

Keynote Address: Terminal of the Future

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Twenty-five years ago capital investment in containerization was primarily by two companies, Matson and Sea-Land. This investment in 9 ships, 20,000 containers, 3 container cranes, and 4 specialized container terminals had a total capital value of less than \$200 million. In comparison, today's investment in worldwide containerization exceeds \$76 billion.

During the past 25 years this writer has had the opportunity to participate, with Sea-Land and other companies, in the basic decisions that are necessary when vast investments in containerization are made. For example, decisions must be made about

- Role of standardization in such areas as container sizes,
- Balance between the capital and the labor components of investment,
- Type of land systems,
- Required vessel sizes and cranes on board vessels or on shore, and
- Intermodal connections.

After 14 years at Sea-Land as Vice President of Engineering the writer joined Puerto Rico Marine Management, Inc. (PRMMI), as Vice President of Operations. During those 4 years he found out what the operators, users, shippers, and labor thought of the decisions engineers were making and the resultant effect on operations and sales.

During the last 8 years in the consulting business the writer has attempted to combine an engineering background with practical operations experience. A valuable lesson learned from this experience is that it is important to consider the ultimate user and the human factor in what is planned and constructed.

In an attempt to quantify future investment in containerization, a graph relating investment to projected number of future 20-ft equivalent units (TEUs) to be handled in the world's ports is shown in Figure 1. Overlaid is a proportional increase in the \$76 billion current investment in containerization. The result shows a total new spending of \$54 billion: \$30 billion for vessels, \$10 billion for

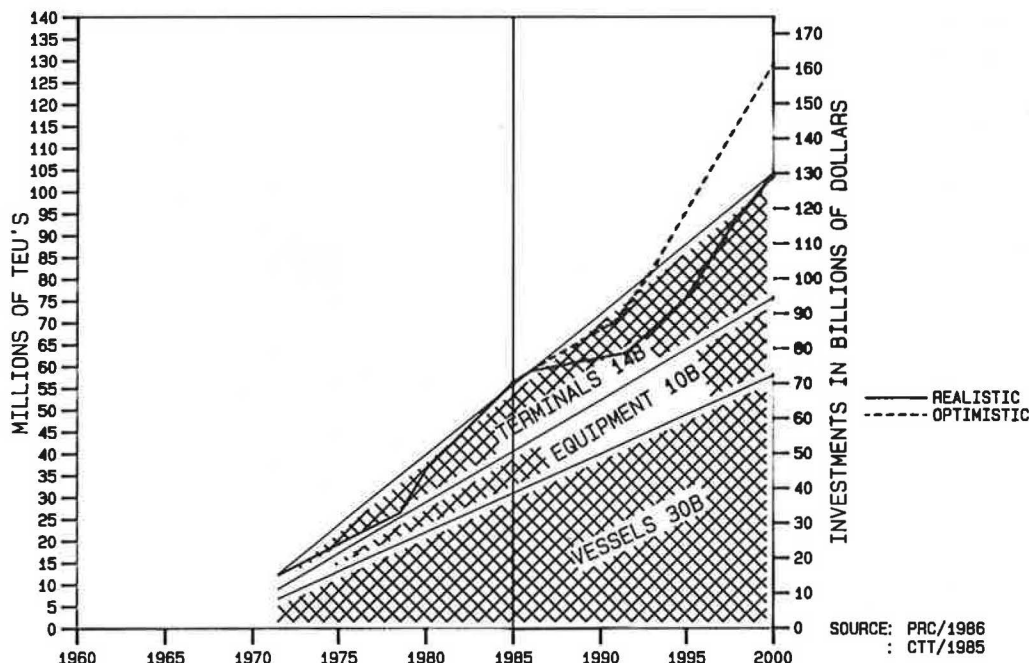


FIGURE 1 Containers handled worldwide 1960-2000.

equipment, and \$14 billion for terminals. Capital investment is defined as the cost of vessels, equipment, and facilities dedicated solely to containerization. It does not include infrastructure such as dredged harbors or highway construction costs. Equipment is rolling stock only. Cranes and cargo-handling gear are included under terminals.

If an optimistic forecast were used, 30 percent would be added for a total of \$70 billion new investment: \$39 billion for vessels, \$13 billion for equipment, and \$18 billion for terminals.

