

BUILDING A MARITIME TECHNOLOGY CLUSTER AT THE SAN PEDRO BAY PORTS

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Introduction

The San Pedro Bay ports, which comprise the Ports of Los Angeles and Long Beach, are the largest port complex in the United States. In 2007, they handled approximately 16 million twenty-foot equivalent unit containers (TEUs). This cargo volume is expected to climb to 43 million TEUs by 2030.

With this growth come impacts and constraints in air quality, security, throughput capacity, power generation capability, and other issues. These problems can be viewed as opportunities, given that, in many cases, they require technological solutions.

This paper addresses the potential for creation of an internationally recognized technology cluster at and around the Ports of Los Angeles and Long Beach. The paper documents the evolution of this San Pedro Bay technology program to date and identifies its planned initiatives and their potential. The paper concludes with an action plan for further development of the San Pedro Bay maritime technology cluster. The program can be used as a case study for development of similar initiatives in other port cities.

The methodology for creation of this cluster was developed in Pasadena, California, by author William F. Lyte, now with Kennedy/Jenks Consultants.

The methodology involves the linkage of public and private institutions, private entrepreneurs, and other stakeholders to identify, commercialize, and use new technologies for economic growth. In Pasadena, the end result of this project has been the formation of more than 200 new technology companies, the investment of \$100 million of angel and venture capital in these companies, and the construction of new technology facilities. The program has expanded to several surrounding cities, including Monrovia (major new technology center), Duarte (City of Hope biomedical technology cluster), and Claremont (Claremont Colleges; Keck Graduate Institute).

This technical paper is divided into the following sections:

- San Pedro Bay Port Growth – Present and Future
- Port Requirements for Technology in Operations
- Growing the San Pedro Bay Technology Cluster
- The Clean Air Action Plan – Catalyst for Green Technology Use and Development
- Building an Infrastructure to Support Technology Growth
- San Pedro Bay Technology Cluster – Action Plan

San Pedro Bay Port Growth – Present and Future

The San Pedro Bay ports, or Ports of Los Angeles and Long Beach, have successfully operated for more than 100 years. Though they function as divisions of their respective city governments, the two ports are semi-autonomous. They generate significant revenues, which are reinvested in port projects.

The two ports collectively have become the largest port complex in the United States. One acknowledged measure of port throughput is the number of “TEUs” a port handles. A TEU is a “twenty-foot-equivalent unit” container, which is the metal shipping box in which cargo is shipped. Many containers are now 40 feet, which equals two TEUs.

In the early 1980s, when containers were just becoming an international standard of cargo operation, the two ports handled approximately 2 million TEUs. By 1990, this number had reached about 3.5 million. In 2007, with the enormous expansion of cargo from Asia, the two ports now handle a throughput of 16+ million TEUs. It is projected that by 2030, they will handle a capacity of 43 million TEUs.

The San Pedro Bay ports will experience this growth because of several factors:

- They have deep harbors that can accommodate the largest ships being built, unlike most other U.S. ports.
- The Los Angeles area has large markets and warehousing and intercontinental transportation systems to accommodate the flow of cargo.
- Many of the widest ships cannot use the Panama Canal – although a multi-billion dollar canal widening program is underway – so even cargo destined for the East Coast lands on the West Coast, for rail transfer across the U.S.

Efforts are underway by other U.S., Canadian and Mexican ports to divert this cargo, of course. But even after all anticipated diversion is accounted for, the San Pedro Bay ports will have significant growth over the coming years.

To accommodate this growth, the Southern California port and intermodal system (railroads and trucks) will require significant capacity upgrades, totaling nearly \$17 billion, according to the 2007 CALMITSAC goods movement system report to the California Legislature.

Port Requirements for Technology in Operations

The San Pedro Bay ports traditionally have been low-technology operations, unlike their counterparts internationally. Major ports in Asia and Europe are highly automated, with much higher throughput per acre than those in the U.S. This disparity has begun to change, however, creating opportunity to technology providers. An overview of trends in the industry is provided here and selectively discussed in more detail in the following sections.

