New Technologies for Transportation:

EDI in Ports; RFID Tags; Port and Airport Technologies

Executive Summary

The port industry is in the middle of a wide and fundamental restructuring. Instead of focusing only on the traditional business of loading and unloading cargo, ports must focus as well on their role in the total transport chain. Trends such as intermodal transportation, a more scientific approach to logistics, and just-in-time manufacturing practices mean that ports must use information technology to record and communicate accurate information.

Internet technologies are an important part of the new technologies used by ports. Part I of this report discusses the fact that ports not only use traditional EDI, but are also adopting hybrid systems that provide EDI over the Internet. Internet EDI has similar capabilities to traditional EDI using private value-added networks, but at lower cost. Most importantly, medium and smaller ports are turning to Internet-based communications using Extensible Markup Language (XML), which allows some of the functions of EDI at much less cost. The new Internet technologies are also receiving support from standards organizations, although XML standards are not nearly as evolved today as are EDI standards. By moving operations onto the Internet to be shared by business partners, ports are able to reduce their paper transactions and speed transactions. Another key development is that, because Internet EDI and XML are much cheaper than traditional EDI, smaller shippers that use ports are more willing to adopt the new technologies.

As discussed in Part II, ports are also making increased use of radio frequency identification (RFID) technologies, which allow tracking of containers and other assets within the terminal and throughout the supply chain. The new technologies allow ports to improve their capabilities, customer service, efficiency, communications and business opportunities. The more sophisticated RFID systems include satellite-tracking technology. Less sophisticated systems are impressive because of their low cost, which indicate that RFID technologies are likely to spread quickly to industries in which they have not been previously affordable.

Ports and airports have other new technologies as discussed in part III. New software packages allow ports to create sophisticated web sites that provide interaction with customers and better service. There are also new port technologies for communications, automated cranes and cargo handling, customs automation, gate technology and underwater imaging. New aiport technologies include airport management systems, cargo handling machines, gate and docking equipment, and airport security systems. Also, the airlines are using the Internet to create an ambitious new combined airline website.

Collectively, these new technologies will make port and airport operations more productive. These technologies can reduce costs, improve inventory management, and strengthen customer communications and service.

I. EDI in U.S. Port Management

This section lists projects and technologies in which ports are using electronic data interchange (EDI) and related information technologies to create new efficiencies.

A. Use of EDI in Ports and the Companies Providing EDI Services

1. Traditional EDI in Ports

For about a decade, U.S. ports have used EDI to optimize the movement of goods through the port and to provide shipment status and location information. Some key examples of the use of EDI in U.S. ports are as follows:

First, the North Carolina State Ports Authority offers EDI communications with shippers, brokers and transportation carriers. This includes: Equipment control reports for steamship lines; online container bookings for steamship lines; freight releases incorporated into container gate operations; and direct receipt of shipper notifications for work orders. The North Carolina ports

use software provided by Sterling Software "Commerce: Network".[1] (Sterling was acquired a year ago by Computer Associates.)

The North Carolina Ports also use GE Information Service's "EDI*Express network".[2] This EDI software enables computer-to-computer exchange of business documents between companies, such as purchase orders, shipping notices, product catalogs, and payment instructions. According to GE: "By automating routine business processes such as sending and receiving purchase orders, shipping notices, product catalogs, and payment instructions EDI cuts administrative costs and streamlines operations." GE's EDI*Express Service allows its customers' computers to exchange business documents with trading partners' computers.[3]

Second, the South Carolina State Ports Authority obtains EDI through the ORION information management system. "ORION is a one-stop-shop for document clearing and processing systems and a host of EDI services. Specifically, it provides access to U.S. Customs' Automated Commercial System (ACS), Automated Manifest System (AMS) and Automated Broker Interface (ABI)." The South Carolina State Ports Authority makes ORION available to various firms in the shipping community, even if they do not ship through the Port of Charleston. The South Carolina Ports Authority claims that this allows others to use ORION while avoiding the start-up costs of creating a cargo clearance and tracking system.[4]

Third, the Ports of Seattle and Tacoma use an electronic data interchange (EDI) system called LINX to optimize movement of goods through the port. First developed in 1990, Linx participants include major ocean carriers, railroads, truck companies, brokers, forwarders and shippers. LINX was originally developed by Sterling Software's ORDERNET Services Division (as noted above, Sterling has been acquired by Computer Associates). LINX also has capabilities to link with other EDI systems used by different ports.[5]

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[1] http://www.ncports.com/ais.html
[2] American Shipper January 1, 2000. No. 13, Vol. 41; Pg. 12
[3] http://www.geis.com/gxs/products/product/ediex
[4] http://www.port-of-charleston.com/customer/technology.asp
[5] Sutton, Judy and Thuermer, Karen, *It's hot, vital and fast; automated technologies used in harbors to facilitate trade growth*, Global Trade, January, 1992, Vol. 112; No. 1; Pg. 14.

Fourth, the Port Authority of New York and New Jersey uses the Advanced Cargo Expediting System (ACES) to provide shipment status and location information. Information provided includes arrival notices from ocean carriers, delivery orders from customs house brokers, cargo status replies from marine terminals, and electronic bookings from freight forwarders to ocean carriers.[6] Similar to the North Carolina ports, GE Information Services also has been the main supplier of this EDI system. GE claims that companies implementing this system benefit from improved productivity and reduced network costs. In addition, GE claims that "EDI is user friendly, offers immediate sending and receiving of documents, allows for multiple trading partners and can help increase accessibility and profitability of companies in the transportation and shipping industries."[7] ACES serves not only the port operations and marine terminal operators, but also connects organizations such as ocean carriers, railroad, brokers, forwarders and other ports to the operations of the Port Authority of New York and New Jersey.[8]

Several similar systems were built by ports in the early 1990s[9]:

- The Georgia Ports Authority created a network called "Customers On-Line with Brokers for Rapid Action (COBRA)". This network has the ability to convert manifest information into EDI format. It provides cargo status information and interface with ocean, rail, and truck carriers, shippers, brokers, forwarders, the U.S. Customs Service, government agencies, and other trade entities. More recently, in 1999, the Georgia Ports Authority created a virtual private network (VPN) for customers to access cargo information handled by ports in Georgia. Steamship lines, agents, freight forwarders, customs brokers, shippers and others can access the VPN either through the Internet or on their own VPN server.[10]

[6] http://www.volpe.dot.gov/infosrc/strtplns/nstc/cargo/chap4.html (citing Intermodal Freight Transportation, 3rd Edition, Gerhardt Muller, p. 190.)
[7] *GE Information Services and Port Authority Celebrate 10th Anniversary* PR Newswire, August 4, 1998.
[8] Sutton and Thuermer, note 5.
[9] These examples are from Sutton and Thuermer, note 5.
[10] Traffic World November 8, 1999.

