innovation-related surveys through use of the 3-digit NAICs codes.

The Orange County Workforce Investment Board (OCWIB), a 3.1 partner, took on the task of identifying CIC clusters of opportunity by aligning the LMID datasets with the IMPLAN Input-Output System provided by the 2005 California Regional Economies Project. CIC clusters of opportunity included:

- Food and Agriculture
- Energy Production and Distribution
- Construction
- Transportation and Logistics
- Environmental and Waste Management
- Education
- Personal Services and Education
- Business Management and Support Services

For the follow-up surveys by WIBs and EDs, LMID provided aggregated information on the seven 3.1 participating counties, based on the 3-digit NAICs code-identified industries with employment greater than 18,000, weekly wages of $900 or greater and/or employment growth greater than 20,000. One caveat to the industry data provided is that, while it has slipped, California manufacturing is still a huge sector, with Los Angeles County alone being the largest center of manufacturing in the U.S. Another note is important: aerospace, bioscience and other emerging technologies reside in multiple NAICs codes, and are therefore problematic to find and measure.
In the Project 3.1 survey (seven county) area, 20 of the total of 32 large, high-wage categories showed good growth, adding over 300,000 jobs in the 2001-2006 period.¹ Key category of interest was Professional and Technical Services, which added 46,000 new jobs during the period, and boasted 450,000 workers with an average weekly salary of $964, for a total payroll of $7.2 billion for the region. Significant contraction was noted (greatest to least) in Management of Companies and Enterprises, Computer and Electronic Product Manufacturing, Transportation Equipment Manufacturing, Fabricated Metal Product Manufacturing, Merchant Wholesalers of Durable Goods. Telecommunications also experienced losses.

The focus industries for Project 1.2 included the following:

- 3254 Pharmaceutical and medicine manufacturing,
- 3344 Semiconductor and electronic component manufacturing,
- 3345 Electronic instrument manufacturing, and
- 5417 Scientific research and development services.

¹ Since Project 3.1 was completed in 2008, there is no guarantee that these growth industries were not impacted by current California and U.S. economic downturn
LMID data for Project 1.2 focused on the difficulty of hiring, minimum education requirements, knowledge and specific ability requirements of seven different occupations, all aligned with identified industry needs of the project partner areas:

- Biological Technician
- Chemical Technician
- Electrical Engineering Technician
- Robotic Technician
- Electronics Engineering Technician
- Industrial Engineering Technician
- Mechanical Engineering Technician

A key finding of the Project 1.2 LMID survey was that respondents indicated that, over the next 12 months they “would be hiring quantities of new workers equivalent to approximately 45% of existing workforces of electrical engineering, mechanical engineering and robotic technicians.” However, the largest numbers of projected hires were reported for biological and chemical technicians”. Approximately 75% of employers indicated a baccalaureate degree as a minimum requirement for these positions.

While the projected growth numbers of chemical and biological technicians are greater than numbers projected for electrical, mechanical engineers and robotic technicians, as shown above, the hiring difficulty of the electrical, mechanical
engineers and robotic technician positions is greater than that of the biological and chemical positions. This is interesting because over 50% of employers responding indicated an associate level degree sufficient for these jobs, implying that, for these positions, it is more difficult to attract a technician with an associate’s degree in electrical or mechanical engineering or robotics than a baccalaureate degreed professional (technician) in biology or chemistry.

This emphasizes the importance of California Community Colleges as preparatory institutions for science, technology, engineering and math (STEM) workers and also indicates that there is improvement needed in community college preparation of STEM workers, as hiring difficulties are being experienced in key community college preparatory positions.

In Project 3.1, 141 companies of the 182 – more than 75% - expressed some concern over shortages in technicians, professionals or both.

Roughly eight of ten times an innovation company in the survey pool mentioned a critical occupation or role, that role would fall within engineering, technical, scientific/R&D, mechanical, or computer science-related functions at the company.”

Because of the nature of the companies/employers surveyed in the Antelope Valley (NASA, aerospace, etc.), the top four critical occupations reported for Antelope Valley were engineering, crossing eleven different engineering specialties, with 73% of Antelope Valley respondents listing engineering as a critical occupation.

In the occupations of focus in both Projects 1.2 and 3.1, there were similar findings in regard to the identification and existence of critical skills.

Project 1.2's LMID results identified the core function of the positions studied as the most important skill in most occupations, but another key skill identified was “communication and/or knowledge of English”. This ranked as most important for the occupations of electrical engineering and robotic technicians, second for all other occupations, except chemical technicians, for which it ranked third. Its average ranking on a five point scale of importance was 4.05. Surveyees for all positions reported computer use as an important skill, indicating use of the computer as one of the most important tools used in the position.
According to the summary report for Project 3.1, “there was sufficient data and commonality among the partners [survey results] to provide an aggregate view of the critical occupations identified by the firms.”

<table>
<thead>
<tr>
<th>Critical Occupation (Respondent-Defined)</th>
<th># Firms Mentioning +/- 10%*</th>
<th>Consolidated and normalized verbatim responses on critical occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>70 (34%)</td>
<td>Engineers: systems, process, aeronautical, rocket, flight test, avionics/navigational, firmware/software, structural and civil, electrical, mechanical, geoscience, metrology, environmental, telecommunications, overhaul/maintenance facility. Also included in this category: architects, surveying, land use planning, material science, composites, fiber optic manufacturing, physical systems, dynamics and control</td>
</tr>
<tr>
<td>Technician</td>
<td>48 (23%)</td>
<td>Includes technicians, installers, inspectors, equipment operators, and workers or laborers requiring precision of technical skills: airport and aircraft maintenance; information tech; lab tech; analysts; composite materials; machinery manufacturing and maintenance; overhaul and maintenance facility; electronics and navigation manufacturing and repair; telecommunications and fiber optics; vehicle maintenance; computer graphics; interior design; computer/telecommunications networks; medical and dental support and radiology; solar electric installers; CNC (computerized network controlled) machines. Also included due to reponse emphasis on precision or advanced skills or unclear responses; metalworking; line services/machinery operators; truck/tractor operators and drivers; ground and material handlers; plumbers; plasterer; lathe operator; sewing.</td>
</tr>
<tr>
<td>Operations/Other Professional or Support</td>
<td>41 (20%)</td>
<td>Category includes a wide range of management and support positions. Due to responses, it was not possible to quantitatively separate management from lower-level support services. Category includes: management, strategy, legal, project management, business development and sales, operations management (supervisors and managers), marketing/advertising/public relations, finance analysts, HR, fundraising</td>
</tr>
<tr>
<td>Scientist/R&amp;D/MD</td>
<td>23 (11%)</td>
<td>PhD and lower level for R&amp;D in research, material science, engineering, composites, product development, chemistry, biology, electric vehicles, clinical science, geology, environmental, avionics/navigation, telecom, chemistry, computer science, biomedical, physics, mathematics</td>
</tr>
<tr>
<td>Machinist</td>
<td>14 (7%)</td>
<td>Composite materials, fabrication and machinery manufacturing, overhaul/maintenance facility machinists, CNC and conventional machinists, surface mount and through-hole operators</td>
</tr>
<tr>
<td>Programmer</td>
<td>9 (4%)</td>
<td>CNC programming, CMM programming, website developers, computer graphic design, firmware/software programming, computer science</td>
</tr>
</tbody>
</table>

1 21st Century Workforce Profile Analysis, California Council on Science and Technology/California Space Authority, 2008
skills across the seven-county survey area. First, respondents were requested to share “their unprompted, top-of-the-mind opinions on the essential skills necessary for the critical occupations they had stated”. The most important area identified among respondents was “industry-specific technical skills”.

### Respondent-Defined Critical Skills: General or Cross-Industry

<table>
<thead>
<tr>
<th>Skill</th>
<th># of Companies Mentioning (out of 185 mentions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem solving and creative thinking</td>
<td>40 (22%)</td>
</tr>
<tr>
<td>Basic workplace skills</td>
<td>39 (21%)</td>
</tr>
<tr>
<td>(time management, reliability, follow directions, social skills)</td>
<td></td>
</tr>
<tr>
<td>Communication skills</td>
<td>35 (19%)</td>
</tr>
<tr>
<td>(verbal, reading, writing)</td>
<td></td>
</tr>
<tr>
<td>Mention of math</td>
<td>20 (11%)</td>
</tr>
<tr>
<td>Computer skills</td>
<td>19 (10%)</td>
</tr>
<tr>
<td>Customer service</td>
<td>15 (8%)</td>
</tr>
<tr>
<td>Mention of science</td>
<td>10 (5%)</td>
</tr>
<tr>
<td>Project management/troubleshooting</td>
<td>7 (4%)</td>
</tr>
</tbody>
</table>


### Respondent-Defined Critical Skills: Industry or Occupation-Specific

<table>
<thead>
<tr>
<th>Skill and Details</th>
<th># of Companies Mentioning (out of 125 mentions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry-specific technical skills</td>
<td>69 (55%)</td>
</tr>
<tr>
<td>(Employer assumption is that the skill was acquired via education and/or prior experience)</td>
<td></td>
</tr>
<tr>
<td>Good basic education in field/Degree or Certificate</td>
<td>30 (24%)</td>
</tr>
<tr>
<td>(If specifically mentioned)</td>
<td></td>
</tr>
<tr>
<td>Prior experience in field</td>
<td>18 (14%)</td>
</tr>
<tr>
<td>(If specifically mentioned)</td>
<td></td>
</tr>
<tr>
<td>Advanced degree</td>
<td>8 (6%)</td>
</tr>
<tr>
<td>(If specifically mentioned)</td>
<td></td>
</tr>
</tbody>
</table>

BASIC’s study in Project 1.2 of the workforce preparedness in the life sciences found that, in addition to academic knowledge acquired in the disciplines, business skills were now necessary to meet the challenges of understanding and successfully navigating the commercial aspects of the life science industry.

Other, more general responses, were not industry-specific, but consistent across industries, as shown below. It is worth noting that the top three categories in the “Respondent-Defined Critical Skills: General or Cross-Industry” each captured 20% of the mentions and collectively represented more than 60 percent of the skills identified.

In addition, Project 3.1 surveyed employers on the importance and performance perceived on five technical skillsets and two social skillsets:

**Technical Skills**

- Problem-solving
  - Workplace skills
    - (judgment, decision-making, resource and time management)
  - Technical knowledge related to the job
    - Technical skills
      - (the ability to use/operate equipment, tools, materials, software, Information systems, or more than one specific technology when hired)
    - Computer skills
      - (using spreadsheets, databases, word processing, graphics, Internet or giving presentations)

- Social Skills
  - Teamwork
    - (coordination, instructing, relationship-building, cross-cultural understanding, negotiation, persuasion)
  - Work ethics
    - (initiative, dependability, reliability)

Workplace skills topped rankings for importance, with Industry-specific technical knowledge and skills running a close second, problem-solving an almost-equal third, all ranking about midway between “important” and “very important”.

Unfortunately, these technical skill areas of high importance also emerged as **critical skill gap** areas. While no severe issues were identified in performance, and while no data was available on “performance” for technical skill set, the following three areas came in as **“areas of concern”:**

- **Workplace skills** (greatest concern) Aggregate performance was ranked the lowest of all skillsets, but the highest in importance, therefore creating the largest skill gap
- **Technical knowledge** (second highest)
- **Problem solving and work ethic** (identified as needing attention, but lower priority)

Initially, Project 3.1 partners queried on “other skillsets” expected in current or future employees. Responses mapped to those above, with some interesting enhancements in the areas mentioned by more than one respondent:

- Interpersonal workstyle (20 of 75 mentions – easygoing, adaptable, tactful, sensitive, good with people, good attitude, good instincts, sense of humor, able to take instruction)

- Communication and customer service skills (11 of 75 mentions)
- Team player and teamwork skills (10 of 75 mentions)
- Cross-cultural skills, bilingual and/or better English ability (9 of 75 mentions)
- Workplace skills (7 of 75 mentions - ethical behavior, honesty, integrity, accountability, punctuality, good work habits, tidiness, grooming, and related “soft skills”)
- Problem-solving (5 of 75 mentions – out-of-the-box thinking and problem-solving, conceptualization, design and analytical skills)
- Self-motivation, eagerness to learn (3 of 75 mentions)

Project 1.2 WIB/ED survey respondents indicated future workforce skills would fall into one of “three categories: understanding new technologies, improved skills and education, increased communication skills”.

Project 3.1 partners surveyed with the question “Are there any new skills sets that may be required of future workers in this industry?” Two responses had over 20 mentions: IT/New Technology and Industry-specific skill.

**In both Projects 1.2 and 3.1, the “ideal” employee or “ideal” skills were addressed.** In Project 1.2, survey respondents indicated that “a combination of education and experience was most valuable at the professional and managerial levels; at the technical level, education was generally ranked as most important, over experience.” Broad skill-building, across domains, was emphasized,
especially to assist smaller companies where employees served numerous functions.

One element of Project 1.2 was a survey and study of 21st Century workforce preparedness in the life sciences. The Bay Area Science and Innovation Consortium (BASIC) produced its study (results of which were part of the Project 1.2 summary report) based on 17 life science employer interviews, 10 PhD employee interviews, various literature reviews and a roundtable forum.

Future skill needs of the life sciences were described as difficult to project because of the evolution of the industry. Key characteristic of this evolution is the “convergence of technology and business trends that are shifting workforce needs in a variety of ways”. While science acumen is required at all levels, including that of the CEO or business leader who need to understand the science and its drivers thoroughly, business acumen is also now emerging as an essential skill. Companies in the life sciences are becoming more vertically integrated, interfacing with other companies in a variety of functions that require more understanding of the lifecycle, not just the science of the compound or product being developed. Ideally, those scientists in decision-making positions would be qualified to ensure product research and development, navigation of the product through trials and approvals, “manufacturing, licensing, patenting, network partnering and marketing”, providing a diverse and broad-based expertise which builds corporate competitiveness. This “ideal” skill set is described in recognition of the increasing mobility of the life sciences workforce, which create challenges for companies wishing to establish employee development programs. According to the employer interviews, universities are stepping to the plate to provide necessary training at the higher academic levels.

Project 3.1 sought input regarding the “Ideal Technical Employee” by asking the following question in its seven-county area: “In terms of technical abilities and organizational fit, please identify the characteristics which best describe your most effective, reliable technical employees for each critical occupation.”
In both Projects 1.2 and 3.1, participants were “less than” satisfied with the preparation of technicians and professionals by the education system. Education reform is indicated at every level.

Also noteworthy is the changing STEM environment. As quoted in the Project 1.2 summary report, “Notably, while chemical technicians had one of the lowest projected hiring ratios to current staffing levels, they had the highest number of reported projected hires.”

According to the Project 3.1 summary report, which synthesized data from the “on-the-ground” surveys conducted with 182 companies by WIBs and EDs in the seven-county target CIC area, “What is overwhelming clear about the top critical occupations for the innovation industries is that 164 out of 205 mentions of occupations require a core level of science, technology, engineering or math (STEM) education or training.”

<table>
<thead>
<tr>
<th>The “Ideal” Technical Employee</th>
<th># Companies Mentioning (out of 280)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good communication skills</td>
<td>33</td>
</tr>
<tr>
<td>(including reading/writing, speaking, presenting, customer service)</td>
<td></td>
</tr>
<tr>
<td>Technically -skilled</td>
<td>32</td>
</tr>
<tr>
<td>Adaptable, learns easily, goes out of way to learn</td>
<td>28</td>
</tr>
<tr>
<td>Motivated, works hard</td>
<td>25</td>
</tr>
<tr>
<td>Problem solver, project manager</td>
<td>21</td>
</tr>
<tr>
<td>Teamwork</td>
<td>20</td>
</tr>
<tr>
<td>Reliable</td>
<td>18</td>
</tr>
<tr>
<td>Takes initiative, able to act independently</td>
<td>17</td>
</tr>
<tr>
<td>Attention to detail</td>
<td>16</td>
</tr>
<tr>
<td>Able to meet deadlines, time management</td>
<td>13</td>
</tr>
<tr>
<td>Experienced</td>
<td>12</td>
</tr>
<tr>
<td>Excellent leader, teacher</td>
<td>9</td>
</tr>
<tr>
<td>Broad range of skills, knowledge</td>
<td>8</td>
</tr>
<tr>
<td>Multi-tasker</td>
<td>7</td>
</tr>
<tr>
<td>Computer skills</td>
<td>5</td>
</tr>
<tr>
<td>Ethical</td>
<td>5</td>
</tr>
<tr>
<td>Highly-educated</td>
<td>5</td>
</tr>
<tr>
<td>Applies education</td>
<td>3</td>
</tr>
<tr>
<td>Work within budget</td>
<td>2</td>
</tr>
<tr>
<td>Bilingual</td>
<td>1</td>
</tr>
</tbody>
</table>

1. Technology Workforce Issues and Opportunities, California Space Authority, 2008
Project 1.2 participants expressed widespread concern that inadequate numbers of people are being prepared for the high-tech workforce. In Project 3.1, not a single level of education (entry level, technician level, professional level) was ranked at a “high level of satisfaction”.

The LMID element of Project 1.2 highlighted the fact that the most significant skills gap can be addressed at the community college level, as its findings showed the most difficult hiring was for positions requiring associate degrees in electrical engineering, electronics engineering and robotics technicians.

The 1.2 PhD project participants interviewed indicated dissatisfaction with their academic preparation, claiming that it “lacked adequate focus on preparation and planning for careers”, according to the 1.2 summary report. The average of eight years to complete their (PhD) degrees was seen to be excessive and indicated that their institutions lacked an “effective connection with the needs of the business community”. Half reported that “their training did not give them the best chance to achieve their immediate career goals”.

Both recent science graduates and science executives interviewed in Project 1.2 applauded the use of programs such as the professional science masters degree, a hybrid that combines science and technological expertise with business experience. While these degrees are not yet much offered, the National Research Council, according to the 1.2 summary report, is encouraging acceleration of professional science masters degrees and the California State University system is expanding its offerings of this degree.

In the WIB/ED element of Project 1.2, every group “expressed concern about the quality of the education system and its ability to provide people with a suitable base of scientific knowledge and practical experience”. Employers, most of whom had developed relationships with local universities and/or community colleges, indicated the need for more hands-on training and pointed out that many educational institutions are not keeping current with technology and/or maintaining close enough ties with industry to adequately serve their students. Top concern for

### Desired Secondary & Community College Training

<table>
<thead>
<tr>
<th>Training</th>
<th># Companies Mentioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>General mechanical &amp; trades; basic electronics</td>
<td>25</td>
</tr>
<tr>
<td>Math &amp; science</td>
<td>24</td>
</tr>
<tr>
<td>General workplace skills/ethics</td>
<td>22</td>
</tr>
<tr>
<td>Communication, teamwork, leadership</td>
<td>20</td>
</tr>
<tr>
<td>Industry-specific technical skills</td>
<td>18</td>
</tr>
<tr>
<td>Computer &amp; programming</td>
<td>15</td>
</tr>
<tr>
<td>Reading and writing</td>
<td>13</td>
</tr>
<tr>
<td>Internship coordination</td>
<td>7</td>
</tr>
<tr>
<td>Project management</td>
<td>5</td>
</tr>
</tbody>
</table>

1 Technology Workforce Issues and Opportunities, California Space Authority, 2008
industry was lack of basic science and math skills, noted with the observation that educators “lack broad understanding of the key elements that are the driving forces of the industries”.

Project 3.1 partners focused their specific questioning on educational offerings on secondary and community college training, which turned out to be a limiting factor in determining baccalaureate, masters and PhD needs. Still, it indicated the areas of interest of industry in regard to course offerings at these levels.

Both projects 1.2 and 3.1 included recommendations regarding workforce development, education and training. Project 1.2 had four recommendations:\n
1. **Actions to better understand pain points**
   - *For scientists and technicians*: Undertake a focused investigation to understand whether the area has a fundamental worker supply problem (lack of people entering relevant courses of study) or an educational capacity problem (inability to graduate enough people with the right skills)

2. **Actions to address acute areas of need**
   - *For scientists and technicians*: Develop an ongoing, institutionalized process using employers and educational institutions to identify and focus on areas of acute and longer-term needs
   - *For scientists*: Establish a specialized technical training academy to supplement university and community college resources\(^2\) with the following components:
     - Focused, rapidly developed and flexible coursework in very specific areas that address acute needs of industry and potentially incorporate retraining of displaced workers
     - Internship placements to address identified needs
     - Industry-sponsored trainers and employers to speak at universities to educate students on career opportunities and to serve as adjunct lecturers
     - Expanded Trade Adjustment Assistance and Department of Labor funding for financial support
     - Web-based information resources for students, counselors, teachers and professors on job opportunities, qualifications, and pathways, such as those at biospace.com and biotechwork.org
     - Work with community colleges and universities to cover other acute needs
     - Coordinate with local policy organizations on policymaker education regarding need for fast-tracked green card program

\(^1\)21st Century Workforce Profile Analysis, California Council on Science and Technology, 2008
\(^2\)21st Century Workforce Preparedness (Oliva, 2008) includes a list of selected current programs intended to expand the Bay Area’s talent base in the life sciences; see pp. 20-24
3. Actions to address longer-term needs
   - For scientists and technicians: Bring together the complete set of educational institution stakeholders spanning representatives from secondary schools, technical training institutions, community colleges, undergraduate institutions, postgraduate universities, and research institutions to be involved in whatever organization is addressing industry-education-government coordination
   - Share these findings more widely to gain support for changes within the academic domain (such as eliminating bias against industry careers, increasing multi-disciplinary elements within university programs, adding a short-track/MS program, adding dual-degree programs, improving career placement services or realigning university mentorship activities with employer needs)
   - On an ongoing basis, analyze government spending, macro trends and other indicators to assess medium-term needs and develop a strategic plan to meet industry workforce needs
   - For technicians: Develop at the state level a common assessment and certification program for basic fundamental technology skill (Career Readiness Program) – basic mechanical, thermal, fluid and electrical knowledge, coupled with problem solving and workplace scenarios, aligned with college entrance assessments (Possible Model: Ohio skills bank)

4. Actions to increase interest in and support for science and science teaching
   - Engage in a coordinated PR campaign such as the Year of Science
   - Rally support for a Junior Achievement-style program for science
   - Promote enrollment in STEM teacher training programs such as CalTeach

Project 3.1 partners contributed a range of “Recommendations for Moving Forward: Regional Training Resources and Strategies”¹:

Recommendation 1. Improve on-the-job training (OJT) opportunities. Partners advised expanding WIB OJT and other OJT programs; building apprenticeship programs on successful models.

Recommendation 2. Expand business-education collaboration for curricula and training programs and outreach. There was significant consensus that training strategies must systematically integrate input from business. A few different models were advanced for doing so.

¹ Technology Workforce Issues and Opportunities, California Space Authority, 2008
Recommendation 3. Improve business, educator, student, employer, and parent understanding of training resources and employment prospects. There was extensive discussion of the difficulty for businesses and employees in understanding training resources and career pathways. Discussion also centered around increasing student interest in training for high-growth industries by increasing awareness of identified growth occupations.

Recommendation 4. Be aware of and responsive to generational issues and the difference between teachable practical skills and skills related to individual character. There was consensus that action was needed to improve both practical and character-based skills, though there was a shortage of ideas on how to handle the latter other than the strategies mentioned above. Potentially more could be done at the K-12 level to address character and attribute issues, and that it might be possible to develop a suite of cluster-specific workplace skills training units.

Recommendation 5. Mobilize leaders. Some partners noted the importance of working with elected leaders to draw attention to funding needs and to increase awareness of existing training resources.

Recommendation 6. Expand the role of Workforce Investment Boards to drive transformational change. Orange County WIB persuasively asserted that WIBs are well-positioned to convene and advocate transformational change that drives integration of workforce and economic development.

Recommendation 7. Work across jurisdictions for identified super-clusters. For super-clusters that reach across major economic regions and deliver wide-ranging benefits across counties and industries, it is recommended that special prioritization and cross-jurisdictional work be undertaken.

Common conclusions reached by Project 1.2 and 3.1 partners were numerous. The following table highlights those most evident.

