Establishing Container Repair and Maintenance Enterprises in Latin America and the Caribbean

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GLOSSARY OF TERMS

1. Containers are reusable cargo-grouping units normally constructed in standard sizes of either steel, aluminium or glass reinforced plywood (GRP) with special fittings at each corner to facilitate their rapid and efficient handling as well as stacking, and permit the consolidation of packages of varying weights and dimensions into sealable units for transport by one or more means between origin and destination without intermediate unloading.

2. The acronym TEU or twenty-foot equivalent unit refers to a Series I International Organization for Standardization (ISO) container of 6 000 mm length, 2 438 mm width and 2 438 mm or 2 591 mm height (20 feet x 8 feet x 8 feet or 8 feet 6 inches) and is commonly utilized as a base measure for, **inter alia**, vessel carrying capacity and port productivity.

SUMMARY AND EVALUATION

To assist the Latin American and Caribbean countries in their efforts to create a "critical mass" of skill, equipment and supporting institutions which would permit increasing anticipation in new transport systems and technologies, the Transport and Communications Division of the United Nations Economic Commission for Latin America (ECLA) in May 1980 undertook, thanks to the generous financial contribution from the Government of the Netherlands, a two year project entitled "Economic co-operation among Latin American and Caribbean countries in the establishment of container repair and maintenance enterprises".

In order to achieve the overall objectives of this project, a work programme was elaborated that includes the following stages: (a) the collection of information regarding the establishment and operation of container repair and maintenance enterprises from appropriate facilities in Europe, Latin America and North America, (b) the preparation of a didactic document by ECLA on the basis of the technical information collected in the previous stage, as well as nine specific area annexes by various industry experts, and (c) the convening of three sub-regional seminars at which the documentation prepared in the previous stage was utilized to evaluate the economic, technical and operational circumstances under which it would be feasible to establish container repair and maintenance enterprises.

During the information gathering stage, missions were undertaken throughout Latin America and the Caribbean as well as to Europe and North America to visit various repair enterprises, their suppliers and customers. At that time, it became apparent that many of the organizations visited had valuable experiences which could not only make a positive contribution to the project but also merited individual analyses. As a result, numerous private sector enterprises, trade associations and international organizations such as Container e Indústria,S.A., Evan's Container Repairs, Hempel's Marine Paints, the Institute of International Container Lessors (IICL), the International Maritime Organization (IMO), Multimodal, S.A., REPCON (UK) Ltd., and Selecto-Flash, Inc., were invited to prepare annexes to the didactic document elaborated by ECLA.

The container repair and maintenance seminars were designed for both the public and private sectors and were initiated with a meeting in Rio de Janeiro, Brazil, from 15 to 16 April 1982. This first seminar was attended by 100 participants from Argentina, Bolivia, Brazil, Chile, Paraguay, Peru and Uruguay. The second seminar took place in Bogotá, Colombia, from 19 to 20 April 1983, and counted upon the participation of 86 persons from Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and

Venezuela. Finally, a seminar from the Caribbean sub-region was held in Santo Domingo, Dominican Republic, from 22 to 23 April 1983, with 62 participants from Dominica, Dominican Repulblic, Grenada, Guyana, Haiti, Jamaica, Netherland's Antilles, St. Lucia and Trinidad and Tobago.

The programme for these seminars included presentations by ECLA and various experts on the following topics: (a) containerization and its importance for the countries of this region, and the economic circumstances under which it would be feasible to establish container repair and maintenance enterprises,(b) establishment and operation of a container repair facility - a case study, (c) special needs of container lessors, (d) the International Convention for Safe Containers and its impact on container repair standards, (e) mobile repair units, (f) modules for the establishment of container repair enterprises, (g) surface preparation and painting of containers, and (h) container markings. During the discussions which followed each presentation as well as at the open debate period prior to the closure of the seminars, it came to light that many participants believed that Latin American participation in the container industry was either impossible or required some sort of assistance from leasing companies and governments to create an appropriate basis for investments. Nonetheless, as the presentations were made, participants began to understand the various entry levels into this field and the advantages of establishing container repair and maintenance enterprises i.e., small capital requirements, labour intensive nature of repairs and the absence of international competition for repair work.

To gather information concerning the impact of this project, a questionnaire was elaborated and sent to seminar participants. Based upon responses to those questionnaires, it was found that (a) 48% indicated that they are utilizing seminar documentation to evaluate the feasibility of establishing container repair and maintenance enterprises, (b) 50% indicated that they believe project seminars should be convened in countries other than those in which the three original seminars were held, (c) 65% indicated that they found seminar presentations and documentation useful in other aspects of their work such as container repair and storage techniques, control of damage to containers during handling operations, the evaluation of marine freight rates for containers in other trades, etc., and (d) 74% indicated that they considered that ECLA should include in its future work programme an evaluation of container handling equipment for varying levels of throughput. As a result of these responses, this Division is currently studying the various means by which technical assistance might be offered, within the concept of technical co-operation among developing countries (TCDC), to those desiring to establish container repair facilities and means by which financing might be obtained to carry out the suggested evaluation.

While not part of the original objectives of this project, it is interesting to note that the Transport, Communications and Tourism Division of the United Nations Economic Commission for Africa (ECA) has evaluated project documentation in the light of the needs of countries of that region and requested ECLA to collaborate with it in the organization of one or more project seminars for the African nations during 1984.

PREFACE

In an effort to create an environment in which appropriate sectors of Latin American and Caribbean countries can assist each other in the establishment of container repair and maintenance enterprises, ECLA's Transport and Communications Division, with financing from the Government of the Netherlands, undertook in May 1980 a two-year project entitled "Economic Co-operation Among Latin American and Caribbean Countries in the Establishment of Container Repair and Maintenance Enterprises". The activities programmed within that project include the preparation of this document and the convening of three subregional seminars.

From the outset it should be understood that this document is not a container repair and maintenance manual. It does, however, seek to present broad outlines of some of the more important requirements for establishment of container repair and maintenance enterprises. For the purpose of this document these requirements are grouped under three headings –economic, industrial and operational.

While opinions vary concerning the advantages of steel, aluminium and glass-reinforced plywood (GRP) as construction materials for dry cargo containers, the fact remains that major leasing companies prefer steel containers,[1] as they cost less to build, less to repair and are less prone to damage.[2] It should be noted that the equipment and personnel skills needed by a repair enterprise are directly related to container type and material of construction. For instance, the repair of refrigerated containers with their special insulation, sealing and compressor systems requires substantially different equipment and personnel skills from that of dry cargo steel containers. Moreover, aluminium containers require highly qualified welders to successfully effect needed repairs. As a result, this document is limited to an evaluation of the circumstances under which it would be feasible to establish repair facilities for dry cargo steel containers. Nonetheless, many of the concepts presented should be equally applicable for the establishment of enterprises which repair aluminium and GRP containers.

During the preparation of this document the following organizations made important contributions: ALMADELCO; Autoridad Portuaria de Buenos Aires, Argentina; Autoridad Portuaria Dominicana, Santo Domingo, República Dominicana; Autorité Portuaire Nationale, Port-au-Prince, Haiti; Berry's Marine Services Ltd.; Carga de México, S.A., de C.V.; Companhia de Transportes UNICO; Consejo Colombiano de Usuarios del Transporte (CUTMA); Consejo Dominicano de Usuarios del Transporte, Inc. (CODUTI); Container Aid International (CAI); Container Comércio e Indústria S.A.; DELCARGO, Inc.; Flota

Mercante Grancolombiana, S.A.; Geoffrey Reyner (Container Repairs) Ltd.; Hempel's Marine Paints A/S; Institute of International Container Lessors (IICL); Inter-Governmental Maritime Consultative Organization (IMO); International Cargo Handling Co-ordination Association (ICHCA); International Organization for Standardization (ISO/TC 104); Kingston Terminal Operators Ltd.; Lingas S.A.; Mander-Domolac Ltd.; Matson Navigation Company; Moore McCormack (Navegação) S.A.; Multimodal S.A.; Overseas Containers Ltd. (OCL); Pandicol Ltda.; Politrans Transportes e Serviços Ltda.; Port Authority of Jamaica; REMAIN (Hamburg); REPCON (UK) Ltd.; Roman Marítima S.A.; Sea-Land Service Inc.; Selecto Flash Inc.; Societé Fosseene d'entretien de Containers; Transportadora Multimodal; and Transporte Combinado, S.A. de C.V.

THE CHALLENGE OF THE 1980s

One of the more important challenges faced by ECLA's Transport and Communications Division in the 1980s is to assist Latin American and Caribbean countries in their efforts to create a "critical mass" of skills, equipment and supporting institutions which will permit growing participation in new transport technologies and systems such as containerization.

Within a transport system as vast as containerization, countries of this region desiring to participate must carefully select an entry level for which (a) the supportive infrastructures either exist or can be easily established, (b) the undertaking is local in nature, i.e., not subject to international competition, and (c) the work involved is labour intensive. While these criteria for evaluating an appropriate entry level into any technology might seem to preclude participation by some Latin American and Caribbean countries in containerization, such is not the case.