- The Port of Baltimore created an EDI network called “the Automated Container Control and Equipment Support System (ACCESS)”. It provides gate activity reports, load/discharge information, and freight bookings.

- The Virginia International Terminals' (VIT) Authority created a network vendor system. Data is translated into EDI by a third party network and can be assigned to a particular steamship line's account. Several major ocean carriers use the system.

- The Port of New Orleans created an EDI system called the “Computerized Reporting and Expediting of Shipments to Control Essential New Orleans Trade (CRESCENT)”. The Port of New Orleans also participates in the Port of New York and New Jersey ACES system.

Another point, as you are probably aware, is that the Port of Kobe is actively implementing EDI. The port has created a useful website that explains its EDI operations. [11] A technology company active in Asian EDI for sea shipping is the Orient Overseas Container Line (OOCL).[12]

2. Advanced EDI Hybrid Systems

More recent EDI technologies in ports have been systems that might be called “hybrids” because they contain elements of EDI combined with the Internet, Intranets and ISDN (Integrated Services Digital Network).[13] This has allowed cost savings by allowing EDI over ordinary personal computers. These systems may also allow for electronic transmission of documents such as Bills of Lading and Letters of Credit.

Examples include the following:

[11] http://www.port.city.kobe.jp/readme/Edi_e.htm
[12] http://www.oocl.com/Default.htm

- Last November, the Port of New York & New Jersey[14] announced its Freight Information Real Time System (FIRST).[15] This is a web-based information system that makes freight traffic information available to terminal operators, shipping lines and other interested parties such as truckers. A web name has been chosen, but the system is not yet operational.[16] The function of the system has been explained by the Port:

  > "Information available on the Web site will be integrated from numerous sources to provide ocean carriers, exporters, importers, foreign freight forwarders, customs brokers, terminal operators and rail and truck providers with 'one-stop shopping' for data required to make decisions about cargo pickup and delivery. For example, a trucking company can use the system to find out the status of a cargo container waiting to be picked up at the port. By verifying first that the container is in and has been released for pick up, the trucker can avoid an unnecessary trip to the port. Additionally, truckers can notify terminals of their impending arrival, which can expedite processing time at the port."

  This system is funded in part as an Intelligent Transportation System initiative of the I-95 Corridor Coalition; the coalition is a regional partnership of transportation agencies along the I-95 Corridor from Maine to Virginia.[17] The construction of the system is being coordinated by the Americas Systems Inc., which is a consultancy specializing in transportation IT projects.[18]

- CNS (Community Network Services) is owned by Associated British Ports and P&O Ports.[19] CNS provides freight information services including network management and website design/hosting. It provides this system to several ports in England, as well as 150 inland freight distribution centers, the Heathrow and Gatwick air courier facilities and four regional airports. It offers an EDI/Intranet system that provides a single source of

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[13] A useful discussion is in Mahon, Tony *How EDI has introduced a sea change to container shipping* Lloyd's List, May 22, 1999, Pg. 8.
[14] http://www.panynj.gov/
[15] http://www.panynj.gov/pr/156-00.html
[16] The site will be www.firstnynj.com.
[17] http://www.i95coalition.org/
[18] http://www.americasys.com/
[19] www.cnsonline.net/

information for all freight movement through the port and links more than 200 port community users.[20] The system is designed to be accessible for smaller shippers.

- The Port of Felixstowe[21] is creating a new Internet-based system called "Felixstowe Online" that will enable shippers to minimize the amount of time they spend collecting containers from the port. It is designed to allow shippers, forwarders, agents and others to establish the area of the container yard where their boxes are being held and access real-time information on the level of demand in that area. The system will also provide real-time bulletins on port conditions that might affect shipyard operations.[22]

- Another new European technology is Bolero (Bills of Lading for Europe), which is an extension of EDI designed to provide guaranteed and secure delivery, in electronic form, of trade documentation.[23]

- The Port of Charleston is mentioned above, along with other South Carolina ports, for the ORION system providing traditional EDI. The Port of Charleston has also established a timeline for the implementation of EDI over the Internet. Sometime in early 2001, the port expects not only to have ORION available over the Internet, but also to have new Internet applications deployed for "track and trace, ad hoc reports, and pickup group functionality."[24]

- Navis LLC[25] sells an integrated software suite that runs on personal computers plus a server.[26] This allows real-time access to data relating to cargo transiting through a terminal. The system is in use in Georgia ports, where it said to enhance "gate operations, import/export processing, bookings, billings, EDI capabilities, work order tracking, and

[20] Lloyd's List, February 6, 2001
[21] www.port-of-felixstowe.co.uk
[22] Lloyd's List, July 5, 2000
[23] www.bolero.net; see additional information at http://elj.warwick.ac.uk/jilt/ecomm/98_2liv/livermor.htm
[24] http://www.port-of-charleston.com/customer/technology.asp#Automation%20Timeline
[25] http://www.navis.com/

vessel, rail and yard operations management."[27] (Navis software is also used in conjunction with RFID components, as discussed in part II below.)

- Similar to Navis, Cosmos software, part of the Hessenatie Group based in Antwerp, is a port management and information technology company. It supplies information technology systems to container terminals and ports.[28]

- There are other efforts to make older electronic document systems compatible with EDI and the Internet. An example is ADEEP (Aligned Documents and Electronic Equivalents Project), which is the effort to make the U.K.'s aligned documents standards compatible with EDI and eventually the Internet.[29]

- There are also companies creating new Internet-based communications networks that will help shipping lines to help track commerce. Nine shipping lines[30] are creating the Global Transportation Network to provide users with a point of entry for tracking cargo with participating carriers.[31]

- Inttra is a similar Internet portal currently under development. Its purpose is to help users track container shipments. It is funded by the Maersk Sealand and P&O Nedlloyd shipping lines.[32]

- There are software companies specifically focusing on building Internet and EDI capable communications networks for the transportation industry, including ports. Tradient software

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[26] Specifically, this software consists of consists of SPARCS, a graphical planning and control system that runs on Windows NT PCs, and EXPRESS, a comprehensive information management system that uses an IBM RS6000 / Oracle server.
[27] http://www.gaports.com/infotech.html
[28] http://www.hessenatie.be/sub06.htm
[29] See http://www.keb.or.kr/htm/eng/dataroom/data119.htm especially Annex III at the bottom of the webpage.
[30] APL, CP Ships, Hanjin, Hyundai, K Line, Mitsui OSK Lines, Senator Lines, Yang Ming, and Zim Israel Navigation Company
[31] http://www.k-line.com/Company/news/001205NeutralInternet.htm
[32] http://www.inttra.com/

of California is supplying special software applications needed for transportation and logistics management.[33] The Global Transportation Network will use Tradient software.