It is striking how similar are the results of the 1.2 and 3.1 surveys to the results of those of other projects in which skill needs were analyzed.
**Common findings Projects 1.2/3.1**

- Engineers and Technicians are most critical occupations for innovation, also map to critical skill shortages
- Science, Technology, Engineering and Math (STEM) education/training is key
- Greater levels of education or certification are anticipated for STEM workers, except perhaps for the doctoral level
- Most critical occupations fall into high-wage categories (engineers: $60-over $105,000)
- Technical knowledge, Communications and Workplace Skills all rank among top three skillsets needed
- Problem-solving and Business Skills also a key need
- No educational preparation or level exceeds employer expectations
- Industry-relevant, real-world experience is critical and sorely lacking in 21st Century workforce development development

**Common Areas of Recommendations**

- Build better linkage between education/academia and industry to ensure relevant knowledge, skill-building
- Educate policymakers about issues, recommendations, resources
- Develop more “real-world”, hands-on opportunities for STEM students
- Develop communications and problem-solving, business and workplace skills alongside technical knowledge
- Increase awareness of STEM career attractiveness among parents, educators, students
- Link educational levels to build on STEM learning
- Align workforce, economic development and education systems to address industry needs (cluster strategies, sector strategy)

**WIRED Outcomes for Education/Training Goals**

At the end of Quarter 4, 2008, after the third year of the CIC WIRED Initiative, the Corridor reported 561 worker placements, 692 individuals having completed workforce training program and 63 students having been awarded degrees or certificates.
**Sampling: Curriculum and Instruction/Training-Related Products and Deliverables**

The following Education/Training Degrees/Certificates and/or Resources were created (see 3.0 Pathway/Projects, page 226 also):

- “WIB/WIA 101” training course – to provide employer HR professionals an overview of the Federal and State workforce system and the services it offers employers (CWA)
- “HR Fundamentals and Strategies for WIBs” training course – orienting WIBs to industry/employer (HR) perspective and how WIBs might work with HR professionals – (CSA)
- HR 101 Bibliography – resource developed for WIB HR training course (CSA)
- California Community College-approved “21st Century Aerospace Manufacturing Technician” Certificate
- University of California Extension approved: “Software Engineering for Aerospace and Defense Applications” Certificate
- Curriculum for 21st Century Aerospace Manufacturing Technician certification (El Camino College)
- California Community College-approved: Associate of Science (AS) degree in Engineering Technology with Emphasis in Mechatronics
- California Community College approved: Certificate in Engineering Technology with Emphasis in Mechatronics
- California Community College approved: Associate of Science (AS) degree in Electronics Technology with Emphasis in Mechatronics
- California Community College approved: Certificate in Electronics Technology with Emphasis in Mechatronics
- Curriculum (powerpoint presentations from) for pilot Systems Engineering Course (The Aerospace Corporation)
- STEM Career Pathways/Academies – guidelines for/identification of high school programs to assist students and counselors in outlining career pathways leading to math, science and engineering programs in the community college.
- Project Lead the Way (PLTW) programs established in Los Angeles County South Bay high schools – enabling 1200 students PLTW pre-engineering coursework (El Camino College)
- Curriculum (powerpoint presentations from) “Basics of System Engineering (BaSE)” Course (Cal Poly, San Luis Obispo)
- Course outline modification to Allan Hancock College’s Space 128 course on materials and processes – revisions to required course offering in Mechatronics A.S. degree and certificate program (Allan Hancock College)
- Guidebook on Creating a STEM Community Pathway – blueprint for community STEM stakeholders to develop a community STEM continuum (Strategic Vitality LLC)
- STEM Education Recruitment Strategy – working model of a replicable recruitment strategy to attract students into technical coursework (Lancaster University Center)
- Resource Guide – training and service provider resources for working or retired professionals seeking to enter STEM teaching (California Troops to teachers)
- Curriculum (powerpoint presentations from) for pilot Systems Engineering Course (The Aerospace Corporation)
- Curriculum (powerpoint presentations from) “Basics of System Engineering (BaSE)” Course (Cal Poly, San Luis Obispo)
- Introduction to 21\textsuperscript{st} Century Supply Chain Management – course outline for pilot course, online delivery – developed into full certificate for California community colleges (Antelope Valley College)
- \textit{Innovation Driven Economic Development Model} – guidebook for EDOs, WIBs, other economic/workforce stakeholders to create innovation-oriented regional culture (BASIC/BACEI)
- Innovation Driven Economic Development Toolkit – see other innovation-oriented products/deliverables, this section and others
- Training/presentation materials from Dec 2008 training webinar on use of the California Innovation Corridor innovation asset portal (ECEDC/addendum to final report)
- \textit{Venture Communities Guidelines} – blueprint for creating venture communities according to Golden Capital Network model (Chabin Concepts)
- Innovation Resource Guide – to provide high-tech LA County companies with comprehensive list of service providers, local, state, federal resources (LAEDC)
- Presentations from Smart Supplier Forums 2006, 2007, 2008 – supplier “transformation” orientation materials to help transition them to global, 21\textsuperscript{st} Century supply chain environment (CSA)
- 21\textsuperscript{st} Century Supply Chain Management Principles – 3 day course (CSA)
- Supply Chain Resource Guide – training and service providers for suppliers (NOVA)
- ETP Overview Presentation for multiple uses – orientation material to acquaint companies with potential State funding for training (CSA)
- Training Resource Guide for employers – (NOVA)
- Entrepreneur Boot Camp Agenda/materials from California Tech 100 – entrepreneur boot camp template (East County ECEDC/Golden Capital Network, CSA)
- Archived presentations from the Stanford AA 247 innovation seminar/webinar course (Stanford)
**Corridor WIRED Projects 3.0**

WIRED Initiative 3.0 projects addressed the talent development needs of the 21st Century innovation-oriented economy. It addresses needs assessing, talent development principles, demand-driven solutions, teacher recruitment, training and professional development, mentoring, internships, project-based experiential learning and WIB transformation. Fourteen projects comprise this strategic goal area, with the goal being to “integrate consideration of current and future industry enterprise needs into workforce and educational planning and policymaking”. The desired state is for education and workforce systems to be responsive and flexible, responding to global market changes, workforce needs with continuity across systems.

**Project 3.1 – By means of a workforce needs analysis of 200 employers in a seven-county area of Southern California, gather information about the skills required for critical employment positions and identify future workforce gaps in order to develop a strategy to address future California Innovation Corridor employer needs.** Project 3.1 was led by the California Space Authority and supported by the State Labor Market Information Division (LMID) of the California Labor and Workforce Development Agency. LMID provided baseline information for industry cluster identification in several Corridor areas, with WIB and Economic Development partners involved (see below) then collaboratively surveying analyzing and reporting data for their areas, identifying skill gaps and future workforce needs which were aggregated into a summary project report (see CSA deliverable, below)

**California Space Authority (CSA):** CSA is a private nonprofit representing space enterprise stakeholders statewide from all three domains: commercial, civil and national security. It provides Voice, Visibility and (competitive) Edge to the diverse California space enterprise community, which includes, satellite manufacturing, launch, satellite services, ground equipment manufacturing, engineering services and government-related space e.g. NASA. California space enterprise provides California a total job impact of 371,397 and a total economic impact of $76 billion. CSA served as the Lead for Project 3.1

**Key Deliverable:** 3.1 Consolidated 21st Century Workforce Analysis WIRED Report Final


**Kern Economic Development Corporation (KEDC):** KEDC represents county economic development interests in this central valley county which is the 62nd largest metropolitan area in the U.S. The City of Bakersfield is known worldwide for its reputation as an early oil exploration center. Known for its state of the art agriculture, oil and aerospace industries, Kern crops provide the world with food
and fiber while its oil and aerospace industries provide the nation with oil and gas and the latest in defense technology. Kern EDC was a project partner responsible for surveying and analyzing the data from its area.

**Key Deliverable:** 3.1 Kern EDC/WIB 21\textsuperscript{st} Century Workforce Analysis WIRED Data

http://www.innovatecalifornia.net/WIREDdeliverables/Kern\%20WIB\%20Consolidated\%20Survey\%20Data\%20Tab.pdf

Los Angeles County Economic Development Corporation (LAEDC) and the Los Angeles City Workforce Investment Board (LAWIB)
The LAEDC represents economic stakeholders of the 88 cities in the Los Angeles County jurisdiction. If the area were a state, it would be the 8\textsuperscript{th} largest in the U.S., with a population of 10.4 million people and a median household income of $50,000. LAWIB works with the Los Angeles City Mayor and Council on policy and strategy to ensure business access to a trained workforce and worker access to quality jobs, managing about $50 million of public funds annually. WIB programs are offered, often at no charge, through WorkSource Centers throughout the City. The LAEDC, with support from the LA City WIB was a project partner responsible for surveying and analyzing the data from its area.

**Key Deliverable:** 3.1 LAEDC 21\textsuperscript{st} Century Workforce Analysis WIRED Report

http://www.innovatecalifornia.net/WIREDdeliverables/LAEDC\%20Survey\%20Results\%20Report\%20\%208\%2028.pdf

Greater Antelope Valley Economic Alliance/Los Angeles and Kern Counties (GAVEA): The Greater Antelope Valley Economic region encompasses over 3,000 square-miles and includes both Northern Los Angeles County and Eastern Kern County and is now home to over 475,000 residents, many employed in its robust government and private-sector aerospace sector. GAVEA was a project partner responsible for surveying and analyzing data from its area.

**Key Deliverable:** 3.1 GAVEA 21\textsuperscript{st} Century Workforce Analysis Meeting of the Minds

http://www.innovatecalifornia.net/WIREDdeliverables/GAVEA\%20Meeting\%20of\%20the\%20Minds\%20presentation10-31-08.pdf

**Deliverable:** 3.1 GAVEA 21\textsuperscript{st} Century Workforce Analysis WIRED Report


Orange County Workforce Investment Board (OCWIB) and Orange County Business Council (OCBC) Orange County is America’s fifth largest county and covers a 789 square mile area in the Greater Los Angeles/Long Beach/Santa Ana metropolitan area with approximately 3 million residents. In Partnership with
the Orange County Board of Supervisors, the OCWIB oversees Orange County’s workforce development activities and establishes programs in response to the workforce needs of Orange County in accordance with its 5-year Strategic Local Plan. The OCWIB system operates through One-Stop Career Centers, and satellite centers, conveniently located throughout the County. Each Center offers wealth of training, information and assistance for businesses and job seekers. The Orange County Business Council (OCBC) is the leading voice of County business on important issues locally, regionally and nationally, working to enhance Orange County’s economic development and prosperity and to preserve a high quality of life. For more than 100 years, OCBC and its predecessor organizations have promoted economic development countywide and now represents businesses with nearly 250,000 employees in Orange County and 2 million worldwide. Collaboratively, the OCBC and the OCWIB were responsible for surveying and analyzing the data from their area. In addition, the OCWIB provided additional analyses in the form of white papers as described below.

Deliverable References:

3.1 OCWIB 21st Century Workforce Analysis Cluster Analysis
http://www.innovatecalifornia.net/WIREDdeliverables/3.1%20Clusters%20Summary%20for%20WIRED.pdf

3.1 OCWIB 21st Century Workforce Analysis Beyond Workforce Investment Borders
http://www.innovatecalifornia.net/WIREDdeliverables/31BEYO.pdf

3.1 OCWIB 21st Century Workforce Analysis WIRED Transformation
http://www.innovatecalifornia.net/WIREDdeliverables/3.1%20Workforce%20Investment%20Transformations.pdf

3.1 OCWIB 21st Century Workforce Analysis
http://www.innovatecalifornia.net/WIREDdeliverables/3%201%20OCWIB%20Workforce%20Analysis%20Report.pdf

Riverside County Economic Development Agency (RCEDA) Riverside County is comprised of 26 cities over a 7000+ square mile area, with over two million residents. It is part of the Riverside/San Bernardino/Ontario metropolitan area. The Riverside EDA has integrated WIB and economic development functions under the organization, providing great continuity for 21st Century capacity-building. Riverside County Economic Development Agency, which also houses Workforce Investment Board services, was a project partner responsible for surveying and analyzing data from its area.
Deliverable References:

3.1 RIVEDA/WIB 21st Century Workforce Analysis WIRED Raw Data, Quantitative Data Summary & Qualitative Data Summary
http://www.innovatecalifornia.net/WIREDdeliverables/RiverWIB-RiverEDAspreadsheetRawDataandSummary.pdf

3.1 RIVEDA/WIB 21st Century Workforce Analysis WIRED Report Final

San Bernardino Workforce Investment Board (SBerWIB) San Bernardino County is California’s largest county, home to over two million people in over a 20,000 square mile area. It is part of the Riverside/San Bernardino-Ontario metropolitan area northeast of Los Angeles. The San Bernardino County Workforce Investment Board (WIB) is charged with addressing major workforce issues in the county. The WIB’s role is to convene appropriate parties around these issues, create dialogue among relevant parties, generate creative, innovative solutions through consensus and to enlist community commitments to action, in order to achieve a competitive advantage. San Bernardino WIB was a project partner responsible for surveying and analyzing the data from its area.

Key Deliverable: 3.1 SberWIB 21st Century Workforce Analysis WIRED Report Final
http://www.innovatecalifornia.net/WIREDdeliverables/SBerWIB%20Final%20Results%20Survey%20Report.pdf

San Luis Obispo County Economic Vitality Corporation (SLOEVC) and Private Industry Council (PIC/WIB) San Luis Obispo County is 3,300+ square miles of rural and beachfront communities on California’s Central Coast, midway between San Francisco and Los Angeles. Its population has grown to over 265,000 residents, mostly employed in the area’s robust wine industry, or other agricultural, government or tourism. A new venture community is also emerging. The SLO EVC and PIC/WIB were project partners collaboratively responsible for surveying and analyzing data from their area.

Key Deliverable: 3.1 SLO-PIC/EVC 21st Century Workforce Analysis WIRED Report Final
http://www.innovatecalifornia.net/WIREDdeliverables/SLOEVC_SLOPIC_WorkforceAnalysis_Report.pdf

South Bay Economic Development Partnership (SBEDP) and South Bay Workforce Investment Board (SBWIB) San Luis Obispo Economic Development Partnership represents the economic vitality of 15 Los Angeles County South Bay communities, with some of those communities situated on 23
miles of the Pacific coast. A high-tech center for both information technology and aerospace, the South Bay is one of the most diverse areas of California, with some of the wealthiest and poorest communities in southern California. The South Bay Workforce Investment Board’s purpose is to promote a fully integrated workforce investment policy development process, forge partnerships among economic and community development agencies, and strive for continuous improvement to meet job seeker and employer needs. The South Bay Economic Development Partnership and Bay WIB, were project partners responsible for surveying and analyzing the data from their area.

**Deliverable References:**

3.1 SBEDP 21st Century Workforce Analysis WIRED Report Final
http://www.innovatecalifornia.net/WIREDdeliverables/SBEDP%20Final%20Report%20081708.pdf

3.1 SBay WIB 21st Century Workforce Analysis WIRED Report Final

Ventura County Workforce Investment Board (VCWIB) Ventura County is an 1845 square mile area with a population of 800,000. The Workforce Investment Board (WIB) administers the distribution of federal Workforce Investment Act funds that are allocated through the State of California to Ventura County. The federal funds help to support the Job & Career Centers and other local programs and services that benefit adult and youth job seekers, dislocated workers, and businesses. Ventura County WIB was a project partner responsible for surveying and analyzing the data from its area.

**Title of Key Deliverable:** 3.1 VCWIB 21st Century Workforce Analysis WIRED Report Final

**Project 3.2 – Purpose of this project was to develop and conduct initial implementation of a consortium model of space science and research, university/industry communities to support affordable space opportunities for small satellite and university payloads, enabling real-world experience for future space workers.**

California Space Authority (CSA) CSA led the effort to develop and implement a space-related university/employer consortium, with the support of the California Space Education and Workforce Institute (Institute). A Consortium was established meant to facilitate university/employer partnerships as well as engage more students in real-world work. As project progressed, obstacles to the consortium model used were identified: necessary networking was already taking
place at established joint conferences, customers had some push-back to student engagement in high-priority systems development, etc. Because of these and other factors, Consortium participation was not enthusiastic. Project evolved into studying the factors characterizing successful science, research and development consortia and completing a report outlining ways to adapt the model for greater effectiveness.


**Project 3.3 – This project was designed to provide undergraduate and graduate payload (Stanford) and launch (Garvey Spacecraft) experiential learning and project-based experience for engineering students of Stanford University and California State University, Long Beach, as well as San Jose State University.**

**Garvey Spacecraft Corporation (GSC)/California State University Long Beach (CSULB) -** GSC’s role was to work with California State University Long Beach, through GSC real-world launch vehicle development projects, opportunities for students in design, development, payload integration and test. GSC leveraged the nanosat launch vehicle development program already underway with the Air Force and NASA sponsorship. CSULB contributed engineering students for the project. Accomplishments included: manifesting of secondary payloads from Cal Poly SLO on the Prospector 7D flight at San Nicholas Island; dedicated WIRED flight test of the Prospector 8A with university experiments: CubeSat (Stanford), data acquisition system (CSULB) and dedicated WIRED flight test of the Prospector 12A with multiple experiments: inertial measurement unit (University of Kentucky), on-board camera and GPS position logger (CSULB), radio frequency telemetry experiment (Santa Clara University) and a data acquisition package (Saratoga High School). GSC provided 80+ students real-world hands-on engineering experience and utilized nine mentors in the process.

**Stanford University (Stanford):** Stanford’s role was to establish a program for student participation in building, integrating and flying payloads on experimental rockets and balloons, for the purpose of engaging students in real-world aerospace engineering projects. Two balloon launches were conducted that contained several student payloads. Students were also engaged in launch vehicle and payload development for ARLISS (A Rocket Launch for International Student Satellites) launches in the desert in 2007 and 2008. Another significant “product” was the demonstration of the “Virtual Classroom” (VC) capability. Stanford worked with San Jose State University (SJSU) and industry mentors to develop a capability to remotely capture and transmit real-time voice, video and data over the internet. This capability was intended to allow a classroom of students to operate in a control room type of environment for launches conducted
at remote locations throughout the world. Additional applications include distance learning, remote mentoring and classroom science and engineering support.

**California Space Authority (CSA):** California Space Authority provided integration of the efforts of the two partners listed above, served as an industry interface, served periodically in a mentor capacity, provided technical assistance and aggregated findings. In Phase II, CSA coordinated a demonstration of the virtual classroom model.

**Deliverable References:**

*Project 3.3 Combined Final Report*
http://www.innovatecalifornia.net/WIREDdeliverables/3.03-Final-Report.doc

*Phase II Virtual Classroom Final Report*
http://www.innovatecalifornia.net/WIREDdeliverables/3.03-Ph2-virtual-classroom-final-report.doc

**Project 3.4 – Goal was to attract 100 working engineers into systems engineering (SE) training programs by developing an outreach program orienting industry, the entrepreneurial sector, government employers and employees about systems engineering training opportunities. These opportunities were to be identified in a SE training online catalogue.**

*Note:* SE is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem. SE is utilized in nearly all high-tech, high-growth sectors, including aerospace.

**The Aerospace Corporation (TAC)** - The Aerospace Corporation is a federally-funded Research and Development Center which supports the U.S. Air Force, other government agencies, and provides some technical assistance to the commercial sector. TAC served as project lead for 3.4, surveying industry SE stakeholders, defining and prioritizing 44 "systems engineering competencies", identifying 200+ SE courses from approximately 20 university, government and private sector training providers suitable for working professionals compiled into a Systems Engineering Training Resources catalogue. TAC also designed and conducted a pilot “Systems Engineering Fundamentals” course.

**Title of Key Deliverable:** Systems Engineering Training Resources Catalogue
http://www.innovatecalifornia.net/WIREDdeliverables/SysEngrgCatalog_.pdf
California State Polytechnic University, San Luis Obispo (Cal Poly SLO) – Cal Poly SLO performed three major roles in Project 3.4. It assisted in identifying industry stakeholders for SE survey, it created an online version of the training resources catalogue, and it refined and delivered the two day SE Fundamentals course to over 90 working engineers.

**Title of Key Deliverable:** A Distributed Systems Engineering Course for Working Engineers


California Space Education and Workforce Institute (CSEWI) – CSEWI served as an industry interface for both TAC and Cal Poly SLO, assisted in survey development with industry stakeholders, and provided support for identification of training resources, as well as recruitment support for pilot and SE Fundamentals course delivered by Cal Poly SLO

**Title of Key Deliverable:** List of SE Fundamentals Attendees


**Project 3.5 – The goal of the Science, Technology, Engineering and Math Collaborative Action Plan (STEM CAP) was to “develop a collaboration and a strategic action plan to increase the number and support the development of STEM students, graduates, teachers, professors and mentors within the California Innovation Corridor and the state of California, leveraging the resources not only of education and academia (K-20, public and private), but of industry and informal science.”**

California Space Education and Workforce Institute (CSEWI) – CSEWI served as project lead for the development of the STEM CAP, as well as providing oversight for the partner efforts surrounding the development of the STEM CAP document (see El Camino, Cal Poly SLO efforts described below). CSEWI formed and facilitated work of the STEM CAP Steering Committee, hosted three statewide STEM CAP forums, which included working group breakouts for STEM stakeholder attendees, with a fourth forum held in Phase II. CSEWI also served as industry and informal science interface. CSEWI’s primary role was development of the STEM CAP, through its contractee, the Alliance of Collaborations for Heightened Education Success (ARCHES), the first collaborative statewide private/public strategic action plan in the nation. ARCHES, on behalf of CSEWI, conducted six regional pilots implementing STEM CAP recommendations. CSEWI also developed, as a California first, an online, searchable private/public STEM Inventory of California STEM programs. In
Phase II, in addition to the fourth STEM CAP forum, CSEWI coordinated development of an environmental assessment of STEM programs in the El Segundo area.

**Deliverable References:**

*Recommendations for STEM Education in California*
http://www.innovatecalifornia.net/WIREDdeliverables/STEMCAPDOC.pdf

*Inventory of STEM programs*
www.STEMInventory.net

(Phase II): **STEM Environmental Assessment**
http://www.innovatecalifornia.net/WIREDdeliverables/3.05-Ph2-STEM-Environmental-Assessment-CSEWI.doc

(Phase II): **Career Readiness Certificate Survey Analysis**
http://www.innovatecalifornia.net/WIREDdeliverables/3.05-Ph2-CRC-Survey-Results-FINAL.pdf

(Phase II): **STEM Inventory Strategy Paper**
http://www.innovatecalifornia.net/WIREDdeliverables/3.05-Ph2-STEM-Inventory-Pointpaper.doc

**California Council on Science and Technology (CCST)** CCST served as a primary interface with the California education system, played a role as a key member of the organizing committee at project start-up. CCST executive director Dr. Susan Hackwood provided context for the development of the STEM CAP with a presentation regarding the national STEM crisis, CCST helped identify existing national STEM-related reports and served as both a Steering Committee and Advisory Group member in the development of the STEM CAP. It also provided teacher support for forums and presentations from its teacher council.

**Deliverable Reference:** *STEM CAP Forum presentation (Dr. Susan Hackwood)*

**California State Polytechnic University, San Luis Obispo (Cal Poly SLO)**
Cal Poly SLO provided an analysis of the California State University (CSU)/NASA Professional Development Institutes, those at Cal Poly SLO, CSU Fresno and CSU Bakersfield, which served 87 teachers, benefited 7000 students and used hands-on NASA curriculum keyed to state science standards, to foster better science teaching. Culminating white paper identified success factors of STEM professional development institutes.
Deliverable Reference: *White paper on CSU/NASA Teacher Professional Development Institutes*
http://www.innovatecalifornia.net/WIREDdeliverables/3.05-Cal-Poly-Professional-Development-Paper-Liddicoat.pdf

**El Camino College (ECC)** The role of El Camino College, a community college in the South Bay of Los Angeles County, was to facilitate Project Lead the Way programs in various South Bay high schools. Project Lead the Way (PLTW) provides rigorous engineering curriculum utilizing a hands-on and inquiry-based approach fostering the kind of engagement of students often leading them to choose STEM-related technical or professional careers. ECC provided over 2,000 hours of training to college and high school instructors in PLTW and robotics over two years, facilitated the certification of 300 students in the ECC pre-engineering Technology/PLTW program through ECC or partner high schools. ECC also established and/or maintained concurrent enrollment agreements with numerous South Bay high schools, offering PLTW through ECC.

**Deliverable Reference:** *Case Study on Project Lead the Way Programs*
http://www.innovatecalifornia.net/WIREDdeliverables/3.05-El-Camino-case-study.doc

**Strategic Vitality, LLC (SVLLC)** Strategic Vitality’s role in the STEM CAP was to provide overview materials for STEM CAP start-up, provide a roster of recruited STEM CAP Steering Committee members, Steering Committee agendas, agenda and recap of facilitator’s workshop, STEM CAP forum agendas/recaps, working group recaps and in Phase II, recap of the final STEM CAP forum as well as a guide to the development of STEM community pathways.