As is demonstrated at some length in this book, the container repair and maintenance industry satisfies these requirements. Nonetheless, since containers continue to be modified to enhance their strength and handling features, they are the subject of ever-increasing levels of technological sophistication. It should be understood that as a transport technology becomes increasingly sophisticated, it will be found more and more expensive, its life span will be shorter, and operational, construction and repair skills will take longer to learn. For developed countries with sufficient financial resources to invest in the necessary facilities and equipment, and qualified personnel to perform repair and maintenance tasks, these rising levels of technology have not created any insurmountable problems. In contrast, due to scarcity of financial resources, skilled personnel and supportive infrastructures, Latin American and Caribbean countries face the very real risk of being so overtaken by such technological changes that they might be unable to participate effectively in this growing industry. Thus, while repair technology is still within the reach of all Latin American and Caribbean countries, appropriate sectors of each country should evaluate not only the feasibility of establishing container repair and maintenance enterprises but also the usefulness of such enterprises as a technological base from which other areas of containerization might be entered.

I. INTRODUCTION

(a) The importance of containerization for Latin American and Caribbean countries

Cargo unitization consists of grouping various small and medium-sized packages of different forms and sizes into larger homogeneous units so as to facilitate their manipulation by mechanical means and make the transport of goods quicker, safer and more efficient, eliminate the risks of breakages, theft or loss, and reduce the costs for the owner of the cargo and the carrier. Instead of handling innumerable boxes, crates, bales, or loose sacks of varying dimensions and weights, the system makes it possible to handle a small number of standard-size units, which results in a substantial increase in productivity not only of the labour force involved but also that of vessels, trucks, trains and airplanes, while at the same time providing an opportunity to considerably reduce, simplify and harmonize trade documentation and consequent formalities.[3]

Although the container appears to be merely another means to utilize cargo, such is not the case. Other transport units such as pallets and pre-slinging, even though extensively used have not had an equally profound effect on the entire transport chain as the container. For example, the extensive use of containers has resulted in a modification of docks and attendant cargo storage areas, shoreside cargo cranes, cargo handling equipment, ships, trucks, trains, transport documentation and Customs procedures in order to facilitate their rapid and uninterrupted movement.

It should be understood that cargo had been loaded into special boxes for ocean transport long before Sea-Land Service, Inc., and Matson Navigation Company introduced large-scale containerization in the mid-1950s. Sea-Land in the Atlantic in 1956 and Matson in the Pacific in 1958. However, they were the first to put the concept into the framework of a system in which cargo would be loaded into a container at the shipper's place of business and move all the way to the consignee without being removed from the unit in route. As rising costs of transport operations at that time were forcing freight rates upward and since carriers had to make major changes to control such upward movement of freight rates thereby ensuring shipper demand, containerization was an idea whose time had come. While the intermodal or through carriage aspects of containerization were comparatively limited in the early development period, containerization worked. The effect of container transport on freight rates in the West Coast-Hawaii trade[4] is a good barometer –by 1964 freight rates had been reduced to their 1961 level and there were no more increases until 1971 when inflation finally overtook container operations.[5]

While the experience of Matson is most instructive of the cost savings that can be passed on to shippers, it should be understood that such savings are, in part, due to the legal environment in which this United States (US) shipping company operates. Since Matson is predominantly a domestic water-carrier, operating between the West Coast of the US and Hawaii, any rate increases for such trade must be submitted to and approved by the Federal Maritime Commission (FMC) of that country.[6] In this sense, a Matson request to the FMC for freight rate increases must be accompanied with information which demonstrates that an increase in operating costs justifies a new rate. Thus, even though US domestic water carriers have a controlled market position in the trade between the West Coast and Hawaii, Matson freight rates do not reflect such a position.

Although the Matson freight-rate experience might be considered unique, in a study issued during 1970 by the Federal Maritime Commission of the US it was concluded that Sea-Land, at that time the largest carrier in the trade between the US and Puerto Rico, thanks to containerization, efficiency, competition, etc., had been able to keep freight rates down.[7] With reference to freight-rate changes in that trade during the same (1958-1968) period, it was reported that

> the over-all cost of moving consumer commodities from New York to Puerto Rico has declined 13.4 per cent since 1958, even though the island's consumer price index has risen 33.7 per cent during the following decade...[8]

The freight-rate experience of many other trades resulting from the introduction of containers, has not been comparable to that of Matson and Sea-Land. For example, following the New Zealand government's initiative[9] to study liner freight rates in its outbound trades and in an effort to review conference practices for establishment of those rates, it was determined that during the last decade, while the consumer price index had risen by 182% and farm input prices by 175%, the cost of shipping wool to Europe had increased by 265%, butter by 349% and lamb carcasses by 431%.[10] The Deputy Director of Lincoln College's agriculture research unit, Dr. P. Chudleigh, indicated that from this data

> one could conclude that the new (maritime transport) technologies adopted in the 1970s have been inappropriate or have been introduced inefficiently or that the lines have not been passing on savings due to the container revolution.[11]

While during the early 1960s there was a growing recognition of the advantages of transporting cargo in containers, it was not until 1970, when the International Organization for Standardization (ISO) approved the standard dimensions,[12] which allow the transport of cargo units by any mode, that the use of containers really spread. Since the container facilitates door-to-door instead of port-to-port transport, its use found rapid acceptance among shippers and carriers from developed regions, and by 1975 one could speak of "containerization" as not only an established state of transport art but also the predominant transport unit used on liner trade routes.

The rapid spread of containerization is largely due to its semi-bulk nature, faster overall transit times and enhanced cargo protection. As bulk and semi-bulk

cargoes present only one type of cargo unit to a port, for example, their handling is easily mechanized. In a similar manner, ISO standard containers present port authorities with a uniform cargo unit and an opportunity to change from labour intensive break-bulk operations to a capital-intensive container handling system. This is accomplished by utilizing specialized equipment such as container cranes, straddle-carriers, fork-lift trucks, etc., which ensure the rapid and efficient loading and discharge of containerships as well as container movements to and from storage areas.

It is interesting to note that, whereas a general cargo ship of 10 000 dwt would remain in port at least 5 days discharging all cargo, a cellular containership of similar tonnage usually discharges the same amount of cargo in less than one day. While the aforementioned break-bulk vessel would require up to 125 stevedores to discharge cargo, the cellular containership requires only 15. In this sense, the managing director of the Ports Division for Nedlloyd, Mr. R.P.M. de Bok, indicated that general cargo vessels remain in port to load and discharge cargoes, as well as waiting for appropriate services, an average of three days per call or about 50% of the time for an entire round-trip voyage. In comparison, containerships have an average port-stay time of less than one day, which is 22-28% of the time for an entire round-trip voyage.[13]

While the disparity in port labour requirements for containerships and break-bulk vessels would seem to create the conditions for severe unemployment among stevedores, authorities at the Port of Rotterdam estimate that for every job at a container terminal, four new jobs will be generated in related areas such as container repair, consolidation and deconsolidation of cargoes, etc.[14] Since the major markets for Latin American and Caribbean exports are those of Europe, North America and Japan and as stevedoring costs at the ports for those markets greatly exceed similar costs in this region, Latin American and Caribbean exporters must either absorb such costs thereby reducing their income or utilize containers.

The productivity of a modern containership in terms of ton-miles per annum is between five to eight times that of a conventional cargo liner, and the productivity of a crew member on a large containership in terms of ton-miles per sea-man is approximately ten times that of a person on a conventional liner in 1965.[15] As a result, one containership can take the place of from three to five break-bulk vessels.

No industry has obtained benefits from a technological innovation to the same extent as ocean transport has from containerization. Cellular containerships are loaded or discharged in one-sixth of the time formerly required, containers can be moved off the piers in minutes compared with the hours and even days required to load trucks. Overall productivity in major ports has trebled with the advent of containers.[16] Despite the extra capital costs for container docks, storage areas, cranes and other handling equipment, investments in these facilities per ton of cargo handled are 60% below those of a conventional general-cargo berth.[17]

The movement of goods in containers permits faster door-to-door transit times, not because ships travel faster –there is no fundamental need for containerships to travel faster than break-bulk vessels– but because port operations and inland transport services can be rationalized thereby reducig the time

goods spend waiting for on-carriage. For example, Cast North America Ltd., operates their ships in the highly competitive North Atlantic container trade at 14 knots. According to Cast President, Mr. H. Graf, "In the final analysis, it's the total transit time from inland origin to inland destination which is of concern to shippers and consignees".[18] It is interesting to note that greater in-movement speed is cost increasing while a reduction in the time goods spend waiting for on-carriage or nationalization and release to consignees is cost reducing. Furthermore, faster overall transit times reduce the disadvantage of distance from the market. That is to say, there are less goods in-transit at an average moment and so less capital is committed.[19]

The number of cargo damage and loss claims presented to ocean carriers has decreased dramatically since the advent of container services, so much so that large reductions in insurance premium costs have been possible. This is of course, due to the physical protection containers provide cargoes from damage by crushing, negligent handling, scuffing, etc. Moreover, as the number of occasions on which containerized cargo is handled is usually reduced –normally only upon stuffing and stripping of containers– this, in turn, reduces the opportunities for damage, delay, errors in sorting and pilferage.[20]

The advantages to shippers, carriers, consignees and others in the transport chain from the use of containers are now generally acknowledged. While the experience with containers has largely involved those trades between industrialized countries, many developing countries are rapidly industrializing and can obtain the same benefits. The shift from the export of basic materials to more processed and finished goods lowers relative cargo density, and thus boosts demand for container volume.[21] Furthermore, many developing country liner cargoes are suited to container transport. For example, some developing country export products such as canned fruit have been particularly successful as container cargo, with a very marked reduction in breakage. Indeed, with the passage of time many more cargoes will be found suitable for containerization than were originally thought to be the case.