- A similar software company is Viewlocity, which offers software that integrates communications in transportation infrastructures.[34] Viewlocity's flagship product is "AMTrix," which the company claims can bridge "the gaps between business processes, databases, technologies, communication layers and applications." This includes software that automatically can change formats from EDI to XML. Viewlocity has worldwide customers, including Malaysia's Kelang Port Management[35] and the China Ocean Shipping Group Company (COSCO).[36]

- Another new technology may be particularly useful for small ports that have been slow to adopt EDI due to cost reasons. EDI typically requires the use of an expensive, private value-added network (VAN). A company called Ornic has created a new email technology to help these ports to make their communications compatible with EDI applications, even if the ports are not using EDI directly. Shippers can send data in various formats by attachment through e-mail, which is then converted to an EDI format by the Ornic software.[37] A similar conversion software package is offered by a company called CommerceQuest.[38]

B. The Costs and Effectiveness of EDI in port management

1. Actual costs of these systems

[33] http://www.tradient.com/
[34] http://www.viewlocity.com/
[35] http://www.kpmport.com.my/. See discussion at http://www.viewlocity.com/clients/frame_casestudies.html
[36] http://www.cosco.com.hk/
[37] http://www.ornic.com/actions/casaveatt.shtml
[38] http://www.commercequest.com/

EDI systems are expensive and the cost of implementing EDI is the major reason why it has not been adopted universally. Although large ports typically have EDI, only some medium and smaller ports have EDI. The cost involves not only the creation of the systems, but also the need for specific IT staff to manage the systems. Moreover, the EDI investment is only useful if shippers and others who use the ports are also using EDI. This is not an issue for the large ports, which are used by large shippers. However, smaller shippers may not be using an EDI system, so the port's use of EDI would not offer an advantage to them. EDI systems may be far beyond the capabilities of smaller shipping firms.

On the other hand, medium and smaller ports have an advantage in being late adopters of EDI technology, since the major development costs have already been paid by the early adopters. Technology systems typically decline in cost over time. Also, later adopters of EDI typically can purchase systems that are more proven and have fewer maintenance problems.[39]

It is difficult to determine the exact cost of EDI systems. Sources indicate that, for a single shipping company, the initial cost of creating an EDI system starts at about $100,000 and the annual maintenance cost is about $20,000.[40] Of course, the cost of an EDI system for a port could be considerably higher than for a single shipper. The monthly maintenance costs for larger

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[39] Consider the following from an article by Post, Gerald V; Kagan, Albert; Lau, Kin-Nam *A modeling approach to evaluating strategic uses of information technology* Journal of Management Information Systems: Fall 1995; Vol. 12, No. 2 Pg. 161-187:
"Technology costs form a crucial part of the model. Historically, the costs of IT behave differently from other business costs. The most important aspect of technology costs is that they decrease over time. Accordingly, initial implementors of IT have to develop the system from scratch, which translates into higher costs, while later implementors would benefit from some of the knowledge gained by the leading edge competitors, generating lower costs.

"Consider hardware and software costs at the introduction of new IT. If the firm uses state-of-the-art equipment, they will undoubtedly pay a premium for initial versions of the equipment. Also, this hardware may be more susceptible to failures, ongoing modifications, or increased maintenance expenses. Even for mainstream technology, costs will decline over time. In addition, a new system may require additional support personnel, especially if interfacing with existing equipment (interoperability) is required. Software costs at this stage ill also tend to be relatively high. In particular, the system will usually have to be custom designed and developed. That means paying the expenses of the analysis and design team, increased hardware use during the development phase, debugging and testing costs, and the cost of management time to aid in the overall design phase."

[40] For example, see Howard Millman "*Easy EDI for everyone; I-EDI can slash the high price of document exchanges"* InfoWorld August 17, 1998 Pg. 38: "For most of the past 15 years, implementing EDI meant purchasing and integrating an unusual combination of software, hardware, and services with an initial cost that could exceed $100,000. Transporting data over value-added networks could cost upward of $20,000 per year."

EDI systems frequently rise as high as $250,000.[41] None of the ports or their suppliers listed above publish information about the costs of their EDI systems. The published budgets of ports do not offer much help either; for example, the Port of Tacoma publishes its budget, without showing a separate breakdown for IT related costs.[42]

As a practical matter, the costs of any system purchased in the past would not necessarily be representative of the costs of new systems today. Also, the costs of EDI systems vary enormously, depending on a variety of factors. The key issue is the extent to which the EDI system must be compatible and interact with other computer systems, such as systems for ordering, billing, etc. Another issue is whether the customer buys an "off the shelf" system or whether it needs a more expensive system that has custom features. An interesting company called "1 EDI Source" specializes on helping organizations to decide on the type of EDI system they need, and helps in negotiating with software vendors. Their web site also discusses the factors to be considered in choosing an EDI system and vendor.[43]

[41] See Emily Kay *From EDI to XML*, Computerworld June 19, 2000 Pg. 84: "EDI also requires dedicated servers that cost from $10,000 to $100,000, says Russom. And that's not all. "It's common for vendors to spend $250,000 per month keeping up the connection to the EDInetwork and keeping the servers up and running'"

[42] http://www.portoftacoma.com/files/01BudWeb.PDF The port does show $134,000 budgeted for 2001 for "hardware/software maintenance." Page 7.

[43] http://www.1edisource.com/index.php

2. Cost-Benefit Analysis of the Effectiveness of Investment

Not surprisingly, companies selling EDI and hybrid EDI systems claim that investment in these systems yields significant positive results.[44] More objective evaluations of business investments are typically made by academics. Unfortunately, there are not any academic studies that focus specifically on the effectiveness of EDI investments by ports. However, a detailed study has been made of the effectiveness of EDI investments by the Chrysler automobile company. The study found that EDI investment allowed Chrysler to significantly reduce operating costs associated with carrying inventories, obsolescence, and transportation. The savings were estimated at $100 per vehicle manufactured.[45] (Note that port operations are similar to an auto assembly plant because they both involve large and complex operations, with many parts and participants. However, unlike many port operators dealing with small shipping companies, an auto manufacturer is in a dominant position and can more easily require its suppliers to adopt

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[44] For example, Viewlocity claims that its pilot project at the port of Quingdao in China led to the following results: "Statistics from the Qingdao Port show that the AMTrix implementation **increased the message process speed 20 times, reduced total transportation costs, and improved customer service**.
"The container throughput in 1996 was 1.91 million TEU, in 1997 the throughput went up to 2.52 million TEU, in 1998 the throughput increased 21% and in 1999 the volume increased 37%. Without the messaging system this rate of expansion would have been impossible," stated Tong Qinhua, Chief Engineer of Shanghai Port Messaging Portal. "AMTrix is the core system in our messaging platform. Since the development process, scale and standard for our port and shipping enterprise are different, our hardware, communication methods, information exchange requirement, data and format transformation are also different, but Viewlocity's product has demonstrated the flexibility to meet our changing needs." (emphasis added) See http://www.viewlocity.com/clients/frame_casestudies.html and click on "Building a Messaging Backbone for China's port operations."