**Deliverable References:**

*General STEM CAP Overview*
http://www.innovatecalifornia.net/WIREDdeliverables/000000-General-STEMCAP-Participant-Overview.pdf

*Recap of STEM CAP Forum June 2006*
http://www.innovatecalifornia.net/WIREDdeliverables/062806-FINAL-RECAP-STEMCAP-FORUM.pdf

*Recap of STEM CAP Forum December, 2006*
http://www.innovatecalifornia.net/WIREDdeliverables/120906-Final-RECAP-STEMCAP-FORUM.pdf

*Recap of STEM CAP Forum September 2009*
http://www.innovatecalifornia.net/WIREDdeliverables/3.05-Ph2-RECAP-STEMCAP-Forum-092609-SVLLC.doc
Project 3.6 – Mathematics, Engineering and Science Achievement (MESA) was engaged as a Corridor WIRED partner and Project Lead of 3.6 to conduct six “Mathematics Physics Technology Institutes (MPTI)” summer STEM-related middle and high school teacher professional development academies (two annually) on university campuses, summer of 2007 and 2008. The Academies were meant to provide teachers a STEM-related professional development experience that fosters innovation by pairing middle and high school teachers, introducing new uses of technology and focusing on space and other applications relevant to math and science content. Two two-week summer teacher professional development institutes (space and technology academies) for middle and high school teachers took place in July and August of 2007. Planning took place for the 2008 MESA teacher professional development academies in early 2008, with MESA finalizing the 2008 curriculum, placing equipment orders, coordinating logistics and beginning to recruit teachers. MESA’s contract was terminated by CSA with an effective date of June 4, 2008. It is believed that the other four institutes took place, but outside of the WIRED Corridor Initiative.

Deliverable Reference: (MESA) Course Schedule and Curriculum
http://www.innovatecalifornia.net/WIREDdeliverables/Project%203.6%20Agenda%20and%20Curriculum.pdf

Project 3.7 – The goal of Project 3.7 was to originate an industry-driven training program to retrain dislocated software specialists for space-related computer science positions. NOVA, the Silicon Valley Workforce Investment Board, by contracting with the University of California Santa Cruz Extension, created a “Certificate in Software Development for Aerospace/Defense Applications”, recruited, screened and enrolled 27 participants in the training program (2 cohorts). All 27 completed the training, 19 have completed services, 16 attained aerospace employment with an average wage of $46.96/hour.

Deliverable References:
Certificate Proposal – Aerospace/Defense Applications
Course Schedule, 2008
http://www.innovatecalifornia.net/WIREDdeliverables/Courses%20Schedule%202008.pdf

Project 3.8 – The purpose of this project was to improve interface of industry and at least three university programs, introducing their students to industry mentors and science/engineering careers. The project included several elements: Orientation of Universities to Aerospace (Cal Poly Pomona, Cal Poly SLO and UC Irvine), virtual mentoring of 10 university students by 5 industry professionals (through icouldbe.org); California Space Enterprise Speaker’s Bureau; Space Space Blog, an informal, online environment for informal conversations about space enterprise. A New Space Professionals survey was also conducted. Phase II activity included introduction of three companies to provide innovation tours to the three target universities, delivery of Space 101 course to students/recent hires. To foster international aerospace education partnering, a Memo of Understanding was executed with the French Aerospace Valley

Deliverable References:

Aerospace Community Development Program
http://www.innovatecalifornia.net/WIREDdeliverables/3.08-Aerospace-Community-Development-Program.ppt

Innovation Tour Report #1
http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Tour%20Report-CPP.pdf

Innovation Tour Report #2
http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Tour%20Report-UCI.pdf

Innovation Tour Report #3
http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Tour%20Report%203.pdf

French Aerospace Valley Agreement
http://www.innovatecalifornia.net/WIREDdeliverables/3.08-French-Aerospace-Valley-Agreement.doc

Project 3.9 – The purpose of this project was to develop a program providing outreach and career counseling to STEM retirees and professionals interested in finding accelerated pathways into STEM teaching. Project served as a pilot to determine if recruitment of industry
retirees for STEM classroom teaching was feasible, with a final white paper outlining findings. Outreach materials and findings were turned over to EnCorps, a STEM teacher recruitment organization funded by the State of California, to ensure sustainability of effort.

**California Troops to Teachers** - As Project 3.9 Lead, Project Pipeline/Troops to Teachers developed the “Scientists and Engineers Alternative Routes to Certification and Hiring – SEARCH” program with the support of its project partner the California Space Education and Workforce Institute (Institute) to provide outreach and career counseling to STEM professionals interested in finding an accelerated pathway to enter the classroom as teachers. The program included the design, development and production of outreach materials; construction and maintenance of a specific program website; the establishment of a computer-based lead and participant tracking system; development of detailed information packets for participants; leveraged links to a network of state approved teacher preparation programs; and trained and experienced counselors to assist SEARCH participants.

**Deliverable Reference:** “SEARCH” White Paper  
[http://www.innovatecalifornia.net/WIREDdeliverables/Transition%20to%20Teaching%20%20SEARCH%20%20SEARCH.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/Transition%20to%20Teaching%20%20SEARCH%20%20SEARCH.pdf)

**California Space Education & Workforce Institute (CSEWI)** – CSEWI served as education and industry interface.

**Project 3.10 Establish a model program for K-U participation in projects that demonstrate technical capability in the design, assembly, testing and operation of electronics applications to observe local and space environments. To have students working with tech mentors on a continuum of projects that will be hands-on activities to build interest and capability for science, technology, engineering and math careers.**

**Stanford University** – The role of Stanford was to provide mentors and technical expertise on foundational electronics-related projects that would provide students an opportunity for hands-on work. Mentors were to work with the same students for at least two years. Virtual Classroom technology provided project-based student experience, as well.

**Deliverable Reference:** Stanford Final Slides  
[http://www.innovatecalifornia.net/WIREDdeliverables/3.10-Stanford-Final-Slides.ppt](http://www.innovatecalifornia.net/WIREDdeliverables/3.10-Stanford-Final-Slides.ppt)

**California Space Authority/California Space Education & Workforce Institute** CSA/CSEWI provided industry interfaces, supported recruitment, provided continuity and facilitated manifesting of student payloads.
Project 3.11 This project had several goals: pilot community college industrial technology-based degrees in Mechatronics; coordinate student recruitment strategies for technical programs with certification potential; develop outreach programs at the junior high (through November 2007), high school and community college levels; work with four year colleges and universities to establish ongoing articulation agreements.

Allan Hancock College (AHC) – AHC, a community college on California’s central coast, served as project lead and piloted the Mechatronics curriculum. It created two California Community College-approved degrees and two certification programs featuring mechatronics: Electronics Technology with Emphasis in Mechatronics (AS degree and certificate), Engineering Technology with Emphasis in Mechatronics (AS degree and certificate). The College also conducted outreach activities to foster recruitment into AHC technical programs.

Title of Key Deliverable: Mechatronics Core Courses
http://www.innovatecalifornia.net/WIREDdeliverables/Mechatronics%20-%20Core%20Courses.pdf

Lancaster University Center (LUC)/Antelope Valley Engineering Programs
LUC’s role was to develop engineering pathways for target Antelope Valley technical/professional careers, to design and conduct outreach activities developed to foster recruitment into the Antelope Valley (four year) Engineering Programs. Over 300 students participated in LUC WIRED-related outreach efforts.

Title of Key Deliverable: LUC Recruitment Strategy

College of the Canyons (CoC) Through November, 2007, when DOL issued new guidance around the allowable minimum age for WIRED project target participants, the College of the Canyons, a community college located in California’s San Fernando Valley of Los Angeles, designed and conducted outreach efforts to interest young students in technical careers early enough to keep their grades and interest in math and sciences high.

Title of Key Deliverable: College of the Canyons Coaches’ Manual (Robotics)

Cerritos College – Cerritos College, a community college located in Orange County in the greater Los Angeles metropolitan area, focused on high outreach...
efforts designed for recruitment of high schoolers into Cerritos College technical programs.

**California Space Education & Workforce Institute (CSEWI)** – CSEWI provided industry interfaces, facilitated cross-talk and coordination among 3.11 partners and provided a final aggregated report for the 3.11 effort.

**Project 3.12** Project goal was to provide four educator launch conferences to coincide with NASA earth science launches from Vandenberg Air Force Base, with a minimum of 150 teachers participating in hands-on, real world professional development around NASA science mission topics. In addition, development of a high school earth sciences curriculum to meet UC admission standards was developed.

**Space Information Labs (SIL):** As noted in its website, “SIL is a nonprofit 501 (c) (3) educational and scientific corporation with operating divisions to improve education and develop innovative products in the field of science and engineering through such efforts as school-to-career pathways, public outreach, and research and development.” SIL developed and conducted four educator launch conferences in cooperation with NASA mission scientists and industry experts, in addition to a session aligned with NASA JPL’s 50th anniversary, and developed the earth sciences curriculum with JPL.

**Deliverable References:**

*SIL Conference Programs*
http://www.innovatecalifornia.net/WIREDdeliverables/3.12%20Conference%20Agendas.pdf

*Mission to Planet Earth Systems (MTPES) Course Outline for UC Approval*
http://www.innovatecalifornia.net/WIREDdeliverables/MTPES%20UC%20Approval%20Course%20Description.pdf

**California Space Authority (CSA)** CSA’s role was to serve as an interface between SIL and both the education and space employer (industry, government agency) community, as well as provide technical assistance as appropriate.

**Project 3.13 - The California Space Education Center (CSEC) is a web-based research, education and workforce collaboratory developed to increase interest in and show relevance of science, technology, engineering and math (STEM) disciplines. Its aim is to expose students to steps in the STEM career path and provide opportunities for students to become involved in a participatory learning community focused around**
STEM careers. California Space Authority and California Space Education and Workforce Institute were partners in this effort.

**Deliverable References:** CSEC Website Outreach Plan Presentation  

**Project 3.14 – This project established a learning community (called the WIB Learning Collaboratory) among California’s Workforce Investment Boards (WIBs) to share and build upon the innovations developed by and among the partners of the California Innovation Corridor and from WIB best practices statewide. In Phase II, a cross-orientation of WIBs and Corporate Human Resource professionals was developed and delivered.**

**California Workforce Association (CWA) –** CWA served as 3.14 lead and contributed the following: survey of WIBs on WIRED-related principles at the start and midway through the Corridor WIRED effort; transformation of its conferences to focus on innovation, talent development and regional strategies; focused its quarterly board meetings around WIRED principles; connected with other systems, domains, e.g. economic development, education, industry; promoted use of WIB toolkit, using it in WIB and other workforce stakeholder orientations; developed white papers (monographs) around WIRED-related topics; developed process to keep Legislative staffers aware of workforce needs; integrated other WIRED products, e.g. WIBs and Supply Chains, into Learning Collaboratory effort. In Phase II, CWA developed the “WIB 101” orientation session and delivered it to Corporate HR professionals recruited by CSA.

**Deliverable References:** CWA 3.14 Mid-Process Survey Results  
[http://www.innovatecalifornia.net/WIREDdeliverables/CWA%203.14%20Mid-Process%20Survey%20Results.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/CWA%203.14%20Mid-Process%20Survey%20Results.pdf)

**Primer for WIBs – Monograph #3**  
[http://www.innovatecalifornia.net/WIREDdeliverables/Primer%20for%20WIBS-Monograph%203.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/Primer%20for%20WIBS-Monograph%203.pdf)

**(Phase II) WIB Info for HR Departments**  
[http://www.innovatecalifornia.net/WIREDdeliverables/3.14-WIB-info-for-HR-departments.ppt](http://www.innovatecalifornia.net/WIREDdeliverables/3.14-WIB-info-for-HR-departments.ppt)

**California Space Authority (CSA):** CSA served as an industry and all WIRED partner interface, as a subject matter expert on industry-related topics such as supplier transformation, and as a recruitment resource for speakers and presentations that became part of the Learning Collaboratory effort. In Phase II, CSA developed the “HR 101” orientation and delivered it to WIBs recruited by the CWA.
Title of Key Deliverable: HR Issues for WIBs
http://www.innovatecalifornia.net/WIREDdeliverables/3.14-HR-issues-for-WIBs.ppt
Workforce Investment Boards: Existing and Potential Roles in the Innovation Economy

As the California Workforce Association (CWA), representative of California’s forty-nine statewide local Workforce Investment Boards (WIBs), states in its final partner report, “In most other states, the public workforce system was not a key player in the first generation of WIRED grants, but in California, CSA included WIBs from the beginning as key players.” CWA was included in the Corridor WIRED Leadership Team, the Project Leads Forum, WIRED Academies and its influence figured significantly in all of the Corridor’s signature products.

Again citing CWA’s final report (Project 3.14, the Learning Collaboratory):

>California Workforce Association’s key accomplishments include refocusing California’s local workforce system on the importance of responding to the needs of their local employers and an emphasis on talent development. Local Boards are identifying sector policies to better help their local and regional businesses stay competitive. CWA has helped forge tighter partnerships among Local Boards to look at issues regionally instead of in isolation. California will be better served if local partnerships understand their importance in the regional landscape. The Corridor will prosper when there is a steady flow of a skilled, educated workforce.

In order to highlight the key roles – both current and potential - of Workforce Investment Boards (WIBs) in an innovation driven economy, featured below are descriptions of several projects and/or products produced by WIBs, or pertaining to WIB participation, responsibility and opportunity in fostering 21st Century workforce competitiveness and developing a job-generating innovation ecosystem.

**The WIB Learning Collaboratory**

One of the Corridor’s Sustainability Projects, as well as a signature project of the “Talent Development” pathway of the Corridor WIRED Initiative, Project 3.14 is the project perhaps most significant to the U.S. Department of Labor and the California Labor and Workforce Development Agency. As the key purpose of the national WIRED Initiative was to foster transformation of the U.S. workforce system to meet the demands of the 21st Century workforce environment, no project in the Corridor had a larger role. While there were dozens of findings pointing out 21st Century WIB challenges and opportunities, and several Corridor projects, studies, and reports that will be covered in this section on WIB roles in the new environment, it is important to begin with the WIB Learning Collaboratory. It was this project that was charged to make sense of all the new Corridor information to the WIB community.
The California Workforce Association (CWA) is a non-profit membership organization that develops public policy strategies and builds local capacity to address critical workforce issues. CWA represents the 49 Workforce Investment Boards, over 200 One-Stop Career Centers and other workforce development partners in California. CWA served as Project Lead for the WIB Learning Collaboratory (Corridor Project 3.14), with the support of the California Space Authority as a project partner.

As described by CWA, the Project 3.14 purpose was to establish a learning community (Collaboratory) among California WIBs, sharing and building upon the innovations developed by and among the partners of the California Innovation Corridor and from WIB best practices statewide. The Learning Collaboratory design is based on “learning community” and “communities of practice” research and practice, which have demonstrated in both the public a private sector that people in the workforce learn better and are more disposed to change when working collaboratively with their peers on issues of mutual interest. As Project Lead, CWA worked with project partner CSA, and CWA staff, consultants and local WIB leadership to design and implement the strategies used to promote and accelerate learning.

While it is the WIB learning that is most significant (see Pre, Mid-Project and Final WIB survey overviews below), numerous outputs of CWA contributed to the project’s success:

- Pre/Mid-Project and Final Surveys (self-assessment tools) of the WIBs to assess progress through the life of the project
- Monographs
  - Regional Workforce Strategies
  - Youth and STEM
  - WIB and Community College Collaboration
  - WIB Primer
  - WIBs and WIRED
- Social Network Survey
- Webinar about California’s role in the global economy
- 10 quarterly meetings with WIB directors, in which WIRED was an agenda item
- 8 regional meetings with One-Stop operators, WIB chairs and other workforce development professionals
- 7 conferences with keynotes and workshops on becoming a demand-driven system, innovation, economic development, collaboration, entrepreneurship and other principles of WIRED

CWA infused WIRED purposes and principles throughout the Association’s existing communications networks and policy development processes, including quarterly Board of Directors meetings, annual conferences (for Workforce Board members, workforce and economic development professionals, educators and
youth service practitioners), WIB Chair and one-stop community meetings, regional WIB meetings, internet communication and resource bases and newly developed monographs.

From revamping quarterly meeting agendas to include a “thought leader” challenging members to think differently to restructuring its conferences and workshops around WIRED principles, integration of economic and workforce development and opportunities for cooperative workforce and education planning to collaborating with CSA on an information exchange between company Human Resource departments and WIBs on workforce issues and operating principles, CWA embedded WIRED thinking into every fiber of its activity. This project fostered transformation, start to finish.

While the transformation support was primarily developed for WIBs, all WIB stakeholders benefited, as well. CWA carried the Corridor WIRED message in its work to educate policymakers about current workforce issues, its collaboration with sister workforce associations across the country, and with a broad base of other stakeholders invested in the success of the 21st Century workforce. Statewide stakeholders/associations/consortia with which CWA interface about the WIRED Initiative included:

- The California WIB (CWIB-State Workforce Board), ensuring that CWIB develops policies that support new WIB roles
- California State policymakers, explaining principles of WIRED and how the workforce system functions
- EDGE Campaign, working to include roles of WIB in collaborative projects
- Community College League, “sorting out” roles of colleges and WIBs for better collaboration

As the Corridor Collaboratory project progressed, the California Workforce Association was able to share the WIRED principles it was learning and passing on to its WIB stakeholders with other workforce and economic development partners around the country at national conferences and workshops, and through presentations to workforce stakeholders in other states.

Having the Collaboratory project as part of the Corridor Initiative ensured California WIBs a voice in the California WIRED effort. Its representation of WIB stakeholders and/or products and deliverables informed other key Corridor projects, such as The Innovation Driven Economic Development Model and the WIB Toolkit Racing for the Future. As a member of both the Corridor Initiative’s Leadership Team and the Corridor’s Project Leads Forum, as well as a participant in the Corridor Partner Meetings, CWA was able to share its Collaboratory findings across the Corridor WIRED partnership and hear other perspectives from potential collaborators and industry. By incorporating WIRED principles, projects, players and ideas into CWA’s conferences and meetings, transformation of the public workforce system became part of ‘business as usual’, rather than a perceived added burden or some new ‘flavor of the month’.”
While some WIBs have always worked with community partners, some have not, or have worked only with certain categories of potential community partners. One of the achievements of the WIB Learning Collaboratory was to increase WIB understanding that it is only through strong relationships of all organizations involved in workforce and economic development, education and industry that the challenges of meeting 21st Century demands can be met by the workforce stakeholders. As shown in Figure 26, every category of community partnering grew during the WIRED performance period and, while over 80% of WIBS were already working with economic development and community college partners, relationships in other partnership categories grew significantly, a promising sign for future systems alignment.

One illustration of the transformational aspect of the growth in WIB working relationships with other partners (including industry) was articulated in the statement of one WIB professional who said:

*In my professional life, I never really engaged with economic development professionals or the senior members of their boards. I wasn’t sure if WIBs should focus on economic development. This project opened my eyes to life outside of the WIA and how WIBs could become more demand-driven by really listening to the needs of business. The WIRED assignments allowed me to broaden my vision about how the workforce system and the economic development approaches could link together and support each other.*
One of the key efforts of Project 3.14 was to expand the thinking of WIB professionals and board members about their role in the workforce arena. Some in the workforce community, including CWA had launched efforts to foster the movement of WIBs to a demand-driven model involving community/industry/stakeholder outreach and collaboration. But as the original WIB benchmarking CWA survey showed, most Corridor WIBs at the start of WIRED were still focused on only the job seeker, not also on the job creators—the employers and industries. This was due in large part because of the need to meet Workforce Investment Act (WIA) performance metrics referred to as the “common measures”, which do not include supporting business or employer services or community collaboration around workforce issues.

In the survey questions to WIBs regarding assessment of their progress in moving to a demand-driven system, progress from the start of the performance period to the end were not impressive, but in fact decreased in several areas. Discussion of the responses, however, told the story of why. **Because the WIA measures focus only on job-seeker metrics, when funding gets tighter, as it did midway through the WIRED Initiative, WIBs reduce the emphasis on business services. They also expressed the belief that the Common Measures do not provide an incentive platform for WIBs to engage in business services when funding is not robust.** Performance on which WIB funding is based does not include a focus on business workforce needs. Nevertheless, this section of the survey showed that WIBs did claim that their overall services are demand-driven and that they are offering more customized training for employers (see Table below: “Progress…demand-driven approach”)

**Progress of your organization in shift to a demand-driven approach**

<table>
<thead>
<tr>
<th>NOTE: Benchmark responses on left - Final survey right</th>
<th>Just starting</th>
<th></th>
<th></th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>We have named employer as primary customer</td>
<td>5%/10%</td>
<td>10%/3%</td>
<td>26%/23%</td>
<td>26%/39%</td>
</tr>
<tr>
<td>We fund business services</td>
<td>10%/13%</td>
<td>10%/13%</td>
<td>10%/13%</td>
<td>18%/23%</td>
</tr>
<tr>
<td>All services are demand-driven</td>
<td>10%/6%</td>
<td>15%/13%</td>
<td>18%/16%</td>
<td>42%/45%</td>
</tr>
<tr>
<td>We provide guidance to the One-Stop to focus on employers</td>
<td>10%/10%</td>
<td>10%/10%</td>
<td>12%/23%</td>
<td>30%/39%</td>
</tr>
<tr>
<td>We fund customized training for Employers</td>
<td>26%/32%</td>
<td>15%/6%</td>
<td>15%/16%</td>
<td>21%/19%</td>
</tr>
<tr>
<td>We have a set of performance Measures for business services</td>
<td>42%/27%</td>
<td>8%/27%</td>
<td>18%/23%</td>
<td>15%/10%</td>
</tr>
</tbody>
</table>
WIB surveys allowed WIBs to self-assess against community leader criteria:

“Our WIB is in the following phase in regard to these activities”

<table>
<thead>
<tr>
<th>NOTE: Benchmark responses on left - Final survey right</th>
<th>Not on WIB Agenda</th>
<th>Haven’t done this</th>
<th>In planning Stages</th>
<th>Just starting</th>
<th>Do this regularly</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIB sponsored Employer events</td>
<td>2%/0%</td>
<td>12%/3%</td>
<td>8%/10%</td>
<td>28%/23%</td>
<td>50%/65%</td>
</tr>
<tr>
<td>Local workforce summits around particular issues</td>
<td>2%/6%</td>
<td>20%/13%</td>
<td>15%/19%</td>
<td>23%/32%</td>
<td>38%/29%</td>
</tr>
<tr>
<td>Creation of new community task forces to look at local workforce issues</td>
<td>13%/0%</td>
<td>18%/23%</td>
<td>15%/13%</td>
<td>23%/26%</td>
<td>31%/39%</td>
</tr>
<tr>
<td>Sponsorship-community focus groups</td>
<td>18%/7%</td>
<td>15%/31%</td>
<td>13%/3%</td>
<td>23%/28%</td>
<td>31%/31%</td>
</tr>
<tr>
<td>Release of labor market studies/other state of the workforce reports</td>
<td>3%/0%</td>
<td>15%/23%</td>
<td>18%/7%</td>
<td>10%/17%</td>
<td>54%/53%</td>
</tr>
<tr>
<td>Relevant media/mktg events highlighting workforce issues, activities,events</td>
<td>5%/0%</td>
<td>15%/19%</td>
<td>22%/23%</td>
<td>22%/32%</td>
<td>35%/26%</td>
</tr>
<tr>
<td>Building new community partnerships</td>
<td>0%/3%</td>
<td>2%/3%</td>
<td>15%/16%</td>
<td>28%/16%</td>
<td>55%/61%</td>
</tr>
<tr>
<td>New resource sharing</td>
<td>8%/0%</td>
<td>5%/10%</td>
<td>32%/27%</td>
<td>26%/23%</td>
<td>29%/40%</td>
</tr>
<tr>
<td>New policies adopted by outside orgs as result of WIB actions</td>
<td>10%/3%</td>
<td>40%/34%</td>
<td>25%/21%</td>
<td>15%/10%</td>
<td>10%/31%</td>
</tr>
<tr>
<td>Better alignment or mobilization of community resources</td>
<td>5%/0%</td>
<td>18%/13%</td>
<td>32%/35%</td>
<td>18%/19%</td>
<td>28%/32%</td>
</tr>
<tr>
<td>Joint planning and marketing</td>
<td>5%/3%</td>
<td>13%/16%</td>
<td>41%/32%</td>
<td>15%/16%</td>
<td>26%/32%</td>
</tr>
</tbody>
</table>
In the chart above, the first category “not on WIB agenda” shows that fewer WIBs are resisting demand-driven practices; conversely, the “do this regularly” column shows substantial increases. Dialogue with WIBs indicates that WIBs knew that community leadership and collaboration were needed, but cited CWA Board meetings and conferences as catalysts to provide influence and support of these activities as additional to WIA oversight.

