Papers —

Eighth Annual Meeting

"Man & Transportation"

September 6-9, 1967

Montreal, Quebec, Canada

TRANSPORTATION RESEARCH FORUM

Impact of Containerization on Ocean Transportation: Dimensions of The Problem*

*by Gayton E. Germane**

There has been great progress in containerization for ocean shipping in recent years. Current operations and plans indicate that an even greater period of development is in prospect. For this reason, it is particularly important that we consider the impact of some of the problems which remain and the nature of the solutions which may be appropriate.

For convenience, I have classified some of these problems under the headings of Standardization, Rates, Waste Space, Administration, Transfers, and Utilization. Let us consider each of them in turn.

STANDARDIZATION

To date, standardization efforts have been focused on the container rather than on the carrying vehicles. In container standarization, the features involved have been dimensions, strength, and various design specifications. After years of work, standards were adopted on these features and were presented for consideration by the International Standards Organization. Unfortunately, as of February 15 of this year, the MH 5.1–1965 USASI Standard, Specifications for Cargo Containers, has been withdrawn. This resulted from concern by the International Standards Organization about the possible deformation of corner fittings under load and a desire to correct some typographical errors in the Standard. Tests indicated that the MH-5 Standard did not provide sufficient strength in corner fittings to resist longitudinal strains which might be involved in lashing of large cargo containers stacked on deck. Ways are now being considered to strengthen the corner fittings with a minimum adjustment of cargo gear designed to match the present MH-5 Standard corner fittings.

What to Standardize. The example of container corner fittings provides an excellent illustration of the need for standardization. Clearly, we must have design features which allow the containers to be used safely and efficiently in interchange service. On the other hand, imagine the domino effect if we were to standardize non-essential items. For example, as a result of recent experience, plastic coated plywood is becoming increasingly popular as a material for container sides. It is cheap, strong, and has several advantages over metal: there is no corrosion problem, repairs can be made by unskilled personnel, and the container doesn't need to be unloaded for repair work. In addition, side posts are avoided allowing greater available cube in the container. If we had specified container sidewall materials instead of performance requirements, this development would have been delayed con-

*1907 *Foundation Professor of Logistics, Graduate School of Business, Stanford University.*

siderably. By making sure that we standardize only on the elements essential for system operation, we provide the flexibility for experimentation and development necessary to improve the system.

An Approach to Standards. It seems clear that we only make trouble for for ourselves if we standardize beyond what we must. A major problem in this area is to distinguish between the necessary and the desirable. Perhaps the best test is to apply the system concept and ask, "Is this standardization essential for the operation of the system?" If the answer is doubtful or "No", then we should not adopt, at that time, a standard on the element of the system being considered.

In addition, we should make certain that the standard is no broader in its application than necessary. Thus, if a container is to be used only in domestic land transportation, it probably will not require the strength features necessary for stacking in the hold of a ship. It may be appropriate to have a different standard for domestic land service containers than is established for containers to be used in ocean commerce. Similarly, if a container is intended only for use in a particular overseas service, it might be 35 feet long, if that fits the ships in the trade. We should not insist that it be of the 20, 30 or 40 foot lengths established in the general standard. The key element here is whether or not departing from the general standard will limit the flexibility of use more than the savings will justify.

When to Change. Another major problem concerning standardization is the matter of changes in standards made possible by changes in law. For example, buses are now permitted a nine foot width in the United States. It has been suggested that the allowable width of trucks be increased from eight feet to nine feet. If this is done, should container standards be adjusted, or should containers stay at the present eight foot width? As another example, what if the greater length of highway vehicles now authorized in some parts of the U.S. becomes common? Should we then modify the container standards to include a 45 or a 48 foot container? To do this would certainly create problems for shipowners who have built vessels with container cells intended for 20 foot containers. On the other hand, to reject the larger size containers would postpone the day when their increased efficiency could be made generally available.

A financial analysis approach can help us with the problem of when to change a standard. Basically, we want to make changes only when they are to our advantage. Thus, if the discounted present value of the profit expected from the proposed system exceeds the discounted present value of the profit from the present system, our total profit will be increased by making the change. The comparison here is between the Net Present Values of the two systems.

As suggested by the name, to calculate Net Present Value, we reduce future in-flows and out-flows of cash over a period to today's value. This is done by discounting the future results at an appropriate interest rate, or perhaps we may use different interest rates for various portions of the period. Using the latter approach, we can allow for anticipated changes in interest rates during a period of years.

An important advantage of the Net Present Value method over the Return on Investment, and the Pay-Out Period, is that the Net Present Value method specifically recognizes differences in the timing of cash in-flows and cash out-flows in evaluating the financial worth of a project. This is entirely appropriate since a dollar today is worth more than a dollar five years hence. Let us consider a specific example to illustrate the difference in evaluation this can make.

Suppose we have two container projects under consideration. Each will require a total investment of one million dollars; each will provide a cash in-flow of $300,000 a year for five years, and both projects will terminate at the end of that period. The financial difference in their cash flow is that Project "A" requires the investment of the full one million dollars at the first of the venture, while the Project "B" investment will be $200,000 the first year, $300,000 the second year, and $500,000 the third year. The table shown in Figure 1 presents these cash flows and compares the two projects according to the Pay-Out Period, Return on Investment, and Net Present Value. While the projects appear to be equally attractive by the first two methods of comparison, Project "B" is much to be preferred, as indicated by its greater Net Present Value.

FIGURE 1

	Project "A"		Project "B"	
Year	Cash In	Cash Out	Cash In	Cash Out
1	$300,000	$1,000,000	$300,000	$200,000
2	300,000		300,000	300,000
3	300,000		300,000	500,000
4	300,000		300,000	
5	300,000		300,000	
	$1,500,000	$1,000,000	$1,500,000	$1,000,000

	Project "A"	Project "B"
Pay-Out Period	3-1/3 years	3-1/3 years
Return On Investment over Project Life	50%	50%
Net Present Value at 10% Interest Rate	$250,700	$365,000
Net Present Value at 20% Interest Rate	$ 76,400	$279,500

Some may feel that the use of 10% and 20% interest rates is unwarranted. However, if we are thinking in terms of the Return on Investment for alternative uses of funds within the firm, these rates of interest may be quite realistic.