Although containerization years ago was only an innovative shipping technique, it is today a vital part of international commerce, inherently tied to world trade. Containerization has proven repeatedly that it can be, by its cost efficiency, the single most significant factor enabling trading nations to better sell and compete in world markets. No longer an innovation, containerization has become the essential lubricant that allows the gears of world trade to function more effectively. According to Mr. H. Graf, President of Cast North America Ltd.,

> Basically, we believe that the ship is just another vehicle in the transport system. It's immaterial. What's material is the container.[22]

(b) Regional container transport activities

While those persons involved in Latin American and Caribbean ocean transport might have different opinions as to how quickly containerization will be utilized in each country's trades, there is agreement that the experiences of other regions such as the Middle East and South Africa would indicate that the process could be quite rapid. Although the degree of container penetration

and its timing will differ from country to country, the process of containerization is, nonetheless, inevitable. Naturally, the current excess tonnage of container vessels will play a part in this, as these vessels will be looking for employment.[23] There are still some major areas of the world that have barely been touched by containerization. As certain Latin American and Caribbean countries as well as numerous nations in Asia and Africa are just starting to utilize containers, one should see great changes during the decade of the 1980s in these areas.[24]

Although the ocean transport of containers has, as yet, to make a heavy impact on the total tons of goods carried in Latin American and Caribbean trades, many countries have recognized the inherent advantages of this technology and begun to utilize cellular vessels in appropriate trade flows. For example, during February 1981, the Argentine national line placed a cellular containership in its trade between Buenos Aires and Santos, Brazil.[25] Furthermore, Latin American national lines are investigating the feasibility of joint ventures with extra-regional shipping companies. For instance, Nippon Yusen Kaisha (NYK), Kawasaki Kisen Kaisha ('K' Line) and Compañía Chilena de Navegación Interoceánica (CCNI) have established a joint full container service between the Far East and the West Coast of South America. Each Line has contributed one vessel in the 500 to 600 TEU class to provide an initial service of one sailing a month.[26] Another example would be the EUROSAL consortium, composed of members of the European, South Pacific & Magellan liner conference, which will provide cellular container services to the West Coast of South America from Europe beginning in 1984.[27]

There has been a marked growth in the use of multi-purpose tonnage suitable for containers in Latin American and Caribbean trades. For example, it was recently noted in a specialized maritime transport magazine that 'K' Line is to introduce such tonnage with a TEU capacity up to 500 units onto the run from Japan and the Far East to the West Coast of South America; Líneas Euroflot is utilizing four vessels of 200-300 TEU capacity from North European ports to Santos, Río de Janeiro, Buenos Aires and Montevideo; and Current Marine is to offer multi-purpose tonnage from the US Gulf Coast to the Eastern Caribbean and North Coast of South America.[28] Finally, during 1979 Lloyd Brasileiro began services with the 12 000 dwt multi-purpose Calandrini and Cantuaria, both offering spaces for 390 TEUs, of which 72 can be refrigerated.[29] Moreover, Lloyd Brasileiro has announced that six of its "Ita" class – fast and heavily geared vessels constructed between 1969 and 1972– are to be converted into fully cellular geared containerships during 1982.[30]

In response to increasing shipper demand for more sophisticated tonnage, most of the major liner companies serving South America are switching to more modern, container-oriented tonnage. For example, during March 1980, Hamburg Süd introduced the first fully cellular containerships, the Monte Sarmiento and Monte Olivia, both having a 530 TEU capacity, of which 300 can be refrigerated. These vessels are to maintain a monthly sailing schedule between Hamburg, Bremen, Rotterdam, Antwerp and Santos, Montevideo and Buenos Aires.[31] Similarly, Nedlloyd has switched two of its 1978-built multi-purpose vessel, which offer a 676 TEU capacity and are fully self-sustaining onto its trades from the Far East to Central and South American ports.[32] Further,

four United Kingdom shipping lines –i.e., Blue Star, Houlder, Lamport & Holt and Royal Mail– have programmed a full container service between Europe, Brazil and River Plate ports with two cellular 384 TEU vessels, of which 132 TEU may be refrigerated.[33]

Within Latin America, the Caribbean and Central America are more advanced in their acceptance of containerization than Mexico and South America, where in 1979 specialized container port facilities were practically non-existent. Nonetheless, due to the dramatic increase in the use of containers by Mexico and the South American countries (see following table), efforts to provide container port facilities have been undertaken. In Argentina, for instance, while the principal emphasis of a port improvement programme costing more than US$ 300 million is on deepening access channels to the grain loading ports, container cranes and appropriate storage areas are included. [34]

After a long delay, Brazil is now seeking to provide a smooth interface for the intermodal capacities of its major trading partners and, during 1981, inaugurated the initial phase of its container terminal at Santos. This terminal was designed for the exclusive use of containerships and will be capable of handling up to 145 000 TEUs per year, with flexibility for doubling that amount in the future. As the Government of Brazil requires an annual container movement of at least 50 000 TEUs to justify the construction of a dedicated container terminal, during the first half of the current decade very few other ports, with the possible exception of Rio de Janeiro, should have similar facilities. Furthermore, Brazilian government officials favour the construction of only a few regional container terminals, such as that at Santos, which would serve as container receiving and disbursement centres for nearby ports.[35]

Based upon the increasing flow of containers through Chilean ports, a new storage area for such units has just been completed in Valparaíso. Although San Antonio, located to the south of Valparaíso, was originally constructed as a bulk-cargo port, it is also handling an increasing volume of general cargo and containers. As an illustration of the port's importance for containers, the joint NYK/K Line/CCNI container service selected that port instead of Valparaíso.[36]

While Ecuadorian trade flows include substantial amounts of petroleum and refrigerated cargoes, the port of Guayaquil has been enlarged to provide more space for stacking as well as stuffing and stripping of such units. In Colombia, based upon the recommendations of a study financed by the United Nations Development Programme (UNPD), the Government is to seek a US$ 170 million loan from the World Bank to finance the construction of container terminals at Buenaventura on the Pacific Ocean and at an Atlantic Ocean port, possibly Cartagena or Santa Marta, as yet to be determined.

As a result of revenues derived from oil production, Mexico is seeking, through its National Industrial Development Plan, to locate new industries away from heavily populated urban centres such as Mexico City, Monterrey and Guadalajara.[37] One part of this Plan is a 20-year, US$ 20.2 billion industrial ports programme that includes, in its first phase which was completed in 1981, modern container terminals at Lazaro Cardenas, Veracruz, Salina Cruz and Coatzacoalcos.[38] The latter two ports will primarily handle transit container landbridge traffic across the narrow Isthmus of Tehuantepec. This landbridge, inaugurated in 1981 at a cost of US$ 140 million, encompasses not

CONTAINER FLOWS IN SELECTED LATIN AMERICAN PORTS

Table 1

EVOLUTION OF THE CONTAINER TRAFFIC IN SIX SOUTH AMERICAN COUNTRIES

(1969-1981)

(Units and tons of cargo)

Port	Year	Total movement No.	Total movement Tons	Containers loaded Full No.	Containers loaded Empty No.	Containers loaded Tons	Containers unloaded Full No.	Containers unloaded Empty No.	Containers unloaded Tons
ARGENTINA									
Buenos Aires	1969	...	3 040	421	...	1 390	415	...	1 650
	1981	152 242	1 070 499	41 007	29 339	385 593	78 561	2 335	684 906
BRAZIL									
Rio de Janeiro	1969	928	2 808	217	...	760	583	126	2 048
	1981	21 629	185 764	6 231	3 039	94 503	5 593	6 766	91 261
Santos	1969	2 605	13 294	568	722	4 194	1 049	266	9 100
	1981	130 403	1 259 693	55 685	10 477	794 100	25 450	38 791	465 593
All ports	1981	208 091	1 911 344	81 861	20 984	1 181 001	40 605	64 641	730 343
CHILE									
Iquique	1978	2 784	13 960	8	1 087	3 050	1 689	...	10 910
	1981	16 591	67 517	13	8 446	369	8 132	...	67 148
Valparaíso	1969	3 827	6 683	588	811	1 710	1 700	728	4 973
	1981	62 447	420 259	6 250	21 361	84 102	29 421	5 415	336 157
All ports	1981	115 402	746 431	14 815	39 236	198 347	49 669	11 682	548 084
COLOMBIA									
Barranquilla	1978	8888	6 218	296*	...	1 950	592*	...	4 268
	1981	10 753	64 857	2 000	3 370	15 821	4 863	520	49 036
Buenaventura	1969	...	86 200	...	...	22 900	...	...	13 300
	1981	14 748	85 995	2 936	4 372	38 453	3 198	2 242	47 542
Cartagena	1969	...	20 800	...	...	1 400	...	...	19 400
	1981	11 986	91 918	4 425	1 729	53 063	3 314	2 521	38 855
All ports	1981	50 044	261 679	12 370	12 341	116 394	16 367	8 966	145 285
ECUADOR									
Guayaquil	1969	4 620	23 025*	1 075	1 025	6 525*	2 460	60	16 500
	1981	23 316	160 874	4 685	6 002	57 315	10 647	1 982	103 559
Manta	1978	4 991	38 600*	1 492	989	14 000*	2 451	59	24 600
	1981	7 811	77 347	2 437	1 603	38 108	3 269	502	39 239
URUGUAY									
Montevideo	1977	2 446	...**	1 100	76	..**	1 130	140	...**
	1981	14 132	77 924	4 525	2 395	46 837	4 210	3 002	31 087

* Estimated.