*The principal take-away is that demand-driven WIB activities can be expected to fluctuate with funding unless policy changes create more flexible funding and performance measures around demand-driven activities.*

Survey asked about the *“main barriers” to achieving a demand-driven vision*. Responses included:

- Changes in performance measures, changes in community colleges to do more open entry open exit
- Marketing of the workforce system so the community knows who we are/what we do. Our county has abandoned economic development due to the (incorrect) belief that ED must be “land intensive” and land is not available, that we must remain a low-paying tourist town
- Reduce the duplication of eligibility paperwork and reporting between TAA and WIA. Continuity or bridges for confidentiality rules of sharing information, alignment of community college governance structure to allow for “demand-driven” training, not the 18 months to a year of an approved curricula that gets paid for on the credit side of CC’s and not a fee-for-services
- Ability to forge more adaptive and flexible alliances with public adult education systems
- We need to reduce the administrative requirements of the program (monitoring, EEO, and updates of plan “busywork”)
- Bringing EDOs closer to the vision, education as a partner is working well, but defining the roles of each party, better alignment with Governor’s 15% funds around industry cluster work throughout the state as a model
- An ROI for incumbent worker training that is accepted by private business. This model would account for paid time for training while employed, the savings due to increased retention, savings in recruiting costs, etc.
- Different from above, an ROI model for customized training delivered to laid-off workers that is accepted by private business. This is an attempt to create a tool which could be used to approach employers and demonstrate that it is financially in their best interests to fund all or a portion of customized training to meet some of their hiring needs
- A better conversation between the educational community and the employer community
- Changes in law to allow flexible, responsive activities across systems. Changes in law to release programs from the shackles of oversight, releasing human resources to get creative rather than mired in the minutia of outdated bureaucracy
- Political will; access to businesses, particularly small businesses; collaboration and alignment with community colleges and training programs; better recognition by region that WIB is the go-to agency on workforce development; regional vision for business development, talent development and community improvement
- EDD to be flexible and local-control supportive, in reality…DW additional assistance, for instance, is a cumbersome, time-consuming process that does not allow us to respond quickly to industry needs
- To provide more business services, we would need training for our staff
- Weight of County/health and human service environment, which is a very risk/leadership adverse culture
- Legislation and policy changes in the applicable organizations including education. More involvement of economic development agencies with education and workforce systems, strong leadership in these systems
- These types of initiatives require complete cooperation/coordination with all levels of the education system. Education already has their own priorities established based on improvement on standardized tests. It is difficult to get them to divert their focus to workforce–related initiatives that are also important
- Organizations and programs that provide assistance to area residents are struggling to survive the continued reductions in funding
- Besides money, we could use better industry contacts to get additional involvement of employers in workforce issues and needs
- Having the time and staff to organize around this issue
- As in the above response, it is about the task of effectively serving the large numbers now coming in the door. Job creation and pathways are critical. There are not enough of the jobs (especially in this service area) as defined in the vision at this point.
- Need more employers to recognize looming workforce crisis and need for them to actively get involved in solutions. Initiatives are embraced by but a few of the early-converts, but it takes an extraordinary amount of effort/time to bring on board the majority of the affected employers. An overall consciousness-raising (i.e. informational campaign) needs to be undertaken with this country’s employers. This would help facilitate the local work then undertaken by the WIBs.

WIB surveyees were also queried about “what they need to help contribute to this vision”. Answers included:

- More flexible funding; State policies to support this work not poverty programs
- Planning grant to facilitate a broader community understanding of workforce
- Other than more money and State leadership to align system partners…the most flexibility to meet the needs of our local economy
- Resources; State-level policy changes; new measurements for success; more flexibility
- Funding
- More funding around planning and development of staff training, continued strong support from DOL in WIRED type initiatives, industry cluster work
- More resources and options to train incumbent adult workers in a place, timing and manner that is tailored to working adults rather than youth
- More flexibility in the educational systems to adjust to new demands
- Mondy
- Stronger partnerships with education and training providers to align vision; stronger understanding of the needs of business in the region in terms of talent development; greater ability to align the actions of training and education with the needs of business; broader collaboration with local government, economic development, education and business toward this goal
- We do not have the funding to focus on anything but the client
- Place WIBs, via statute, into economic development environment. Get them out of welfare departments. At national level, get Labor and Commerce more closely aligned
- Technical assistance and best practices on how others are doing this
- New workforce legislation that supports the vision
- We are in the planning stages on 3 initiatives and will be looking for funding to help us implement
- Less regulation from the DOL and the State EDD! The regulations attending Core funds and any State grant proposal are far too burdensome. We spend all of our time responding to frivolous rules and inquiries, rather than using our time to get something important accomplished
- Sharing of best practices and successful system models
- Funding to help support initiatives that address current and future employer and regional workforce needs
- We need funds to do this as our regular formula funds are tied up
- The current economic climate is uneasy about how best to react to global market change and it is very difficult in an area of extreme unemployment how to be responsive to all, however, it is our duty to use the “systems” to better serve our community
- A better local economy and resources to promote the concept
- More dedicated resources for collaboration-building (with resulting ability to handle more sector-focused initiatives) Can only handle two now – would like to expand to several more

Additional WIB survey inputs under “anything else helpful for us to know”: 
We would welcome ideas and brainstorming about how we could develop policy and strategies for moving workers out of dying industries before they die. For example, what would it take to build new skills for thousands of automotive workers, while they are still working, so that they more easily transition to new employment before being laid off and while they have the support of wages and being employed? This could be a cornerstone of a workforce system that is truly responsive to global changes.

- The WIBs can be leaders in this effort, but it can’t happen without Education as a full cooperating partner
- We don’t hear much from the State about this, so we are not sure where we fit in
- FLEXIBLE SYSTEMS!!
- Need to keep our eyes on the long-term picture, and not let the current economic upheaval either a) diminish attention on employer as customer and/or b) lull the “system” to think that, in an “employers market” the looming workforce skills shortage is no more

Two final points emerging from the survey interesting to the WIRED work:

- Of WIB benchmark surveyees early in the WIRED effort, 45% did not know what STEM (science, technology, engineering and math) was, although, once it was explained, many were addressing it; in the final survey only 6% still did not know the term but 64% responded that, yes, they were addressing STEM, as opposed to only 26% in the original survey
- Technical worker training actually went down (from 77% to 70%) for WIBs from the benchmarking survey to the final survey, due, it was explained, to decreases in overall training because of budget cuts

Learning Collaboratory Monographs

As mentioned above, some of the key deliverables of the WIB Learning Collaboratory project were the monographs it produced. Not only were these monographs used in the project’s embedded WIB training in normal CWA activities, but they also provided content resources for the WIB Toolkit described later in this section. A brief overview of each monograph is provided below, but the rich content of each white paper can only be seen by visiting the links provided.

Regional Strategies in Workforce Development
http://www.innovatecalifornia.net/WIREDdeliverables/MonoGraph1-Regional%20Strategies%20in%20Workforce%20Development.pdf
Written in 2007, the *Regional Strategies in Workforce Development* monograph first emphasizes that "today’s workforce problems and solutions transcend geopolitical boundaries and even labor market areas" and that "regional initiatives seek solutions by dramatically improving the collaboration among workforce, economic development and education". Industry, or the employer community, of course, would be a valuable workforce collaborator, as well. The report reminds us that there is "no single definition of a region", but rather that a "region is defined by the nature of the workforce problem and the resources essential for effective response", with any particular WIB or other organization involved perhaps in many regional initiatives, each across different boundaries. A common feature of regional efforts, according to the monograph, is their intent to achieve or advance more sustainable and competitive communities.

The monograph states that there are both “pros” and “cons” of regional strategy, with the "pros" being consistency with a demand or sector-driven approach, access to more partners and resources and, if focused on a workforce challenge, there is likely to be a more "coherent" response. The “cons” center primarily around the complexities of coordination among multiple fund sources, changing regional dynamics and the long lead time needed to develop regional collaborations.

Four models of regional strategy are then presented in the monograph, each described, with examples of WIB utilization of the model provided and a resource listing featured at the end of the report.

- **Organize around sectors**
  
  “collaboratives made up of employers within an industry sector partner with a broad range of economic development, workforce development and education organizations to address the talent needs of the industry”. The regional configuration adapt to the geography of that industry.
  
  - WIBs in Silicon Valley, East (San Francisco) Bay and San Diego collaborate on a sector strategy around biotech (with the same WIBs working with different WIB partners on other sector initiatives, e.g. health care or manufacturing)
  - Michigan has introduced the Michigan Regional Skills Alliances (MiRSAs), locally managed partnerships formed to address strategic workforce issues affecting groups of firms in the same industry in a certain region
  - Washington State has funded 40 industry skill panels of public/private partnerships of business, labor and education
  - Pennsylvania has introduced Industry Partnerships as a means to “help connect and meet the needs both of workers and businesses”
Bay Area of California, using a model adapted from the City of Boston, is partnering with the State of California to create a health care and life sciences initiative called the Bay Area Workforce Funding Collaborative.

The monograph cites two analyses on industry sector strategies:
- National Network of Sector Partners
- Aspen Institute’s Workforce Strategies Initiative

**Organize around issues**

Issue-oriented regional strategies focus on things like educational reform or housing or transportation that are cross-jurisdictional in terms of the organizations likely to be stakeholders. Partnerships can be informal or often more formalized, such as those of “Councils of Governments, Metropolitan Planning Authorities and Organizations, Joint Power Authorities” and others. By their very nature, these initiatives are more place-based, according to the monograph. New and evolving regional initiatives based on issues include:
- the “green” or “sustainable economy” issue, which, like labor and environmental issues, enable coalitions across regions
- the “innovation” issue as central to regional economic competitiveness

Various alliances, legislative initiatives and reports are cited in regard to the two issue-oriented regional strategy examples shown above.

**Organize around Data, Customers and Markets**

In this approach, according to the white paper, asset mapping and “building the brand” of a geographic region are important. Stating that certain WIBs have built a significant expertise around this approach, the report cites the San Diego Workforce Partnership and the Orange County Workforce Board, as well as the Humboldt County Workforce Board. Other data and customer-driven initiatives mentioned include:
- Joint Venture Silicon Valley
- Valley Vision
- Great Valley Center
- San Joaquin Valley Partnership

A frequent characteristic of these data-driven initiatives is that the data-gathering precedes “developing and organizing more issue or sector specific campaigns. The process of defining regional issues, gathering and interpreting the data, contributes to the identity of a
region and helps identify, and quantify, regional strengths and weaknesses.

- **Reorganize or Change Structures**

In this regional strategy model, change or reorganization of an existing structure is characteristic. This is possibly the most difficult model because of the fact that geo-political boundaries are mandated, making implementation of a structure initiative advocated by regional partners very challenging.

In California, according to the monograph, WIB administration is often housed in a local agency such as economic development or welfare. Examples of this model:

  - Stanislaus County WIB/Economic Development Corporation merged into a single administrative entity
  - State of Indiana, which initiated a statewide structural change to WIB administration
  - California – consolidation of Workforce Areas through the California Performance Review Commission

State-driven change structure models are most effective, says the report, when the goal of the restructuring is to better align with the state’s definition of regional economic priorities. Consolidation for streamlining or leveraging of resources across jurisdictional boundaries is likely to be counterproductive, according to the monograph, because provincial perspectives may present an obstacle to using local resources in achieve regional objectives. This is especially true in California, where economic development is largely funded by local entities like cities and counties where revenues are generally driven by sales tax, thus pitting local communities against each other, undermining regional strategies.

Lessons learned in regard to regional strategy include:

  - Regional strategy must be **Mission-driven**
  - Regional strategies involve **Long lead time, patience**
  - Regional strategy requires **Dedicated staff and volunteers**
  - Regional strategy benefits from **Partnership incentives, shared benefit, defined and rewarding partner roles**
  - Regional strategy can only succeed with **Good information, consistent information**
Youth and STEM ("Y Math + Science")
http://www.innovatecalifornia.net/WIREDdeliverables/Youth%20Monograph%20Final.pdf

This 15-page CWA monograph outlines for WIBs the growing importance of science, technology, engineering and math (STEM) as a keystone to 21st Century workforce success. It emphasizes the new focus educators are taking towards STEM and suggests that increasing the STEM talent pool is important for relevant workforce development. The monograph, however, is focused on answering the question of how to entice young people who may have dropped out or are at risk of dropping out, to study STEM subjects that “they may not be interested in or prepared for”. Meant to help youth organizers as a tool to inspire consideration of STEM careers, it uses profiles of actual STEM workers or college students, interviewed in a format that reveals the person’s nature, STEM inspiration, goals, job or discipline, next steps and free-time pursuits. A sampling:

- Milan Arellano, from a tiny rural agricultural community, who is working on his B.S. in Engineering with a Math minor at Cal Poly San Luis Obispo, now looking for an internship in industrial engineering
- Greg Sims, 48, who is an Associate in Manufacturing Cell Culture Operations at Amgen, Inc., a retrainee after a job-related injury. His advice to high schoolers: “you only have the first 18 years of life to prepare you for the remaining 60 years and you only get one shot; find your passion and figure out a way to make a career out of it!” Greg also has founded a nonprofit to operate a safe haven for Bay Area youth to socialize and work toward their goals
- Therisa Truong is a 26-year old scientist with a degree in Human Development from University of California, Davis. At graduation, she enrolled in a Biotechnology Program funded through a local WIB. Therisa extracts RNA from blood samples and checks the quality and quantity of RNA in blood, getting paid “for doing experiments that I enjoy doing!”

WIB and Community College Collaboration ("Workforce Investment Board and Community College Collaboration, Building a Competitive Workforce Advantage")
http://www.innovatecalifornia.net/WIREDdeliverables/WIBs%20and%20Community%20College%20Collaboration.pdf

As a means of better aligning for the benefit of workers and employers the two systems of workforce development and education, the California Workforce Association initiated a relationship with the California Community College. This relationship was inspired by a Government Accountability Office (GAO) report about the collaboration across the country between community colleges and WIBs. Using a CWA-developed framework describing the seven characteristics
of a competitive workforce advantage, a framework designed through the input of hundreds of workforce, education and economic development professionals, CWA developed this monograph as a tool for WIB members and staff to see how better to collaborate with community colleges.

The monograph first discusses “The California Landscape”, sharing that California Community College system serves more than 2.5 million students and represents the largest system of higher education in the world. California also has 49 Workforce Investment Boards focused on finding workforce solutions. Historically, according to the monograph, these two systems have mixed success in working together, driven apart, as they were, by changes in federal law stemming from the Workforce Investment Act, which so strengthened the reporting rules for the Eligible Training Provider List (ETPL) that it was made almost impossible for community colleges to comply. The lengthy process entailed in developing community college curriculum also inhibits potential for collaboration between the two systems. Despite these obstacles, it is noted that there has been considerable progress in California in the two systems working together and the monograph provides an overview of that progress – in both the statewide policy and local practice arenas. Examples:

- Several collaborative initiatives between the California WIB and the Chancellor’s Office of the California Community College, e.g. Career Advancement Academies
- California’s WIRED grant, administered by the California Space Authority, which encourages and expects WIB/community college cooperation
- Colleges and WIBs have joined together to work on the EDGE campaign, with the Community College League representing community college districts, and the CWA, representing WIBs, are both founding members of the EDGE campaign working for a new statewide workforce development framework

Using the seven-point competitiveness framework, CWA discusses how each can feature WIB and community college collaboration:

- **Forward Thinking Community Leaders**
  Engage community policymakers and use data to help support strategic objectives
- **Business Investment in Human Capital**
  Convene employers to share skill needs, connect them to public training resources, broke cooperative efforts toward more relevant community college curriculum or training to better meet employer needs
- **Strong and Diverse Economy**
  Leverage WIB and community college research for economic development initiatives
- **Integrated Infrastructure**
Through work on community infrastructure initiatives, whether they be transportation or child care, find ways for WIBs and community colleges to work together toward mutually important goals

- **Effective, Articulated Education System**
  Share opportunities through the WIB youth outreach and community college high school outreach to educate young people and educators about workforce and higher education opportunities

- **Clearly Defined and Accessible Career Pathways**
  Occupational pathways designed by WIBs and/or community colleges offer opportunities for joint or collaboratively-designed apprenticeship programs and other means of guiding young people in understanding career pathway opportunities

- **Ready, Willing and Able Workforce**
  Work together using the skills assessment, training experience of both WIBs and community colleges to better equip workers for the 21st Century

The monograph ends with success stories about WIB/community college collaboration:

- **Sector-Based Successes**
  - Verdugo WIB, LA County/three community colleges and four regional hospitals – Training program to address nursing shortage
  - Imperial County WIB/Imperial Valley College – LVN training
  - Tulare County WIB/Porterville College/College of the Sequoias – RN “Bridge” program to facilitate transition from LVN to RN
  - Alameda County and San Mateo County WIBs/Ohlone Community College/Skyline College – program to place 193 dislocated workers as manufacturing technicians into biotech firms
  - San Bernardino County WIB/San Bernardino Valley College/Chaffey Community College/SB Manufacturer’s Council – customized training to upgrade incumbent worker skills, entry-level electrical skills training supporting promotion in Electrical and Mechanical advanced occupations

- **Systems Integration**
  - Tulare County and Kern/Inyo/Mono County WIBs with Porterville and College of the Sequoias developed a 20/20 program whereby employees receive 40 hour week salary, but work 20 hours, attend community college 20 hours
  - Alameda County Career Pathway Pilot Project for high-risk and foster care youth, a collaboration with Ohlone, Peralta and Chabot community colleges
  - San Benito WIB/Gavilan College partnered to allow use of community college computer lab and classrooms for WIB Educational Component training
o Sonoma County WIB/Community College Foundation – foster care youth initiative supporting training on “independent living skills”
o Oxnard College/County of Ventura’s Job and Career Center – Center located at Oxnard College, with services fully integrated
o San Diego and Imperial Counties Community College Association/San Diego Workforce Partnership – Workforce Alliance Project fosters stronger dialogue between industry and education regarding the high-demand, high-wage occupations of San Diego
o Santa Cruz County WIB/Cabrillo Community College – long range strategic planning for regional economic development

**WIB Primer: Workforce and Economic Development**
http://www.innovatecalifornia.net/WIREDdeliverables/Primer%20for%20WIBS-Monograph%203.pdf

The WIB Primer, according to its introduction, is designed to “aid local Workforce Investment Board (WIB) members to provide community leadership around workforce development issues.”

It outlines the broad policy role that the Workforce Investment Act (WIA) affords WIBs in addition to WIA program oversight management of the WIA funding stream. To effectively pursue key community roles, WIBs need an understanding of the various federal and state funding streams and their impact on local WIBs. To serve as a community convener or broker, WIBs need an understanding of “all the right people and agencies” to bring to the table, in order to leverage community assets. Therefore, the Primer provides an overview of California’s education, workforce and economic development systems and provides examples of collaboration among these systems. It includes lessons learned, as well.

**WIBs and WIRED (“How Workforce Investment Board Connect to WIRED Projects”)**
http://www.innovatecalifornia.net/WIREDdeliverables/How%20WIBS%20connect%20to%20Wired%20Projects.pdf

The monograph focuses on five strategies which leverage the Corridor WIRED effort to move towards a talent development system as opposed to just a WIA oversight system.

- Develop Strategy Using the 5 Roles of the WIB
- Collaborate with Economic Development
- Collaborate with Education
- Know Everything about Your Labor Market Supply and Demand
- Cultivate Networks
The monograph cites specific WIRED projects that informed or transformed the work of the WIBs and concludes by stating that the WIRED initiative gave the California workforce system many gifts, with nearly every project changing in some way the thinking of the WIBs about their roles, opportunities and responsibilities in the new economy.

**WIBs and Social Networks**

The California Workforce Association under Project 3.14 also undertook a study to document and evaluate the network created by the Corridor WIRED work. As stated in the introduction to the “Networks in Workforce Development, Relationships Among WIBs, Local Partners, State Agencies, and the Role of the WIRED Grant” by Deone Zell and Richard W. More of the College of Business and Economics, California State University, Northridge (CSUN) for CWA: [http://www.innovatecalifornia.net/WIREDdeliverables/Networks%20in%20Workforce%20Development%20-%20Final.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/Networks%20in%20Workforce%20Development%20-%20Final.pdf)

This report represents an effort to describe the growing network of Local Workforce Investment Boards (WIBs), their local partners and state partners, strengthened, in part, through the California Space Authority’s (CSA) Workforce Innovation in Regional Economic Development (WIRED) project.

Using the latest in social network analysis methods, CSUN was asked to show:

- How local WIBs network with each other
- How local WIBs network with local partners
- How local WIBs network with state agencies
- How local WIBs who were WIRED partners (funded and unfunded) are embedded in the networks described
- How local WIBs network with the WIRED project

CSUN began with describing social network analysis, which, in organizational studies, is the mapping and measuring of relationships between people. As the value of the relationships between people (rather than the people themselves) have been perceived as increasingly important, social network analysis is being used in human resources, leadership development, organizational structure and design, mergers and acquisitions, knowledge management and the diffusion of innovations. In addition to the mapping of relationships between individuals, mapping of organizational networking is taking place, due to the fact that so many social problems are complex, requiring cooperation of numerous service providers.

CWA remarkably engaged every single one of the state’s 49 WIB in the online questionnaire, promising anonymity and sharing of results, for an astounding 100% response to the CSUN survey!
In the “relationships with WIBs” portion of the study, the question was “Who have you worked with on regional issues, programs or projects in the last year?” Reciprocal ties, which represent the actual exchange between two organizations were indicated as “very strong and powerful”, according to the report. Certain WIBs even function as regional “backbones”, fostering the partnering among regional WIBs.

In the “relationships with local partners” segment of the study, the following graphic (Figure 27) shows relationships between WIBs and local partners.

![Figure 27 WIB Relationships with Local Partners](image)

Note: Ties are one-way, from WIBs to local partners

In the following table, WIB working relationships with State agencies are explored, with, predictably, relationships with CWA, the State Employment Development Department and the State WIB as being the greatest, as there is mandated or vested interest incentive for those relationships.
Working Relationships, Tie Strength, Trust and Accessibility Measures Between WIBs and State Agencies

<table>
<thead>
<tr>
<th>State Agencies</th>
<th>Percentage of WIBSs who say they work with each organization</th>
<th>Average tie strength that WIBs extend to each organization</th>
<th>Average amount of trust extended from WIBs to each organization</th>
<th>Percentage of WIBs who believe each organization is accessible</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Workforce Association</td>
<td>96%</td>
<td>82%</td>
<td>89%</td>
<td>94%</td>
</tr>
<tr>
<td>EDD’s Workforce Investment Division</td>
<td>89%</td>
<td>45%</td>
<td>58%</td>
<td>60%</td>
</tr>
<tr>
<td>California Workforce Investment Board</td>
<td>83%</td>
<td>40%</td>
<td>65%</td>
<td>62%</td>
</tr>
<tr>
<td>Employment Training Panel</td>
<td>60%</td>
<td>15%</td>
<td>40%</td>
<td>47%</td>
</tr>
<tr>
<td>Chancellor’s Office of the California Community Colleges</td>
<td>28%</td>
<td>8%</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td>California Department of Social Services</td>
<td>21%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>California Department of Education</td>
<td>15%</td>
<td>4%</td>
<td>7%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Figure 28 WIB and State Agencies

Finally, the graphic to follow indicates that both the funded and unfunded WIBs, are working with local partners to a greater degree than are non-WIRED WIBs.