Note, in Figure 1, that at each interest rate, the difference in Net Present Value Between the projects is caused entirely by the difference in the timing of the cash out-flows. Differences in the cash in-flows would also produce differences in Net Present Value. In general, the greater the difference in the annual net cash flows, between the projects, the greater will be the difference in their Net Present Value. And the higher the interest rate used, the greater will be the difference in the Net Present Value of Projects "A" and "B".

These comments on methods of analysis have referred specifically to the decision alternatives of a single enterprise. Doubtless there are human factors which would influence the actual choice of analytical tools. We all recognize that complex tools can be wasted on simple problems. And of course, we must consider the salability of a technique, or its acceptance by senior management, in deciding what method of analysis will produce the best results.

These financial analysis concepts, however, are also appropriate in evaluating the "When to Change" question from the viewpoint of a national, or international, standards group. In such cases, the available data will not be complete, and probably will be more subject to error than for a single enterprise. In spite of this, I believe that by applying current financial analysis techniques we can improve the decision making by our standards groups. Using these concepts, we can obtain a perspective, and a basis for testing decisions, far beyond that available through individual experience or simple analysis.

RATES

In a competitive economy, the price of a service may be affected by all of the factors that affect the supply and demand for that service. It is not surprising, therefore, that the problem of rates for container service becomes involved with a wide variety of technical, legal, operating, and market considerations. The specific topics to be considered here are: Rate Base, Mixing Rule and Joint Rates.

Rate Base. In many cases container rates have simply followed the pattern of rates for other types of service. This has meant that a considerable element of the Value of Service concept has been reflected in container rates. It seems likely that this, in turn, has tended to restrict the volume of traffic developed from the high rated commodities. Since the low rated commodities often are handled in bulk, rather than in containers, and breakage or pilferage is not a serious problem, a Value of Service rate element does not result in an increase in low rated commodity traffic by container to offset the restriction in the volume of the high rated items. As a result, it seems likely that the potential volume of container traffic, and possible economies of scale, have not been achieved.

It is to be hoped that, in the future, increased emphasis will be given to Cost of Service as a base for container rates. This would have certain advantages: (1) It would benefit shippers through providing somewhat lower rates. (2) These rate reductions would tend to increase container service traffic volume, offering the carriers an opportunity to achieve economies of scale. (3) Increased emphasis on cost-based rates would provide ocean container service with a natural defense against other types of service which otherwise might gain special advantage by pricing on a Cost of Service basis to attract the highest rated traffic available to the container service systems.

Mixing Rule. A further complication in container rates has been the carry-over of the idea that commodities moving together should carry the rate of the highest rated commodity in the group. As a result, full utilization of containers is discouraged because the shipper is reluctant to add higher rated commodities to a container already partly filled with lower rated items. Hence, the shipper is likely to use container service less often than he otherwise might, and to hold containers longer accumulating a load rather than add high rated commodities.

Elimination of the Mixing Rule would be desirable as a means of developing container service volume. And, of course, the greater use of FAK (freight all kinds) rates would assist further. The FAK rates have the additional advantage of avoiding the temptation for some shippers to misclassify their freight, and makes it unnecessary for the carrier to check the container contents to protect himself against this. In some cases, the simplicity of FAK rates may also encourage the use of container service when compared to individual rates or classifications offered by competing modes of service at about the same price level.

Joint Rates. It came as a shock to many persons to find that there was no organization in the U.S. Government with the authority to approve joint rate arrangements between international air and water carriers. With the prospect of the development of the giant cargo aircraft in the near future and the desirability of providing coordinated service, this legal deficiency aroused considerable concern. As a result, in 1965 companion bills were introduced in the House and Senate,

> ". . . to authorize common carriers under the jurisdiction of the Civil Aeronautics Board, Federal Maritime Commission, and Interstate Commerce Commission to enter into joint rates, and provide for their regulation by a joint board . . ."[1]

This proposed legislation met considerable opposition from groups which feared that a super regulatory agency was intended. Others opposed certain parts of the bills such as that which would make recovery of straight overcharges and reparations from air carriers available on a basis similar to the recovery provisions applicable to surface carriers. As a result of these objections, the bills did not pass. However, one of the staunch supporters of this legislation is the present Secretary of Transportation who formerly was Chairman of the Civil Aeronautics Board. It is believed by some that similar legislation will be sponsored in Congress in the next year or two by the Department of Transportation. And as of the Spring of 1967, staff members of the Air Transport Association of America, and the Association of American Railroads, have developed language for a Joint Board Bill for consideration by their associations.

The legal authority to approve and regulate joint air and water rates is a matter which appears to be well on its way toward solution. Surely, by the time we are ready to interchange cargo between the Boeing 747s and container ships, appropriate joint rate legislation will be on the books.

WASTE SPACE

This is a problem area closely allied to Rates. Rate adjustments have long been one of the principle means used to reduce the amount of unutilized space. There are two particular aspects of Waste Space that will be considered here. These are: Contents vs. Container, and the Empty Return. These topics involve rates, customs, and technology.

Contents vs. Container. The problems in this area result from the fact containers sometimes are not entirely filled. Nevertheless, they generally are

1 Senate Bill 1950, 89th Congress, 1st Session, introduced May 12, 1965.

charged for on the basis of the gross weight or cube, whichever produces the greater revenue for the carrier. This is consistent with the Measurement Ton concept in ocean shipping but discourages container service in many cases, since the shipper of dense commodities can do little about the unutilized cube inside the container. In some cases, container service is now being offered with rates based on the net cargo, rather than on the gross weight or cube of the container and cargo. If the carriers find that other economies, and possibly higher rate levels (recognizing improved door-to-door service), offset the costs of the "space lost", we can expect to see an increase in this net cargo type pricing. Certainly, it appears to offer considerable advantages to the shipper in simplicity and convenience, and to the carrier in greater volume and possibly better future utilization of the container transport system as a whole.