[45] Mukhopadhyay, Tridas; Kekre, Sunder; Kalathur, Suresh *Business value of information technology: a study of electronic data interchange.* Society for Information Management; MIS Quarterly, June, 1995, Vol. 19 ; No. 2 ; Pg. 137:

"Our analysis of the last decade's performance data at Chrysler's assembly centers confirms that modern information technology such as EDI has enabled Chrysler to significantly reduce operating costs associated with carrying inventories, obsolescence, and transportation. Effective use of information to coordinate material movements by Chrysler and its suppliers has resulted in significant savings. Our estimates indicate that they are over $100 per vehicle, for a typical assembly plant, translating to an annual savings of $220 million.

"The study controlled for changes in factors such as parts variety, engineering changes, and volume. The analysis shows that significant savings have been realized from reduced inventories, lower write offs each year following model change, and reduced premium freight. Furthermore, from a cost perspective (despite increased usage of trucking, a more costly, though flexible, mode of transportation than rail), Chrysler's EDI program has resulted in a net reduction of $7.19 per unit vehicle inbound transportation costs."

EDI.) Also, there is a useful study of the specific management practices that Hewlett-Packard implemented to transform its supply chain operations.[46]

Most importantly, there is a large body of material that analyzes the effectiveness of IT investment by firms generally. The leading scholar on this topic is Erik Brynjolfsson, a professor at MIT's Sloan School of Management.[47] As early as 1993, he argued that there has been substantial positive returns on many firms' IT investments. However, this is difficult to measure because:

(1) measurement of IT investment is difficult due to rapid changes in the prices and quality of IT;
(2) there is a time lag because the benefits will not be realized until the IT is spread throughout the organization and people are experienced using it;
(3) management practices in the organization must adapt to take advantage of what the new technology offers; and
(4) even thought individual firms may gain an advantage over competitors through IT investment, this does not necessarily mean that productivity for the society as a whole will increase, only that profits may be redistributed among firms.

In a more recent paper, he expands on this problem of evaluating the costs and benefits of an organization's IT investments. Such evaluation is difficult because too often the "investment" is considered only in terms of the money spent directly on computers, software, and similar items. Instead, the concept of investment should be broader, especially to include the commitment of the organization to integrate the technology into its operations. Moreover, the "return" on this investment is also difficult to measure, because the benefits of IT investment are often intangible and difficult to measure. Professor Brynojolfsson believes that, if these intangible benefits are considered, IT investment contributed substantially to U.S. economic growth even before the economic boom of the 1990s.[48]

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[46] For example, *How Do Caterpillars Learn to Fly? Transforming Supply Chains at Hewlett-Packard* Supply Chain Management Review Winter 2000, Vol. III, No. 4; Pg. 22-32.
[47] http://ecommerce.mit.edu/erik/
[48] Erik Brynjolfsson and Lorin M. Hitt**,** *Beyond Computation: Information Technology, Organizational Transformation and Business Performance* Journal of Economic Perspectives, Fall, 2000.

A very recent report on this topic was published in February 2001 by Center for Research on Information Technology and Organizations (CRITO) of the University of California, Irvine.[49] This report examines all of the previous academic studies on the effectiveness of individual firms' investments in information technology. This report reviews studies that conclude that there may currently be a massive underinvestment in IT. In part, this is because the returns on IT investment are difficult to measure, so firms become reluctant to make the investment even though the benefits are real. In its conclusion, this report finds that: "On average, IT spending does pay off, and there is no need to fear that technology investments are a systematic waste of scarce resources. Rather, managers should be concerned with whether their own IT investments are paying off and what they can do to maximize the returns on those investments."[50]

The implications are that managers should be making information technology investments and that this will benefit their firms. However, the benefits will only result if the practices of the firm -- strategy, employee involvement, and organization -- work with the investment. In particular, firms that are highly structured, with centralized management authority, benefit less from these investments that decentralized firms. Each department within the firm should be given considerable leeway in structuring its IT operations and deciding how it will interact with outside customers and suppliers.

C. Current issues in EDI for port management

1. Standards

The nature of EDI demands standards. The purpose of EDI is to allow trading partners automatically to create contracts involving purchase orders and confirmations, as well as to exchange information on order shipment status and inventory management. The trading

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http://ecommerce.mit.edu/erik/JEP%20Beyond%20Computation%208-13.html

[49] Kenneth Kraemer, *The Productivity Paradox: Is it resolved? Is there a new one? What does it all mean for managers?"* (CRITO publication, February 2001.)
http://www.crito.uci.edu/itr/publications/pdf/it_prod_paradox.pdf

[50] Id. page 6.

partners have to be certain that the information created by one partner's computer system will be understood by the other partner's systems.

There are three levels of standards. For EDI transactions within the United States, standards are developed under guidelines established by the American National Standards Institute (ANSI). An industry group called the "Accredited Standards Committee X12 (ASC X12)" is recognized by ANSI as the official body to develop EDI standards within the United States.[51] (The set of U.S. EDI standards are commonly referred to as "X12" or "ASC X12".) Also, the Data Interchange Standards Association (DISA)[52] has been created by industry to coordinate its input to the standards-making process.

Second, international EDI standards are established by the United Nations Center for Trade Facilitation and Electronic Business (UN/CEFACT).[53] Representation of the United States is jointly made by the combined ANSI and DISA, with ASC X12 providing technical support. This international EDI standard is commonly called "EDIFACT". There is substantial overlap between X12 and EDIFACT, which has led to speculation that someday the two standards will be combined. This is opposed by some people within the United States who are comfortable with the current X12 standard and are concerned with the cost of changes.

Third, there are also industry-specific EDI standards, since particular industries need their own EDI codes for particular transactions. There is a useful list of industry-specific EDI codes maintained by the Foresight Corporation.[54]

For traditional EDI, the current standards issues are minor. They are mostly technical compliance issues, related to modifications in the schedules of standards.[55]

[51] http://www.x12.org/
[52] http://www.disa.org/
[53] http://www.unece.org/cefact/
[54] http://209.15.77.27/pages/resources/guidelines.html
[55] For current x12 technical issues, see http://www.x12.org/x12org/Subcommittees/dev/200006SR.pdf. For current EDIFACT technical issues, see http://www.unece.org/cefact/.

There are more fundamental issues with EDI standards in hybrid systems. Specifically, smaller organizations that cannot afford traditional EDI are eager to use the Internet and a technology called XML to lower their costs. These issues of XML standards are discussed two sections below, in part "3. Costs." The need for standards for lower cost hybrid systems is the largest issue confronting EDI today.