Working Relationships Between WIBs, Local Partners and State Agencies

Figure 29 Working Relationships: WIBs, Local Partners, State
The conclusions of the *Networks* study included the following eight insights:

- Strong informal collaborative regional networks of WIBs have developed within California’s WIA system
- Some WIBs play a valuable “boundary spanning” role connecting regional networks
- WIBs have developed strong local networks with partner agencies, but ties vary substantially by WIB and by local partner
- Collaborative relationships between WIBs and local partners have increased dramatically over the last three years
- Ties to state agencies vary substantially in an expected pattern
- WIRED partners are embedded in the targeted regional networks
- WIRED partners (both funded and un-funded) appear to work more actively with state agencies and local partners
- More research is needed

According to the report, CWA believes that this study is the first statewide analysis of local WIBs’ networks. The “more research is needed” conclusion is based on the fact that the study engendered more questions around how and why the networks formed, how effective they are, who provides leadership and why do some WIBs remain outside the regional networks. For the full report, visit the link shown above.

**WIB Learning Collaboratory Phase II**

CWA and its Phase II Learning Collaboratory partner, the California Space Authority (CSA), took full advantage of the WIB surveys, monographs, WIB-focused projects or project elements listed below, as well as industry presentations and supplier survey findings to launch a pilot orientation between industry and California WIBs, providing WIB orientations to industry Human Resource (HR) professionals, and industry HR presentations to WIBs.

The purpose of this project, according to the CWA final Phase II report, was to “enhance orientation of Workforce Investment Boards to Corporate Human Resources hiring, workforce development considerations, constraints, and increase orientation of employers to WIB job placement, dislocated worker and talent development resources through facilitation of a shared strategy.”

The value of the cross-orientation opportunity for WIBs and employers was to recognize each other’s needs, processes, and resources. The project “fosters better understanding by targeted industry HR professionals of WIBs as workforce resources, better understanding by target WIBs of industry workforce issues and priorities – all in support of greater worker opportunity and success.”

Key deliverables of the project were a “WIB 101” toolkit and a WIB 101 orientation for HR professionals (CWA); the development and delivery of a
Strategic HR orientation to WIBs, as well as integration of both toolkits and the HR/WIB communities, outreach to the WIB and industry HR professional community and interface with other WIRED projects as appropriate (CSA).

In describing the key accomplishments of this project and their importance to the Corridor, the State and/or the nation, CWA and CSA stated:

One of the fundamental motivators behind the Phase II Task 3.14 was for the Learning Collaboratory to create a strategic partnership between WIBs and HR. Through the two presentations and CWA’s participation in the Professionals in Industry Human Resources Association (PIHRA), this has truly been accomplished. WIBs and HR are now informed about how they can align resources on a wide range of business services to assist job seekers and employers alike.

Part of the WIB Learning Collaboratory work was to develop a set of policy recommendations for advancing WIRED and California Innovation Corridor projects. But since the recommendations apply beyond the WIRED initiative, to the 21st Century WIB environment in general, we will cover those recommendations in the section of this report entitled Key Findings in Innovation Support, Supplier Competitiveness and Talent Development, page 270.

The projects below helped inform the work of the Collaboratory and the work of the Collaboratory informed the activity of these projects.

The WIB Toolkit
http://www.wibtoolkit.net/

The “splash” page of the online “Workforce Investment Board Toolkit” states that WIBs “offer some of the best opportunities for supporting California’s high-tech workforce needs at the local level throughout the state”. But because every region is different, and WIB can vary “in form and function” in different regions, it has historically been difficult for WIBs to retain the “big picture” perspective, keep up with economic trends and explore new approaches, especially when funding is tight.

Declaring that “focus and information are key”, the Racing for the Future WIB Toolkit, a cooperative project of the California Council on Science and Technology (CCST), the California Space Education and Workforce Institute (CSEWI) and the California Workforce Association (CWA), was designed to help WIBs “understand their environment and adapt to it”. While WIBs have different charters, organization and regional priorities, they share a “set of central functions”. The Toolkit was designed to “build upon and support those functions”. An “online sourcebook”, the WIB Toolkit contains over 150 pages of material, and includes 11 original downloadable support documents, with links to dozens more
that are potentially useful to WIBs. WIB Toolkit content is sorted into five cross-linked sections:

- **Background** – What’s changing in California and how it affects workforce development
  - Innovation and California
  - Workforce Trends
  - The Impact of Global Production
  - Defining 21st Century Skills
  - Digital Age Literacy
  - Staying Competitive – The Bottom Line

- **Five Core WIB Roles**
  - Convener
  - Workforce Analyst
  - Broker
  - Community Voice
  - Capacity Builder

- **Industry Profiles** – Overviews of key high-tech industries in California
  - Nanotechnology
  - Advanced Manufacturing
  - Biotechnology
  - Intelligent Transportation

- **Case Studies** – Six programs making a difference

- **Resources** – Useful publications and links

Many WIBs, according to the CWA, have begun using the Toolkit “as a way to think about their work and to help in strategic planning and in educating new WIB members in orientation”. The CWA has used the Toolkit in California to train new WIB members, train WIB Directors and in strategic planning. Outside of California, the CWA has used the Toolkit to train other systems about workforce development and the roles of the WIBs.

*WIBs and the Supply Chain (“Supply Chain Transformation, The Role of Workforce Investment Boards”)*
http://www.innovatecalifornia.net/WIREDdeliverables/SupplyChainTransformation%20-%20Role%20of%20Workforce%20Investment%20Boards+Appendix.pdf

The NOVA WIB was invited to participate in the “smart supplier” initiative (Project 2.2) by the California Space Authority because of its ongoing relationship with its region’s high-tech manufacturing sector and its 20 years of experience in labor market research studies. The Smart Supplier Initiative was to identify common learning outcomes required of today’s “smart suppliers”, but the project actually went further than that, designing a four-module Supply Chain Management course and several half or one-day courses meeting specific supplier training needs. NOVA’s role was to learn about the challenges and opportunities occurring with the supplier transformation and to share that information with the
California workforce investment community. The result is the *Supply Chain Transformation* white paper.

NOVA's experience in developing a “true understanding of an industry, its culture and language, threats and opportunities, requirements for operations, inefficiencies, and what creates a competitive advantage” was the perfect foundation for its exploration of supply chain transformation and its impact on workers and the public workforce system.

NOVA pointed out that much of the advice to suppliers about the global transformation were also appropriate for anyone “doing business” in the 21st Century environment, including WIBs:

- Accept the reality of a global marketplace and understand cultural differences
- Understand the need for speed (time is money)
- Meet the transformation incrementally
- Your middle name must begin with “e-“ (go paperless)
- Embrace 6 Sigma and Lean (“Lean” your processes to stay on par with current business practices)
- “If it ain’t broke, break it!” (Anticipate 21st Century needs and adapt)

The paper begins by explaining what a supply chain is (“sequence of steps, often in different firms and/or locations, needed to produce a final good from primary factors, starting with processing of raw materials, continuing with production of perhaps a series of intermediate inputs, and ending with final assembly and distribution”) and what supply chain management is (“integrates supply and demand management within and across companies”). It states that the three primary elements of any supply chain are suppliers, producers and customers.

Its introductory section covers:
- Globalization
- Supply Chain Integration (evolution of the chain into a network of suppliers)
- Why Supply Chain Transformation is Important to Understand (3.5 million manufacturing jobs lost in the U.S. over past decade and a half, so need to increase global competitiveness of U.S. suppliers is significant)

The paper then describes the key findings of the Supply Chain Transformation Survey conducted by Project 2.2 partners, with two data points of special interest to WIBs: shortage of skilled production workers, scientists and engineers is seen in small, medium and large companies, with shortage of skilled production workers being most critical to small companies. The paper also cites the survey findings as revealing that a “highly trained workforce” is second only to “lowering production costs” as one of top three success factors for suppliers.
Training priorities and delivery of training, as analyzed from the survey, were discussed, with “Workforce Practices” also being a section of the paper, describing how companies plan for workforce development and attraction. Key finding was that, while most large companies have a process in place, forty percent of small companies have no plans in place, suggesting a potential need for Human Capital Development training for small companies.

Several areas are recommended as potential arenas for WIB involvement:
- Recruiting the Aerospace Workforce
- Assisting in the Development of Training Programs
- Serving as a Connector (intermediary between employers, educators, labor, economic development, etc.)
- Best Practices from Other Regions

In conclusion, NOVA wrote:

_Workforce investment boards can contribute to supplier success by assisting with workforce recruitment, providing links to training resources, and by utilizing their many partnerships to make connections between industry, economic development, education and job seekers. WIBs can enhance their contributions to the economic success of their communities by developing an understanding of the requirements and challenges of the driving industries in their regions._

_WIBs and Innovation (Innovating Workforce Development by Supporting Business Innovation: Case Studies from California)_
_http://www.innovatecalifornia.net/WIREDdeliverables/WIB%20Tool%20Piece-Final.pdf_

The San Diego Workforce Partnership (SDWP) was a partner in Project 1.4 in support of entrepreneur training. As part of that effort, it was determined that it would be valuable to enlist SDWP’s expertise as a WIB in developing a paper that would outline various ways that WIBs could support innovation through workforce development.

After reviewing the “Flat World” environment of the 21st Century, SDWP provided an overview of the “case studies” it would present to show the breadth and diversity of WIB work being done in support of innovation-oriented businesses and hopefully inspire other regions to take up the cause.

- **Life Sciences Summer Institute** – A San Diego County partnership between the San Diego Workforce Partnership (San Diego WIB) and BIOCOM, the region’s life sciences industry association
• **Solar Industry Training Program** – A Silicon Valley partnership of the NOVA WIB, the emerging solar industry consortium (SolarTech) and three community college districts

• **Small Business Entrepreneurship Support** – A North Central California WITED initiative of the Northern Rural Training and Employment Consortium and the North central Counties Collaborative (two WIBs), in partnership with the region’s small business development centers and regional economic development organizations

• **Transit Training Partnership Program** – A Sacramento County partnership among the Sacramento Employment and Training Agency (SETA), the Sacramento County Office of Education, American River College, Holt, Inc. (a large local employer), and the California Labor Federation, designed to train mechanics to work with green technologies on biofuel diesel engines

• **Nanotechnology Partnership Program** – Co-location and mutual support between the Silicon Valley Workforce Investment Network (Work2Future) and the International Association of Nanotechnology

A historical note was included, mentioning that “WIBs were designed to provide job training opportunities to the most disadvantaged people in particular communities. The move toward economic development is very recent, and possibly at odds with the core mission of many WIBs who see their primary role as supporting low-wage or dislocated workers and disadvantaged youth. The stories presented here were selected precisely because they represent a departure from the bread-and-butter activities of WIBs, and demonstrate what might be the next stage of workforce development”.

Full case studies can be accessed by visiting the link under the title of the white paper listed above.

**WIB Transformation: Sustainability**

The transformational value of the projects or project elements described above cannot be underestimated. What has happened through these efforts is the “institutionalization” of an understanding of the new global workforce environment, of key competitiveness factors involving workforce and of new opportunities for U.S. workers. The work of these efforts will live on for many years to come, in strategic planning for individual WIBs and WIB collaborations with other systems, across California as these principles are embedded beyond the Corridor, and across the nation, as the efforts of the WIB and other partners mentioned above acquaint other U.S. colleagues of their findings and initiatives.
Key Findings in Innovation Support, Supplier Competitiveness and Talent Development

In establishing the California Innovation Corridor (CIC or Corridor), the funded partners and supporting organizations involved pledged to “Optimize the Corridor for innovation and 21st Century workforce competitiveness”. This was an overarching “intention” meant to drive the transformational goals of three unique, but intertwined pathways, that of Innovation Support, of Industrial Rejuvenation/Supplier Transformation and that of Talent Development. Because the WIRED Corridor grant was part of a U.S. Department of Labor initiative, it was understood that the U.S. worker was the ultimate “client” of the Corridor effort. However, it was also recognized that only by understanding and creating a regional infrastructure around Innovation Support, Supplier Competitiveness and Talent Development - one attuned to the 21st Century global competitive environment in which business now operates - could the workforce be supported and the U.S. worker thrive.

The insights shared below lay the foundation for that infrastructure to be developed, with the key enablers of innovation, including model practices, to follow in the next section of “Conclusions”.

Understanding Innovation and Its Economic and Worker Benefits

The foundation of the WIRED Initiative (both nationally and in the Corridor) rested on the following belief:

“Innovation will be the single most important factor in determining America’s success through the 21st Century.”

---Council on Competitiveness, “Innovate America”, 2005

The importance of technology and innovation to the U.S. cannot be overestimated. It has been reported (2004, National Science Foundation) that “Scientific innovation has produced roughly half of all U.S. economic growth in the last 50 years.”

Still, in several projects, partners felt the need to validate and enhance the articulation of that concept. As pointed out on page nine in the Innovation Driven Economic Development Model (Model) produced by Collaborative Economics for the Bay Area Economic Institute/Bay Area Science and Innovation Consortium (http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Driven%20Economic%20Development.pdf), in the section entitled “Without An Innovative Economy, Other Community Outcomes Are Difficult to Achieve”:

An innovative economy is at the core of regional vitality and quality of life. Without an innovative economy, any gains in social inclusion, livable community, and collaborative governance are short-lived. An innovative
economy is the engine that produces economic opportunity and community revenues that make possible career mobility, investment in educational systems, development of community infrastructure and amenities, investments in environmental preservation, and other critical assets for regional vitality and quality of life.

Further validation of the value of innovation was realized in comparing small business innovation and technology company/job impact to retail/service company/job impact.

According to the Obama Administration, approximately 70% of U.S. jobs are attributable to small business. State resources show that 95% of California firms qualify as small business based on the Small Business Administration’s definition (less than 500 employees). Hence, small business is important to the U.S. and California economies.

Yet the most relevant part of the story for those wishing to create and/or retain the greatest number of jobs is that all small businesses are NOT equal in terms of job generation or economic impact. Few in California question the value of the tourism industry and the positive job environment it creates. Yet many do not understand the value of the innovation and technology sector which surpasses it (see Economic Impact, p. 271).

One of the California Innovation Corridor projects under the “Innovation Support” Initiative included an element to identify an economic impact model and produce model data that would inform economic developers and workforce professionals about the importance of supporting and growing jobs in innovative industries as a strategic means of enhancing economic vitality through job creation/job retention in a regional economy. The Southern California Edison (SCE) Economic Impact (sometimes referred to in partner reporting as the Pollack) Model was employed to compare the job and economic impacts of a small aerospace firm with that of a similar-sized retail/service firm.

Personnel Placement - Multipliers/Effort: Small Hotel (Retail/Service) vs Small Aerospace Company (Innovation/Technology)

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Average Salary Sm Hotel</th>
<th>Average Salary Small Aerospace Co</th>
<th>Impact Sm Hotel Multiplier</th>
<th>Impact Sm Aero Multiplier</th>
<th>Hiring Impact Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>$33,400</td>
<td>$103,450</td>
<td>$45,090</td>
<td>$305,177</td>
<td>6.8</td>
</tr>
<tr>
<td>Indirect</td>
<td>$47,000</td>
<td>$68,529</td>
<td>$63,450</td>
<td>$202,160</td>
<td>3.2</td>
</tr>
<tr>
<td>Induced</td>
<td>$43,800</td>
<td>$41,818</td>
<td>$59,130</td>
<td>$123,363</td>
<td>2.1</td>
</tr>
<tr>
<td>Multiplier Total</td>
<td>1.35</td>
<td>2.95</td>
<td>$167,670</td>
<td>$630,701</td>
<td>3.8</td>
</tr>
</tbody>
</table>
Economic Impact of Operations – Small Hotel vs Small Aerospace Co

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Small Hotel Jobs</th>
<th>Population</th>
<th>Small Hotel Personal Income</th>
<th>Small Hotel Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>20</td>
<td>42</td>
<td>$668,000</td>
<td>$1,712,000</td>
</tr>
<tr>
<td>Indirect</td>
<td>2</td>
<td>4</td>
<td>$94,000</td>
<td>$262,000</td>
</tr>
<tr>
<td>Induced</td>
<td>5</td>
<td>11</td>
<td>$219,000</td>
<td>$621,000</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>57</td>
<td>$981,000</td>
<td>$2,595,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Small Aero Co Jobs</th>
<th>Population</th>
<th>Small Aerospace Company Personal Income</th>
<th>Small Aerospace Co Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>20</td>
<td>42</td>
<td>$2,069,000</td>
<td>$6,108,000</td>
</tr>
<tr>
<td>Indirect</td>
<td>17</td>
<td>36</td>
<td>$1,165,000</td>
<td>$3,087,000</td>
</tr>
<tr>
<td>Induced</td>
<td>22</td>
<td>46</td>
<td>$920,000</td>
<td>$2,605,000</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>124</td>
<td>$4,154,000</td>
<td>$11,800,000</td>
</tr>
</tbody>
</table>

The analysis showed that worker income in a small innovation company was more than three times that of workers in a small hotel, that the job impact and economic impact of the innovation company were four times greater than those of the hotel. By focusing job creation efforts in the innovation arena, the U.S. can produce more jobs and a better quality of life for more workers.

Besides seeking to understand the value of innovation, Corridor partners sought to gain an understanding of the nature of innovation, in order to better define it. (See Innovation Support, pages 74-79):

On April 5, 2007 in Silicon Valley, the Bay Area Science and Innovation Consortium (BASIC) hosted an “Innovation Network Roundtable” as an information-gathering effort supporting the development of the Innovation Driven Economic Development Model. Invitees were Silicon Valley and global innovators, entrepreneurs and researchers. One innovation insight shared at the Roundtable event was provided by Navi Radjou of Forrester Research, who described the four kinds of people key to the innovation process: “Inventors”, the intellectual powerhouses who drive invention; the “Transformers” who commercialize or adapt inventions for internal or external use; the “Financiers” who (usually) exchange some intellectual property rights for funding for Inventors and Transformers and “Brokers”, who serve as matchmakers or facilitators in the innovation system, finding and connecting the other three types of people. Emerging patterns of the next wave of innovation (see p. 272) were drawn from the ideas exchanged that day and summarized in the Innovation Network Roundtable report.
**How Innovation Works in Today’s Economy/Communities**¹

- Innovation is about ideas and recipes
  - Expertise – Innovation comes from all corners
  - Interaction – Face-to-Face still very important for exchange of ideas, synergy creating new business models, marketing plans or products
  - Diversity – Ideas get better when openly discussed by mix of people with varying backgrounds, research fields, approaches and mindsets
  - Application – Ideas are useless unless used. True proof of value is commercialization
- Innovation is unpredictable and disruptive
- Innovation is open and global

**Emerging Patterns of the Next Wave of Innovation**²

- A networked environment – in which ideas are brokered both within and between organizations – is critical to creativity
- Regional capabilities must be connected to global networks
- Maintaining and attracting a talented workforce is a critical factor in an innovation infrastructure; businesses need to draw on the best talent from wherever it can be found, including globally
- Companies must be flexible and adaptable to changes affecting their markets and technology platforms
- Ideas come from everywhere; companies must lose any “not-invented-here” mentality
- Taking risks and not being afraid to fail are essential
- Innovation on the business side of the process can be as important as the science
- The four network roles of **Inventor**, **Transformer**, **Financier** and **Broker** are at the core of the new global innovation model, so it is important to pick the right role or roles for your particular company

¹ *The Innovation Driven Economic Development Model, Collaborative Economics for the Bay Area Council Economic Institute, 2008*

² *Bay Area Innovation Network Roundtable: Identifying the Emerging Patterns of the Next Wave of Innovation, Bay Area Science and Research Consortium, 2007*


While some partners explored innovation from a broad perspective as illustrated above, other partners examined it from the individual company perspective.
Sample of Findings from Innovation Companies, Joint University Innovation Model

- The reward system is an effective parameter for innovation
- The market/customer determines the need for new products
- Financial health of the company affects R&D investment
- Benefits of innovation are measured by customer satisfaction, revenue
- Primary collaborators are in U.S., 50% are in California
- Outsourcing is done to reduce labor compensation, penetrate new markets
- Language barriers affect outsourcing
- Companies concerned those outsourced to are too far away
- R&D driven by top management, then engineering
- Only 12% of online surveyees (106 companies) partner with university labs
- CA companies stay in California for the availability of highly educated professionals
- Companies hire primarily locally, with exception of employees with advanced degrees, for which they prefer to hire within U.S., locally if possible
- Outright sale is preferred exit strategy (4-6 years online surveyees)
- There is no “magic formula” for innovation in a company
- Individuals may be singularly significant, e.g. Steve Jobs, Apple
- Networking a critical innovation factor - between those with technology needs, those with technology solutions

1 Partners: University of California, Riverside; Stanford University, California Space Authority.
   Data from innovation company interviewees and 106 surveyed companies

In studying the nature of innovation, the different projects adopted or created varying definitions of innovation. But the consensus was that a new technology or process is truly innovation only when that technology or process is put into service (e.g. commercialized), producing a new or vastly improved product, service or application, one which reveals or meets a demand.

**Innovation Funding**

The definition above has great importance related to the state’s R&D tax policy. According to the California Council on Science and Technology (CCST) report on the state’s research and development (R&D), California ranks first in the nation for receiving federal R&D investment, receiving $19.4 billion in the year 2005. In that same year, $50 billion in R&D was conducted in California by industry. (Overview of California State-Funded R&D, 2004-2007: Understanding the State’s Role in Shaping R&D Spending: http://www.innovatecalifornia.net/WIREDdeliverables/CCST%20Final%20Project%2011-25-08%20-%2020%201.1.pdf)
It is likely that most of that investment was in “development” research, as industry, according to the report, is the largest provider of development research. Development research as described in the report is the “final stage in preparing a product or process for public consumption (primarily by industry)” and is the type of R&D more likely to drive innovation as described above (i.e. commercialization of new technology, processes or applications). The rationale for R&D incentives to industry in general, and that of California in instituting R&D credits in the last decade, is that industry’s commercialization of innovation will bring a healthy return on investment to the state. Unfortunately, in 2008, that rationale was not accepted and restrictions were made to the California R&D tax credit that decreases its usefulness to companies by 50% through the 2010 tax year. Since 31 states now offer R&D tax credits, the California R&D tax credit adjustment could become a competitive advantage to other states. This reduction may also lay an additional burden on small business for, as the CCST report states, “most tax returns with R&D claims are filed by small and medium-sized businesses; in 2002, over 60 percent of returns with research and development credit (RDC) claims were filed by businesses with gross revenues of under $1 million”.

The CCST report states that California leads the nation in total R&D dollars, enjoying over three and a half times that of any other state. It also points out that, in at least some of California’s R&D investments, the return is two to one from other sources. Yet, per capita, California R&D is slipping and California also now ranks only 19th for academic R&D funding relative to its GDP. While it is generally understood that California’s R&D investments play a role in directing R&D funding in the state, better and more consistent tracking of state-funded R&D as part of a state R&D investment strategy on R&D is needed to support California’s high-tech sector.

The R&D funding provided companies by venture capitalists was also addressed by the Corridor project. Guidelines to developing venture communities were produced by Chabin Concepts, with the support of Golden Capital Networks: [http://www.innovatecalifornia.net/WIREDdeliverables/Venture%20Communities%20Guidelines.pdf](http://www.innovatecalifornia.net/WIREDdeliverables/Venture%20Communities%20Guidelines.pdf). A chapter on venture communities “lessons learned” provided key insights:

- Full support of innovation entrepreneurs requires more than holding an annual event.
- Investors are the key to attracting companies.
- Companies—enough to be worth their while—are the key to attracting investors.
- Any community or region over 100,000 can conduct a Venture Communities program, but all communities and regions should be aware that companies are not concerned with geopolitical boundaries.
- One year may be too short a time period for measuring results when innovation entrepreneurs are involved.
Innovation entrepreneurs have different workforce needs.
Innovation entrepreneurs need more training in the stages of risk capital.
Local leadership must take ownership to sustain the program
To support entrepreneurs, communities can work to build and support visibility for innovators, vertical and functional networks, access to all stages of capital, access to talent, access to customers and strategic partners, and establishment of anchor companies in the local community

**Identifying and Understanding Innovation Assets**

Several projects required identifying regional innovation assets and a better understanding of the following resulted:

- The importance of better understanding regional innovation assets and yet the broad lack of understanding most regions have about their innovation assets – of the companies, universities, federal labs and military installations that exist in their regions
- The lack of understanding most regions have about the innovation sector in general, what its primary needs are, how it differs from other sectors
- Knowing that a set of companies resides in a certain industry sector no longer means that the capabilities, workforce needs and activities of those companies is similar - activities of innovation-oriented companies even in traditional sectors may be vastly different than the activities/capabilities formerly representative of that sector or even from each other
- Developing relationships with regional innovation companies is perhaps more difficult than developing relationships with local businesses. Innovation companies are likely to be working nationally or globally, with less connection to the local community – EDOs and workforce professionals must answer the “What’s in it for me” question to engage innovation companies
- As stated in the final report of the Workforce Analysis project: “Aerospace, bioscience and other emerging technologies reside in multiple NAICs codes and are therefore problematic to find and measure – requiring other qualitative approaches to truly gauge breadth of emerging industries in a region”
- The Corridor’s Innovation Asset Mapping Inventory is the type of tool that can assist in identifying emerging regional innovation assets because it is capabilities-based rather than industry-based. It can provide the foundational company or organization information that enriches the essential face-to-face or phone contact necessary to stay abreast of the always-evolving innovation community
Global Models of Innovation Support: What We Can Learn

An early effort to better understand the global innovation environment and its regional characteristics was begun with the Corridor requesting support of the U.S. Department of Labor technical assistance provider New Economy Strategies (NES). NES performed an “innovation audit” on the Corridor and numerous other global centers of innovation. (See page 277 or for full report: http://www.innovatecalifornia.net/WIREDdeliverables/CIC%20WIRED%20Lightening%20Bolt.pdf)

Public-Private Collaboration
The innovation support insights described above, many experienced early in the work of the Corridor partners, were found valuable throughout the rest of the Corridor WIRED Initiative, not only to those gaining these insights, but to partners in other projects, as partners shared insights across projects.