Various equipment developments have been introduced aimed at this problem of waste space in the container. Early this year, American Export Isbrandtsen Lines demonstrated a gondola container with spring-loaded, adjustable corner posts. This container can easily be adjusted in height to match the load. The corner posts permit the container to be stacked in a vertical container cell aboard ship without the weight of the containers above bearing on the freight in the gondola container itself. This container is now being tested as a means of shipping aerial bombs and ammunition to Viet Nam. It also appears to have possibilities for general cargo and, with some modifications, as a means of handling efficiently small shipments of mineral concentrates.

A van container of adjustable height was introduced a few years ago by United States Steel Corporation as a part of a family of advanced design containers of various sizes and types. This Expandable Van Container is illustrated in Figure 2. It was described in the following terms:

> "Featuring a bottom section which telescopes into the top, this concept permits a variation in van height from 4-1/2 feet in the down position (similar to the top photograph) to 8-1/2 feet when van top is fully raised (bottom right). Because it can be loaded in three different ways, this van will carry a variety of commodities—dry bulk cargo, packaged goods or heavy, bulky items awkward to handle.
>
> Dry bulk cargoes, for example, are funneled into the van via four ports in the top (bottom left). Packaged goods can be loaded through doors at one end which open on hinges at the top and bottom (lower right). Awkward cargoes, such as lumber, can be loaded with an overhead crane by removing the cover altogether and filling the bottom section. The cover is then replaced (top) and lowered to the proper height."

Gondola and van containers of the types described appear to have real advantages in flexibility and in space saving potential for container ship service. Further developments of this type should be encouraged in the interests of shippers and carriers alike.

Empty Return. A problem related to the waste space difficulties discussed

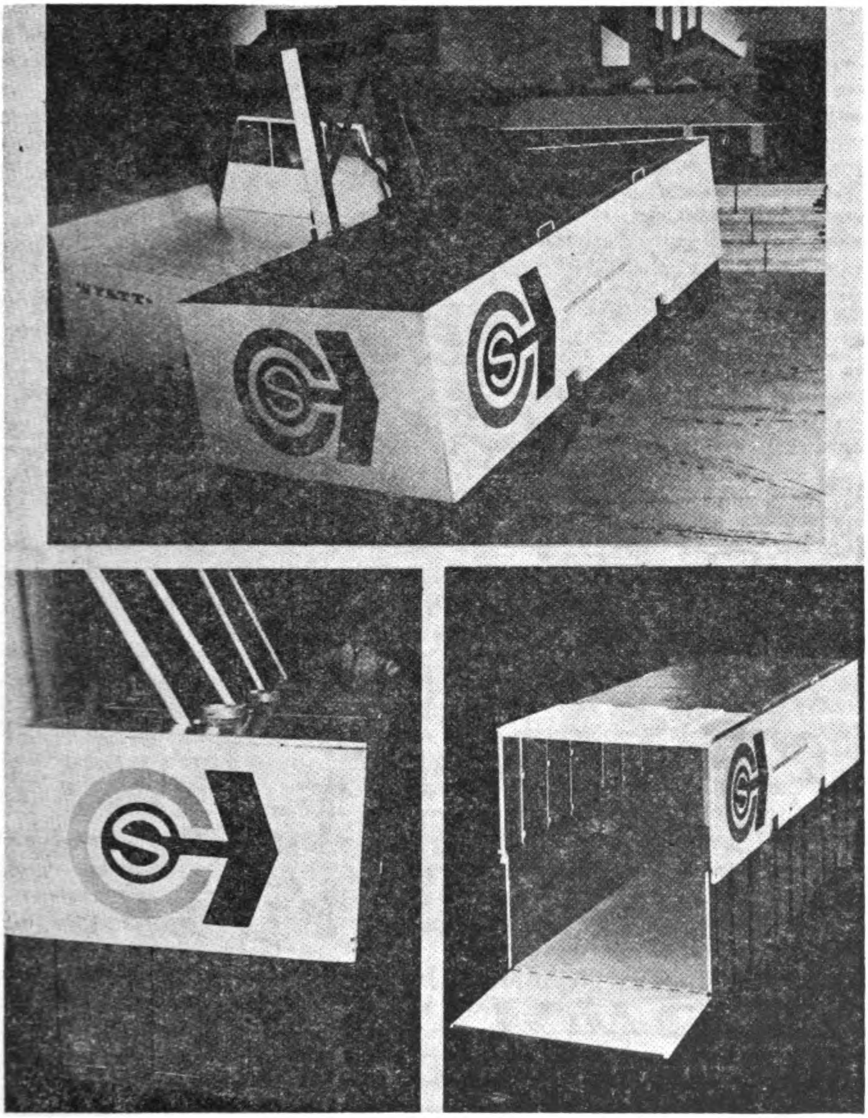

FIGURE 2

Expandable Van Container

above is the handling of containers for which no revenue load is available on the return voyage. This has sometimes been met by adjustment of rates, resulting in a rate differential by direction. In other cases, carriers have provided a low, arbitrary rate for the empty containers, as a means of encouraging container use. Specific development of cargo to fill empty containers on the back-haul has also been attempted. None of these measures has been entirely satisfactory so here also, attempts have been made to reduce the importance of the problem by ingenious container design.