** Container tonnage is not recorded separately.

only the already mentioned ports but also 305 kilometres of modern highway and rail systems which will facilitate the handling of inter-ocean container traffic, provide an alternative to the traditional route through the Panama Canal and reduce the time, fuel and distance between, for example, the Orient and Europe by approximately 2 000 nautical miles. Further, the landbridge is expected to handle between 70 000 and 90 000 units of containerized cargo during the first year of operation, with an annual volume of 500 000 units anticipated within five years.[39]

While the container throughput at the port of Montevideo, Uruguay, has been low, due to its strategic position on the River Plate Basin for transshipment traffic with neighbouring countries and aided by a US$ 50 million World Bank loan, in 1979 the Government of that country undertook the construction of a specialized container berth. It is programmed that the reclamation work is to be completed by 1981 with a projected start-up date of 1983.[40]

Like Mexico, Venezuela is utilizing oil revenues to improve its ports. A five-year US$ 900 million investment programme has been undertaken by the Instituto Nacional de Puertos. While this programme largely focuses on port facilities for oil and break-bulk cargo, specialists have prepared port development plans which include container berths.[41]

All the indications are that Mexico will be the point of concentration for the next stage of containerization in the Caribbean. While the use of containers for import cargoes on Mexico's Gulf Coast has reached an encouraging level, the liner trade between Europe and the Caribbean region as a whole retains its traditionally unbalanced character. However, this imbalance is perhaps not so marked as it once was, with there being somewhat more cargo for the eastbound trip. This has in part been fostered by the introduction of containerization –opening up as it has a wider market for agricultural products from certain areas– and in part because the Association of West India Trans-Atlantic Steam Ship Lines (WITASS) has established commodity box rates[42] and promotional rates for non-traditional exports. The latter have had a positive effect in attracting new exports of manufactures and cultural products from the Central American countries, Colombia and Jamaica.[43]

II. THE ECONOMIC ENVIRONMENT

(a) The impact of container trade flow imbalances on the demand for repair services

In certain countries of the region, governments have pursued import liberation policies in an effort to stimulate their national economies. While these policies have been largely successful, they have also created a healthy domestic demand for goods manufactured outside the region, which, in turn, has brought about large inflows of such goods in containers. Moreover, for many developing countries the trade pattern is to import manufactures and export produce and commodities. In this situation few trades are likely to be completely balanced –that is, the number of loaded containers entering a country or trade area equals those leaving with export cargoes. This is important, because container service costs are more sensitive to an imbalance than those of break-bulk services, for the simple reason that empty journeys for containers are unremunerated journeys.

In order to better understand the impact of container trade flow imbalances on the demand for repair services, a brief evaluation of the situations in Argentina and Panama is presented. The containerization of Argentina's general cargo trade began in 1967 and is now well under way. By 1980 container throughput at Buenos Aires reached 122 655 TEU, five times that of 1978. While the total container throughput appears healthy, it should be understood that such figures mask a serious container flow imbalance in favour of imports. For example, during 1980 only 31 607 TEU left Buenos Aires loaded.[44]

Since 1976 Argentine governmental authorities have steadily reduced export taxes and liberalized imports in an effort to stimulate the economy. Nonetheless, the problem of internal inflation remains. As the Argentine peso was not devaluing against the United States dollar at a sufficiently high rate to offset such inflation, the price of Argentine manufactured goods rose in world markets, with obvious detrimental effects on that nation's industry and its export potential.[45] If the exchange rate were favourable the manufacturing sector would have an incentive to export, thereby utilizing part of the container inflow. Moreover, if part of this inflow were utilized for Argentine exports, there would be a need for container inspection, cleaning and repair services. In this sense, Mr. R. Destefano, General Manager of Multimodal, a container repair enterprise at Buenos Aires, indicated that due to the Argentine container trade-flow imbalance and the unfavourable exchange rate between the Argentine peso and the United States dollar, the demand for repair services has been dramatically reduced. However, Mr. G. Macmillan of Transamerica ICS, a major

container lessor, mentioned that the only reason for not repairing containers where demaged would be that either the repair facility could not properly effect this type of work or that such work could not be carried out in a timely manner.

The Panamanian container trade-flow imbalance is principally due to that country's geographical position as an entrepot, which leads to a natural availability of manufactured goods, limited industrial production for export, and a natural reluctance on the part of shippers and their agents to change from a known transport system to one which, to them, is unknown. Mr. A. Cano, General Manager of Sea Shops, a container repair facility located at Colón, Republic of Panama, mentioned that this situation, combined with a decision by certain leasing companies to store their containers in another Caribbean basin country with a greater demand for their export use, has nearly eliminated the demand for repair services. Consequently, it is those countries which utilize containers in their export trades and have favourable exchange rates with the United States dollar which may be considered possible areas of growing container utilization and should be evaluated to determine the economic, industrial and operational feasibility for establishment of container repair/storage facilities.

Due to trade flow imbalances, the costs incurred by leasing companies in repositioning containers held on master lease agreements[46] have greatly increased. These costs for Sea Containers rose by US$ 10 million between 1978 and 1979 to nearly US$ 39 million -almost four times the amount of five years ago.[47] As trade imbalances show no signs of going away in the foreseeable future, there has been growing recognition among lessors that containers can be repositioned only 2 or 3 times before such costs equal or even exceed the purchase price of new equipment manufactured in the Far East.[48]

In order to reduce repositioning costs lessors have a number of means at their disposal to correct the effects of trade flow imbalances on container movements. First, while a master lease purports to permit lessees to drop off and pick up as desired, such is not entirely the case. To avail themselves of this contractual right, lessees must pay a drop-off charge which varies from a minimum of US$ 25 to a maximum of US$ 625. This charge is utilized by the leasing companies to pay for container repositioning costs. Second, lessors offer a bonus of up to US$ 50 to lessees who drop off containers at ports where there is a heavy export demand. Third, certain leasing companies permit lessees to avoid drop-off charges by effecting direct interchanges –a container is transferred from one lessee to another without going off-lease. In this situation containers should, nonetheless, go through equipment interchange inspections to determine possible damage and responsibility for payment of repair work. Finally, lessors store containers at designated depots until they have a sufficient number to justify the charter of an entire vessel for their relocation. Additionally, leasing companies have undertaken negotiations with ocean liner conferences to obtain more favourable freight rates for the carriage of empty containers.

The impact of a container trade flow imbalance and attendant drop-off charges at the national level is most clearly demonstrated by evaluating the Paraguayan situation. While this country's principal port, Asunción, has only one immovable crane for container loading and discharge operations, there was

nonetheless a throughput of 1 500 TEU during 1980. Moreover, as a former rail ferry, the Tabare, has been converted to carry 130 TEU in a feeder service between Asunción, Buenos Aires, Argentina, and Montevideo, Uruguay, this container throughput should continue to increase.[49] While Paraguay largely exports agricultural products, there are a number of commodities which can be easily containerized. For example, cotton may be press-baled, thereby making its transport in containers cost-effective. Nonetheless, more than 90% of these containers leave Asunción empty. The utilization of these containers in the Paraguayan export trades is of paramount importance to avoid unremunerative relocation charges. One container leasing company currently charges lessees US$ 625 to relocate an empty unit from Asunción to demand areas such as Brazil or Colombia. As a result, the price of Paraguayan containerized imports must be increased by nearly US$ 1 million to pay for this "dead freight". It is interesting to note that the Captain-General of the port of Buenos Aires, in an effort to avoid this situation, has promulgated a measure[50] requiring that all forms of unitization, including containers, be employed in the Argentine import and export trades.

(b) The cost structure of and demand for container repair services

Latin American and Caribbean countries face four aspects of containerization: (i) route conversion; (ii) cargo conversion, (iii) establishment of inland cargo terminals, and (iv) port infrastructure conversion. The first of these, route conversion, involves the use of cellular container tonnage by ocean transport companies serving ports of this region. Second, the employment of cellular tonnage on these trade routes would require shippers, freight forwarders and others to convert cargoes to be carried from general to containerizable. Third, as the clearance of containerized cargoes at ports of entry has resulted in major congestion problems, certain countries of this region[51] have begun to emulate those of Europe by establishing cargo terminals at origin for export and destination for import cargoes. These cargo terminals offer the same full range of complementary services normally found in ports, thereby permitting the nationalization as well as the consolidation and deconsolidation of containerized cargoes. Finally, port infrastructure must be converted to permit the efficient unloading and loading of capital-intensive cellular container vessels as well as the uninterrupted movement of containers between such vessels and consignees or shippers.

As is obvious, the common denominator for each of these aspects is the container. Not equally obvious, however, is the pivotal role container repair and maintenance enterprises play in ensuring that containerized cargoes are protected from the weather, that damaged containers once repaired may continue to be handled with standardized cranes, fork-lift trucks, etc., and that they may fulfil their maximum economic lives.

The domestic container repair industry reflects domestic container needs, flows and export usages. If the export container usage for any given country is dynamic, stagnant or depressed, then so will be the container repair industry. Moreover, it should be noted that container repair sales areas are geographically distinct: land, labour, customers and competition will vary considerably from

one geographic location to another. The expansion of repair activity can only be done by opening new facilities in new locations, thereby proportionally increasing overhead expenses.