Security Technology. The September 11, 2001 attacks on the U.S. triggered tremendous focus on the vulnerability of U.S. ports to terrorist attacks. The San Pedro Bay ports were at the top of the priority list because of their volume. The port leadership had to rapidly assess, purchase, and install systems to secure the port perimeters, scan cargo for radioactive, biological, and chemical weapons, perform employee and contractor background checks, and interface with business and government information systems worldwide. Major technology providers from the security,

engineering, aerospace, and telecommunications fields converged on the ports to present their systems and approaches.

The ports formalized relationships with the federal research laboratories to gain its assessments of these technologies and recommendations for the best ones. Among the security technologies now being implemented is the Transportation Worker Identification Card, or TWIC. Other security measures are systems integrated into containers to track cargoes, and their status around the world beginning from their point of origin.

On-Dock Information Systems. Until the early 2000s, many of the cargo transactions handled at the ports were processed by staff using a paper system. Then, as the result of labor negotiations after the crippling port labor disruption of 2004 (which cost the U.S. economy \$5 billion in ten days) the port terminals were computerized. Now, cargoes move much more rapidly through the ports, tracked with radio frequency identification device (RFID) systems. This automation also helps to improve truck throughput, as cargoes can be located more rapidly and readied for pickup. These RFID-based cargo management systems are now in use nationally throughout the goods movement system, tracking cargoes from Asia into the distribution warehouses and beyond.

Goods Movement Transportation Systems. Cargo is moved through the ports by truck transport directly to the end users, by truck haul to Los Angeles area rail yards or to Inland Empire distribution warehouses, or by on-dock rail to destinations out of region. All of these systems rely on petroleum fuels and generate considerable pollution; therefore, the ports and goods movement community have investigated a range of systems to streamline goods movement and to carry it out in a cleaner fashion.

These systems collectively are known as Intelligent Transportation Systems, or ITS. According to the U.S. Department of Transportation's research division www.its.gov, "ITS encompasses a broad range of wireless and wire line communications-based information and electronics technologies." These include transponder tags to track cargo containers, and for drayage operations, to implement automated systems and robotics to optimize limited dock and port space.

Beyond ITS, considerable research is underway on new systems to actually move cargo on magnetic levitation devices, and on other systems running on electricity instead of petroleum-fueled products. The San Pedro Bay ports will be at the leading edge of applying this range of systems to its daily operations and transportation of cargoes from the ports throughout Southern California.

Environmental Controls and Systems. The greatest challenges to the San Pedro Bay ports are air pollution and the effects of goods movement operation on global warming. Consequently, a massive effort is underway to reinvent how these ports operate that will become a cornerstone of technological innovation in Southern California. This topic is discussed in great detail under the Clean Air Action Plan section of this paper, with website references. The environmental controls programs being implemented in the San Pedro Bay are being emulated at ports around the United States and internationally, and the technologies used in the San Pedro Bay will likely become the standard nationally and internationally.

Energy Systems. With the focus on pollution control, fuel efficiency, and reduction of an operation's CO₂ "footprint," new types of energy generation are being rapidly explored. Liquefied natural gas, or LNG, is viewed as a clean-burning fuel for many port equipment

applications. In addition, there is great interest in ensuring that power provided to high-electrical-use operations is generated with wind, solar, or other “green” systems.

Collectively, the ports’ need for this range of technologies creates a fertile arena for suppliers of such systems.

Growing the San Pedro Bay Technology Cluster

Pasadena’s Gold Line Technology Corridor Program. Discussion of a new technology cluster at the San Pedro Bay ports benefits from a look at a similar initiative, the Gold Line Technology Corridor program. Launched in 1991 by this paper’s author, this program ultimately involved many public and private sector participants. It originally was conceived as a collaboration among the City of Pasadena, California Institute of Technology, Jet Propulsion Laboratory, and Pasadena’s engineering industry with the objective of commercializing environmental technology.

Ultimately, the Gold Line program became a multi-city technology complex, anchored by a \$600 million light rail line, multiple universities, and a County of Los Angeles technology incubator, the Business Technology Center (www.labtc.org). More than 200 companies have been commercialized, including 100+ from Caltech alone. Substantial venture and angel capital resources have been developed, new facilities have been built for the technology firms, and a promotional program, Los Angeles County Technology Week www.latechweek.com, was created to showcase the initiative. Legal, accounting, real estate, and other service firms are involved in the program, which is now being used internationally as a template for technology cluster development.