One attendee of the Corridor’s Innovation Network Roundtable event early in the performance period of the Initiative was John Kao, who described the event in his book Innovation Nation¹. His resulting description of the innovation support needed by innovators is perhaps a good summation of what those interested in fostering innovation need to keep in mind:

This gathering offers a glimpse of what the future of our country’s approach to innovation might look like on the ground. Our national agenda should not be a grand project along the lines of the old top-down five year plans, but rather a free-flowing, unencumbered dance among the private and public sectors, among academics and NGOs, entrepreneurs and individual citizens. It is neither the bureaucratic top-down of a government agency, nor the invisible hand of the private sector. What we need is a blend of the two that finds the sweet spot between the invisible hand and the controlling hand – in short, the helping hand.

¹ Innovation Nation, John Kao, Free Press, A Division of Simon & Schuster, 2007
Innovation Success Factors/Global Best Practices
Lightening Bolt Challenges: Obstacles and Opportunities
Unearthed in the Global Benchmarking of Regional Innovation Capacity

- Economic development planning supported by innovation metrics
  **Best Practice: John Adams Innovation Institute – Greater Boston**
  Editions of the annual "Index of the Massachusetts Innovation Economy" provide valuable innovation metrics for MA, CA, NY, other key innovation states (e.g. SBIR awards, Patents, Corp R&D expenditures, innovation cluster employment, etc.)

- Robust adult/continuing education programs
  **Best Practice: Dipoli – Finland**
  "Dipoli, the Lifelong Learning Institute of Helsinki University of Technology, is one of the premier continuing education institutes for engineering in Europe. It works with companies to provide specifically designed programs for training in engineering and management and may serve as a model for bridging the gap between formal academic programs and training within firms"

- Promotion of a variety of advanced certification programs
  **Best Practice: Technical Education in India**
  A National Skills Standards Act was passed in India in 1994 by the “All India Council for Technical Education, the central body responsible for India’s 1,346 engineering colleges, to facilitate development of voluntary skills and certification standards. India’s Department of Higher Education cites 357 Industrial Training Institutes with a capacity to serve 1.5M people in over 200 industries. Mid-level professionals requiring advanced applications training are served by 290 polytechnics nationwide.

- Leveraging of public/private technology parks, infrastructure, collaboratories
  **Best Practice: Singapore Science Park**
  A set of Singapore technology parks founded co-locating academic institutions and industrial facilities has created a particularly strong infrastructure for technology transfer. Singapore Science Park consists of three different parks with a “vast array of customized facilities created to support work in a variety of fields from medicine to media” and also contains Asia’s first R&D facility dedicated to telecommunications

- Endorsement of a globally networked business model, leveraging global outsourcing to ensure its companies/workforce are more competitive
  **Best Practice: Outsource Competitor/Partner – India**
  The country has defined itself as a hub for IT software and consulting services, employing its vast technically educated workforce in the service of growing India’s IT industry by means of leveraging its talents first on low transnational telecom cost work outsourced from other countries

- Proactive Federal and State policies toward technology competitiveness
  **Best Practices: Singapore and Korea**
  Despite its small size, Singapore recently devoted $5B USD on R&D, both public and private, in key industry sectors, acknowledging thereby the advancement of its innovation policy. Korea is moving towards a knowledge-based economy through its Vision 2025, setting a goal of achieving competitiveness with G-7 nations. Both Singapore and Korea have developed and are implementing aggressive innovation policy

- **Best Practice: Many of the above-mentioned players**
  “It was evident from our review of global best practices in innovation capacity that challenger nations have developed more formalized networks. Often these networks are government-led and have resulted in industries and firms that have benefited from strong alignment between government policies and firm success. This organized dialogue amongst industry, academia and government over policies for the successful development of innovation capacity has often resulted in success for all three sectors of society.”
Characterizing the New Supplier Network Environment

The single most important insight gleaned from the Industrial Rejuvenation/Supplier Competitiveness pathway is this one, learned in relation to aerospace, but applicable to other industries/sectors, as well:

*As prime contractors have become focused on final integration, with 80% of systems development now moved out to the supply network, the result is that 80% of product and process innovation is also now expected from suppliers.*

With this fact in mind, regional fostering of innovation which includes supplier support and building supplier understanding of the importance and principles of innovation can be recognized as critical to California and U.S. global competitiveness. With the U.S. industrial base already facing enormous challenges from cost-induced constriction, decades of overseas outsourcing, and accelerating foreign supplier competency, this new challenge to our suppliers could not come at a worse time (see Supply Evolution below, *Figure 4* from page 119).

The importance of the challenge to quickly bring California and U.S. suppliers up to 21st Century standards cannot be overstated. It is primarily the manufacturing sector which offers workers and small business owners pathways out of poverty and into the kind of work promising long term family-wage incomes. California is home to 50% of U.S. manufacturing. Failure to keep our California industrial base globally competitive, and the results which would cascade from that, threaten not only our national security, but our very quality of life.

**SUPPLY EVOLUTION**

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From the California Space Authority’s final report on the Supplier Transformation project: “As supply chains have evolved into dynamic complex supplier networks, unless there is sufficient change, trust, collaboration and communication, with clearly defined and communicated technical and business requirements, balanced accountability, responsibilities and reward, less than optimal results can occur.” Observations about the characteristics of the new supplier innovation environment from the same report, some of which align with findings in the Joint University Innovation Model project, include:

- The need for balancing innovation and risk – failures can lead to success
- Suppliers across the supply chain network are expected to share the risk, investment and reward of innovations
- Early collaboration with customers and suppliers, innovators and markets is critical
- Methodologies to measure and value innovation are required
- Interdisciplinary skills and teams are required, as are ad hoc project teams
- Common assessment processes are needed across the supply chain network

### A Changing Landscape for Aerospace Suppliers

- Suppliers are working in a global “flat world”
- They are doing business in a digital, socially networked world
- Supplier work is changing from “Stable & Certain” to “Sense & Respond”
- Collaboration and competition are coming from more places
- 6 Sigma and Lean are standard, not exceptional
- Marketplace is moving from “Make & Sell” to “Sense & Respond”
- Suppliers exist in an E-Commerce, E-Process global marketplace
- Data, information and communication are more critical
- Pace of change is accelerating

#### Key Messages for Suppliers

1. Nearly 80% of former “prime” manufacturing/assembly work had moved down to suppliers, with most primes now focused on final integration
2. Impact: 80% of the innovation and engineering falls to suppliers
3. Suppliers unlikely to remain competitive simply providing components
4. Supplier transformation and training are only competitive options

### The Best Companies Are Adjusting to Stay Successful

1 From Presentations, Handouts, Supplier Transformation Forum, November 9, 2006
Throughout the Supplier Transformation project, supplier Subject Matter Experts (SMEs) were called on to offer first their expertise in characterizing the changing nature of the supplier environment (see p. 279 above), then to help articulate the success factors required for suppliers to succeed in this new environment (see Smart Supplier Success Factors below).

### Smart Supplier Success Factors

1. Successfully managing supplier relationships (upstream, downstream)
2. Successfully managing process and quality performance demands in an environment of both vertically integrated chains of companies as well as dynamic, distributed networks of companies
3. Remaining flexible, agile, to deal rapidly with changes/disruptions in one layer or node of the supply system
4. Expanding capacity to take on new functions, e.g. design, engineering, quality assurance formerly a responsibility higher up the chain
5. Engaging earlier in the product development cycle with both customers, suppliers, i.e. requirements definition, design
6. Real-time, open sharing of more data, earlier, more often, i.e. schedule, quality (open systems)
7. Digital modeling and simulation capabilities (utilization of high performance computing if possible)
8. Full understanding of customer requirements
9. Performing to industry standards
10. Aligning research/development
11. Software engineering and systems engineering capabilities
12. Solid planning, process, risk, LTS management (schedule, cost, quality control)
13. Recruitment and retention of quality-conscious workers (technicians, engineers)
14. Effective inventory, logistics, materials management
15. Effective sub-contract, intellectual property management
16. Development of long-term strategic relationships (customers, suppliers)
17. Reputation management
18. Incorporate foreign content to assure foreign market access; control counterfeits
19. Ongoing training in latest technologies, basic skills, business practices
20. Lean practices
21. Willingness/ability to expand to meet customer needs (e.g. equipment, facilities)
22. Customer and supplier collaboration (process streamlining, cost/risk reduction, product design, development, etc.)
23. Regulatory compliance (e.g. ITAR), regulatory flowdown management
24. Product lifecycle management
25. Forecasting
26. Rapidly introduce new technologies
27. Focus on core competencies
28. Capture and proposal strategies
29. Supplier diversity
30. Understanding program pricing targets and company’s contribution
31. Obtain/maintain appropriate certifications
32. Utilize internal audits
33. Market solutions providing differentiation (technology, cost, speed)

1 From presentations, handouts and information provided at the October, 2007 Supplier Transformation Forum, October 2008 Forum
Analyzing Current Supplier Adaptation to the New Global Environment

A supplier survey of 288 California suppliers was summarized in a report entitled California Aerospace Supplier Transformation Requirements for the 21st Century (http://www.innovatecalifornia.net/WIREDeliverables/CSA%20AVC%20Supplier%20Initiative%20Report%20Wired4Web.pdf). Much of the information leading to the development of the common learning outcomes identified for continuity across the supply chain network training provider community will be covered later in this section and the next, as well as in a previous section (Industrial Rejuvenation/Supplier Competitiveness) beginning on page 112. Here we would like to share just a few of the key insights from the survey and that report (Capabilities graph below is Figure11 from page 123).

As you can see above, the percentage of suppliers – large or medium - currently possessing the six capabilities identified as common 21st Century practices, is not promising for global competitiveness. For small supplier companies, the learning curve is huge, with five of the six capabilities resident in only 50% or less of the small suppliers. For the virtual/digital simulated prototyping that reduces costs and streamlines production time and that together address the top two priority supply chain metrics, only 30% of small suppliers indicate capability, let alone competency.
In Figure 14 above from page 124, it is evident that workforce issues and increasing costs are uppermost in the minds of suppliers, inhibiting the potential for taking on the long term strategic planning for product innovation and supply chain integration necessary to distinguish the successful players in the 21st Century supply chain network.

Policy and funding issues impacting aerospace industrial base include:
- Lack of consistency of flow down requirements of government customers (i.e. NASA, national security requirements for aerospace suppliers are not aligned, although efforts are underway to create more alignment)
- Decreasing number of programs, cost-driven decision-making threaten diminishment of aerospace supplier base
- Compliance with burdensome export regulations raise the cost of doing business for suppliers

In terms of corporate policy and practice, increased product and process content is demanded from the supplier value network, but innovation is also expected. As prime contractors have chosen to focus more on integration, less on systems development, it is estimated that 80% of innovation is now expected to come from the supplier network. R&D is spread throughout the supplier network and as stable vertical supply chains become dynamic complex networks, innovation, open collaboration and communication become imperatives for success.

**Identifying Smart Supplier Requirements**

Based on the survey and the Supplier Transformation forum insights, the following “Smart Supplier Requirements” were developed as an element of the common learning outcomes the California Space Authority and its supply chain network partners produced in advance of designing instructional materials to support supplier training efforts. The common learning outcomes will also be featured in the next section of this report.

**Smart Supplier Requirements**

**Looking Upstream in the Supply Chain – (What does customer want?)**

- International Traffic in Arms (ITAR) or “export controls” compliance
- Capabilities for involvement with design collaboration – New product design, Design for Manufacturing & Assembly (DFMA), Engineering Analysis, Non-Destructive Testing (NDT), Prototyping, Design for Six Sigma (DFSS)
- Metrics in place for On Time Delivery
- Risk analysis and mitigation planning
- Establish cooperative relationships and effective coordination
- Maximize flexibility and responsiveness
- A workforce development plan in place
- Pursue supplier-integrated product and process development
Looking Within the Enterprise – (What are my capabilities?)

- A Culture of Improvement - Management commitment, Infrastructure
- Visual Workplace - Value Stream Mapping, 6S, Visual Controls
- Lean Product Development - DFMA, Flattened Bill of Materials (BOM)
- Process Focus - Continuous Flow, Parts Presentation, Cellular Mfg, Right-sized equipment, Operator versatility
- Just In Time - Inventory Levels, Pull Systems, Load Leveling, Single Piece Flow, Setup
  Time Reduction, Takt Time
- Control of Processes - Mistake Proofing, Six Sigma, Self-Verification, Root-Cause Analysis, Total Product Management (TPM)
- Standard Work - Defining, Cycle Time, Sequencing, Standard Work in Progress (WIP)
- Continual Improvement - Kaizen, Performance Measures, Quality Management System, Six-Sigma, Statistical Process Control (SPC)

Looking Downstream – (What do I need from my suppliers?)

- Design of the supplier network architecture
- Development of complimentary supplier capabilities
- Creation of flow and pull throughout the supplier network
- Cooperative relationships and effective coordination throughout the supplier network
- Maximize flexibility and responsiveness
- Pursue supplier-integrated product and process development
- Integrate knowledge and foster innovation
- Demonstrate continuous performance improvement

The above list is an impressive illustration of the minimum competency expected of today’s suppliers, and as you will see in the forthcoming section on promising model practices, the coursework developed for the Supply Chain Management Course successfully addresses much of the area covered above. But suppliers hoping to make “top of the mind” for standing out from the crowd cannot stop here.

Another insight coming from this project is that, because the business and supplier environment is constantly evolving, supplier training needs to, as well. Designing a curriculum based on the above requirements, while absolutely necessary, is not enough. Delivering the same content for the next five years will not be sufficient to bring suppliers to global competitiveness. Every day new issues emerge, which must be addressed by would-be supplier trainers. These are very specialized areas, such as “global parts counterfeiting” for which Subject Matter Experts must be sought and curriculum quickly developed, with supplier training opportunities numerous and diverse. This issue will be discussed later in this section as part of “Talent Development”, but the supplier-related insight is that California’s education system is not set up, and does not have the resident
expertise to address this need of this new 21st Century quickly-changing environment.

*Pulling Together a Supply Chain Network Strategy*

Based on the Supplier Transformation Survey results, Supplier Forum findings and discussions with both primes and suppliers, it is clear that the California and U.S. supply chain network, while it has stellar players at all levels, is not yet as a whole equipped to be competitive in the 21st Century supply chain network environment.

Because the learning curve is so steep, and because foreign supply chain network competitors are nipping at the heels of the U.S. industrial base, speed in addressing supplier shortfalls is critical. The Smart Supplier Strategy developed under WIRED and described later in this report under “Model Practices”, is a good start. The Sustainability Strategy described on page 138 provides an even better solution, designed as it is to “sense, assess and respond”. But suffice it to say that if California and the U.S. do not invest in meeting the growing training needs of the supply chain network, the global “Gold Standard” set by the U.S. industrial base will be a legacy, not a characteristic of the 21st Century economy.
Developing STEM Talent to Meet 21st Century Needs

The genesis of the Talent Development pathway grew out of the need for an understanding by the education and workforce systems of the global technology and innovation era and the call for a serious innovation-oriented STEM focus to meet the demands of the 21st Century employer and the needs of the 21st Century worker. Georgetown University Center on Education and Workforce has estimated that the percentage of the workforce requiring some college or above is expected to increase from 59% in 2007 to 63% by 2018. The Center states that "unless we increase output from postsecondary institutions, the demand for college talent will exceed its supply."

Nearly every position imaginable in today’s workplace now depends on technology or uses it as a tool. From computerized cash registers to robotic assemblers to automated patient monitoring equipment to “smart” homes and offices featuring electronic HVAC systems – technicians as well as 21st Century professionals need more STEM skills than ever before. At the same time, science and math skills and STEM graduates are declining.

These two opposing trends, more STEM workers needed and fewer STEM professionals and technicians available to meet the demand are creating a growing crisis. This is a crisis not only for our national workplace, but in our economy, the competitiveness of which depends on STEM professions and skills. And it is a crisis not only for our economy, but for U.S. workers and families themselves. According to the Annie E. Casey Foundation, “Eighty-eight million adults do not have the basic skills necessary for 90 percent of the jobs in the fastest-growing industries.”

A key insight expressed by the California Workforce Association (CWA), the San Diego Workforce Partnership and other WIBs is that, while supporting innovation in industry from a workforce prospective was transformational, the current WIA system of common measures is wholly funded with established standard operating procedures and metrics that do not recognize or support industry-driven innovation activities. It seems that ETA is aware of this, and recognizes that WIA legislative reform is the only way to address the issue.

The California Workforce Association, as a Corridor WIRED partner leading the WIB Learning Collaboratory (3.14) project and in its role as the voice of California’s 49 Workforce Investment Boards, identified several barriers that, according to the Policy Recommendations report the organization developed as a result of DOL’s request for regions to identify obstacles to WIRED principles, “impede the implementation of the WIRED agenda at the local level”. CWA proposes policy recommendations that would, once implemented, “improve opportunity for WIB leadership in demand-driven strategies and advance strategic investment in workforce talent development”.

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The CWA-identified WIB “Barriers and Recommendations” include:

- **Issue #1: Performance Measures**
  “There is a significant disconnect between Workforce Investment Act (WIA) performance measures – that is, incentives and sanctions relative to WIB investment of WIA funds – and both the nation-wide priorities of WIRED and its implementation in California through the California Innovation Corridor.” At the national level, WIRED promotes the transformation and system change priorities of the Department of Labor, and through the California Innovation Corridor, promotes a focus on entrepreneurship and industrial rejuvenation through smart supply chain management. Neither DOL’s nor the state’s goals for WIRED are aligned with WIA performance measurements, which are still tied to job-seeker outcomes.”

  **Recommendations:**
  - **Federal:** DOL explore new ways of negotiating performance, such as ways to weight common measures to have less impact. This would be to encourage states to add additional standards that focus on system change, business services, convening and brokering services, and functions that are associated with intermediary work.
  - **State:** California Workforce Investment Board (CWIB) explore setting alternate performance measures to support innovative strategies, business services, support for entrepreneurs, etc. and provide incentives for achieving and exceeding standards with new measures. Provide support for local WIBs to develop performance standards that reflect the demands of the region.
  - **Local:** Set local standards that reflect the local WIBs strategies.”

- **Issue #2: Demand-Driven Design**
  “While WIA improves upon past legislation in promoting demand-driven strategies that recognize the important role of business as the customer, WIA is largely silent on the role, local authority and responsibility in responding to business needs.

  Although the majority of WIBs in California have redesigned their services to focus on business as the primary customer, the scope and reach of these services vary widely around the State.

  One of the key features of the California Innovation Corridor’s WIRED strategies is working with entrepreneurs. It has been difficult to make the connection for WIBs to this aspect of the WIRED work. There is very little perceived value for WIBs in working with entrepreneurs and start-up companies. The role a WIB could and should play is unclear.”
Recommendations:

“Federal:” Amend WIA to define and more explicitly promote services to business in WIA, including recruitment and staffing services, training and development, information and resources, and outplacement and business retention services. Encourage coordination with economic development, linkage of local employers with One-Stops, brokering services for businesses, and regional skills alliances led by Local Workforce Investment Boards.

State: Add language in State law that further codifies the role of WIBs in California, and the business services activities permitted through WIA and encouraged through State statute. CWIB provide resources for capacity building and training for business services.

Local: Ensure that business services are being delivered to key industries. Develop strong working relationships with industry associations associated with innovative businesses and with Small Business Development Centers, and work out roles for working with entrepreneurs.”

Issue #3: Role of the WIB

“The Workforce Investment Act describes the role of WIBs throughout the legislation, but does not sufficiently specify the role that the WIRED initiatives envision, nor the role of workforce intermediary, which most successful WIBs have become. WIB success in working with K-12, Community Colleges, Four-Year Colleges and Universities, organized labor, Chambers of Commerce, economic development agencies and other regional planning and strategy boards is constrained by a lack of clear policy direction and of dedicated strategic planning resources. Clarity of purpose and financial support will be essential to catalyze transformative WIB engagement with all of these institutions.”

Recommendations:

“Federal:” Amend WIA to establish a new, separate subtitle, dedicated to defining and advancing the leadership roles of WIBs in strategic planning and to fund them based on defined strategies for exercising policy leadership and innovation, particularly with respect to their roles as:

- Conveners…
- Brokers…
- Developers and Interpreters of Workforce Intelligence…
- Community Voice…

The proposed new subtitle and funding for strategic planning will result in greater coordination of existing and private sector resources and more targeted investment in industry sectors which suffer critical skills shortages and which represent the greatest opportunity for employment in high wage jobs.

State: Provide funding for WIBs to engage in regional strategic planning. Provide incentives for WIBs to design and develop projects with other key
stakeholders. Develop language for State legislation that lays out the role of the State and the local WIBs. Provide capacity building resources for technical assistance and peer support to develop stronger WIBs. **Local:** Review and revise local plans toward further articulating roles in service as workforce intermediaries, in coordinating public and private investment in target industry sectors and in regional strategic planning.”

**Issue #4: Access to Resources**

“California WIBs are dramatically underfunded relative to the resources necessary for effectively investing in skills and talent development. Such investment is essential to fill the pipeline of workers responsive to 21st Century opportunity and demand.”

**Recommendations:**

**Federal:**

- H1B Visa Funds and Sectoral Strategies: Establish a new, separately funded subtitle under Title I of the Workforce Investment Act, reserved for investing in sectoral partnerships dedicated to help local industries grow and re-tool their workforces for the future. Funded through H1B visa fees, Local Areas may access this resource only by establishing a local industry plan, requiring co-investment by local business and industry.
- WIA Funding Formula: Adjust the Workforce Investment Act state allotment formulas consistent with GAO recommendations, eliminating threshold measures that lead to unpredictable and inequitable fund distribution, and replacing them with factors more reliable for delivering funds to eligible client populations and regions with demonstrable need.
- Trade Adjustment Act: Reauthorize Trade Adjustment Act, expanding the definition of trade-impacted workers such that accommodates the new global economy and labor market forces in a broader range of industries and occupations; increases funds for case management services; and improves upon worker opportunity to access training by requiring coordination between the Trade Adjustment Act program and WIA.

**State:** Ensure that WIA funding is dedicated to WIBs. Phase out the practice of providing WIA funding to other State agencies, all of which have dramatically higher funding. Phase in policies that require all Governor’s discretionary funding to go to and/or through WIBs, so that WIBs can be supported in their role as local system builder.

**Local:** Develop partnerships with industry sectors suffering critical skills shortages and which offer career ladders to jobs with quality wages and benefits; develop and implement strategic plans to increase access to public and private sector resources for improving the pipeline of skilled workers.”
By implementing the recommendations above, changes in labor market forces would not take the national, state and local workforce systems by surprise – as conveners, brokers and business service providers they would be connected to a network instantly impacted by outside labor market forces. The workforce system, likewise, would be naturally incentivized to stay current with changes in labor market forces and be responsive to them, able to automatically adapt strategies and resources to newly identified needs because the overarching workplace environment strategies and partners would already be in place. (See systems alignment as a key enabler, next section of this conclusion)

Somewhat like the many elements of the workforce system which were caught off-guard as the U.S. economy and workplace became part of a larger, even more competitive global market environment, many in the education system were slow to recognize that the industrial era was over and that the information and innovation age were upon them.