A container repair facility is something of an anomaly within containerization – it is localized, serving a specific area usually near a port or large industrial centre, while the rest of containerization is of an international nature. Furthermore, as each case of container damage is more or less unique, the opportunities for mechanization are minimal. For example, a breakdown of container repair costs shows that for the average repair, material cost is about 30% of the total, while labour can account for two-thirds.[52] As a result, the container repair industry is predominantly labour-intensive in a highly capital-intensive field, thereby centering the individual facility around people and their skills rather than equipment and materials.

As container repair and maitenance is a labour-intensive industry, its costs are basically of a fixed nature. Repair work supplied on a peak and trough basis logically leads to significant fluctuations in the work force, bringing with it social and other disruptive consequences, or to pricing structured to generate sufficient funds in the peak days to cover unavoidable losses in the troughs. In order to create and maintain a skilled and experienced workforce, the owner of a repair facility must be willing to accept that a high percentage of his costs are fixed. Coping with these changes in repair volume is fundamental to the professional repairer. Nonetheless, the possible impact of these high fixed costs with changes in volumes of repair work can be lessened if a facility works for numerous container owners. For example, Dr. W. Greverath, General Manager of REMAIN at Hamburg, Germany, believes that his firm is able to offer better repair services by working for as many customers as possible. Furthermore, other facilities such as Sea Shops, at Colón, Panama, have also undertaken the repair of trailers so as not only to offer a complete range of services to operators and lessors but also to have an income source which might offset the cyclical nature of container repairs.

A peak or high volume of repair work provides the industry with an incentive to invest in more land, plant and equipment. If investments are made to properly service this peak volume of work, however, the trough will be all the more marked when it comes, as the increase in capacity will be chasing a reduced volume of work. Nonetheless, it is interesting to note that the non-utilization of the container fleet in 1979 due to the lack of adequate repair facilities around the world rose from 10% in 1978 to 12% while some leasing companies had up to 16% of their fleet awaiting repair. The relocation of empties accounted for another 6-8% of unutilized containers. Thus, during 1979 approximately 20% of the world container fleet was non-utilized. Moreover, damaged containers tend to sit around awaiting repairs for considerable periods of time. As a result there has been an increase in the relocation of empties to meet the cargo demand, and this in turn has led to the construction of new containers. In some places, especially in developing countries, containers tend to be used as temporary warehouses, which again increases the demand for new containers.[53]

As a container repair facility has a high percentage of fixed costs, not the least of which is labour, fluctuations in the amount of repair work can make it

difficult to determine an adequate pricing level. The fluctuation of demand against a fixed cost background is thus by far the most important factor in determining workshop pricing.

(c) Criteria for establishment of and investment in container repair enterprises

The majority of container repair and maintenance enterprises tend to be relatively small but highly flexible concerns which have entered the industry through performing related services for container owners. Quite a few repairers, such as Geoffrey Reyner (Container Repairs) of Manchester, United Kingdom, have come from the road haulage industry and, in competing for the road transport of containers, have offered to store them, which has led to their repair.

As the basic skills involved in the repair of steel containers are not difficult to acquire and require only a small initial investment, it is one of the fastest growing containerization industries. Nonetheless, it must be understood that many inexperienced enterprises have started up quickly and failed just as quickly. Many have not suffered this fate, however, and have survived the uncertainties of container damage work-flows to emerge in a relatively strong position.

The greatest advantage for Latin American and Caribbean repair facilities lies in their competitive labour costs. Most developed country repair and maintenance enterprises must pay higher wages than those of this region. These higher wages, when combined with the labour-intensive nature of container repair and maintenance, create an uneconomic and uncompetitive situation for such business.

Although this might not seem immediately obvious, it is the small repairs to containers which are the most profitable. In fact, it should be noted that holes and dents account for approximately 80% of all repair work.[54] While a leasing company inspector will readily authorize repairs costing US$ 20-50, he will be more thorough for a US$ 500 repair and call for several estimates.[55] This has the effect of reducing the profit margin for the repairer, since he must compete against normally strong opposition. In these cases, the smaller repairer with lower overheads will have a cost advantage over other companies which have made substantial investment in plant and equipment. It can be quite frustrating for the latter companies to see the more lucrative work go to small enterprises which are often unable to undertake major structural repairs. Nonetheless, it should be understood that while container owners do not require large enterprises to effect needed repairs, they do require competent repairers who will carry out the job to the desired quality standard, at an acceptable price and within a reasonable period of time.

Apart from a repairer's investment in people, his largest financial requirements involve land, buildings and equipment. While the skills and investment required to enter the business in a small way are minimal, the repair facility can be expensive with the high costs for buildings and equipment such as cranes, fork-lift trucks, service vans, shotblasting and spray-painting. Nonetheless, it should be understood that there are entry levels through which most repair en-

terprises have successively passed-storage, repair and finally refurbishment of containers.[56] While container storage requires only a small investment for companies with appropriate handling equipment, such as that for trucking and stevedoring, with each successive level, the financial requirements become greater.

The level of investment required to establish a container repair facility is difficult to quantity as there are so many variables involved. Nonetheless, once it is determined that the export container flow in the area where a facility is to be located is adequate, inquiries can be made as to the purchase and leasing costs of suitable land, buildings, fork-lift trucks, welding equipment, compressors, steel cutting and bending machines, shotblasting and spray painting equipment, as well as the necessary administrative infrastructure. It should be understood that if capital is scarce –and this is almost always the case– then investment should be made not in specialized equipment, which cannot be efficiently employed in a variety of jobs, but in a system which is as flexible as possible.

With an investment of this magnitude, many repair enterprises consider that container leasing companies and shipping lines should offer them long-term repair contracts which provide sufficient security for the required investments. However, due to the fortuitous nature of container damage, it is difficult if not impossible for owners to guarantee or contract with only one repairer, as they may have no way of knowing where a unit may be when it is damaged. Moreover, the unremunerative transport costs for empty-damaged containers needed to comply with such a contract would be prohibitive.

One of the most important factors for setting up an efficient repair and maintenance enterprise is recognition of the fact that every hour, day, or week that a container is out of service means revenue lost to its owner. The time factor in container depends on:

(a) the extent of damage,
(b) the repair facilities available,
(c) the distance the container has to be transported to be repaired, and
(d) whether the container has to be unstuffed before the damage can be repaired.

It should be understood that the transport of a container any distance to undergo repair work not only increases the length of time it is out of service, but also increases the cost of such repair due to transport charges. In order to reduce unremunerative transport costs in respect of damaged containers, most leasing companies have a policy of repairing such containers at facilities close to the place where the damage occurred.

In summary, the criteria for establishment of a container repair and maintenance enterprise are (a) low wages, (b) low taxes, (c) national sources of repair materials and equipment or favourable excise duties for their importation, (d) availability of moderately skilled workers, (e) good conditions for investment-stable political, economic and labour situations, (f) a favourable geographical situation relative to export container flows, (g) favourable currency parity with the United States dollar, and (h) availability of suitable land for establishing the repair facility.

III. INDUSTRIAL ANALYSIS

(a) Principal characteristics of the world container inventory

While there are many aspects of the world container inventory that should be given careful study in determining the feasibility of establishing repair and maintenance enterprises, some of the more important for this discussion are (i) size and growth potential, (ii) age, (iii) scrappage rates, (iv) type and material of construction, and (v) ownership.

(i) Size and growth potential

It should be understood that the world container inventory has grown quite rapidly. For example, from the end of 1970 to the end of 1977 the total world container inventory virtually quadrupled.[57] Several recent surveys indicate a current inventory of between 2.1 million TEU and almost 2.5 million TEU.[58] The world container inventory is expected to continue increasing to a level of around 4.1 to 4.3 million TEUs by the end of 1985, an increase of 72%.[59]. The container inventory has probably now reached a figure in excess of 2.5 million TEU and may, by some estimates, even be approaching a figure as high as 3 million TEU.[60] According to data compiled by **Containerisation International**, a specialized container magazine, the present inventory could increase to about 6 million TEU by the end of this decade if the current trend for door-to-door services continues to use up more containers on the inland ends of the transport chain. As a result of this inland use of containers, there has been a steady increase in the ratio of containers to vessel slots from 2.9:1 in 1970 to 4.6:1 in 1979.[61]

Estimates for future growth of the world container inventory vary somewhat:

	Sources	
	(1) "Containerisation into the 1980s"	(2) "Containerisation International Yearbook 1979"
1980	9.0	12.0
1981	6.0	9.0
1982	4.0	6.0
1983	4.0	6.0

Beyond 1983 these sources differ in growth rate projections. Whereas the first predicts an increasing growth rate, the second foresees a flat growth rate through the 1980s.

(ii) Age

With rapid growth in the 1970s, it is not surprising that the world container inventory is quite young.

Year built	TEU ('000)	% of end-78 fleet	
58-67	89	3.6	12 + yrs. old: 89 000 TEU 3.6%
68	85	3.5	
69	96	3.9	
70	122	5.0	6-11 yrs. old: 878 000 TEU 36.0%
71	162	6.6	
72	202	8.3	
73	211	8.7	
74	201	8.3	
75	197	8.1	1-5 yrs. old: 1 463 000 TEU 60.4%
76	215	8.8	
77	350	14.4	
78	500	20.6	
Total	**2 430**	**100.0**	

Source: "Containerisation International Yearbook 1979."
Similar figures appear in "Containerisation into the 1980's".

The average age of the inventory at the end of 1978 was 4.9 years. As approximately 300 000 TEU were constructed in 1979, the inventory increased its average age to 5.2 years at the end of 1979. Since annual construction is expected to remain near 1979 levels until well into the 1980s, the average age of the world container inventory should continue to increase.