Many of the individuals involved in establishment of the Gold Line program are now helping to grow the technology cluster at the San Pedro Bay ports. A number of them reviewed this technical paper, and are acknowledged herein.

Existing San Pedro Port Technology Activities and their Potential. To help grow a technology cluster, one must identify existing resources and channel them into productive technology initiatives. Over the past eight years, the two parts have collaborated on technology initiatives (discussed below in “South Bay Port Area Goods Movement Technology Programs”). Yet there also has been a traditional separation of the resources between the two ports (and their respective communities), Port of Long Beach (Long Beach) and Port of Los Angeles (San Pedro/Wilmington). The present and future evolution of these separate ports/communities as technology centers is discussed in the section titled “Building an Infrastructure to Support Technology Growth.”

All indications point to the ultimate collaboration of the two ports and their communities in a master technology initiative, such as the facts that they have complementary resources and are working together on shared technology initiatives. The final section of this technical paper, the action plan, addresses the technological synergy among the ports and their communities and how to advance it.

South Bay Port Area, Goods Movement Technology Programs. Technological collaboration among the Ports of Long Beach and Los Angeles and research and business organizations are changing the way goods movement is planned and implemented. The programs described below are laying the groundwork for robust collaboration and technological evolution.

- **Applied Goods Movement Programs**

- **PierPass** (www.pierpass.org). PierPass is a not-for-profit organization created by marine terminal operators to reduce congestion and improve air quality in and around the Ports of Los Angeles and Long Beach. OffPeak is the off-peak hours program created by PierPass. OffPeak provides an incentive for cargo owners to move cargo at night and on weekends, in order to reduce truck traffic and pollution during peak daytime traffic hours and to alleviate port congestion. After it was implemented in 2005, the results were immediate. In its first two weeks of operation, more than 80,000 trucks were diverted to off-peak hours. This helped reduce congestion on the I-710 Freeway, the principal transportation artery to the ports.
- **Virtual Container Yards** (www.emodal.com). Virtual container yards are being jointly planned by the ports and the goods movement industry. Traditionally, as a customer service amenity, many shipping lines keep duplicative supplies of containers and the trailers on which they are loaded, which generally are stored on valuable land near the ports. With efficient scheduling, multiple shipping organizations can share these containers and trailers. This will improve port area land use and reduce highway congestion.
- **Gateway Cities Technology Programs.** In the early 2000s, staff of both ports as well as the Gateway Cities organization <http://www.gatewaycog.org>, which represents the port-area cities of the South Bay, led a federally funded program showcasing emerging Intelligent Transportation Systems (ITS) for improvement of freight congestion. This program has since evolved into an expanded technological focus by the Gateway Cities organization, which has received funding for development of truck emissions-reduction technology.

The organization also has a well-funded truck replacement program, through which older, highly polluting trucks are taken off the roads. The Clean Air Program consists of three elements. The first element, Fleet Modernization, is managed by the Gateway Cities Council of Governments. More than 75% of its funding to date has been provided by the Port of Los Angeles, which seeks to modernize the truck fleet that frequently calls at POLA terminals. The second element is a pilot program that Gateway Cities is conducting on behalf of the San Pedro Bay Ports to install emission-reduction devices on port trucks. The third program element focuses on cleaner off-road vehicles and is managed by the Port of Long Beach.

- **California Marine and Intermodal Transportation System Advisory Council (CALMITSAC).** A statewide public-private goods movement organization, the California Marine and Intermodal Transportation System Advisory Council (CALMITSAC), with strong ties to the Southern California ports, established the first statewide maritime technology committee to support the growth of this sector. This was discussed in detail in its 2006 and 2007 “Reports to the California Legislature on the Status of Goods Movement in California.” CALMITSAC has now joined the UCSB research team discussed below

under Transportation Research and Development to participate in the analysis of new technologies to optimize goods movement. With its statewide reach, this council will become the clearinghouse for information on the newest transportation technologies. CALMITSAC also is discussing within its board membership and political constituency the application of the San Pedro Ports technology cluster methodology for development of a maritime technology incubator at the California Maritime Academy at Vallejo.