In the United States Steel Corporation container system designs, there were two pallet containers which offer ways of reducing the empty return space problem. These are shown in Figures 3 and 4. The design in Figure 3

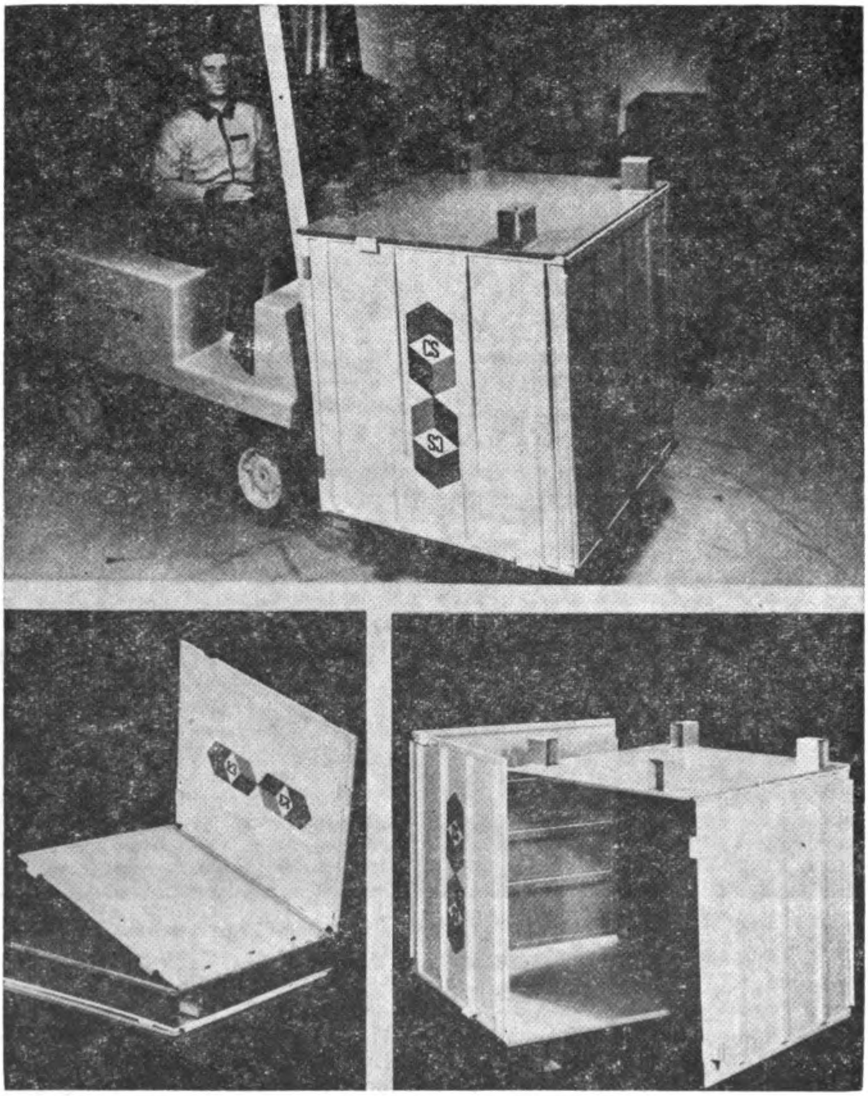

FIGURE 3
Hinged Pallet Container

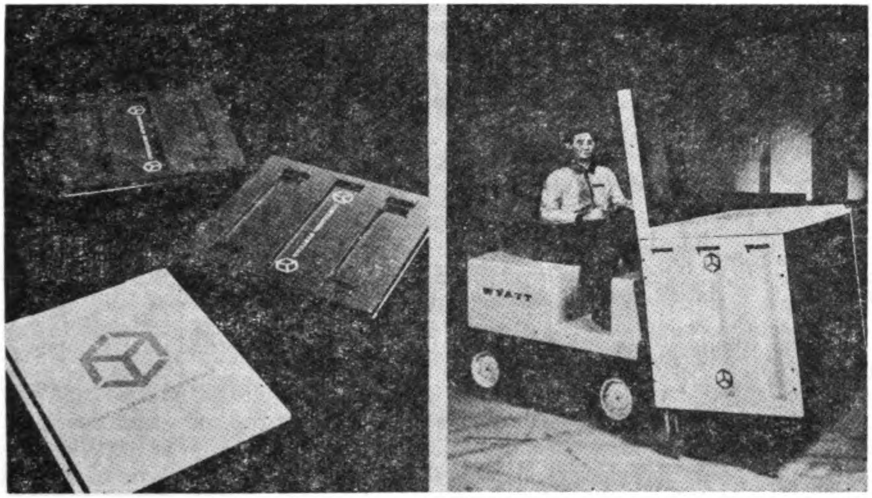

FIGURE 4

All-Weather Corrugated Pallet Container

is called a Hinged Pallet Container. It is described, in part, as follows:

> ". . . this flexible concept composes two identical assemblies, each consisting of three components: a pallet base hinged to a pair of hinged sides (bottom left).
>
> Both assemblies are folded out and one inverted over the other (bottom right) to form the covered, all-weather container which has legs on top and bottom panels. Arranged in an offset pattern, all eight feet support the load when containers are stacked."

Figure 4 is described as an All-Weather Corrugated Pallet Container. The features were explained in the following terms"

> ". . . this versatile design which may be adapted for use either as three separate pallets (left) or, if assembled, as a totally enclosed container (right).
>
> This concept features the use of bolts mounted in pallet feet on end panels as a means of securing components. When used as an enclosed container, these feet are recessed into the sides as seen in the darker panels. . ."

While it is clear that these designs wouold require considerable modification to be suitable in van container sizes, they point the way to possible means of reducing the empty container space problem. This, in turn, can reduce cost and improve revenue space available for the carriers involved. With the present lively interest in thru-container service from nation-to-nation, it seems likely that the potential of these special designs will receive considerable attention in the next few years.

ADMINISTRATION

Over the years, paperwork and government requirements concerning international trade have developed to such a degree that they represent a substantial barrier to trade. Container service has encountered its share of these difficulties: delays waiting for inspection, special handling charges, interference with the passage of sealed transit containers, duty assessed against containers, and excessive paperwork, etc.

These difficulties in international trade and transport have developed to the point that a number of organizations are actively pushing programs for the facilitation of international trade. Here are several examples of the progress:

Special Charges. The White House Conference on International Cooperation, in December 1965, found that,

"1. One of the major problems to be overcome in the successful development of containerized and unitized movement of cargo is the elimination of special charges in ports for the handling of this type of cargo. So-called 'heavy lift' charges are a serious deterrent to the acceptance and efficient handling of these consolidated movements."

Registry of Containers.