(iii) Scrappage rate

While the British Standards originally estimated the life of a container at three years,[62] certain operators such as Japan's K line and Mitsui OSK lines and several leasing companies such as CTI and Sea Containers are now estimating serviceable life to be in excess of 15 years with at least two refurbishments during that period.[63] These life expectancies have to be modified, however,

for trades between developed and developing countries. For example, Johnson Line has encountered a service life of 8 years for steel containers in such trades, and a major lessor only 5 years.[64]

It should be understood that such service lives are averages and that numerous containers are sold for scrap each year due to:

(i) damages in excess of economic repair cost;

(ii) old age – GRP becomes structurally unsound after 8-10 years
– excessive corrosion for steel containers renders them structurally unsound and refurbishment is too costly.

(iii) obsolescence – phasing out of 8' high TEUs in favour of 8'6" high units.

As the average serviceable container life has been increasing, "Containerisation into the 1980's" predicts the following scrappage rates:

Year	*TEU scrapped*
1980	73 000
1981	83 000
1982	91 000

Since containers eligible for scrappage can either be refurbished or replaced, these estimates provide an indication of the potential worldwide refurbishment volume. As can be seen, the refurbishment volume is not large. Furthermore, as the replacement price for a steel TEU produced in the Far East is approximately US$ 2 200-2 400[65] owners have an incentive to replace instead of refurbishing containers.

(iv) Type and materials of construction

In reviewing the world container inventory by equipment types and construction materials, it is evident that the majority of containers are dry cargo steel vans and, therefore, the majority of repair work involves such containers.

Types		*Construction materials*	
Dry cargo van	84.5%	Steel	58.0%
Refrigerated	6.1%	Aluminium	35.0%
Tank	0.4%	GRP	7.0%
Other	9.0%		**100.0%**
	100.0%		

Source: **Containerisation into the 1980's** and **Containerisation International**, November 1978.

As can be seen from the above table, the world inventory of GRP, aluminium, tank and refrigerated containers is sufficiently small for the newly established enterprise to consider the advantages –such as reduced capital investment and repair skills– of repairing only dry-van steel containers. Once workers are efficiently performing repair work on steel containers, the facility could expand its services, if necessary, to include these other container types and materials of construction. There is already a marked preference for steel as a container construction material, and the dominance of steel should increase, as the majority of new construction orders are for steel containers.

(v) Ownership

An analysis of container ownership indicates that leasing companies have become the dominant class of owners.

	Share of ownership		
	End 1977	*End 1978*	*End 1980*
Leasing companies	40.3%	51.0%	61.0%
Steamship lines	58.6%	44.5%	
Other (railroads, shippers military)	1.1%	4.5%	39.0%
	100.0%	**100.0%**	**100.0%**

Sources: Container News, June 1979, p. 18.
Containerisation International, May 1978.

It is interesting to note that from the first oil price increase in October 1973 up to the present the world has gone through a series of recessions which have had a dramatic effect on the ocean transport industry. As a result of each round of oil price increases, shipping lines have been less inclined to commit themselves to the financial burden of buying their own containers. Given these factors, then, it is understandable that more and more shipping lines have begun to utilize leased containers.

In response to this situation, during the 1970s leasing companies instituted aggressive building programmes. While leasing company ownership growth to the level of 61% by the end of 1980 was an optimistic estimate, it is very probable that such level will be reached during the early part of this decade.

(b) Major customer groups

Prior to the mid-1960s, owners of general cargo vessels merely supplied the transport capacity –i.e., cargo holds– to prospective shippers. However, by 1970 vessel owners in developed countries, if still in business, were offering not only transport capacity but also uniform transport units-i.e., containers. While the cost of specialized vessels with cellular construction for the transport of containers has by itself greaty increased the vessel owners' financial needs, it

must be understood that the container has permitted the realization of the through transport concept –door-to-door– thereby greatly increasing the requirements for containers. To gain an idea of such requirements it is necessary to understand that container vessels require approximately five containers for each slot. If it is assumed that a container vessel with a useful life of 20 years has 1 000 slots, that the useful life of a container is ten years, that 20% of the containers over the vessel's life will be "lost" or damaged beyond repair, and that the cost of a new container will average US$ 6 000 over the vessel's life, then the shipowner's financial requirement for the purchase of containers would be approximately US$ 72 million, without including costs such as repair and insurance. The increased capital outlay of shipping lines implicit in the ratio of containers to slots has prompted them to look to others to finance the extra burden of paying for containers not only to fill their ships but also to satisfy inland transport requirements.

The rapid growth of the container leasing industry is a result of the profound changes brought about in ocean transport due to the widespread use of containers. While the lessors have come to provide a myriad of services to owners of container vessels, perhaps two of the most important relate to container acquisition and the correction of trade flow imbalances.

In many trades, especially those between developed and developing regions, there is a flow of manufactured goods in one direction and of raw materials and agricultural products in the other. Containers utilized for the transport of manufactured goods are seldom used for raw materials, however, and only under certain circumstances are they employed in the transport of agricultural products. As this type of trade flow creates an imbalance in the utilization of the containers. It is interesting to note that every trade is imbalanced to some extent, which was the **raison d'être** for the lessor in the first place.[66]

The owners of container vessels have recognized these aspects of containerization and have turned to leasing companies for their container needs. These companies provide vessel owners with containers at a reasonable lease rent per day with the option to drop them off and pick them up as their requirements dictate. While companies such as Zim Container Service and Matson Navigation Company maintain that it is less expensive to buy containers than lease them, since 1979 container leasing companies have acquired 50% of all TEUs. Furthermore, industry spokesmen have indicated that they expect the leasing companies' shares of the world container fleet will continue to increase, to reach 75% by the end of the decade.[67]

While both leased and carrier-owned containers are physically capable of travelling anywhere, containers owned by carriers are generally captives: they do not often leave the control of their shipping line owner and are not diverted to supply demands beyond their line's routes. A container owned by a shipping line normally travels back and forth over the line's own routes, thus substantially increasing the likelihood that trips in one direction will be made empty.

As can be seen from the industry analysis, the main customer group is the leasing industry. This group requires depots which offer a full range of services including repair, inspection, handling, storage and, at times, refurbishment. This group of customers is stable, and once aligned with a repairer a leasing company will not readily switch to another repairer. Within the container in-

dustry, this group is a high growth sector. On the other hand, the secondary customer group consists of shipping lines. This group requires repair work and some refurbishment but without interchange inspections or storage. Nonetheless, only a small proportion of shipping lines' repair work is contracted out to independent repairers. Repair work for shipping lines is unstable, since they will contract such work on a least-bid basis and move from repairer to repairer. This group is a low growth sector.

Leasing companies encourage their customers (lessees), generally shipping lines, to inspect containers when they take possession of them under a lease. During the term of a lease, containers are in the exclusive possession and control of lessees in order to provide maximum flexibility in container use, and lessees are responsible for repair and maintenance while the containers are on lease. At the end of a lease or upon the return of the container, the leasing company and lessee once again perform the task of inspection. If any damage is discovered, repairs are generally carried out at this time. In order to assist these operations, the leasing industy has prepared a series of inspection and repair publications.

The principal characteristics steamship lines and leasing companies look for in repair enterprises are high quality repair work at a reasonable price. Inadequacy in either of these areas can be sufficient to cause a change in repair organizations. If quality and repair costs are adequate, then repair time becomes the deciding factor.

Usually, leasing companies have found that their container depots in deloping countries go through two stages in providing services. First, their activities are limited to receipt, inspection, handling, storage and minor maintenance of containers. Once a depot is performing these tasks adequately, it may be asked to undertake the repair of damaged units.

Leasing companies, in particular, are very concerned about the lack of repair facilities and are committed to assisting persons in appropriate locations with the establishment of such facilities in order to speed up the repair of damaged containers, raise the utilization rate and reduce costs for the relocation of empties. In an area where there are no container depots, leasing companies often encourage local trucking and stevedoring enterprises to undertake depot operations, as they usually have the necessary container transport and handling equipment. Nonetheless, one German repair enterprise indicated that much overcapacity in the European repair and refurbishment industry was caused by container owners such as leasing companies who have encouraged new entrants into this field.

An enterprise which seeks to provide repair, maintenance and storage services to the leasing industry should be aware of the documentation and information processing requirements of this sector. For example, both lessors and lessee require documentation[68] for the pick-up and return of containers at depots. Further, inspection reports and repair estimates must be provided promptly and in detail. Additionally, certain leasing companies require daily or weekly reports on container movements, repair activity, and depot inventories.

In summary, the leasing companies' characteristics are as follows:[69]

–They need a full range of services– inspection, handling and storage, in addition to repair and, at times, refurbishment;

–They form a stable customer group– once aligned with a repairer, they change infrequently; price is not as critical as with shipping lines;

–The volume of repair work is unsteady– week-to-week and seasonal fluctuations are great;

–They are a homogeneous customer group– the leasing industry is very concentrated[70] and has similar repair specifications, container design and documentation. Repair work is more comparable among leasing companies than among shipping lines;

–A wide range of repairs is needed– very minor to major repairs; both vital and cosmetic work required;

–The volume of refurbishment work is unsteady– leasing companies tend to contract this type of work on a least-bid basis;

–Special documentation requirements are involved– documentation must be provided for both leasing companies and lessees and periodic status reports to the former.