- **Transportation Research and Development**

- **National Consortium on Remote Sensing in Transportation.** In the late 1990s, staff from both Ports participated in a federal research project, the National Consortium on Remote Sensing in Transportation (www.ncrst.org). This project involved 14 universities and four federal laboratories, including NASA Jet Propulsion Laboratory and the CSU Long Beach Geography Department. It applied advanced remote-sensing tools to analyze goods movement corridors – specifically, truck connectors – to the \$2.5 Alameda Corridor. In 2006, Phase II of the NCRST program (www.metris.dgrc.us) received federal funding for development of truck-tracking technologies. This program is led by the UC Santa Barbara Department of Geography.

Center for Commercialization and Deployment of Transportation Technologies. At California State University Long Beach, the Center for Commercialization and Deployment of Transportation Technologies (CCDOTT), www.ccdott.org, is well underway in investigation of systems and technologies for goods movement. Funded by the U.S. Departments of Transportation and Defense, CCDOTT developed a range of technologies for optimization of port functions. Most recently, their magnetic levitation system for container transport has received considerable interest from both ports, which are jointly studying the use of innovative technologies for goods movement.

- **USC Center for Sustainable Cities – The Sustainable Enterprise Executive Roundtable (SEER).** SEER enables collaborative learning among Southern California business leaders, benefiting the environment and the bottom line through the implementation of projects that promote sustainable development. Projects include (1) creating strategies for reducing the ecological footprint of a cargo container and simplifying/greening supply chains, and (2) experiments with customer recognition programs, which aim to allow SEER participants to design and implement experiments in partnership with the Port of Los Angeles that are aimed at helping that port meet its Clean Air Action Plan (CAAP) deliverables while offering learning on new technologies.

The Clean Air Action Plan – Catalyst for Green Technology Use and Development

Since the early 2000s, the two ports have undergone a “sea change” in the way they address environmental issues, particularly the issue of diesel emissions from trucks, ships, and trains and their health effects on the community.

In 2006, a first-of-its-kind business alliance between the Ports of Los Angeles and Long Beach led to the passage of CAAP (www.cleanairactionplan.org). This plan’s objectives are to reduce the air emissions from port operations to much lower levels, while allowing a tripling of cargo through the ports. The costs of the program, estimated to be \$2 billion or more, will be paid partly by the Ports themselves, a portion by port tenants during expansion or remodeling programs, and the remainder by proceeds of California bonds and other sources to be determined. The

program includes retrofit of nearly every type of operational system to reduce air emissions. In addition, both ports will be providing land-based electrical hookups to ships in port (alternative maritime power, or AMP), to allow ships to shut off their polluting engines in port. Ships are now required to reduce speeds when approaching the ports and to switch to less-polluting fuels.

CAAP Technology Advancement Program (TAP). Of particular relevance to the goal of building a maritime technology cluster at San Pedro Bay is the ports' joint "Technology Advancement Program," or TAP. The TAP is jointly funded by each port at \$1.5 million per year over five years. The intent of the TAP is to identify, and assist in the regulatory permitting of, innovative technologies that may advance the Clean Air Action Plan. On the board of the TAP are representatives from both ports, the South Coast Air Quality Management District (SCAQMD), the California Air Resources Board (CARB), and the U.S. Environmental Protection Agency (USEPA).

Current TAP programs include:

- **Ocean-going Vessels, APL Singapore Vessel Retrofit.** This project is assessing the use of emulsified fuel for main and auxiliary engines and fuel-efficient slide valve technology for reduction of oxides of nitrogen and particulate matter.
- **Harbor Craft, Foss Maritime Diesel/Electric Tug.** This project is exploring the first-time use of hybrid technology in a tugboat and downsized diesel engines for emissions reductions.
- **Cargo Handling Equipment, LNG Yard Hostler.** This project involves the first-time use of LNG in cargo handling equipment. The systems would be used in both ports' terminals.
- **Cargo Handling Equipment, Hybrid Yard Hostler.** The project is a hybrid yard hostler project developed by the Port of Long Beach, in conjunction with the EPA, Kalmar, Long Beach Container Terminal, and Calstart. It will develop and demonstrate performance of hybrid technology in yard hostler application.
- **Cargo Handling Equipment, Vycon REGEN System.** This project is a flywheel energy storage system, installed on rubber-tired gantry cranes (RTGs). It is currently undergoing CARB verification.
- **Locomotives, Pacific Harbor Line Locomotive Retrofit.** This project entails the first-time U.S. use of Tier 2 switch locomotive engines and retrofit with MobiClean™ diesel particulate filters.
- **Trucks, Balqon Corporation Electric Class 8 Truck.** This project involves the development of a prototype low-speed full-electric tow tractor (Class 8) to transport containers to and from near-dock rail facilities.