If anything, the national, state and local education policymakers, systems and resources are characterized by less continuity than that of the workforce system, which operates primarily under one set of WIA guidelines. State K-12, community college and each university system – the four public education systems in California - operate virtually independently, with school and community college districts, and university campuses within these four systems also enjoying much autonomy.

While this should make it more common to respond to local worker and employer needs, that is only true for those districts or university campuses that see themselves as part of the total economic picture, linked to the marketplace by employers and workers with 21st Century skill needs that they can provide. If the district or university campus sees its role differently, it will not be the resource expected by workers and employers.

To some stakeholders from industry, economic and workforce development and the nonprofit sectors, it was stunning to see the lack of coordination among California’s four systems of education. Many assumed that there was a significant amount of collaboration among the systems to assure continuity, and effective inter-segmental coordination. It was assumed by some that career pathways designed across systems and broad articulation within disciplines from one education level to the next would be common. Instead, it was learned that each system, nodes within those systems like districts and campuses, and within districts and campuses schools and departments characterized by much less cross-talk, collaborative prioritizing and planning and leveraging of resources than ever could have been imagined.

This made it all the more challenging, yet important, to address the national and statewide science, technology, engineering and math (STEM) crisis by brokering
a collaboration among all four systems, plus industry and informal science, in addressing the challenge. At the start of the effort, a highly-placed individual in one education system’s executive office made the observation that only an outside entity like the California Space Authority could have brought all four systems to the table. Each education system is so strongly independent that it would have been unlikely, according to this source, for any one of them to have been able to “submit” to being convened by one of the other systems.

Actually, for the California Space Authority and the California Space Education and Workforce Institute (Institute), which convened the four systems, engaging the cooperation of the executive office of each, was relatively simple. In 2006, when the convening took place, each system had really only begun to address the STEM challenge, and were still open to support in doing so.

In attempting to develop a Science, Technology, Engineering and Math Collaborative Action Plan (STEM CAP), the California Space Education and Workforce Institute (Institute), its STEM CAP contractor the Alliance of Collaborations for Heightened Education Success (ARCHES), and the STEM CAP Advisory Committee identified four key challenges:

- Fewer high school students are interested in preparing for and obtaining a college degree in STEM
- Too many of California’s students do not have access to high-quality science and mathematics instruction or quality materials
- Large percentages of California students, especially those in low performing schools, receive instruction from under-performing teachers
- California lacks state-level leadership to make high-quality science and mathematics education for all students a priority

All of these are quite real and significant. But through other Talent Development projects, we learned of other challenges or challenges worthy of greater mention than that made of them in the STEM CAP:

- Recognition of education’s role in preparing the 21st Century workforce does not seem widely accepted within the education community. Surprisingly, the number of systems, districts, campuses, educators or education policymakers understanding they are part of a demand-driven system seems less than the number of those believing they operate somehow outside the national, state and local economic sphere of activity
- Lack of support within the four systems for student, parent, teacher career awareness, career relevancy and career preparation pathways, especially impacting students without college educated parents
- Willingness to see industry, industry associations and employers as partners and subject matter experts, as well as outside funders
- Less educator accountability than necessary for assuring a quality, relevant learning experience for all students
Systemic education issues that do not seem resolved by additional funding

Critical importance of educators remaining current with the educational needs of today’s workers

Importance of inquiry and project-based learning in today’s global environment. As it is now impossible to learn everything in school needed for success in the 21st Century career marketplace, it is increasingly important for students to engage and succeed in real-world scenarios to prepare them for the ever changing environment in which they will work

Broader recognition of the value of Career Technical Education (CTE) as a pathway to success and family wage jobs for students not interested or able to pursue college after high school graduation

Importance of an interdisciplinary approach to career preparation. Nearly all of today’s careers, as will be seen below, require cross-disciplinary skills and competencies. The strict departmental structure of our universities and the single focus of many of our degrees does not lend itself to the relevancy required to keep our universities cutting edge.

There is also recognition of the need for more hybrid degrees which would address the domain understanding needed by a professional managing a technology firm doing scientific or high-tech work. Such a degree, exemplified by the new California State University “Professional Science Masters” degree, addresses the competencies needed to manage or market a domain-based high technology business, for someone who does not plan to actually engage in domain-based (e.g. biotech) work itself.

Some of the above additions to the challenges identified in the STEM CAP can still be addressed through the STEM CAP recommendations. A few will take major systemic changes in our nation’s education systems and, as so, are beyond the scope of the STEM CAP.

Industry surveys were conducted as part of several of the Corridor projects. There was surprising consistency in the results of those surveys. Probably the most important, yet not surprising insight, is that pretty much across all key industry clusters of numerous Corridor sub-regions, two occupations emerge as the top careers in demand, time after time (often alternating as #1 or #2 in importance, demanding on the employer population):

- Engineers
- Technicians

Two notes to the above:
- Need for systems engineers seems to be growing as technologies become more complex
- In heavy biotech-oriented regions, scientists and technicians may appear as numbers one and two (e.g. Bay Area)
While not definitive because it does not integrate findings of all surveys, the aggregated findings of the Workforce Analysis (3.1) project is representative of the greatest number of regions surveyed and also representative of the insights garnered from all workforce demand data produced in the Corridor.

An interesting fact gleaned from observing two of the Workforce Analysis project result tables is this...when asked where are the most critical skills shortages (see Skills Shortages, below) the top response was in technical (technician) positions, with professional occupation shortages second. This is consistent with Project 1.2 results, where biotech industry technicians – a two-year degree required - were where the hiring difficulty was, greater than the hiring difficulty for the four-year professional graduates (see Talent Development pathway section above, beginning page 146).

Also similar across all surveys was the finding that, in additional to the domain discipline, today’s workers need a set of additional skills to be competitive. (See Skillbuilding box below)

Also similar across all surveys was the finding that, in additional to the domain discipline, today’s workers need a set of additional skills to be competitive. (See Skillbuilding box below)

One note to the list in the Skillbuilding box below: University of California, Riverside had a similar list, with one important distinction – innovation-oriented employers they surveyed also expected business knowledge, no doubt because of the importance of commercializing innovations.

When the 3.1 surveyees in all the sub-regions were asked in general about what were the most critical occupations (not shortages of certain positions),
Technical and Professional replies switched, with a professional position (engineer) at first, technician at second.

<table>
<thead>
<tr>
<th>Critical Occupation (Respondent-Defined)¹</th>
<th># Firms Mentioning +/- 10%*</th>
<th>Consolidated and normalized verbatim responses on critical occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>70</td>
<td>Engineers: systems, process, aeronautical, rocket, flight test, avionics/navigational, firmware/software, structural and civil, electrical, mechanical, geoscience, metrology, environmental, telecommunications, overhaul/maintenance facility. Also included in this category: architects, surveying, land use planning, material science, composites, fiber optic manufacturing, physical systems dynamics and control</td>
</tr>
<tr>
<td>Technician</td>
<td>48</td>
<td>Includes technicians, installers, equipment operators, and workers or laborers requiring precision of technical skills: airport and aircraft maintenance; information tech; lab tech; analysts; composite materials; machinery manufacturing and maintenance; overhaul and maintenance facility; electronics and navigation manufacturing and repair; telecommunications and fiber optics; vehicle maintenance; computer graphics; interior design; computer/telecommunications networks; medical and dental support and radiology; solar electric installers; CNC (computerized network controlled) machines. Also included due to repondee emphasis on precision or advanced skills or unclear responses; metalworking; line services/machinery operators; truck/tractor operators and drivers; ground and material handlers; plumbers; plasterer; lathe operator; sewing.</td>
</tr>
<tr>
<td>Operations/Other Professional or Support</td>
<td>41</td>
<td>Category includes a wide range of management and support positions. Due to responses, it was not possible to quantitatively separate management from lower-level support services. Category includes: management, strategy, legal, project management, business development and sales, operations management (supervisors and managers), marketing/advertising/public relations, finance analysts, HR, fundraising</td>
</tr>
<tr>
<td>Scientist/R&amp;D/MD</td>
<td>23</td>
<td>PhD and lower level for R&amp;D in research, material science, engineering, composites, product development, chemistry, biology, electric vehicles, clinical science, geology, environmental, avionics/navigation, telecom, chemistry, computer science, biomedical, physics, mathematics</td>
</tr>
<tr>
<td>Machinist</td>
<td>14</td>
<td>Composite materials, fabrication and machinery manufacturing, overhaul/maintenance facility machinists, CNC and conventional machinists, surface mount and through-hole operators</td>
</tr>
<tr>
<td>Programmer</td>
<td>9</td>
<td>CNC programming, CMM programming, website developers, computer graphic design, firmware/software programming, computer science</td>
</tr>
</tbody>
</table>

¹ 21st Century Workforce Profile Analysis, California Council on Science and Technology/California Space Authority, 2008
While only truly aggregated findings of Projects 1.2 and 3.1, the following table is representative of the findings of all the employer surveys, with just a few minor exceptions.

<table>
<thead>
<tr>
<th>Common findings Projects 1.2/3.1</th>
<th>Common Areas of Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineers and Technicians are most critical occupations for innovation, also map to critical skill shortages</td>
<td>Build better linkage between education/academia and industry to ensure relevant knowledge, skill-building</td>
</tr>
<tr>
<td>Science, Technology, Engineering and Math (STEM) education/training is key</td>
<td>Educate policymakers about issues, recommendations, resources</td>
</tr>
<tr>
<td>Greater levels of education or certification are anticipated for STEM workers, except perhaps for the doctoral level</td>
<td>Develop more &quot;real-world&quot;, hands-on opportunities for STEM students</td>
</tr>
<tr>
<td>Most critical occupations fall into high-wage categories (engineers: $60-over $105,000)</td>
<td>Develop communications and problem-solving, business and workplace skills alongside technical knowledge</td>
</tr>
<tr>
<td>Technical knowledge, Communications and Workplace Skills all rank among top three skillsets needed</td>
<td>Increase awareness of STEM career attractiveness among parents, educators, students</td>
</tr>
<tr>
<td>Problem-solving and Business Skills also a key need</td>
<td>Link educational levels to build on STEM learning</td>
</tr>
<tr>
<td>No educational preparation or level exceeds employer expectations</td>
<td>Align workforce, economic development and education systems to address industry</td>
</tr>
<tr>
<td>Industry-relevant, real-world experience is critical and sorely lacking in 21&lt;sup&gt;st&lt;/sup&gt; Century workforce development</td>
<td></td>
</tr>
</tbody>
</table>

With the insights described above regarding innovation support, supplier competitiveness and talent development, it was interesting to see that there were three key enablers that could enhance each of these domains. That is the subject of the next section.
Industry Engagement, Systems Alignment and Model Practices: Key Enablers in Fostering Innovation and Driving Regional Prosperity:

Regional collaboration, as anticipated, was indeed a success factor of the Corridor Initiative projects. It was also an identified success factor for supporting an innovation culture beyond WIRED and the Corridor. But without the other enablers listed below, regional collaboration would not be enough to foster innovation and drive regional prosperity.

The Corridor Initiative, in its three pathways of activity and in its 25 discrete projects, especially those from the start labeled as “sustainability projects”, again and again discovered that project and/or Corridor success was dependent on these key factors:

- Industry Engagement
- Systems Alignment
- Model Practices

In today’s vernacular, these three success factors are “golden”. These “key enablers” are distilled from across the CIC WIRED pathways and 25 projects, across the broad-based accomplishments of the 42 funded partners and across the 82 scopes of work making up the California Innovation Corridor Initiative. The Corridor’s validation of these key success factors offers invaluable insight to the rest of California and the nation in how to bring about the transformational change necessary to ensure California and U.S. economic and workforce competitiveness in the now-global marketplace.

Behind this insight is perhaps another Corridor success factor worthy of mention. The economic vitality necessary for full or high employment requires job creation and/or job retention, and because workers are dependent upon thriving industries for long term opportunity, it is critical to include the industry perspective as early and often as possible in planning and implementing an initiative seeking positive impacts for workers and regional economies. The Corridor Initiative was conceived and managed by the California Space Authority, which represents the private and government space enterprise community (employers) throughout the state. Many of the 25 projects included in the Corridor’s original WIRED proposal, while often having cross-industry applicability, derived from objectives in CSA’s eight years of industry strategic planning. Because CSA as an association of employers understood the value of engaging industry and employers or their representative associations at the outset and throughout, nearly every project did so.
The industry engagement and perspective so central to the success of the Corridor Initiative may have been realized to a large extent because the Initiative was led by the space industry-oriented representative (CSA), even though several projects targeted other industries. Likewise, the need for systems alignment may have been more apparent to CSA as an industry representative, with CSA knowing from the beginning that industry and workers benefit most when a region has mastered alignment among the three systems of workforce and economic development as well as education. Systems alignment provides the central focal point for the systems to coordinate collaborative strategy and resource planning.

While conducting a sector strategy was not the purpose of the Corridor Initiative, the Corridor Initiative’s success, based so much on its early and frequent engagement of key industry sectors and its call for systems alignment in support of workplace sector needs, lends credence to the cluster-driven, sector strategy model that the State of California has been attempting to implement through its “Industry Clusters of Opportunity” initiative.1

Because the very nature of innovation as defined above requires “putting into service or products” new ideas, technologies or applications, and this requires commercialization accomplished through companies within industries, there is much to be learned about building a regional innovation culture by engaging innovation-oriented industry participants. Thus, in a globally competitive environment, it is critically important for regional economies and ultimately the State and Federal policymakers to recognize the importance of creating regional economies that can be fostered and supported at the intersection of the public and private sectors.

**Industry Engagement**

Industry engagement became an asset in addressing the transformational goals of each of the three CIC WIRED pathways above, as well as a recommendation in many of the models and products produced.

Following are some examples of CIC project use of, findings relevant to, or recommendations regarding industry engagement. While only a sampling, these examples collectively should illustrate why this key success factor was identified as so important to fostering an innovation culture.

There is perhaps no better way to articulate the value of early engagement of industry than what was said in the *Innovation Driven Economic Development Model*. As it states on its page 32, under “Connect the Innovators”:

> (Innovation) Brokers should start at the source. The *drivers of innovation will primarily come from the private sector.*

Development activity for creation of the *Innovation Driven Economic Development Model (Model)* itself began with an Innovation Roundtable event summoning the best thinking of Silicon Valley innovators about the regional environment and culture necessary to support ongoing innovation. Review the insights expressed at the Innovation Roundtable Report by seeing page 75 or by visiting this link: (http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Roundtable%20Report.pdf)

Industry engagement was also a recommended *strategy* in The Model. The suggested “cluster of opportunity” mobilization process outlined in the Model “engages employers from the region’s driving industry clusters and gains their insight and commitment to strengthen a region’s asset base”. In terms of policy, this recommendation is drawn to align with the State Economic Strategy Panel’s regional cluster initiative, and also fits well with the State’s emerging sector strategy approach.

The development and implementation of the Model, this signature *Innovation Support* project, while it *began* with industry engagement, also *ended* with industry engagement. In Phase II, Los Angeles County’s South Bay Aerospace Consortium’s industry partners identified their top ten employment needs and both the Consortium and the Antelope Valley Board of Trade aerospace partners provided input to the development of strategic regional economic/workforce vision documents.

The new regional economic development mantra of “knowing what innovation/industry assets you have” necessitates industry engagement. In the Corridor’s Innovation Asset Mapping Inventory project, economic development (ED) project partners were asked to profile key innovation assets in their areas. While the categories of assets to identify was broader than industry, innovation-oriented companies, entrepreneurs and private-sector research and development centers comprised many of the profiles completed. The California Space Authority, as project lead on the Asset Mapping Inventory, with the technical assistance of the California Connectory, founder of the electronic platform on which the Inventory was placed, produced briefings and orientation materials emphasizing the importance of not only electronic outreach but ongoing, on-the-ground or on-the-phone engagement with companies to accurately assess the company’s capabilities, workforce needs, expansion or relocation plans, etc.

The Venture Communities element of the Corridor Initiative engaged industry entrepreneurs in addition to venture capitalist groups to exchange information, and better understand each other’s priorities. In a related effort, entrepreneurial training was provided to start-up or very young companies, with company progress and economic impact tracked; high-tech companies were recognized by the State in the California Tech 100 event. Industry was featured in the
production of a video celebrating California innovation and touting its benefits. (For more on the above, see Innovation Support, beginning on page 71)

The “21st Century Workforce Profiles” project engaged the biotech industry in interviews and engaged companies from numerous industries in a survey to characterize 21st Century employer and training needs. Its sister project, “Workforce Skills Analysis for 100 Key Entities” used workforce and economic development entities in seven California counties to engage nearly 200 companies in a workforce skills survey to identify critical position skills and future workforce gaps to lay the foundation for the design of strategies addressing worker needs of employers. (More information/comparisons of survey results on these two projects are available in Training, Education and Needs Assessing for the 21st Century Workforce, page 223)

Industry was significantly engaged in the “Joint University Innovation Model” in a variety of ways. University of California Riverside, in its investigation of how higher education could better meet the needs of the innovation employer community, made 23 industry site visits and analyzed 106 online survey responses. Stanford University and the California Space Authority employed industry subject matter experts in their innovation webinars.

The Industrial Rejuvenation/Supplier Competitiveness pathway of the Corridor Initiative began with industry engagement, as well. CSA convened a “Supply Chain Industry Advisory Group - SCIAG” to guide Projects 2.1 and 2.2, which were merged in year two. The Supplier Transformation project was one of the initial Sustainability Projects and the SCIAG remained an advisory group throughout Phase I and II of the Initiative. In addition, 288 supplier companies participated in the Supplier Transformation Survey, laying the groundwork for the development of the Smart Supplier Strategy. The Strategy included identification of the common learning outcomes required for 21st Century supplier competitiveness, development of a Supply Chain Management course as well as forums and workshops to address these outcomes. Industry played a role in all of the above. Industry representatives provided data and presentations on the characterization of the supply chain transformation and provided survey development feedback, as well as input informing the identification of common learning outcomes. Suppliers completed surveys helping to characterize the supply base and identify employment needs. Industry provided feedback to the drafts of the Supply Chain Management course, as well as panels, presentations and audience for the workshops and forums.

In the creation of coursework for dislocated workers seeking retraining through the Software Engineering for Aerospace and Defense Applications certificate, CSA helped the Silicon Valley (NOVA) WIB and the University of Santa Cruz Extension recruit members of the aerospace industry to offer training program development input, provide class presentations, and offer placement opportunities for approximately two dozen workers.
In the Employment Training Panel (ETP) Employer Outreach project, CSA solicited employers to participate with the state’s ETP program offering training funds for incumbent worker training to meet new skill needs. 364 incumbent workers completed training.

The Manufacturing Technician Certification program was created by El Camino College with the support of manufacturing associations and local industry representatives, with Northrop Grumman offering 29 positions for certified trainees. The two Mechatronics Degree programs and complementary certification programs of Allan Hancock College benefited from industry insights and priorities, as well.

CIC WIRED mentoring-related projects engaged industry members either as high school or university mentors, requirements advisors, or project advisors.

In southern California, Garvey Spacecraft, an actual space industry company, developed an experiential learning opportunity for California State University Long Beach engineering students by having the students work on development and testing of an actual company-produced rocket, offering them end-to-end training - development through analysis. In northern California, Stanford University students performed actual corporate satellite payload work to gain relevant real-world experience.

Asked in the partner final report to address “transforming education to better meet required 21st Century workplace skills”, Stanford University wrote:

_Giving students the opportunity to work on exciting hands-on projects and becoming exposed to the high tech space industry will 1) show students how exciting these high tech, higher paying jobs can be, 2) point out that they can qualify and are capable of learning the basics for these fields and 3) emphasize the importance of the basic skills they must learn_

Teacher professional development projects in the Corridor Initiative also utilized industry expertise in developing programs and offering equipment and/or sponsorships.

The Science, Technology, Engineering and Math Collaborative Action Plan (STEM CAP) project, a Corridor Sustainability Project, was conceived by CSA, an industry representative. It engaged industry members through appointees to the STEM CAP Steering Committee and STEM CAP Advisory Group, held breakout industry group meetings at one of its forums and hosted numerous industry focus groups as part of its development of the STEM CAP. Among the ten final STEM CAP recommendations were included two industry-related items showing that the desired industry engagement took hold:
- **Recommendation 9:** Create industry partnerships directly engaged with educators to deliver relevant, motivational and exciting instruction to reinforce and enhance STEM curriculum while setting the foundation for building a competitive and qualified workforce in tune with emerging work realities.

- **Recommendation 10:** Create hands-on internships and fellowships for students, teachers and faculty with employers in industry, academia, informal science networks and civic organizations.

The Plan’s “Actions”, which were mapped to the recommendations, included creating tax incentives for science and technology (S&T) companies offering science and math teachers summer research employment and to those loaning technical staff to schools for career-related and classroom support. Collaboration with S&T industries to identify future sector demand and STEM workforce projections was also a recommended action. The STEM CAP also featured an element entitled “Industry/Employer Role” (in STEM education). This section pointed out that industry/employers had three areas of support to offer: people, facilities and content.

The STEM Inventory engaged industry to profile its STEM programs online for STEM stakeholders to utilize; the STEM Community Pathway Guidebook developed in Phase II recommended inventorying industry and employer STEM programs to leverage creation of a community STEM continuum.

The WIB Learning Collaboratory project was led by the California Workforce Association (CWA), and a parallel and complementary Corridor effort was led by the California Council on Science and Technology (CCST) to develop a “WIB Toolkit” addressing the workforce role and needs of the innovation economy. Industry engagement was inherent in these projects, as the CWA and WIBs include industry participation on their boards and many of their advisory groups. But through the Corridor WIRED Initiative, industry engagement was enhanced.

The various products and deliverables of the Learning Collaboratory and the WIB Toolkit content were informed by CWA and CCST participation on the Corridor WIRED Leadership Team and Project Leads Forum, as well as their seats on CIC WIRED project steering or advisory committees and participation in the WIRED Partner Meetings, all of which engaged industry.

The first industry panel to be included in the CWA’s annual Meeting of the Minds (MMM) Conference in Monterey (conducted in coordination with the WIRED Learning Collaboratory project) was organized as part of the 2006 MMM Conference, with industry presenters included again in 2007.

Phase II of the Learning Collaboratory project coordinated a joint effort between the California Space Authority and the California Workforce Association whereby CSA oriented WIBs to employer needs/priorities, perspective and the CWA oriented employers to WIB roles, functions and services.
During the Learning Collaboratory project, CWA produced several monographs, with those following referencing industry engagement:

- **A Primer for Workforce Investment Boards** (in discussing the potential WIB role as a regional “convener”)

  *WIBs bring together business leaders to respond to local workforce needs…Convening businesses within key industry sectors to better understand the needs of the industry provides valuable information for organizations providing education and job readiness services*

- **Regional Strategies in Workforce Development** (on Regionalism)

  *Such vision for economic stability and social equity is a natural link to contemporary thinking in workforce development…The growth, particularly, of industry sector initiatives in workforce development, has borrowed freely from the goals of serving business and worker prosperity across regions.*

  One of the four models of regional workforce strategy featured in the monograph was “Sector Strategy”, where “collaboratives made up of employers within an industry sector partner with a broad range of economic development, workforce development and education organizations to address the talent needs of the industry”.

- **Workforce Investment Board and Community College Collaboration**

  In discussing appropriate ways in which WIBs and community colleges could collaborate, the CWA uses its “Competitive Workforce Advantage Framework”, featuring seven characteristics of a competitive workforce advantage. From the monograph:

  …the “end game” for our collaboration is to work towards building the skilled workforce that business needs, and build an infrastructure that supports this work.

  One of the seven characteristics described is “Business Investment in Human Capital” and advocates that WIBs engage with business and industry in the following ways:

  *WIBs can convene employers in the same industry to discuss skill needs; connect employees to public resources for skills upgrade training; act as a broker with community colleges/higher education and University Extensions for curriculum design; provide data about prevailing wages, occupations, future trends and act as human resource departments for*
small business. Community colleges can convene employers to understand current and future skill needs, and design both regular and credentialed classes, and contract education strategies with specific employers and industry associations.