"2. In order to stimulate the interchange of containers, both between different owners in one country and also between different owners in different countries, it will be necessary to establish a registry for standard containers. Only registered standard containers should enjoy customs clearances, public health and agricultural waivers, interchange, and intermodal privileges."

The Bureau of International Commerce of the U.S. Department of Commerce has also been active. It provided strong support for the Senate ratification of two international agreements affecting containerization. These were:

Duty-Free Entry.

1. **Customs Convention on Containers.** This agreement provides for temporary duty-free entry of large containers used in international trade.

Transit Without Inspection.

2. **Customs Convention on the International Transport of Goods under Cover of TIR Carnets.** This agreement allows a loaded container to pass through a country without inspection if it will be inspected at destination.

Clarification of Liability. Last year, agencies of the Government of the United States and the Government of Great Britain issued a joint report designated, "North Atlantic Container Experiment, 1966." It stated, in part:

> "The allocation of liability appears to be a major impediment to simplifying container documentation by substitution of a genuine through document for the multiple documentation normally used to cover shipments from inland point to inland point."

Single Government Agency. In 1967, various groups are actively promoting the proposal that a single inspection agency be created at ports to handle the routines now performed separately by four different U.S. agencies. And in April of this year Federal Maritime Commissioner George H. Hearn recommended that a single agency be established for the regulation of international movements of containerized cargo.

Computerization. This Spring, a major project was proposed for the Transportation Association of America. It was asked to provide direction and guidance in the computerization of rates and tariffs. It was believed by the sponsors of the proposal that the work now going forward in about 15 different groups could best be accomplished if it were under central direction. This is one more step in paperwork simplification and will assist container services as well as other transportation activities.

These various developments indicate that the problems of administration and paperwork are being attacked on several fronts. If we lend our support to the interested groups, it seems likely that further progress can be achieved and the way to greater use of container by all modes can be smoothed considerably.

TRANSFERS

One of the difficult problems of ocean container service has always been the physical transfer of the containers to and from the ship. As the size of the container ships has grown, the need for speed in transfer operations has increased. Certain reasons for this are very clear: (1) The greater number of containers to be handled with the large ship takes more time. (2) The large container ship costs more per hour of vessel time than its smaller predecessor. (3) This large size, and matching investment, in new container/ships has produced a further problem in serving small volume ports. With ship time so costly, it may not be profitable to go into a port for small loads that were formerly attractive.

You are all familiar with many of the designs and facilities used to speed the transfer operation. The Roll-on, Roll-off ship was developed to load and discharge vehicles quickly. Container ships were designed with multiple cranes to speed unloading and loading. Shoreside cranes of great capacity were installed at some ocean terminals to handle the containers expeditiously.

In addition to these developments, there are two recent plans for speedy transfer of containers that deserve special attention because of their distinctive features and their service potential. These plans are the Sea-Bee System of the Lykes Bros. Steamship Co., Inc., and the Containership Helicopter System demonstrated by the American Export Isbrandtsen Line, in cooperation with the Sikorsky Division of the United Aircraft Corporation. These projects are discussed below.

Lykes Sea-Bee System. The features of this system were described earlier in the year by Mr. Frank A. Nemec, President of Lykes Bros. Steamship Co., Inc., in a speech before the National Transportation Institute. The ship and barges are illustrated in Figure 5, and the physical and operating characteristics of the equipment are summarized in Figure 6. An extract from Mr. Nemec's address follows:

"Within the next month Lykes expects to issue invitations to domestic shipyards to bid on the construction of three new, large all-purpose carriers. These ships will be gigantic by any standards, measuring about 875 feet in length and 106 feet in beam. They will be capable of carrying large amounts of cargo in various types of containers, barges, or vehicles. For example, the ship in its present design configuration can carry either 38 fully-laden barges or a total of somewhere between 1500 and 1600 cargo containers of the 8′ x 8′ x 20′ standard size. In physical terms this will enable the movement of approximately 1,400,000 cubic feet of cargo; in addition, each ship can carry about 15,000 tons of cargo liquids in its various deep tank spaces.

With a cargo lift of about 20,000 tons each ship will have a sea speed of 21 knots and three of them in combination will enable a ten-day frequency of service between Gulf ports to European continent. To illustrate the immense size of this vessel, each of the 38 standard design barges to be carried by this ship will be 97-1/2 feet long and 35 feet wide. The clear deck space on the upper deck, for example, is the length of two football fields and is 75 feet wide, free of any clutter or supporting stanchions. While the lower decks are equally as long, it is structurally necessary to provide a row of centerline stanchions in each of these decks.

Each of the barges can be tailored so as to handle special type cargoes economically and efficiently. For example, barges may be adapted to carry molten sulphur, kraft paper or liner board or unitized general cargo or containers. Initially, and until container volume develops to a substantial level, containers will be carried in or on barges. Arrangements, however, have been made and design patents are pending on special devices which will enable extremely efficient handling of container cargo into all three decks of this ship.

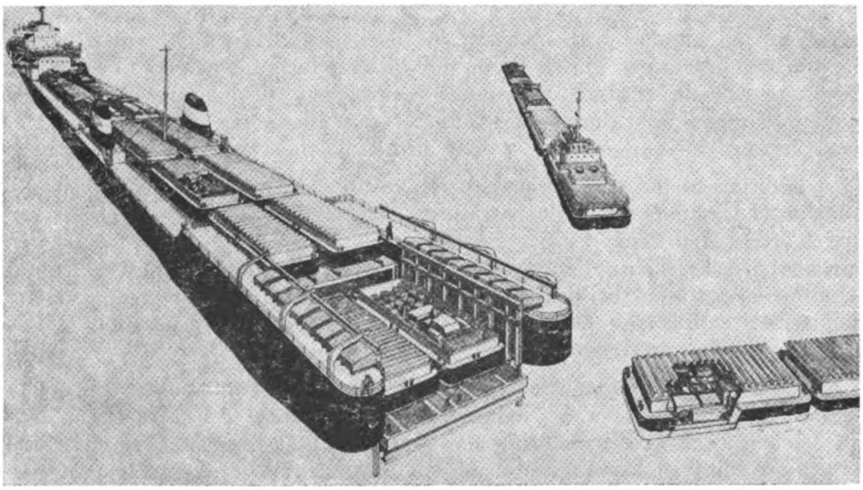

FIGURE 5
Ship and Barges of Lykes Sea-Bee System

LYKES INTER-MODAL CARRIER

(WITH FACILITY TO CARRY CARGO BARGES, CONTAINERS, VEHICLES AND UNITIZED CARGO)