These systems are all technically in the research stage. Each has corporate champions or sponsors, which will help in their commercialization, manufacturing, and supply. To support these activities, an "entrepreneurial ecosystem" is being established at both ports, using a combination of existing and planned infrastructure.

CAAP Joint Port Transportation Technology Review Program. The San Pedro Bay Ports also have a program underway, called the Zero Emissions Container Mover System Evaluation, to assess the most efficient ways to move containers from the ports to near-dock rail terminals. . Fourteen technology systems, listed below along with their manufacturers, are being assessed in this program:

- **Electric Cargo Conveyor System** – General Atomics
- **Environmental Mitigation and Mobility initiative** – American Maglev
- **Magnetic Levitation, or Maglev** – TransRapide
- **Safe Freight Shuttle** – Freight Shuttle Development Corporation
- **Air Rail** – SkyTech Corporation
- **Southern California Guideway** – Whelan & Associates
- **Cargo Rail** – Mega Rail Transportation Systems
- **Rail Motor** – Launch Point Technologies
- **LIM-Rail and Mag-Rail** – Innovative Transportation Systems
- **Automated Shuttle Car System** – Automated Shuttle Car System
- **Container Port Skid** – Tubular Rail
- **Container-Express** – Citi-Car
- **AirHeLo** – Teeco International
- **Aeroscraft** – Worldwide Aeros Corporation

One or more of these systems will be chosen in 2008 for future development by the ports, under public-private partnership programs, which will be coordinated with the Clean Air Action Plan guidelines.

Building an Infrastructure to Support Technology Growth

With the Gold Line system as a model, an starting list of public and private technology support resources would include:

- City and county agencies
- Ports of Los Angeles and Long Beach
- Educational institutions
- Civic and business organizations
- Large and small companies
- Service provider
- Scientists and Entrepreneurs

Each of these entities plays a critical role in the growth of a technology cluster. Using the “Gold Line” methodology, the objective is to combine their skills and resources in a series of shared initiatives which, over a period of time, generates major growth in the technology sector.

In the following section, , the technology support resources of the two San Pedro Bay port communities, Long Beach and San Pedro/Wilmington, are analyzed along with those of the Ports themselves.

Long Beach Technology Sector. Long Beach has a strong lead in technology growth. The city has a formidable base of economic resources to be applied to growth in this sector. Among these are:

- **California State University Long Beach.** This university's resources include a startup technology incubator linked to the L.A. County Business Technology Center. This incubator, called the CSU Long Beach Regional Technology Center (CSULB-RTC), will support an emerging technology commercialization program, the first in the CSU system. In addition, CCDOTT, which is developing MagLev and other transportation technologies, is located at CSU Long Beach.
- **Long Beach City College.** This college has organized two recent trade and technology conferences and has a strong base of training resources for emerging technology companies.
- **City of Long Beach.** The City is very proactive in technology-based growth. They have a strong Economic Development Department, whose staff is extremely knowledgeable of and experienced in the establishment and support of emerging technology industry.
- **Corporate Community.** Long Beach also has a very strong corporate community, including energy, maritime, engineering, aerospace, and finance. The Long Beach World Trade Center and the Chamber of Commerce International Business Association are active in support of technology programs.
- **Maritime Technology Base.** In this sector, Jacobsen Pilot Service is a leading developer/user of computer simulation programs for the shipping industry. Also, emerging maritime technology firms are locating in Long Beach, led by Extengine (www.extengine.com), a diesel emissions technology systems manufacturer.