2. Regulation

The legal relationship between parties using EDI is generally governed by a written trading partner agreement entered into at the beginning of the relationship. This agreement establishes the types of transactions that the parties agree to conduct through the use of EDI, and the parties' agreement to treat electronic messages as the equivalent of signed paper documents. There are Model Trading Partner Agreements that are widely used for these relationships. Also, EDI technology has also been specifically approved by the U.S. Government for use in government contracts.[56]

There have been very few regulatory difficulties involving EDI. This is most likely because EDI transactions are typically between large companies that have ongoing, substantial relationships. When disputes do arise, the parties are able to work out the problems on their own. It is significant that one of the leading treatises on electronic commerce does not cite a single judicial decision in its several sections on the law of EDI transactions.[57]

3. Cost and the Trend to Use XML

EDI has been used primarily by large corporations because of the expense involved in designing business processes to generate a standardized output. There are also indications that the ports

[56] In re National Institute of Standards and Technology--Use of Electronic Data Interchange Technology to Create Valid Obligations, 71 Comp. Gen. 109 (Dec. 13, 1991).
[57] Stephen T. Middlebrook and John Muller, "*Survey: Thoughts On Bots: The Emerging Law Of Electronic Agents,"* The Business Lawyer (publication of the American Bar Association) vol. 341, page 56, November 2000.

industry generally has lagged behind large companies in adopting EDI.[58] The alternative for small and midsized organizations is to use a new Internet technology called XML.[59] Just as the major web language for the web is hypertext markup language (HTML), extensible markup language (XML) is a computer language that can be read by humans, Web browsers and databases. XML is compatible with any computer linked to the Web. The key feature of XML is that it can "tag" a piece of information within a document. Thus, an XML document can have various lines tagged as representing name, address, price, or any other type of information. Naturally, this is of value only if there is a standard for the tagged pieces of information. Then, XML documents can be exchanged with the data appropriately and automatically recorded.

Adoption of the XML is moving very quickly. Microsoft now includes a free XML application with its networking software package. German software giant SAP AG has integrated the technology into its new mySAP product. E-commerce software specialists, such as CommerceOne and Ariba, have published XML standards for online communication. Virtually all of the Internet based transportation companies have built their systems on XML software, and Internet retailers such as Amazon.com use it extensively.[60] Larger companies can even provide XML to smaller suppliers. Traditionally, if a small company does not have EDI, the large company may send an order by fax, which requires the large company to keep a paper record. With XML, the large company can instead send the small company an email with XML fields in a web page. The small company then fills the order and emails the form back, and the large company can automatically integrate the data into its databases.[61]

Thus, XML makes possible a Web-based EDI alternative for small and midsize organizations that don't have the resources to implement EDI systems. Companies can also run XML

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[58] Journal of Commerce - JoC Online November 3, 2000: "The emergence of global terminal operators and the significant improvements in supply chain management in the past few years has highlighted the failures of the ports industry. 'There are huge rigidities in systems and a complete lack of flexibility in most ports,' said Emanuele Grimaldi, managing director of Grimaldi Group, the Italian shipping line that is the biggest shareholder in Atlantic Container Line. 'They have completely lost touch with reality, living in a non-competitive world, providing services in a monopolistic environment.'"

[59] XML was first published in 1998 by the World Wide Web Consortium (W3C) www.w3c.org

[60] Forsyth, Gordon *XML Breaking down IT barriers in logistics; Extensible Markup Language* American Shipper June 1, 2000 No. 6, Vol. 42; Pg. 20

[61] Id.

applications on inexpensive Web servers over existing Internet connections. One estimate is that, while EDI might cost a small company $10,000 per year, XML will cost only $650-$1000 per year.[62] Also, XML messages present data in a human-readable format, so it is easier to train programmers.[63] On the other hand, XML is less secure than EDI, since EDI runs on closed value-added networks (VANS).

There are some who argue that XML will replace EDI. However, this does not appear likely to happen anytime soon. EDI has been in use by large organizations for as long as 20 years. These organizations have a major investment in EDI and, most importantly, they trust their current EDI systems to work and are reluctant to abandon these systems for alternative technologies. It seems more likely that hybrid EDI/XML systems will be adopted. These systems allow for traditional EDI. However, if a trading partner does not use EDI, the system will automatically translate EDI into XML code. An example of a company that provides such translation software is XMLSolutions Corp., which sells software to translate its EDI documents to XML, and vice versa.

The major problem with this approach is that there is no single standard XML code today, nor is one likely to develop soon. Instead, many different software companies and industry groups are developing their own versions of XML.[64] The Uniform Code Council[65] in the United States and EAN International[66] in Europe are working to establish XML standards. The ASC X12 and DISA organizations (discussed above) are also active in XML standards. Many companies around the world will be affected by these standards, meaning that they may want to participate

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[62] Howard Millman *Easy EDI for everyone; I-EDI can slash the high price of document exchanges* InfoWorld August 17, 1998 Pg. 38: "It used to cost small suppliers roughly $10,000 per year to do EDI," says Geri Spieler, an analyst at Gartner Group, in Stamford, Conn. "Today, that figure ranges between $650 to $1,000 for Internet-capable EDI services."

[63] Emily Kay *From EDI to XML*; Computerworld June 19, 2000 Pg. 84

[64] Some of the leading versions include the ebXML effort, which is being lead by The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) and the Organization for the Advancement of Structured Information Standards. OASIS is sponsored in part by IBM, Netfish Technologies, Sabre and Sun Microsystems. BizTalk is a Microsoft initiative. See Ken Vollmer *Don't Believe The Hype: EDI And XML Are Just Perfect Together* InternetWeek January 15, 2001 Pg. 29.

[65] http://www.uc-council.org/

[66] http://www.ean.be/

now in these organizations to influence the ongoing process. Because XML is so new and many companies have an interest, the development of XML standards is expected to be a slow process.

II. Use of RFID Tags for Container Shipments

A. RFID Tag Technology

RFID tags perform like barcodes but have several advantages. Like barcodes, the tags hold essential information about a product, but RFID tags can be rewritten and updated as needed, including while in transit. In addition, several of the tags can be read or written to simultaneously. Theft and counterfeiting is lessened because it is difficult to copy an RFID tag. Moreover, because the information is exchanged by radio communications, there is no need for line-of-sight reading of the tag. Another key advantage of RFID over barcodes its that RFID codes offer much more detailed information within the logistics system, while being easier and faster to read.[67] RFID is not likely to replace barcoding in the near future. Rather, they are compatible technologies that are used together to track cargo.