In reviewing this graph many questions arise. The first is how good are the numbers? The writer is not an economist, but he did review the rationale used and found it to be reasonable. The proportional approach to investment and moves is simplistic and ignores such factors as inflation, transshipment, load centers, and replacement of assets. In the writer's opinion the pluses and minuses of these factors will balance out.

The same proportional evaluation was done using information from another source. As shown in Figure 2, using world container ship capacity to the year 2000, the total investment related to the realistic projection is again \$130 billion. In the writer's opinion, these huge sums will be spent on new, modern vessels so as to minimize per slot costs. The equipment number may appear high in light of today's depressed production, but new sizes, shapes, and types of cargoes will spur a resurgence of equipment construction.

Spending on facilities will occur primarily because of expansion and growth of containerization into areas of the world where containerization is an emerging technology. Figure 3 is a breakout of Figure 1 using the Figure 1 optimistic projection. Notice the large growth percentages in Africa, Southeast Asia, and especially South and Central America.

To plan and construct these assets, many technological decisions must be made. The agenda of this conference covers many basic issues ranging from facility design criteria, to the relationship of design to intermodality, to future operations and

process control systems. For engineers it is an opportunity to get to know the operators, and for operators it is a chance to tell the engineers "the facts of life."

Certain factors and technologies should be considered in the design of the container terminal of the future:

1. Terminal design starts with vessels. Future vessels will be even larger than Panamax. Frequency of sailing will decrease and fast turnaround times will be required. Thus terminals must be designed for both peaking and low utilization.
2. Container sizes will vary greatly with the needs of customers and intermodal economics. Thus future terminals must be flexible in size and equipment capability, and positive container identification systems must be perfected and installed.
3. Crane productivity must be made to rise significantly. New innovative use of buffer systems and methods of delivery to shipside must be made together with agreeable accommodations with labor.
4. Intermodal interchange will be more important each year, especially as the domestic freight of countries becomes highly integrated with international freight.

The following is a list of specific, promising state-of-the-art and emerging technologies recently identified:

1. State-of-the-art technologies
 - Infrared data transmission systems,
 - Double-trolley container cranes,
 - Multitrailer systems, and
 - Integrated terminal design and operations.
2. Emerging technologies
 - Automated trim and list control systems,
 - Cell guides for container stowage on deck,
 - Semiautomated or fully automated cranes,
 - Buffer systems to decouple major equipment and reduce dead time,
 - Chassis guide systems to speed container placements,