PROFILE OF PRINCIPAL CHARACTERISTICS

LENGTH OVERALL	875 FT.
LENGTH BETWEEN PERPENDICULARS	723 FT.
BEAM EXTREME	107 FT.
DEPTH TO UPPER DECK	72 FT. 6 INCHES
MAXIMUM DRAFT ABOUT	39 FT.
DESIGN DRAFT	31 FT.
DWT AT 39 FEET	40,000 TONS
DWT AT 31 FEET—NORMAL EXPECTANCY	25,625 TONS
CARGO DWT IN BARGES AT 31 FT. DRAFT ASSUMING FUEL FOR 5200 MILES—33,000 SHP VERSION	17,500 TONS
CARRYING FULL COMPLEMENT OF 38 COMMERCIAL TYPE BARGES, EACH BARGE CAN CARRY AVERAGE OF (STOWAGE FACTOR = 84 CU FT PER TON)	460 TONS
TOTAL USABLE BARGE CUBIC ABOUT	1,400,000 CUBIC FT.
TOTAL LIQUID CAPACITY IN 56 TANKS	1,200,000 CUBIC FT. OR ABOUT 35,000 TONS
CLEAR DECK AREA	146,000 SQ. FEET
CLEAR DECK HEIGHT	17 FT. 9 INCHES/UNLIMITED ON UPPER DECK/
SHP—COMMERCIAL	33,000 SHP
SPEED TRIALS 31 FT. DRAFT	22-1/4 KNOTS
SPEED SERVICE—31 FT. DRAFT	20.8 KNOTS
FUEL CONSUMPTION/ STEAM PLANT/	150 TONS/DAY

BARGE CHARACTERISTICS

COMMERCIAL BARGE CHARACTERISTICS:

LENGTH	97 FT. 6 IN.
BEAM	35 FT.
USABLE SPACE TO UNDERSIDE OF COVER	13 FT. 2 IN.
DISPLACEMENT	1,000 TONS
CARGO DWT	850 TONS
CORRESPONDING DRAFT	10 FT. 8 IN. IN FRESH WATER

CONTAINER CAPACITIES

STANDARD 8′ x 8′ x 20′ DIMENSIONS.
CAN CARRY ABOUT 1500/1600′ SUCH CONTAINERS IN FULL LOAD CONFIGURATION

FIGURE 6

Importantly, changes can be made in the special cargo facilities of individual barges without in any way affecting the long-term usefulness of the carrier vessel itself.

I want to emphasize that more than simply being a new ship, the Lykes Sea-Bee System is an entirely new method of transportation

—and one which is based on an entirely new method of handling ship-board cargo. Heretofore and with only insignificant exception, general cargo has been stowed on board ships by method or methods involving the lift of that cargo from a dockside location into the holds of ships; lifting devices have varied, utilizing ships' booms, cranes or gantries—but the principle has always been the same. Thus, even technologically advanced methods such as the handling of containers on board ships follow exactly this same principle. In the Lykes case, however, we have completely departed from this principle and substitute the elevator and the wheel for the lift and fall system.

Let me explain to you how this is done. The principal novel features of the new Lykes ships revolve about—

1. An extremely large stern elevator having a total lift capacity in excess of 2,000 tons.

2. A novel and ingenious method involving the use of wheeled hydraulic transporters for moving barges or other cargo from the elevator into the decks of the ships, and

3. The wide-open decks which permit this cargo to be rolled into its final resting place rather than lifted and stowed.

Thus, in its simplest form, the Lykes elevator will move cargo, whether in barges, containers or otherwise, up to one of the three deck levels. The cargo-loading function will then be taken over by wheeled hydraulic transporters which will automatically carry and stow this cargo in its predesignated place on one of the decks.

It is a system of magnificent simplicity and tremendous productivity. Based on our systems analysis we expect that a fully-laden ship carrying 38 barges can be loaded and unloaded in the short space of 8 hours.

It is the first completely inter-modal carrier capable of carrying cargo barges, containers, vehicles, or unitized cargo with equal facility. In its evolution, the ship that began as a barge carrier has become the first all-purpose inter-modal carrier completely adaptable to the carriage of such specialized forms of cargo. This is a facility that no other cargo system offers."

Containership/Helicopter System. This represents another way of dealing with the transfer problem. After informal discussions with various groups, the Department of Defense issued a request for proposals (REP) on a containership/helicopter system. Two teams responded. One of them was the Sikorsky Division of United Aircraft Corporation in cooperation with American Export Isbrandtsen Lines. The other team was the Vertol Division of Boeing Aircraft in cooperation with Seatrain Lines. As of the Spring of this year, only the Sikorsky/AEIL team had demonstrated its system.

Speed and flexibility are two of the outstanding features of the containership/helicopter system. This ship can be unloaded in deep water and does not even need to stop. The helicopters can deliver the cargo to destination points at a considerable distance from the vessel without reliance on land transport or materials handling facilities ashore. This ability to "leap-frog" port congestion (or availability), and land transportation shortages, makes this system particularly attractive for use in Viet Nam. It is estimated that the containership/helicopter system might save as much as 53% of the intransit time on cargoes moving from the West Coast of the United States to Viet Nam destinations. The development of this estimate is shown in Figure 7.