(c) Customer relations

The relationship between a repair facility and leasing company is formally created through the execution of a Depot Agency Agreement.[71] Nonetheless, this relationship is also controlled by other instruments such as instructions for the operation of a container depot, IICL repair guidelines and the commercial terms or trading rules utilized by the facility in accordance with its national commercial code.

The Depot Agency Agreement should be viewed by a repair facility and its legal representative as a basis for discussions rather than as an instrument which must be either totally accepted or rejected. As leasing companies have prepared these agreements in the manner most favourable to their own interests, each clause must be studied with care and, if found to create an uncommercial business environment for the repair facility, necessary modifications or counter proposals must be prepared. While there are many provisions in a Depot Agency Agreement which must be studied with care, some of the more important relate to (i) free storage days, (ii) responsibility for payment of repairs, (iii) responsibility for negligent repairs, (iv) repairs effected by third parties, (v) amount of public liability insurance, (vi) responsibility for personal injury or damage to property, (vii) applicable law, and (viii) prices charged to customers.

All major leasing companies normally seek an exemption from the payment of container storage charges until damaged units are repaired. The reason for this is to accelerate a process they view as largely controlled by repairers –that is, container inspection, preparation of repair estimates, and ultimately the execution of repairs. Nonetheless, the commercial reality is somewhat different in that containers are usually inspected upon arrival at a facility, with a repair estimate and request for authorization to effect repairs being dispatched within hours. Further, this process is not entirely controlled by repairers as there may be delays in the granting of repair authorizations by leasing companies to repair enterprises. As a result, leasing companies usually compromise by accepting and exemption from the payment of container storage charges for the time period between receipt of a repair authorization by a repairer and the completion of such work.

Since responsibility for payment of container repairs is, pursuant to the agreement executed between leasing companies and lessees,[72] an obligation of the latter, depot agency agreements normally require that repair facilities must seek such payments from the appropriate lessees. While these agreements would seem to make only lessees liable for the payment of repairs to containers, such is not entirely true, however. The prevailing commercial practice is that the party requesting the repairs –whether it be the lessor or lessee– is primarily responsible for payment of such repairs. For example, where a lessor requests repairs to a container which has entered a repair enterprise and terminated its lease, that lessor must pay for such repairs even though the damage might have occurred during the lease term and even though the lessee may be liable to the lessor for repair cost. Likewise, where the lessee requests repairs to a container from a repair enterprise during the lease term, that lessee must pay for such repairs even though he is not owner of the container. Nonetheless, in this latter example a situation could develop in which the lessee who requested the repairs cannot make the required payment –for whatever reason– and there is no specific provision in the depot agency agreement through which the enterprise may receive payment from the leasing company. To avoid this situation the repair enterprise would be well advised to include in its depot agency agreement a statement to the effect that if the lessee fails to pay for repair work, the leasing company will respond.

Normally, leasing companies incorporate into their depot agency agreements a clause through which repair enterprises agree to indemnify the former for "any and all claims" arising out of their negligence in the performance of repairs. While leasing companies have every right to expect that repairs shall be properly effected, the use of such an indemnification clause does not take into account current business practices. It should be understood that leasing companies not only publish container repair standards but also maintain qualified surveyors to review damaged units and approve estimates of repair and, even more important, to approve the repair work effected. Therefore, as repair facilities and leasing companies are both intimately involved in the repair of containers, the former might wish to consider eliminating the phrase "any and all claims" and limiting such indemnification to the amount of the repair in question.

Depot agency agreements usually provide that designated facilities will permit third parties to effect container repairs on their premises. To correctly evaluate the impact of this provision it is necessary to understand that container repairs can be effected with very little capital investment by persons possessing the requisite sheet-metal and welding experience. Nonetheless, an enterprise which offers a full range of services –storage, repair and refurbishment– requires a substantial capital investment. As a result, the small open-air or mobile repairshop has much lower operating overhead and can price its work substantially less than that of enterprises which offer an enclosed workshop with a paved storage area and a full range of services. If a repairshop is permitted to carry out container repairs on the premises of another facility it would, in effect, be utilizing the overhead of the facility without making any contribution thereto. The economic impact of this provision would therefore appear to require careful evaluation before acceptance.

Most depot agency agreements require repair facilities to maintain public liability insurance policies in amounts of, for example, US$ 1 000 000. As these provisions do not take into account local business practices, national commercial codes nor the high premium cost of such policies in developing regions, repair enterprises should seek to negotiate appropriate policy amounts which take these factors into account.

While it would appear administratively efficient for a leasing company to have all of its disputes subject to the same legal régime, it must be recognized that these companies not only have representatives in regions with significant container flows but also receive benefits from those regions served –e.g., income from the use of their equipment and protection by the police and fire departments. Moreover, as newly established repair enterprises in developing regions normally lack sufficient funds to send a representative to jurisdictions selected by and most convenient for leasing companies, such enterprises might wish to consider the advantages of having depot agency agreements subject to the jurisdiction and legal régime of their national courts.

The remuneration for services rendered by repair enterprises should be the result of free and open negotiations between such enterprises and their prospective clients. Nonetheless, leasing companies include a provision in depot agency agreements to the effect that the prices they are charged shall be the lowest prices charged to any customer for similar services. This provision effectively eliminates the possibilities of growth through promotional pricing, as any lower prices must be immediately extended to all other leasing company clients. The acceptability of such a provision should therefore be carefully evaluated.

Many repair facilities have found that once their estimates for repair of damaged containers are received by leasing companies, negotiations usually commence between such companies and the relevant lessees to determine which damage or parts thereof might be considered fair "wear and tear" and who is to pay for the repairs. Once these negotiations are completed, the leasing companies normally notify repairers by telex, telephone or through their local representatives as to who will pay which part of the repair work and authorize the facility to carry out designated repairs.

In negotiating with repair enterprises over the prices at which their containers are to be repaired, leasing companies do not discuss the price for a completed repair but rather break these overall prices into individual components –number of days containers are stored free, hours to effect each repair, hourly rate for repair workers and material costs– and negotiate each separately. In this way leasing companies not only exercise a greater degree of control over their repair costs but are also formidable negotiators. For example, the management of a European repair enterprise indicated that the lack of bargaining power vis-à-vis container leasing companies has created the situation illustrated in the following table:

	Repair time (hours)	US$/hour	Materials	Total
England	10	20	50	250
Germany	6	30	100	280
Latin America	22	8	70	246
Lessor	6	8	50	98

While the overall differences between total bid prices for England, Germany and Latin America are small, container lessors will select the lowest amount for each bid item and then seek to have the work done at that price –i.e., US$ 98.00. Therefore, repair enterprises would be well advised to generate cost, material and man-hour data which can be utilized during such negotiations to justify their prices.

As spare parts utilized in the repair of damaged containers are normally charged by repairers to container owners at cost plus a percentage mark up in recognition of the opportunity costs in such inventory, certain owners have begun supplying their own spare parts, thereby eliminating this source of revenue. Many repair facilities have found that the key to their profitability is not agreeing upon prices but rather agreeing upon what work is included in the estimate for each repair, thereby avoiding "free" repairs.

(d) Repair standards

The Institute of International Container Lessors (IICL), which counts all the major leasing companies among its members, is one of the few organizations which gave an early lead in preparing manuals for container repairs, though many shipping lines and classification societies have subsequently followed this initiative. The IICL manuals define terms such as "slight", "moderate", "heavy", "acceptable" and "unacceptable" damage and provide recommended procedures for repairs. Nonetheless, these manuals are not mandatory, and as stated in the introduction to the repair manual for steel freight containers: "The Institute expects to continue to issue revised editions of its publications from time to time and welcomes suggestions as to improvements or omissions which should be taken into account in the next edition".

While the IICL manuals do make a major contribution to the effectiveness and standardization of container inspection and repair, they are regarded only as guidelines, and leasing companies are fully aware that as such they are subject to varying interpretations. Therefore, many leasing companies supplement these manuals with detailed programmes of seminars, films, etc.

It should be noted that leasing companies make frequent checks to assure full compliance with their repair standards. To accomplish this, such companies normally have a representative who, depending on the volume of work, is either on-site permanently or visits a number of facilities on a regular basis. For the newly established enterprise, these representatives can easily provide much-needed technical advice at no direct cost to such enterprise.

As different owners and users of containers expect different standards of repair, less responsible repairers exist, since there is no control over repair standards and they can often make sub-standard repairs at low prices. Major repairers and owners are aware of this situation and agree that more control is needed over repair standards. For example, Overseas Containers Limited has prepared a written repair manual but found that problems arising from language and regional attitude differences have made it necessary to convert it into a pictorial manual, thereby reducing the amount of written description which can lead to misinterpretations.

Many repairers do work to established standards and have gained the approval of classification societies like Lloyd's Register of Shipping, Germanischer Lloyd, Bureau Veritas, etc., but there is no compulsion for them to do so. In

fact, many repairers believed that the classification societies who approve new containers would subsequently recommend that, when damaged, they should go to approved repair companies, but this is generally not the case. Indeed, classification society-approved repair companies have made little impression on certain owners who have large technical staffs and prefer to do their own "approvals".