RFID technology typically involves a tag containing a tiny silicon chip and an antenna. The RFID system also includes a device to read the tag, called a "reader" or "interrogator," and a server with a database to store the information. Because the chips are small, they are usually mounted on paper or tape, but this has no technical function and damage to the paper or tape does not interfere with the operation of the tag. There are two different kinds of RFID tags, active and passive. The type of tag determines how information is gathered by the interrogator. The passive tag reflects the signal from the interrogator and returns an identification. The active tag has a battery and can start itself and transmit on its own. The interrogator device receives the information from the tag and transmits it to a server where the data is stored and accessed by users. Users can access the data for tracking purposes or to generate reports for better management of the organization. The RFID systems are expensive, however, especially because a system needs many costly interrogators to track shipments throughout the process.

[67] Kathleen Hickey *A Diamond in the Rough* Traffic World May 3, 1999, Pg. 30

The costs for RFID tags vary widely. The cost of sophisticated tags begins at about $10 per tag,[68] and the interrogators can cost several hundred dollars. As discussed below, however, Motorola and International Paper are working on a simple RFID tag that may cost as little as 10-30 cents. Of course, like many technology products, the cost of RFID tags is likely to decline over time, as the systems are more widely used.

B. Current Development and Use of RFID Technologies

This section lists projects in which ports are using RFID technologies and companies supplying RFID technologies. The footnotes point to the location of further details.

- The Port of Charleston has implemented a radio-frequency-based, real-time yard management system. According to the port, this system provides port management, stevedores and customers with virtually instantaneous status information on shipments, speeding up the movement of cargo and increasing space utilization.[69]

- The Georgia Port Authority has combined Teklogix equipment with Navis software in its RFID operations. The combination of equipment and software allows ports to collect and use information in real time, controlling the movement of containers using vehicle-mounted and handheld computer terminals. These computer terminals provide response times of less than a half second per message.[70] At Georgia's Garden City Containerport Terminal, an RFID system using this equipment and software is being implemented: "The new software will help reduce underutilized yard space and optimize container and equipment moves, while virtually eliminating misplaced containers and excessive dwell times. GPA personnel will also be able to review real-time container and equipment activity on-line for increased yard management control efficiencies. The system will enable port personnel to

[68] http://www.amtech.com/technology/intellitag.htm
[69] *Ports are Made for Talking* Traffic World August 9, 1999 Pg. 29
[70] *Ports are Made for Talking* Traffic World August 9, 1999 Pg. 29

automatically determine yard segregation criteria, allocate yard space, assign container and chassis positions and maximize container handling dispatching."[71]

- Teklogix[72] is a major supplier of RFID equipment; it has supplied RFID equipment for yard management systems to approximately 100 port customers. RFID equipment typically is combined with container shipping software. Navis LLC[73] is a major supplier of this software to terminals and ship lines.[74]

- Another key supplier of RFID equipment is AMTECH[75] (part of TransCore Inc.). AMTECH provides systems consisting of tags, antennas, and readers. The reader's RF source is either integrated or a separate component. The reader broadcasts RF energy over an adjustable area called the read zone or reader footprint. The tag on the vehicle reflects a small part of this RF energy back to the antenna. The reflected radio waves denote the tag's unique identification code and other stored data. The antenna relays the signal to the reader, which can add information such as date/time to the tag's identification code, and stores it in a buffer. The reader can also transmit the tag's identification code to the customer's information management system.[76]

- Another RFID equipment vendor is SAMSys Technologies Inc., which provides hardware for high volume pallet and reusable container tracking applications.[77] Part of the company's strategy is to create and patent RFID readers that can read tags made by many different manufacturers. Financial information on the company is available.[78]

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[71] http://www.gaports.com/infotech.html
[72] http://www.enterprise.psion.com/teklogix/; see especially http://www.enterprise.psion.com/teklogix/logistics.htm
[73] http://www2.navis.com/home.jsp
[74] According to its website: "Navis LLC is the leader in software solutions. Terminals and ship lines worldwide use the Navis integrated product suite for greater profitability and superior customer service. Navis provides seamless integration with technologies of leading industry companies. With over 150 customer sites in 39 countries, Navis is recognized as the international industry standard." See *ibid.*
[75] http://www.amtech.com/
[76] http://www.amtech.com/technology/index.htm
[77] http://www.samsys.com
[78] http://www.investorfile.com/client_news.asp?newsid=660180

- MICRON Communications[79] makes RFID products also. One key product is the DuraTracker tag, part of a high-performance RFID system, is designed for use in applications such as container tracking and fleet vehicle-management operations.[80]

- SAVI Technologies Inc. is almost wholly devoted to RFID products. Savi has large contracts with the U.S. military and transportation companies. Savi's leading product is its "SmartChain" platform, which collects RFID data and integrates that data into the entire supply chain. This technology interacts with EDI, positioning satellite data and other system in real time. It is designed for high-volume logistics management.[81]

- During June 2000, Texas Instruments, Zebra Technologies and Symbol Technologies announced a new alliance to create RFID tagging systems using UHF frequencies. They believe that this frequency provides "the longer read range needed in large warehouse environments for the rapid and accurate identification and tracking of individual pallets and containers."[82]

- The Fowler Company offers basic RFID tags. Its website provides substantial technical specifications.[83]

- INTRANSIT [84] is a part of the Infrastructure Protection and Operations Division located at the Volpe National Transportation Systems Center (part of the DOT's Research and Special Programs Administration).[85] INTRANSIT is a research program focused on extending remote communication capabilities, interrogation of RFID tags, and construction of RF LANs.[86] The Volpe Center also has an "Enhanced Goods and Freight Movement at

[79] www.microncommunications.com
[80] http://www.micron.com/news/1999_releases/3_2_99.htm
[81] http://www.savi.com/solutions/platform.html
[82] http://www.ti.com/tiris/docs/news_releases/rel21.htm
[83] http://www.fvfowler.com/tag.html
[84] http://intransit.dot.gov/
[85] http://www.volpe.dot.gov/
[86] http://intransit.dot.gov/TopLevel/RFID.htm

Domestic and International Gateways" partnership, which specifically includes research on combining RFID, EDI and related technologies.[87]

- One of the more unusual RFID initiatives, announced in January 2000, is a joint effort between Motorola and the International Paper Company to incorporate very inexpensive RFID tags into cardboard boxes.[88] This "smart cardboard" would allow the use of RFID tags even for the shipment of low cost products. International Paper believes it may be able to incorporate RFID tags on packages ranging from breakfast cereals to lipstick boxes. Costs are low because the tag uses a paper transponder instead of the usual wire coil, and connects this with a Motorola silicon RFID chip. The tags will be programmable and will carry 96 bits of information. The antenna is printed with carbon ink on paper, rather than using a metal etching process. Costs are expected to be only 10-30 cents per tag, and eventually may be as low as 2-3 cents per tag.