SAVINGS IN TIME REQUIRED
TO MOVE CARGO FROM SAN FRANCISCO TO DISTRIBUTION POINT IN VIET NAM

	CONVENTIONAL	CONTAINERSHIP HELICOPTER
LOADING	5 DAYS	2 DAYS
STEAMING	16½ DAYS	16½ DAYS
WAITING	10 DAYS	—
DISCHARGING	7 DAYS	2 DAYS
MOVEMENT FROM PORT AREA TO DISTRIBUTION POINT VIET NAM (ESTIMATED)	5 DAYS	—
TOTAL	43½ DAYS	20½ DAYS

SAVINGS IN TIME 23 DAYS

% REDUCTION IN SHIPPING TIME — 53%

FIGURE 7

At the demonstration provided for the Department of Defense, off Bridgeport, Connecticut, the helicopter moved six containers an hour, over a five mile route, ship-to-shore. This was accomplished in spite of a 40 knot wind and waves eight to nine feet high in anchorage area. Under the proposed plan of operation, five helicopters would "work a ship" together, providing a container pickup every two minutes, if the haul were five miles. More helicopters, or longer pickup intervals would be involved for greater delivery distances. The containership and helicopter used in this demonstration are pictured in Figure 8. The outline and dimensions of the helicopter are shown in Figure 9. The specifications for the Sikorsky S-64 helicopter are given below.

REMARKS

The first flight of the twin-turbine-powered Sikorsky S-64 Skycrane, a universal transport vehicle with both military and industrial potential, took place May 9, 1962. The S-64 carries a 10-ton payload. First deliveries of the S-64 were made to the West German Ministry of Defense. The U.S. Army