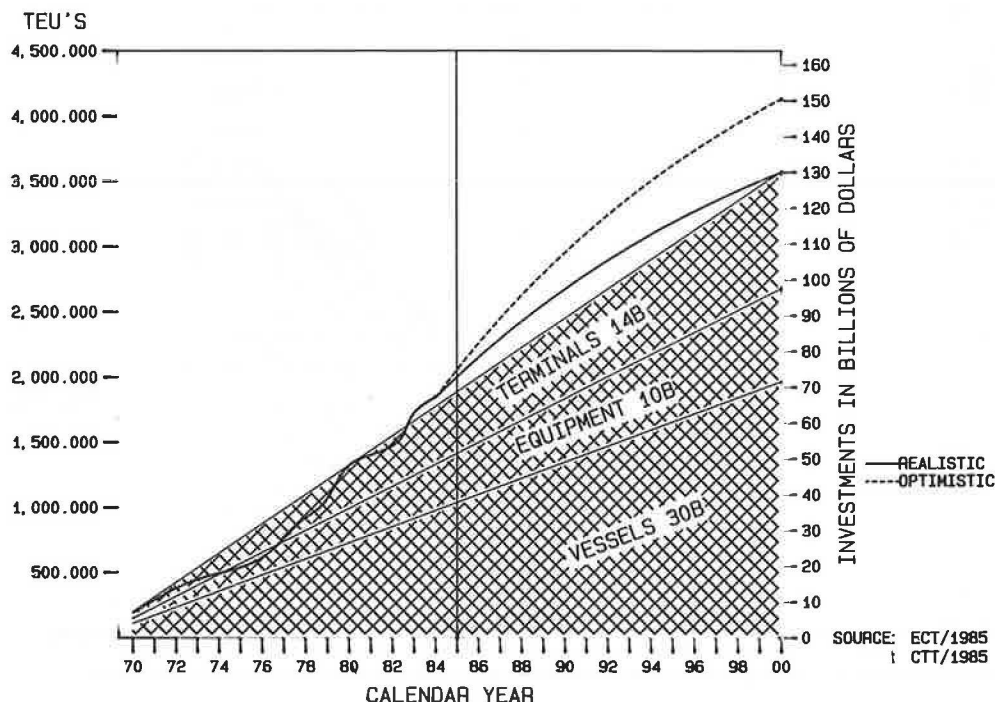
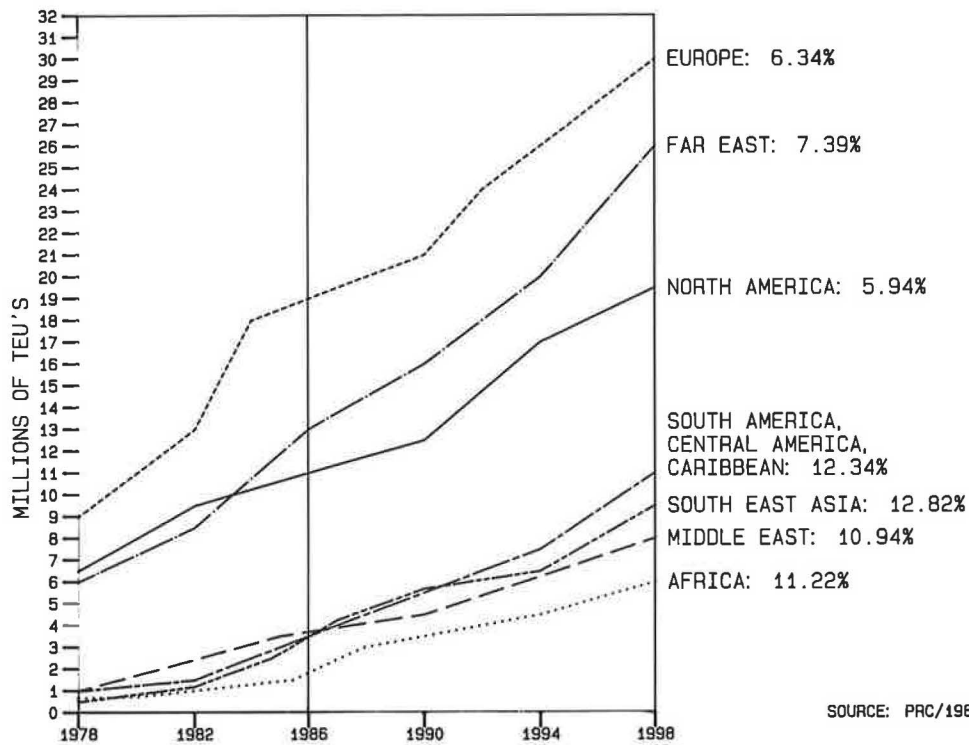


FIGURE 2 World container ship capacity (TEUs).



SOURCE: PRC/1986

FIGURE 3 Containers handled by world port regions 1978-1998, optimistic forecast.

- Passive and active/passive equipment identification systems,
- Automated container storage and retrieval systems,
- Automated guided vehicles,
- Voice recognition technology for equipment commands and data entry,
- Hand-held interactive computer terminals,
- Advanced rail car and chassis designs,
- Stowage planning systems,
- Decision support computer models,
- Networking and data base management systems, and
- Crane simulators and operations simulators for planning purposes and for personnel training.

With all this technology in place and with the cooperation of labor, the writer envisions a container terminal where

- Vessel turnaround is 12 hr,
- Container crane production exceeds 60 boxes per hour,
- All cargo clears ports in 24 hr with certain intermodal cargoes assigned to liner trains clearing in less than 12 hr,
- Terminal never closes nor has any labor difficulties, and
- Costs through the terminal are less than \$100 per container.

Many would say this can never happen, but, with technology and a need to remain competitive in the world, this goal needs to be met. This conference and exchange of views should be the start of a process that will result in transportation users of the next 25 years being able to take advantage of the technology of the future.