- **How Workforce Investment Boards Connect To WIRED Projects**

On page 3 of the above monograph, the CWA writes:

…virtually all WIBs have adopted an industry sector approach, in which they analyze their local and regional labor market, and select key industries that are driving the economy, and the **work with employers in those industries to better understand their needs, and help find the solutions to needs.**

**Systems Alignment**

One of the principal challenges of creating a successful regional collaboration in support of an innovation culture and its job creators and workers is that of systems alignment among workforce and economic development and education. Some Corridor partners were already aware, prior to the WIRED Initiative, of the obstacles that stood in the way of aligning these systems. Other partners learned of these barriers as they undertook the projects described below which attempted a systems alignment approach.

There are several factors that make the alignment of workforce and economic development and education resources quite difficult:

1. Their funding streams come from different sources with differing mandates and requirements
   a. Local workforce system funds come primarily through state employment agencies from the U.S. Department of Labor and are aligned with the Workforce Investment Act requirements
   b. Economic development system funds are the most diverse, with local counties, cities and consortia all providing services across various jurisdictions through both public and private funding, often actually competing against each other for business attraction. In California, they compete for retailers whose retail sales taxes fund a community’s retail tax base, making it sometimes difficult to partner with a neighboring community interested in the same retailers.
   c. Education system K-12 funds come from the State, much of it from Federal funding often committed to mandated Federal programs, with hundreds of school districts in line for K-12 funding and 122 community colleges seeking State funds. University of California and California State University funding are also part of State
budgeting. Note also that local school district boards (K-12) and community college district boards are separate and have influence over property tax dollars used for education.

2. Systems have disparate goals and sometimes mandated metrics or regulations determining their priorities, with these priorities seldom addressing a demand-driven innovation workplace
   a. While new WIB roles are now emerging, traditionally, WIB services were focused on the perceived core mission (and government metrics) of supporting low-wage or dislocated workers and disadvantaged youth
   b. Economic development entities have focused their services on attracting, retaining and expanding businesses, serving as a link between business and government, often advocating business-friendly incentives
   c. K-12 education has now for several years under the “No Child Left Behind” legislation focused on test-focused instruction, with few learning/skill building opportunities for those not wanting to immediately pursue college; community colleges forced to accept anyone applying no matter the skill level, are finding their college preparatory and vocational objectives often being decelerated by competing priorities to build basic skills; universities are preparing more PhDs and liberal arts majors than are finding jobs, while STEM-related positions are going begging

3. Jurisdictional boundaries of the three systems are not aligned with the governance bodies which rarely support regional strategies that cannot be directly tied to local support for the local jurisdiction.

Building a regional collaborative in such an environment requires creativity and a willingness to value a regional economy perspective. Stakeholders from all three systems must recognize that the industries generating the jobs and regional prosperity through their investments in facilities, people, and business-to-business services do not recognize nor are they interested in government jurisdictions that do not map to any true flow of economic activity. This has been exacerbated by the global economy where services and products can be sourced from around the globe.

Since the alignment of systems behind Corridor WIRED Initiative objectives was a continual focus of the CIC Project Leads and partner meetings, there were numerous occasions for exploration of how systems could better align, including that in project practice, with the following as merely a sampling of where in the Initiative system alignment activity took place:

- In several projects or pathways, the economic development and workforce partners were asked to jointly pursue the project objectives, addressing the difficulties of aligning their perspectives and approaches “on the ground”, during the performance period
o In both the 21st Century Workforce Profiles and the Workforce Skills Analysis of projects, CSA requested ED and workforce partners from the same sub-regions jointly to agree on industry cluster targets, and jointly to develop, disseminate and analyze employer surveys, collaboratively reaching conclusions about industry worker and skill needs, forcing participants from disparate entities to work together, thus building relationships.

o In addressing the unique needs of the entrepreneur community as part of the entrepreneur orientation/training/tracking/venture opportunity-related project elements in Projects 1.1 and 1.4, ED and workforce partners were asked to align their thinking and come from a regional economy perspective.

o Systems alignment in the Supplier Transformation pathway was interesting, as it was the partners themselves representing the systems and integrating their research and development of their WIRED projects which shows the importance of systems alignment to Supplier Transformation. NOVA, the Silicon Valley Workforce Investment Board, represented the workforce system, assisting with the survey, providing a Supplier Resources Guide and a white paper for WIBs on the WIB role in supplier transformation. The economic development perspective was represented through the California Manufacturing Technology Consultants (CMTC), a U.S. Department of Commerce Manufacturing Excellence Program (MEP) as well as a WIRED partner. CMTC supported the supplier survey development and distribution, identified the common learning requirements for supplier competitiveness with support from CSA, and conducted a demonstration project proving the value of the findings of the Supplier Transformation project to an individual supplier. Antelope Valley College, which designed and analyzed the survey with the guidance of CSA and support of the other partners also developed the report with partner support, providing the characterization of the supplier community and its training needs. El Camino College, developed a Manufacturing Technician Certification program which trained and certified 29 students.

 In the Corridor’s "system-related" signature Sustainability Projects, Project Leads were encouraged to take a systems alignment approach to their models

o Systems alignment within the STEM CAP effort was ensured by all three systems being represented at the table. Like industry, workforce, education and economic development representatives were participants in the STEM CAP advisory bodies and forums which provided input to the final STEM CAP recommendations.
The Innovation Driven Economic Development Model recognizes the need for alignment of systems alignment without specifically mentioning the three primary “system” players (Model, page 19):

Regional innovation is the product of economic, social, environmental, and other place-based factors. It requires innovative companies, but also talent with education, skills and creativity, and livable communities that provide a quality environment, one that is attractive and supportive for people and commerce. It also requires effective regional governance, the ability of public and private entities to work together across boundaries to strengthen economic, social, and environmental assets that are the key to regional vitality and quality of life.

This statement from the Model was informed by the work of William F. Miller of Stanford University. In the following quote from his Regionalism, Globalism, and the New Economic Geography, cited on page 18 of the Model, Miller discusses the “regional habitats” of innovation driven economic development:

…What is effective are “people and place” policies. What does not diffuse away quickly are infrastructure and workforce. Although a few key people may be mobile, large numbers of the workforce are not mobile. Policies that support the education and training of the workforce, that support research combined with education, that support a modern infrastructure, and support the development of institutions that facilitate collaboration between business, government and the independent sector will have lasting effects of building capacity that does not diffuse away. Develop the people and places – the habitat for living and working.

The Learning Collaboratory’s final monograph How Workforce Investment Boards Connect to Wired Projects lists five strategies intended to allow WIBs to continue moving to a talent development system by capitalizing on the work done through the Corridor WIRED Initiative

- Develop Strategy Design Using the 5 Roles of the WIBs
- Collaborate with Economic Development
- Collaborate with Education
- Know Everything About Your Labor Market and Supply and Demand
- Cultivate Networks
Model Practices

The utilization of model practices or actual proven models is included as an important innovation enabler because it has the potential to accelerate the creation of a regional innovation ecosystem.

The California Innovation Corridor WIRED Initiative produced hundreds of deliverables. Many of these featured model or promising practices or described actual recommended models for replication.

What follows will be a brief description only of the models derived from the Sustainability Projects identified early on in the Corridor Initiative simply to show the breadth and scope of the model practices developed by the Corridor partners.

The resource bank for all Corridor deliverables, including those featuring model practices, is itself a model. It is the website created to highlight the work of the partners and collaborators of the California Innovation Corridor WIRED Initiative. InnovateCalifornia.net features descriptions of the 25 CIC WIRED projects, partner profiles, model practices and some (unfortunately not all!) the Corridor WIRED success stories and finally, the Corridor deliverables. Please visit: (www.InnovateCalifornia.net)

The Innovation Driven Economic Development Model

A key part of the Corridor WIRED Initiative was to help economic development entities (EDOs) understand the benefits of moving to a 21st Century innovation economy approach and offer EDOs a blueprint to follow in getting there. The Innovation Driven Economic Development Model, features in Part I the “Changing Nature of Innovation and Its Implications for Economic Development”. Part II is entitled: “The Innovation Driven Economic Development Model and the Regional Innovation Broker”. The Model can be accessed by visiting:

http://www.innovatecalifornia.net/WIREDdeliverables/Innovation%20Driven%20Economic%20Development.pdf

“Economic growth – meaning a rising standard of living for the majority of citizens – more often than not fosters greater opportunity, tolerance of diversity, social mobility, commitment to fairness, and dedication to democracy.”*

*The Moral Consequences of Economic Growth, Benjamin M. Friedman, as cited in The Innovation Driven Economic Development Model, page 9
“Without an Innovation Economy, Other Community Outcomes Are Difficult to Achieve” is the title of an opening section of the Model (page 9) which explores the importance of an innovation economy.

According to the Model, “it is not possible to sustain regional vitality and quality of life over the long term without an innovative economy…”

It is important to note that innovation does not reside in one industry, company or organization, (as pointed out in the Model and shown as Figure 2 on page 84 of this document:

![Table of Open vs. Closed Innovation Logic](image)

Guidance is provided EDOs and regions on transforming the economic development focus from the “expectations and metrics of a cost-driven economic development model” to a regional, innovation driven focus (See page 21 of the Model).

<table>
<thead>
<tr>
<th>Key Characteristics</th>
<th>Cost Driven Economic Development Model</th>
<th>Regional Innovation Driven Economic Development Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Domestic competition Zero sum game</td>
<td>Global competition and collaboration Positive sum game</td>
</tr>
<tr>
<td>Logic</td>
<td>More inputs (land, labor, capital) create more output</td>
<td>More efficient and innovative use of higher-value inputs (physical, human, knowledge resources) creates more profitable output</td>
</tr>
<tr>
<td></td>
<td>The lower the costs of inputs, the higher the profitability of outputs</td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td>Growth of jobs</td>
<td>Increasing productivity and per capita income</td>
</tr>
<tr>
<td>Approach</td>
<td>Incentives to attract or retain cost-driven firms and industries</td>
<td>Investments in talent and infrastructure to support innovation-driven clusters</td>
</tr>
<tr>
<td>Role of economic development practitioners</td>
<td>Lead industry attraction and marketing efforts to firms and industries</td>
<td>Broker innovation networks, connecting inventors, financiers, and transformers, to produce results</td>
</tr>
<tr>
<td>Performance metrics</td>
<td>Quantity of jobs, number of firms attracted/retained</td>
<td>Quality jobs, wage and income growth, innovation (e.g., patents, commercialization, start-ups, etc.)</td>
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</table>

Since the “Desired State” for creating an innovation ecosystem in the Corridor (see above page 60) involves “**purposeful support** for innovation,” the Model outlines six steps to do so (see page 309), with these steps forming a model practice appropriate for economic development entities or other innovation stakeholders wishing to step up to serve as “Brokers” for a regional innovation strategy.
By giving economic development practitioners a “way forward” in approaching innovation support, the *Innovation Driven Economic Development Model: A Practical Guide for the Regional Innovation Broker* and its accompanying tools, provide a customizable template for regions seeking economic vitality.

This model was field tested and validated as effective in Phase II of the Corridor WIRED project, in which two areas of the Corridor (Los Angeles County’s South Bay and Antelope Valley) implemented the model. Through the South Bay Aerospace Consortium and the expanded Antelope Valley Board of Trade, industry was engaged, systems were aligned and a long-term collaborative strategy to support the aerospace sector was developed for each geographical sub-region. Effectiveness of the *Innovation Driven Economic Development Model* in guiding the collaboration process was applauded by both sub-regional constituencies.

**The Innovation Asset Mapping Inventory**

The Innovation Asset Mapping Inventory is a model practice meant to address the need for a region to identify and understand its innovation assets. Leveraging over $3 million of previous investment in platform infrastructure in *The California Connectory*, the California Innovation Corridor created an online, capabilities-based, searchable inventory of key innovation assets in the Corridor. Assets identification was expanded in this model practice to include not only innovation-oriented companies, but also corporate research and development centers,
federal laboratories, military installations and university research centers. Asset profiles can include not only capabilities, but special facilities, personnel, equipment, patents or official designations (e.g. Veteran or Minority-owned business). Providing visibility and expanding partnering for small business, the California Innovation Corridor Innovation Asset Mapping Inventory is aligned with the Model’s statement that “Assets are critical building blocks for regional innovation”, and also the Model’s recommendation that innovation brokers need to do a new kind of assessment, including asset inventorying that includes “R&D/Technology” (see Model, page 28.)

This Asset Mapping model practice offers another advantage to workforce and education stakeholders.

- The Learning Collaboratory’s final monograph *How Workforce Investment Boards Connect to Wired Projects* lists five strategies intended to allow WIBs to continue moving to a talent development system by capitalizing on the work done through the Corridor WIRED Initiative. One of those cites the critical need to understand your region’s companies and workforce opportunities, which directly aligns with the Asset Mapping project’s capabilities-based asset inventory.

  - Develop Strategy Design Using the 5 Roles of the WIBs
  - Collaborate with Economic Development
  - Collaborate with Education
  - **Know Everything About Your Labor Market and Supply and Demand**
  - Cultivate Networks


**The Science, Technology, Engineering and Math Collaborative Action Plan**

While industry has recognized the need for more science, technology, engineering and math (STEM) technicians and professionals for over a decade, the education system had not really recognized the issue until the publication of the *Rising Above the Gathering Storm* report of the National Academies. Even
then, it was really only California’s two university systems which responded. While California’s two university systems were collaborating on a math and science teacher initiative, CSA was told that the STEM Collaborative Action Plan (STEM CAP) effort led by the California Space Education and Workforce Institute (Institute) was the first attempt to bring all four California education systems – University of California, California State University, California Community College and K-12 – together in support of STEM enhancement. While California education funding is problematic in light of the state’s budget woes, many of the recommendations in the STEM CAP can be pursued regionally and there is now support from the Gates and Bechtel Foundations for a statewide initiative to continue the STEM network and effort begun in the STEM CAP development process.

The STEM Collaborative Action Plan (High Stakes: STEM Education, The Essential Ingredient for California Competitiveness, http://www.innovatecalifornia.net/WIREDdeliverables/STEMCAPDOC.pdf, developed by the Institute with the support of the Alliance for Regional Collaborations to Heighten Educational Success (ARCHES) includes 10 recommendations and accompanying actions for all four California education systems, as well as industry and informal science involvement. It utilizes NASA’s Strategic Education Framework (see left) as an organizing principle. It was developed with over 400 participating STEM stakeholders. Executive-level representatives from California’s four education systems, teachers, education policymakers and program personnel, industry, government STEM employers, California Science Teachers Association, California Math Council, and informal science representatives all participated either as Steering Committee members

<table>
<thead>
<tr>
<th>STEM CAP Methodology*</th>
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<tbody>
<tr>
<td>▪ A broad-based coalition comprised of industry, informal science, K-12 education, community colleges, colleges and universities (public and private), education policymakers</td>
</tr>
<tr>
<td>▪ Regional field tests</td>
</tr>
<tr>
<td>▪ An in-depth inquiry</td>
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<tr>
<td>▪ Forum and focus group analysis</td>
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*From High Stakes: STEM Education, The Essential Ingredient for California Competitiveness, Nov 2008
or forum participants, with the STEM CAP Advisory Group organizing targeted focus groups with associations of school boards, principals, superintendents, industry associations and informal science stakeholder groups.

The STEM Inventory, developed to complement the STEM CAP, is California’s first private/public STEM inventory of programs (www.StemInventory.net).

The STEM CAP, the STEM Inventory, as well as the white paper on STEM teacher professional development through the California State University system are all worthwhile models for other regions to consider.

**The Smart Supplier Strategy**

The supplier transformation enabling success in the 21st Century networked, global environment requires understanding of the new supply chain network in which suppliers must operate. The four-module, two day “Smart Supplier” course, highlights of which are shown below, incorporate the common learning outcomes identified in the supplier project (learning outcomes are shown as sub-heads in the Modules below).

<table>
<thead>
<tr>
<th>Module 1</th>
<th>Module 2</th>
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<tbody>
<tr>
<td><strong>Principles of Supply Chain Management</strong>&lt;br&gt;Introduce the concept of global supply chain operations and the fundamentals of managing the supply chain</td>
<td><strong>Introduction to Supply Chain Relationships</strong>&lt;br&gt;Understand supply chains across functional and organizational boundaries and the contribution of strategic alignment of the supply chain.</td>
</tr>
<tr>
<td>■ Strategic Framework of Supply Chain Management&lt;br&gt;■ Evolution of Supply Chain&lt;br&gt;■ System Engineering to Aerospace&lt;br&gt;■ Supply Chain&lt;br&gt;■ Business Models of Supply Chain</td>
<td>■ Network Structure of Supply Chain&lt;br&gt;■ Supply Chain Integration&lt;br&gt;■ Coordination in a Supply Chain</td>
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<tr>
<th>Module 3</th>
<th>Module 4</th>
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<tbody>
<tr>
<td><strong>Principles of Procurement &amp; Sourcing Management</strong>&lt;br&gt;Introduce the importance of international procurement and sourcing management to an organization</td>
<td><strong>Introduction to Law and Regulation of Business</strong>&lt;br&gt;Understand the key areas of law and regulations as they apply to aerospace daily operations and logistics management.</td>
</tr>
<tr>
<td>■ Outsourcing, Make or Buy Decision&lt;br&gt;■ Procurement Strategies&lt;br&gt;■ Project Management</td>
<td>■ Quality and Compliance Management Systems&lt;br&gt;■ International Trade&lt;br&gt;■ Domestic and International Regulatory Requirements</td>
</tr>
</tbody>
</table>
The “Principles of Supply Chain Management” forming the basis for foundational supplier transformation training was another key Project 2.2 model:

**Principles of Supply Chain Management**
- I.1. What is Supply Chain versus Logistics Management?
- I.1.1. Definition
- I.1.2. Business Objective
- I.1.3. Scope of Responsibilities
- I.2. Evolution of Supply Chain Management
  (how the discipline started and where it is headed)
- I.3. System Engineering to Aerospace Supply Chain
  (DNA of business and enterprise supply chains)
- I.4. Supply Chain Business Models
  - I.4.1. Continuous Replenishment Supply Chains
  (where relationships matter most)
  - I.4.2. Lean Supply Chains
  (Focusing on efficiency and lowest cost-to-serve)
  - I.4.3. Agile Supply Chains
  (where quick response is paramount)
  - I.4.4. Fully Flexible Supply Chains
  (where nothing is impossible)

**Introduction to Supply Chain Relationships**
- II.1. Network structure of Supply Chain
  (vertical collaboration)
- II.1.1. Vertical Collaboration
- II.1.2. Horizontal Collaboration
- II.1.3. Upstream Partnership
- II.1.4. Downstream Partnership
- II.2. Supply Chain Integration
- II.2.1. Push-Based Supply Chain
- II.2.2. Pull-Based Supply Chain
- II.2.3. Push-Pull Supply Chain
- II.3. Coordination in Supply Chain
- II.3.1. 3rd Party Logistics Partnership
- II.3.2. 4th Party Logistics Partnership
- II.3.3. Lead Logistics Partnership (LLP)

**Principles of Procurement and Sourcing Management**
- III.1. Outsource, Make or Buy Decision
  - III.1.1. Decision Making Process
  - III.1.2. Risk and Benefits Analysis
  - III.1.3. Differential Analysis
  - III.1.4. Break-even Analysis
- III.2. Procurement Strategies
  - III.2.1. Kraljic’s Supply Matrix
  - III.2.2. E-Procurement
  - III.2.3. RFI / RFP / RFQ
- III.3. Project Management
  - III.3.1. Project Life Cycles
  - III.3.2. Supply Chain Projects
  - III.3.3. Project Process Groups
  - III.3.4. Project Management Techniques

**Introduction to Law and Regulation of Business**
- IV.1. Quality and Compliance Management Systems
  - IV.1.2. Ethical & Social Responsibility
  - IV.1.3. Mission Assurance
- IV.2. International Trade
  - IV.2.1. Supply Contracts for Aerospace Industry
  - IV.2.2. Trade Risks & Incoterms
  - IV.2.3. Trade & Customs Issues across the Global Supply Chain
- IV.3. Domestic and International Regulatory Requirements
  - IV.3.1. Uniform Commercial Code
  - IV.3.2. Antitrust and Trade Regulation
  - IV.3.3. Regulation of U.S. federal procurement
  - IV.3.4. Regulation of International Commerce

**The Simulation Game**
- V.1. Introducing the Role-Play Game
  - V.1.1. Background
  - V.1.2. Rules of the Game
  - V.1.3. Steps of the Game
- V.2. Post-game Discussion
- V.2.1. Results of the Game
- V.2.2. Experience
- V.2.3. Human Behavior
The models developed under the Supplier Transformation project also included the NOVA whitepaper on WIB roles in supply chain transformation, and the curriculum for the Manufacturing Technician Certification.

Phase II of the project produced a supplier company and a supply chain worker self-assessment and converted the SCM course to an online format to enhance supplier accessibility. The models developed as part of the Smart Supplier Strategy could help regions make great strides in retaining California and U.S. supplier competitiveness.

**The Workforce Investment Board (WIB) Learning Collaboratory and the WIB Toolkit**

The Workforce Investment Board (WIB) Learning Collaboratory was a Sustainability Project identified in the original California Innovation Corridor Project Integration Protocol developed by the Corridor Leadership Team. Developing WIB talent through the Learning Collaboratory was seen as a critical piece in developing Corridor/California talent for the jobs of the 21st Century economy.

Led by the California Workforce Association, a nonprofit which represents California WIBs, the purpose of the Project 3.14 (WIB) Learning Collaboratory as described in the CWA final report, was to “establish a learning community, called here the Learning Collaboratory, among California’s Workforce Investment Boards, sharing and building upon the innovations developed by and among the partners of the California Innovation Corridor and from WIB best practices statewide.”

Project 1.7, the “WIB Toolkit” (*Racing for the Future*), developed by the California Council on Science and Technology (CCST) in cooperation with CWA and the California Space Education and Workforce Institute, became the repository for much of the research done as part of the Learning Collaboratory effort, as well as a model in its own right. Part of the Learning Collaboratory work was to begin using the WIB Toolkit (*Racing for the Future*) as a foundation for both WIB strategic planning and community workforce system overviews.
Other regions could learn from the five potential roles appropriate for WIBs to play in the new economy: Convener, Workforce Analyst, Broker, Community Voice or Capacity Builder.

Part of the model practice developed by the Learning Collaboratory was to infuse its ongoing conferences, board meetings, workshops, initiatives and presentations with key messages drawn from the WIRED Initiative – messages about innovation, systems alignment, STEM, Supplier Competitiveness, etc.

In addition, the Learning Collaboratory practice developed monographs around topics complementary to building an innovation workforce, with WIRED participating WIBs contributing additional white papers, all of which became content for WIB development through the Learning Collaboratory. Samples:

- Regional Strategies in Workforce Development
- Workforce and Economic Development in California: A Primer for WIBs
- Y Math & Science? Stories from Young People: A Monograph for Youth Providers
- Workforce Investment Boards and Community College Collaboration
- Innovating Workforce Development by Supporting Business Innovation: Case Studies from California
- The Role of the Workforce Investment Board in Supply Chain Transformation

**Key Enablers Foster Innovation and Workforce Competitiveness**

In the 21st Century, regions that can identify resources and collaboratively create programs effectively addressing the workforce needs of key industry clusters in an innovation-based economy will generate the greatest success.

Engaging industry to better understand a region’s key workforce assets and leverage the insights of business owners, executives and other employers is a first, interim, and final step in the development of a regional innovation economy. Industry can assist in assessing needs and analyzing possible solutions in the beginning, provide expertise, facility or funding resources and development feedback in the interim and help evaluate results and re-design after implementation.

Regions and states with strong state leadership and an understanding of the value of economic and workforce development and their potential effective interfaces with education will have greater success in pulling collaborations together to help align systems behind a common innovation-support focus. This focus will be the support of high-tech innovation-oriented industries identified through data trend analysis to have measurable growth opportunities or large numbers of high-wage jobs that justify an investment of resources.
Finally, development or selection of model practices can ensure replication, accelerate implementation and provide confidence to funders that their investments will provide a worthy result.

The California Innovation Corridor welcomes your review of the many projects, activities and deliverables that led to the conclusions above: www.InnovateCalifornia.net.
Appendices

Appendix A: Partner Final Report Q8, Local/Regional Relationships Built

Appendix B: Partner Final Report Q9, State/National Consortia Engaged

Appendix C: Partner Final Report Q10, Major WIRED-Related Presentations

Appendix D: Partner Final Report Q11, Reports/Studies/White Papers/Surveys

Appendix E: Partner Final Report Q13, Websites/Videos/Databases