San Pedro/Wilmington Technology Sector. In San Pedro/Wilmington, the principal institutional resources include:

- **Harbor Community College,** which has recently undergone a \$200+ million capital program, as part of the larger Los Angeles Community College District \$2+ billion retrofit program.
- **San Pedro Peninsula Chamber of Commerce.** The San Pedro Chamber is in active discussions with the Port of Los Angeles to establish a technology incubator, the Maritime Technology Complex (MTC), linked to the Port of Los Angeles Technology Advancement Program.
- **Port of Los Angeles Marine Research Complex.** This concept facility, planned for City Dock 1 at the Port, would establish the Port of Los Angeles as a world center for marine sciences research and development. A recent press release on the program is available at http://www.portoflosangeles.org/News/news_102507cd1.htm
- **Other university linkages.** Through the Los Angeles business and institutional community, there is considerable interface between the San Pedro/Wilmington

community and Loyola-Marymount University, University of Southern California, Caltech, and other organizations.

- **Corporate Resources.** Corporate resources in the San Pedro/Wilmington area include Northrop Grumman as well as major energy and maritime companies.
- **Training Resources.** Harbor Community Adult School will be a critical training resource for creation of a technology workforce for this initiative. At the high school level, there would be formal interfacing with groups such as the ITEP Program at Banning High School and student organizations at Port of Los Angeles Charter High School.

Port Area Industry Association Support. Both Long Beach and San Pedro/Wilmington have strong support from major local industry associations. Among these are the Harbor Association of Industry and Commerce, Propeller Club, Foreign Trade Association, International Business Association, and CALMITSAC. Within these organizations are top executives of the engineering, maritime, energy, railroad, gas, electrical, and water utilities, as well as senior executives from both ports.

San Pedro Bay Technology Cluster – Action Plan

A successful scenario for the growth of the maritime technology sector involves both ports and their communities, along with the following elements over the next two years:

Port/Community Relationships. Each port would have an important collaborative relationship with its emerging-technology incubator and other local technology resources.

- **Long Beach.** The Port of Long Beach would begin working with the CSU Long Beach technology incubator. The focus of collaboration would be the Port's Technology Advancement Program and commercialization of technologies generated with professors from CSU Long Beach professors and/or CCDOTT.

This incubator would initially be a virtual incubator, utilizing the relationship with the L.A. County Business Technology Center. Ultimately, the incubator and its associated activities could relocate to a space such as the CSU Long Beach Technology Center. In this area of north Long Beach, new technologies could be manufactured, installed, and serviced and technicians trained in their use.

- **San Pedro/Wilmington.** The Port of Los Angeles would formalize a relationship with the San Pedro and Wilmington Chambers for establishment of the Chamber's planned incubator, tentatively located in excess space at the Port of Los Angeles Charter High School. Ultimately, this incubator would be relocated to the Port of Los Angeles Marine Sciences Center once built (approximately 2012). It would then become an integral part of a larger university research park.

In the early planning stages of this incubator, a strong relationship would be built between the San Pedro and Wilmington Chambers of Commerce. Each community brings distinct resources to the project. San Pedro would become the corporate, research, and development center, and Wilmington would manufacture the systems.

Corporate Involvement. Major U.S. and international corporations would be approached to be involved in the maritime technology complex. These corporations are involved with the Harbor Association, Propeller Club, Foreign Trade Association, or Long Beach International Business Association. They could be involved in the following ways:

- Identification and co-development of priority technologies, which they would purchase if available
- Licensing and potential co-commercialization of technologies through the two incubators
- Mentorship of emerging companies and entrepreneurs
- Direct funding of support programs, as described below

Funding. Aside from public funding for this technology initiative, such as direct funding from the ports through TAP, funding for technology companies and support activities can be secured in several ways.