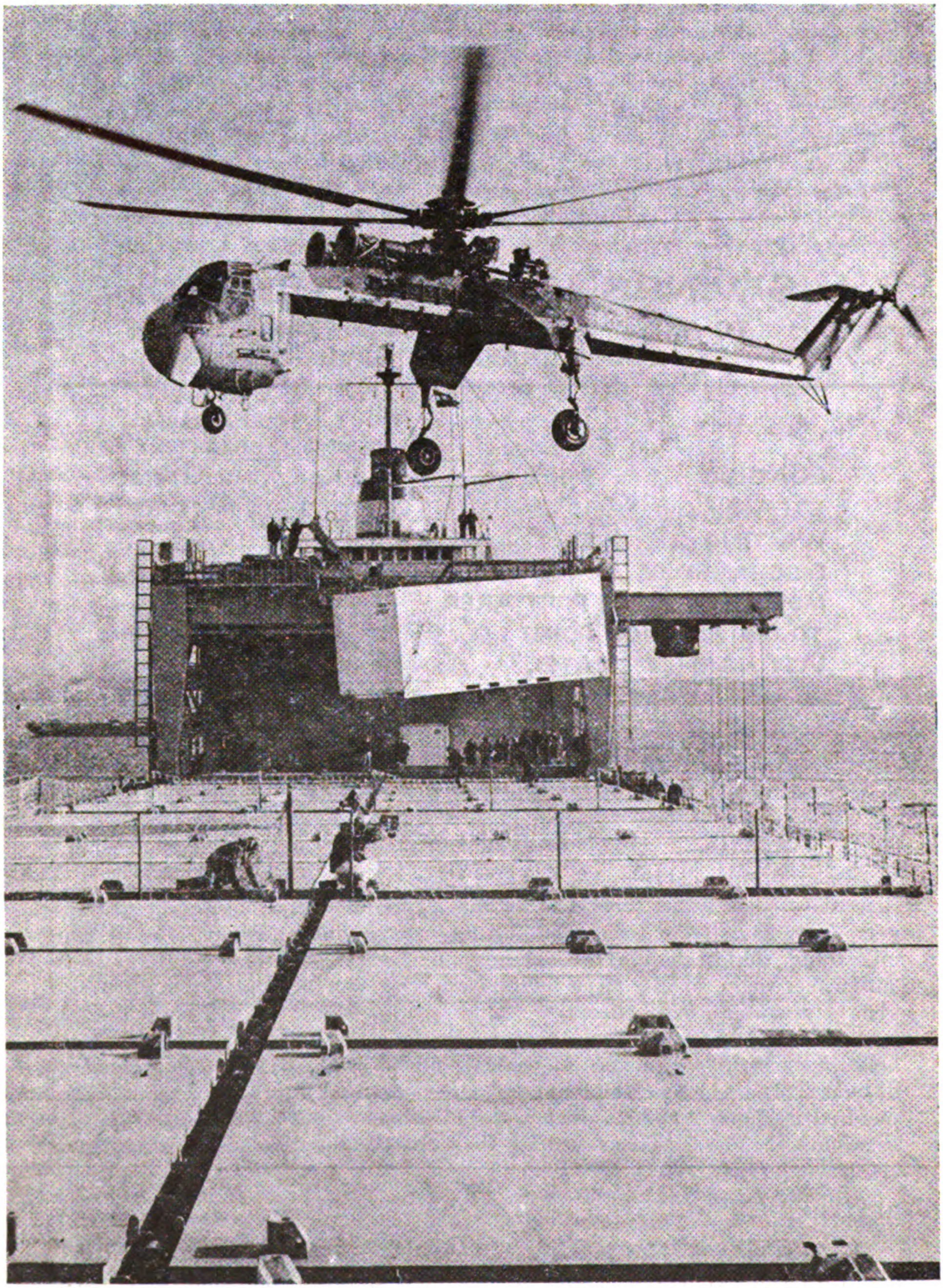

FIGURE 8
Unloading A Container Ship By Helicopter

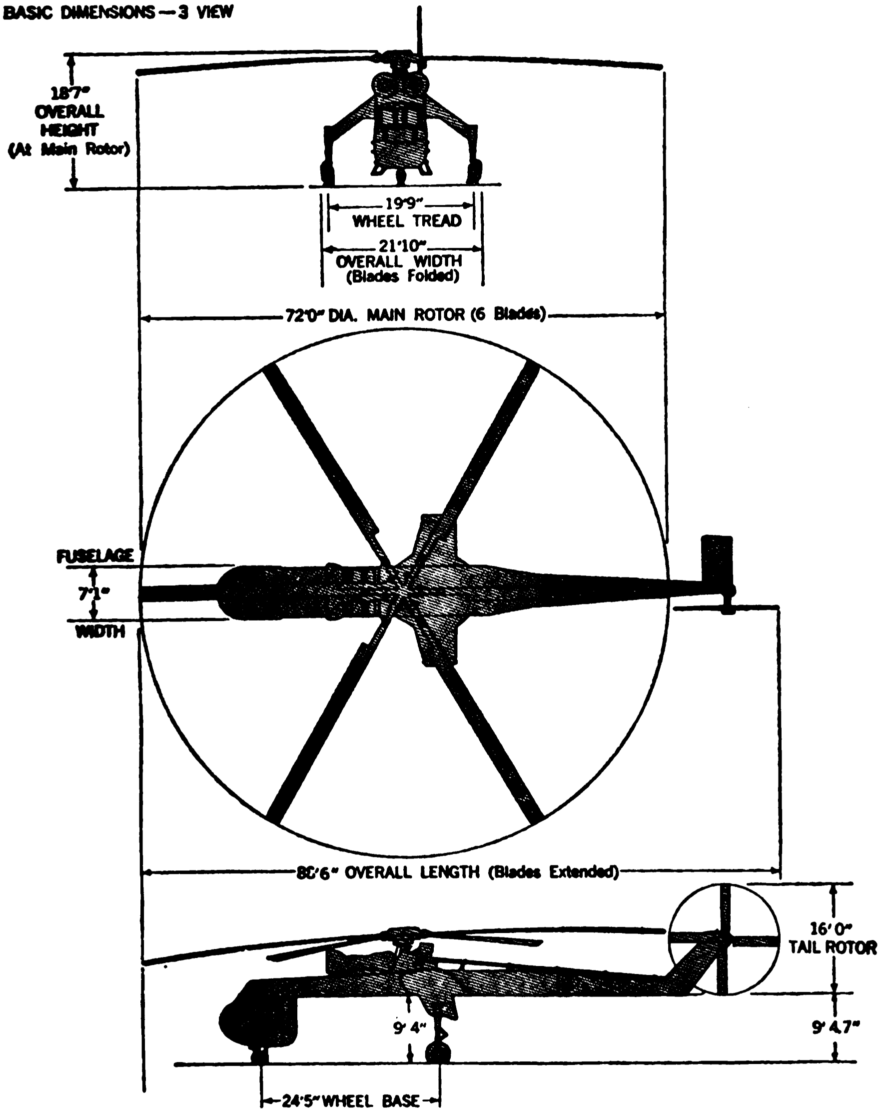

FIGURE 9

purchased six in 1964 and has ordered additional quantities. The S-64 is designed to carry its cargoes externally. It has a rear-facing pilot's seat to provide a clear view of the cargo during pick-ups or deliveries. By means of a hoist it can pick up or deposit loads without landing. A lightweight van, for such military uses as a field hospital, command post, and repair shop, or for such civilian applications as a skybus or construction headquarters, can be attached to the Skycrane fuslage. The Skycrane has proved particularly useful for recovering aircraft downed in enemy-held territory and for other heavy-lift duty in combat zones. It has a strong potential for use in ship-to-shore cargo carrying.

SPECIFICATIONS

Maximum Speed	124 mph	Engines (2) Pratt & Whitney Aircraft, JFTD-12A of 4,050 hp each.	
Cruising Speed	110 mph		
Best Rate of Climb	1,700 fpm	Weight Empty	18,969 lbs.
Service Ceiling	13,000 ft.	Normal Gross Weight	38,000 lbs.
Range with 10% reserve	253 mi.	Useful Load	19,031 lbs.
	Designation:	Sikorsky S-64 Skycrane; U.S. Army CH-54A	

It is interesting to note that this helicopter model has a flight range of just over 250 miles. This should permit a group of "sky cranes" to move from point to point, to provide an unloading service at several different locations.

Contrasting performance features between the rival systems are the fact that the Sikorsky helicopter can lift more than the Vertol helicopter, but the Vertol helicopter flies faster than its rival. Thus, for destinations about 17 miles from the ship, the Vertol helicopter will match the tons-per-hour performance of the larger Sikorsky. And for longer hauls, the Vertol will move more tonnage per hour. Both helicopter manufacturers are now working on larger models of their designs.

The application of a containership/helicopter system to commercial trade is an intriguing prospect. A. Theodore DeSmedt, President of American Export Isbrandtsen Lines expressed his view in these terms.

> "The commercial possibilities are overwhelming. With Skycranes we could place cargo on the delivery scene while the ship is still miles offshore."

Both the Lykes Sea-Bee concept, and the containership/helicopter system, offer a means of speeding container transfer, and of making possible the economical handling of small lots of cargo by very large ships. The elimination of the need to enter port, tie up to a pier, etc. is the key to this ability. In addition, the containership/helicopter system may have a special advantage along coasts where adequate harbors are widely separated. With helicopter delivery, cargoes could be moved directly between cities and the containership as it proceeded along the coast. This would avoid expensive and time consuming backhauls by land transport from the nearest suitable port.

These two new systems for container transfer offer prospects for greatly expanded and improved container service by ocean carriers. It behooves us all to appraise their potential carefully so that we can foresee the opportunities and, perhaps the problems, which they will provide us in the future.

UTILIZATION

This performance measure is affected by all of the problem areas discussed earlier in this paper. In fact, the requirements for achieving high utilization can be expressed in terms of those problems. Thus, utilization provides a convenient focus for a review.

To attain good utilization we must have:

1. **Standardization** of essential elements to assure system compatability.
2. Improved **transfer** systems for fast interchange and turn-around.
3. Simplified **administration** (documentation and regulations), to permit more rapid and convenient service.
4. Reduced **waste space** to improve carrier efficiency.
5. Attractive, simplified **rates** to build volume and profits.

If we can provide all of these things, we'll get high utilization, and a chance for improved profits with improved service. Anyone interested in developing new methods, concepts, designs or legislation can find challenging problems on which to work in this area of containerization and ocean transportation. The opportunities are waiting.