C. Current issues in the use of RFID tags

1. Standardization of RFID Tags

Standardization is viewed as a way to make the cost of RFID tags as low as possible. Standards are also necessary if the data collected by RFID tags is to be shared among different systems in the supply chain. The key international body working on this is the International Organization for Standardization (ISO).[89] Within the ISO's Joint Technical Committee (JC T1), subcommittee 31 (SC 31) has responsibility for RFID and related barcode standards.[90] According to a recent interview with the head of SC 31, the subcommittee is focused on "the issues of automatic identification and data-capture techniques, which underlie bar-code technology. The group is particularly concerned with the standardization of data formats,

[87] http://www.volpe.dot.gov/infosrc/strtplns/nstc/ports/chap3.html
[88] *Paper transponder cuts RFID costs* Design News January 08, 2001 Pg. 52
[89] http://www.iso.ch/
[90] http://www.iso.ch/meme/JTC1SC31.html

syntax, structures and coding."[91] RFID is viewed as the future of bar coding, including for containers transiting ports. The information from RFID tags will far exceed that of ordinary barcodes, and this information can monitor conditions of the cargo. "For example, a chip with RFID capabilities can be embedded on a frozen-food container that's planted in a truck body to read information about the temperature and other conditions that allows for a written history of the product during shipping."[92]

A second, related issue concerns Dedicated Short Range Communication (DSRC) standards, which use radio frequency tags. As part of its development of Intelligent-Transportation Systems, the U.S. Department of Transportation is considering standards for DSRC systems that will be used by truckers, travelers, the toll industry and for cross-border transportation.[93] There is ongoing concern that the DSRC standard be chosen in a manner that allows interoperability with other intelligent transportation system projects.[94]

2. Frequency Issues for RFID Tags

The frequencies used by RFID tags require trade-offs between cost, range of operation, speed, and ability to operate in foreign countries (which may not make a particular frequency available). The following summary of these trade-offs may be useful:

> "Most popular RFID tags work in one of three frequency ranges. Low-frequency tags generally operate below 135 KHz and are commonly used for access control and industrial control. Equipment operating in this frequency is inexpensive to design and build, and the energy readily moves through people and other obstacles. However, data rates are relatively low compared with those of other technologies.

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[91] Amy Zuckerman *Bar-code harmony may rock status quo: Global Products Standards* GLOBAL COMMERCE January 12, 2000 Pg. 10.
[92] Id.
[93] The original proposed rulemaking is at http://www.its.dot.gov/tcomm/dsrc1299.htm. A supplemental notice is at http://www.its.dot.gov/tcomm/dsrcfrule.htm.
[94] Amy Zuckerman *Rules on the way for tech suppliers: Global Products Standards* Journal of Commerce December 29, 1999. See also, the supplemental notice, *ibid.*

Another frequency band popular for RFID centers around 2.45 GHz. This band operates under the same regulatory guidelines as the popular local area networks OpenAir and 802.11. Data rates are much higher than for low-frequency systems, but the ability to "see" through obstacles is somewhat reduced. The higher frequency also allows much smaller antennas-often small enough that they can be etched or screen printed instead of wound from wire.

Contactless smart cards use 13.56 MHz, a frequency that has been allocated in much of the industrialized world. Devices designed for this frequency can often be deployed around the world with little or no modification. Data rates are higher and antennas are smaller than with other frequencies, but read ranges are often shorter."[95]

III. Other New Technologies For Port and Airport Management

A. New Port Technologies

1. Internet "Portal" Web Sites for Ports

An Internet portal is a site that attempts to create a community by offering information and online services. Ports can create such sites to interact with customers and provide better service. Through a portal website, a port can manage bookings, respond automatically to routine questions, report on cargo and offer financial information. A company called APL Limited sells website software for ports called "HomePort." This software allows a port to obtain the basic capabilities that it needs for a web site and then customize the site as needed.[96]

[95] The summary was written by idSystems. http://www.idsystems.com/reader/1998_11/st1198_sb1.htm
[96] http://www.apl.com/html/homeport.html

2. Port Communications Technologies

The Port of New York & New Jersey[97] is developing communications systems that encompass both land and water-based operations. This is called the Port Information Network System. This links navigational systems such as chart information to a so-called Oceanographic Real Time System that measures the rise and fall of tides and vessel clearances in navigation channels.[98]

Another port communications technology is offered by MariTEL, the "Marine Telephone Company," which provides radiotelephones for ports and marine operations. Its telephones use VHF frequencies to connect to an onshore tower and then to the regular telephone network. The use of VHF frequencies allows MariTEL phones to operate as much as 100 miles offshore. MariTEL claims significant technological innovations in the marine operator network, including automated calling procedures and new privacy features. [99]

3. Automated Cranes and Cargo Handling

One key problem for ports is to unload ships quickly. Containers are typically unloaded at a maximum rate of 25-30 per hour. Faster unloading would allow ships to stay in port for shorter periods and for trucks to spend less time waiting at the shipyard terminal. More organized unloading, with container stacking, means that ports need less physical area and can make better use of the space that they have.[100]

Companies are now developing new technologies to address these issues. August Design Inc., of Ardmore, Pennsylvania, is developing an automated system called GRAIL.[101] A semi-automated version is in use at the Sea-Land terminal in Hong Kong. The system is planned to offer

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[97] http://www.panynj.gov/
[98] *Ports are Made for Talking* Traffic World August 9, 1999 Pg. 29
[99] http://www.maritelusa.com/
[100] Gene Linn *It's not automatic* Journal of Commerce June 26, 2000, Pg. 22
[101] http://www.august-design.com/. This site has a great deal of information about GRAIL, but the site is divided into frames, not separate web pages. To find the information, go the site, search for "GRAIL," then scroll down to the appropriate link.

management and control of cargo containers throughout a shipping facility. The system includes traffic management, collision-avoidance systems, technology for placement of containers in the yard, and a data-management system that displays the entire yard. The system also includes autonomous mobile robot cranes that move the containers.