- **Corporate Sponsorship of Technology Conferences.** Conferences are an excellent way for emerging technology companies to meet investors and strategic partners. An annual maritime technology conference will be co-organized by the Harbor Association and its sister organizations. Corporate sponsors would pay for this event and others of its kind.
- **Grants.** The federal Small Business Innovative Research (SBIR) grants are one common way of funding emerging technology companies. Each federal agency has SBIR programs, which progressively fund a series of phases of a company's growth. Both Long Beach and San Pedro/Wilmington will have comprehensive SBIR grant training programs underway.
- **Mentor-Protégé Programs.** Another federal program of value to technology firms is the Mentor-Protégé program, which provides funding for major federal contractors to mentor small firms. Generally, the firms mentored have systems or technologies that would be beneficial to the federal agency funding the program. The mentor is provided as much as \$250,000 per year for a two-year period to provide expertise (marketing, organizational skills, operations support, software and systems, etc.) to the smaller company. Many federal contractors are operating at the ports, particularly major engineering firms, which are very familiar with this program and could use it to support emerging maritime companies.
- **Angel Investment Network.** Angel investors are smaller local investors with the capability to invest \$25,000 or more whose funds are pooled to invest in emerging technology companies. The Pasadena technology program led to the establishment of a 100-investor network (Pasadena Angels). Another major network is the Tech Coast Angels coastal Southern California. These angel groups, and others yet-to-be-formed, would provide a valuable source of funding for emerging maritime technology companies.

Public Relations and Marketing. As the programs progress, efforts to publicize them would continue, including the major Long Beach maritime technology conferences, the Harbor Association technology showcase, and the CSU Long Beach L.A. County Technology Week events.

A considerable number of articles have been written on this initiative, including Long Beach Magazine, various publications covering the Port of L.A. Marine Sciences Center, and other publications. The Harbor Association has showcased the program in its newsletters, and CALMITSAC will be focusing on the capabilities of individual technology firms as a benefit to its members.

Local journalists would be invited to learn about the technology programs underway and feature the scientists and entrepreneurs responsible. The institutions involved, universities, ports, industry, and governmental organizations, would be encouraged to showcase their own programs. These materials would be circulated throughout the emerging technology community to bolster the program and provide opportunities for emerging companies.

On the national and international level, this maritime technology effort is very important. Systems used in the San Pedro Bay ports may well become global standards. Therefore, companies from around the maritime world would want their systems to be considered for use. Therefore, the outreach efforts for this technology initiative would also focus on the international community. This can be achieved through the international industry associations involved with the ports, through the port tenant organizations directly, and through the consular and trade commissions offices of the Los Angeles international community.

Training. This maritime technology initiative requires new skills and knowledge of systems; therefore, staff training is important to its success. Within the two incubators, in Long Beach and San Pedro/Wilmington, formal mentorship programs would be established. Emerging companies would be provided best practices for business plan development, finance and accounting, legal and intellectual property issues, sales and marketing, product development, and networking. This training would be provided by local and regional business community volunteers.

Other training would be provided by colleges and universities and the industrial community. The CSU Long Beach Center for International Trade and Transportation (CITT) would be an excellent resource for training companies in the operations and techniques of the international business sector. CSU Long Beach, CSU Dominguez Hills, Long Beach City College, and Harbor Community College have specialized extension courses for entrepreneurial support. State-sponsored business training programs could be helpful as well.

The corporate and labor communities have a vested interest in the availability of well-trained staff. Many of the new systems require sophistication to install and operate. Corporate partners could help fund, staff or arrange training programs for this purpose.

Land Use and Facilities. To support technology activities in both locales, enterprise zones and other special economic zones would be considered. An enterprise zone is in place in Long Beach; one would have to be planned in San Pedro/Wilmington. Collectively, a technology-based enterprise zone area could surround both ports to support the expanding technology-based business activity in both locations.

All three areas, Long Beach, San Pedro, and Wilmington, will be active in land use planning and corporate recruitment. The San Pedro and Wilmington Waterfront plans are well along and will accommodate land uses for technology-based industry. Ultimately, the Port's Marine Sciences Center will be a magnet for university-focused research and technology commercialization. Long Beach has active land use initiatives for such land uses as well.

One objective of a successful action plan is to keep the emerging maritime initiative companies in the local area, so they can generate jobs and tax base, succeed, and subsequently spin off other firms. If companies receive investment from outside the area, they will be encouraged to relocate to the funding party's geographic area (Silicon Valley, specifically); therefore, good facilities must be accompanied by availability of substantial local funds.

International Community Involvement. The international community, including port tenants, consular organizations, and other international firms, would play a major role in the growth of San Pedro Bay Maritime Technology program. This program could well become the prototype for use in ports around the world. In this regard, both p are working closely with ports in Asia to standardize environmental, security, and other operations practices. Recently, a top governmental delegation from Western Australia, one of the world's largest minerals exporters, visited the Port of Los Angeles to learn about the Clean Air Action Plan and lessons applicable to Australian ports.

Each contact brings further opportunities for technology review, collaboration, and problem-solving. It may be that off-the-shelf technologies from major Asian or European business organizations may be adaptable to use in local ports. International investment in Southern California technology innovation is likely.

Becoming A Model of Best Maritime Technological Practices

With these collective activities, and many others, the San Pedro Bay Ports will become a showcase and model for best maritime technology practices from around the world. Southern California, as a community of innovators, has the responsibility to build this program so that it helps to solve the critical environmental problems of our civilization, grow our economy, and build our manufacturing and export base and so that it can be a model for other growing economies.

The author appreciates reader input to this paper and looks forward to working with all participants and interested parties in making these program elements a success.

About the Author

William F. Lyte is a senior client manager with Kennedy/Jenks Consultants, a major West Coast engineering, environmental, sustainable practices, and technology firm based in San Francisco. He has 25 years in this industry with a focus on transportation, environment, and technology.

Transportation. Mr. Lyte is President of the Harbor Association of Industry and Commerce (HAIC), which supports industrial growth in the San Pedro Bay. As a board member of the statewide goods movement group CALMITSAC, he co-authored the 2006-07 California Goods Movement Report to the California Legislature and led support for passage of the \$20 billion Proposition 1B California transportation bonds. In the 1990s, he worked to obtain funding and build political support for nearly \$4 billion of transportation projects, including the Alameda Corridor, Alameda Corridor East, and the L.A.-Pasadena Light Rail (Gold Line). He also led a three-year USDOT research project with JPL and the ports, assessing the Alameda Corridor with satellite imagery.

Technology. Mr. Lyte has consistently assisted the growth of early-state technology companies (optics, computer software, transportation and environmental systems, maritime, etc.). In 1991, he organized an economic initiative in Pasadena, California, with Caltech, JPL, and the engineering industry, to support technology commercialization. The program was successful, resulting in 200+ startup companies, an angel/venture capital base, and new facilities. Then he was appointed to chair the startup of L.A. County's new technology facility, the Business Technology Center (www.labtc.org). The program expanded regionally (the "Gold Line Technology Corridor") and is now the template for the San Pedro Bay technology cluster. The promotional program he co-founded, Los Angeles County Technology Week, (www.latechweek.com) is now in its fifth year, with countywide events each January.

The Ports and Technology Initiative. In 1992, Mr. Lyte published *The Pasadena to the Ports Trade and Technology Corridor* to support completion of the Pasadena-L.A. light rail and Alameda Corridor projects. Then he presented the concept to L.A. Times journalist James Flanigan, who covered it henceforth. In 1996, he lectured on the program in Los Angeles, sparking media coverage and business support organizations. Through the USDOT research project with the ports, JPL, and CSU Long Beach, he built relationships among those institutions. After September 11, 2001, he arranged discussions on homeland security technology between JPL and the U.S. Coast Guard. In the early 2000s, with CALMITSAC leaders, he developed a Silicon Valley Meets the Ports program to promote a statewide port-technology focus. He has since showcased maritime technology applications in numerous Harbor Association newsletters and in Long Beach Magazine's article, "Long Beach – Center for Maritime Technology." In June 2006, with Long Beach City College and the World Trade Center, Mr. Lyte co-organized a port technology event. Speakers represented the Port of Long Beach, BNSF Railroad, and Hutchison Whampoa from China. In 2007, his Harbor Association forums showcased railroad green technologies and the joint ports' Technology Advancement Program (TAP). He serves as advisor to CSU Long Beach's new technology incubator, and to one planned in San Pedro to support the pending Port of L.A. Marine Sciences Center.

Education

Mr. Lyte graduated in Environmental Studies from U.C. Santa Barbara, specializing in the use of satellite remote sensing. He now works with UCSB on transportation research projects.

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