Another company working on similar technologies is the Robotic Container Handling Company of Bellvue, Washington, which is working with several large engineering and construction company to create automated cargo handling systems. It hopes to develop systems that can unload 60 containers per crane per hour, which is roughly double the current rate. Key innovations include techniques for separate storage of empty containers, to minimize shuffling of containers, and precise positioning of containers to allow automated movement. These systems would cost about $400 million apiece. The Port of Seattle has agreed to allow the company to test its products at the port.[102]

Other research on automated unloading systems is being supported by the DOT. Since 1983, the DOT's MARAD[103] has administered and participated in the Cargo Handling Cooperative Program (CHCP). The program's primary objective is to develop leading-edge cargo handling technologies for commercial and military use.[104]

Along with the machines for cargo handling, ports need automated cargo handling software that will allow their organizations to make the most efficient use of space in overcrowded container yards. An example of this is the Georgia Ports Authority (GPA) program to find new technology to coordinate its cargo handling. The GPA is using software provided by Navis LLC that is called "SPARCS."[105] This is a graphical planning and control system that runs on Windows NT PCs. (Navis combines this with another of its software products called "EXPRESS," which is a comprehensive information management system that runs on the GPA's Oracle server.) SPARCS allows real-time access to data on cargo transiting the GPA's Garden City

[102] Gene Linn *It's not automatic* Journal of Commerce June 26, 2000, Pg. 22
[103] http://www.marad.dot.gov/
[104] September 24, 1998 Testimony Of Clyde J. Hart Maritime Administrator, Before The House Transportation And Infrastructure Committee Coast Guard And Maritime Transportation Subcommittee.
[105] http://www.navis.com/

Containerport Terminal. The GPA believes that this "enhances gate operations, import/export processing, bookings, billings, EDI capabilities, work order tracking, and vessel, rail and yard operations management." [106]

4. Customs Automation

The U.S. Customs Service currently uses the Automated Commercial System (ACS), a mainframe computer system that electronically clears imported merchandise. This system is in need of additional funding for maintenance and is operating a capacity far beyond its original design. The Customs Service also wants to build a new system, the Automated Commercial Environment (ACE). U.S. ports and related organizations have formed the Coalition for Customs Automation (CCAF) to urge government funding of these initiatives; there is widespread belief that ACS must be replaced. A congressional hearing was held on April 4, 2000, as part of the U.S. Customs budget hearing, to consider this. Many shippers are also concerned that the new ACE should be compatible with the international system ITDS (International Trade Data System).

5. Gate technology

Cosmos Data offers a "Visual Gate System" that allows trucks to efficiently pass through a gate by collecting much of the pertinent data through digitally photography, OCR and a database module.[107]

Another gate technology to reduce or eliminate paperwork at gates is the system developed by Maher Terminals, a large terminal operator. Maher uses a technology known as Computer Character Recognition to automatically take an encrypted digital picture of each truck container,

[106] http://www.gaports.com/infotech.html
[107] http://www.cosmos.be/frames.asp?/products/content_new.html. Other Cosmos port management products are discussed at http://www.cosmos.be/frames.asp?/products/content_new.html.

chassis and driver. This is combined with an Electronic Gate System and the Security Electronic Grid System are designed to allow for both port security and paperless gate operations. [108]

6. Underwater Imaging

A company called Everest VIT provides remotely operated underwater cameras that can be used to inspect for underwater corrosion and similar purposes. [109]

B. New Technologies for Airports

1. Airport Management Systems

Late last year, Motorola and InterSystems jointly announced new software for airport management.[110] Their RapidAIMS system will combine Motorola's telecommunications and systems-integration expertise with InterSystems' next-generation airport-management applications and operational database software.[111] The goal of RapidAims is to place real-time information in the hands of mobile resources at various locations across the airport. This information will allow various airline and airport teams to receive, monitor or report information, which can result in improved on-time departures, customer service, ground handling, cargo and baggage handling.[112]

Motorola also provides a "portfolio" of combined communications and communications services to airports.[113] InterSystems specializes in airport database software and displays.[114]

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[108] http://www.mtls.com/automated.html
[109] http://www.v-i-t.com/new/new_press03.html
[110] *Twin technology solutions* Jane's Airport Review November 1, 2000 Vol. 12; No. 9
[111] http://www.intersystemsww.com./aims.html
[112] http://www.motorola.com/LMPS/pressreleases/page1363.htm
[113] http://www.motorola.com/MSD/AirportSolutions/
[114] http://www.intersystemsww.com./

2. Cargo Handling

Telair International, USA develops and produces advanced aircraft air-cargo handling and retention systems. Complete cargo-handling systems for wide-bodied aircraft can be supplied in either powered or manual modes, as well as bulk handling systems for narrow-bodied aircraft.[115]

3. Gate and Docking Equipment

JetLink is a system that has been introduced by FMC-Jetway Systems.[116] This system monitors passenger boarding bridges and related equipment. The system can exchange data with the related systems of other manufacturers, such as aircraft docking guidance systems. The data can also be incorporated into systems for general airport management.[117]

Honeywell Airport Systems,[118] manufactures a "VDGS visual docking guidance system," to help airplanes dock at gates. This system has been installed a 36 gates at the new Beijing terminal that opened in October 1999, the company is supplying 44 systems to the new Inchon International Airport under construction in Korea.[119] A competing system is sold by Safegate International AB of Sweden.[120]

[115] http://www.telair.com
[116] http://www.jetway.com/
[117] *Building smarter bridges* Jane's Airport Review December 1, 2000 Vol. 12; No. 10.
[118] http://www.airportsystems.honeywell.com/
[119] *Equipment - Docking Guidance*; Jane's Airport Review February 1, 2000; Vol. 12; No. 1
[120] http://www.safegate.com/6.htm

4. Airport Security

The DOT funds research on new technologies for the detection of illegal materials at airports.[121] In 1996, the federal government completed a detailed study on needed security measures at airports. This study suggested that airport security systems should focus on the following areas: "New developments such as computerized systems with high resolution digital displays, innovative use of color to highlight threat objects, and ability to accommodate technologies such as threat image projection to maintain screener performance, can provide enhanced security. The FAA should review available technology for screening carry on items, regularly update minimum standards for new installations, and develop programs for upgrading deployed technology."[122] New security equipment recently introduced by industry includes the PX2000 x-ray security screening system[123] from PerkinElmer Instruments,[124] which was released last October.

5. Combined Airline Website

Although it is a new airline initiative rather than an airport initiative, it is worth noting that a major new website is being created by the airlines. In addition to their individual online efforts, Orbitz[125] is a new combined online effort of the five largest airlines-- American, Continental, Delta, Northwest, and United. They are building a new site that will not only sell their tickets and services, but also sell the services of 22 car-rental companies and 22,000 hotels. This raises antitrust issues and the consortium is being monitored by the Department of Justice. Government officials have indicated that they do not want to stop this site, but will watch this and similar sites to see if anticompetitive practices result. The Orbitz site is expected to become operational in the near future.

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[121] http://www.its.tc.faa.gov/aar500/library/content/FactSheet.pdf
[122] http://www.airportnet.org/EXHIBITS/depts/Regulatory/gorefinal.htm (see section 3.15)
[123] http://instruments.perkinelmer.com/news/2000/2000-0911.asp?s=1&ss=2
[124] http://www.instruments.perkinelmer.com/index.asp; see also *Handling new products in Atlanta* Jane's Airport Review September 1, 2000 Vol. 12; No. 8.
[125] http://www.orbitz.com/

Final Comment

We are grateful to have had the opportunity to prepare this report for you. If you have any questions, if you would like additional information, or if you would like copies of the articles cited, please do not hesitate to contact us.