There have already been various attempts at establishing repair standards. Container Aid International (CAI) was founded in 1968 as a worldwide association of container repair enterprises. While full membership is limited to those repair organizations which have been approved by a classification society, associate membership is available to all repairers and other parties interested in the industry. The main purpose of this association is to make available the broad experience of its members and associates to facilitate the provision of efficient repair services, and to have the repairers' view taken into consideration in the preparation of standards for the design, repair and safe handling of containers. Some repairers believe that repair standards change with company financial results –when owners have the money the standards go up, and when they haven't, standards go down. The whole question of the standard to which repairs should be carried out remains a confused one. For example, some owners do virtually nothing to their containers at any time, with the repairer shotblasing and painting mammoth creases in panel sections rather than straightening them out, in contrast with leased containers just off hire which are repaired to the highest standards.[73]

Due to the abundance of container repair standards, the container repair industry has evolved the following general rule which dictates the nature and standard of repair work: in all cases it is necessary to replace damaged material with spare parts of the same strength and type. Where like for like replacement is not possible the repairer will supply certificates on steel gauge and quality, while the customer, for his part, is able to specify exactly the material gauge and quality required.[74]

The differences between repair standards of leasing companies and other container owners such as shipping lines are due to the nature of the former's business. As a result of the lease relationship, unless lessees receive containers in "like-new" condition there would be endless negotiations concerning when the damage occured –either before or after acceptance by lessees– to determine who is responsible for repair costs. For this reason, leasing companies normally require even cosmetic repairs during refurbishment to ensure that lessees will receive containers in "like-new" condition. By way of comparison, other container owners such as shipping lines require only that their containers have no structural defects which might render them unsafe or unable to be handled with specialized equipment, and that they be wind and water tight to protect cargoes transported.

While container repair facilities have test equipment which can assure that, for example, the International Organization for Standardization's (ISO) new construction tolerances have been met, neither the container owners nor the repair industry believe they should pay for such tests.[75] The container lessors have indicated that the repair industry should absorb the cost of such tests, as they would be testing the effectiveness of their own repair work.

(e) Sources of container damage

There is wide agreement that of the operational phases capable of inflicting container damage, those involving the actual handling of containers at terminals are the most significant. This is due to the nature of container handling facilities –they require a high throughput to justify their installation and rely heavily upon operator dexterity for safe operation of container handling equipment. Furthermore, it should be understood that container stuffing and stripping areas, such as those found in interior cargo terminals and shipping departments of major exporters, are generally congested, thus creating another source of container damage.

A recent study[76] indicated that 45% of all damage to containers is related to mishandling in terminals. Damage during railroad, highway and sea transport amounted to 30%, while improper stowage was responsible for the remaining 25%. Since most damage in terminals occurs during handling, which is only a short period of time in the total transport cycle, it is evident that areas near such terminals might be a productive location for establishment of a container repair enterprise. Nonetheless, it should be understood that since the majority of containers handled at marine terminals are subject to further on-carriage, any damage will be only temporarily repaired to permit such onward transport. Only when the containers are unstuffed can final repairs be undertaken, as welding and other repair procedures can damage the cargoes carried.

While it might appear that regions which have had over 20 years of container experience would have only minimal container damage, such is not the case. For example, Matson Navigation Company has found in its service between the West Coast of the United States of America and Hawaii, which is basically a closed-loop transport operation with little on-carriage, that with each handling –e.g., unloading from a ship and transfer to a storage area– 10% to 20% of the containers are damaged. Further, Overseas Containers Limited has found that 39% of its containers utilized between developed regions are returned to the United Kingdom damaged, with an average repair cost of US$ 140, and that in its service to the Persian Gulf area 54% are damaged with a repair cost of US$ 160-475.

Both Matson and Overseas Containers Limited employ cellular vessels for the transport of containers, but a recent unpublished master's thesis by L. Collantes and E. Silva of the Catholic University of Valparaíso, Chile, provides an important insight into the percentage of containers damaged where general cargo vessels and non-specialized port facilities are utilized. This thesis indicates that where containers are transported on the hatch covers of general cargo vessels which call at numerous ports on the West Coast of South America prior to final discharge at Valparaíso, Chile, an average of 78% were found to be damaged when finally unloaded at the latter port. This high percentage of container damage is due to the employment of non-specialized vessels and port facilities, lack of experience on the part of longshoremen, and the need to temporally off-load containers at each port to gain access to cargo holds for loading and/or discharge operations.

IV. OPERATIONAL ENVIRONMENT[77]

(a) Location

While there are many important factors that should be taken into account when evaluating the proper location for a container repair facility, some of the more important for this discussion are (i) container flows, (ii) export usage and (iii) transport costs to repair facilities.

A port may have a large throughput of container traffic, but such throughput may be largely unrelated to its productive hinterland and therefore provide very little work for a repair facility. For example any containers damaged while utilizing the port of Antofagasta, Chile, in transit for La Paz, Bolivia, the land bridge between Salina Cruz and Coatzacoalcos, Mexico, or Kingston, Jamaica, as a transshipment centre, would be temporarily repaired to protect the cargo, with permanent repairs effected when the container has completed its journey and is unloaded. In this situation, these port authorities might wish to consider the benefits which could result from the setting aside of a small area within their ports where temporary repairs might be effected. These repairs would assure that any transport delay due to container damage is minimized and that the cargo is immediately protected.

Although ports such as Buenos Aires, Argentina; Valparaíso, Chile; and La Guaira, Venezuela, may have substantial container throughputs, they would be considered potential locations for repair enterprises only if they have or are close to productive hinterlands which utilize containers in their export trades. When containers are employed in a country's export trade, they must be first inspected and, if necessary, repaired to ensure that the cargo will be protected.

Since many Latin American and Caribbean countries have productive hinterlands adjacent to or near their major ports, and as the use of master lease agreements is increasing, which provide containers at locations convenient to shipping lines, an evaluation of possible facility sites might begin with port areas. However, in evaluating possible locations it should be kept in mind that the most economic repair facilities would be those sited close to major consumption and export centres where containers are stripped and stuffed.

Container repair facilities located close to major trade flows have another advantage, in that the transport costs for damaged units are minimized. For example, Dr. W. Greverath of REMAIN at Hamburg, Germany, indicated that he would not consider siting a facility more than three kilometres from a port or productive hinterland. It is true that there is a facility ten kilometres from the Hamburg port area which specializes in major container damage, but this specialization was considered justified because transport costs to and from the facility represent a smaller percentage of repair costs than for minor container damage.

(b) Physical plant

While there are many factors that should be taken into account when planning the physical plant of a container repair and maintenance enterprise, some of the more important for this discussion are (i) the workshop, (ii) storage area and (iii) administrative offices.

Although European container repair facilities have fully enclosed workshops, in many Latin American facilities such as Lingas, Reparación do Contenedores and Politrans, the repair areas are only covered by a roof.[78] The use of a roof for the workshop provides workers with a dry place to effect repairs during the rainy season, but at the same time reduces needed investment. As an example, Lingas began operations with only a small covered workshop, under which approximatey eight containers might be repaired simultaneously. As the demand for repairs has grown, it is planned to double the covered workshop area.

While workshop floor areas for European and most Latin American repair facilities are of cement, LLOYDBRATI at Santos, Brazil, has utilized removable 2 metre square reinforced concrete "rafts" for its workshop floor. These concrete squares require only a levelled sandy base, can be installed in a minimum of time and may be reutilized at other locations. Their advantage is that they may be easily lifted by a fork-lift truck for rapid installation or removal to another location. Nonetheless, if they are exposed to the weather, joints must be carefully sealed or water will enter, permitting the "rafts" to rock and thereby pumping a mixture of sand and water to the surface.

As the covered area for the newly established enterprise will be relatively small, it is necessary to ensure that this area is not used for the storage of containers or spare parts. The covered repair area should be viewed as the most important revenue-generating area and, therefore, utilized for the repair of damaged containers to its fullest extent.

In order to attract repair work from leasing companies, repairers must offer sufficient container storage area. There are no mathematical formulas which will assist in determining the total area needed for a container repair and storage facility. The relevant factors which should be considered, however, are (i) the desired container stacking heights in relation to the cost of handling equipment and storage area surfacing, (ii) the average time during which the container will remain at the facility –both for repair and storage, (iii) the proportion of 40' and 20' containers at the facility, and (iv) the number of customers and their requirements. With reference to the latter, most leasing company depot agreements require storage space for a specific number of containers, such as 850 TEUs.

While opinions vary as to what type of surface covering is needed for a container storage area. Mr. J. Evans of Geoffrey Reyner (Container Repairs) Ltd., at Manchester, United Kingdom, indicated that the land must be self-draining to protect wood floors and must have a gravel surface, thereby making it serviceable in all seasons. On the other hand, Dr. W. Greverath of REMAIN at Hamburg, Germany, considered that a flat-cement type of surface for the storage area was necessary to reduce the costly wear and tear on container handling equipment such as fork-lift trucks. Another alternative which could be utilized

to achieve surfacing economies would be placement of the aforementioned concrete "rafts" under container corner fittings. In this manner these "rafts" could be utilized to reduce pavement costs by providing pads for supporting container corners, with unsurfaced gravel between them.

The majority of new repair facilities utilize containers for office space, storage of spare parts and tools, and to provide sanitary and lunch room facilities for employees. For example, Politrans at Rio de Janeiro, Brazil, has utilized three FEUs and two TEUs in a stacked combination to create movable workshop and office areas on a leased site no more than 500 meters from the dock area.

In summary, the physical plant for a newly established container repair facility should include the following:

(i) a roof for the workshop area;
(ii) a cement floor for the workshop and adjacent handling area;
(iii) a gravel surface for the storage area; and
(iv) three to five modified containers for an office, spare parts and equipment storage, sanitary facilities, etc.

(c) Equipment and spare parts

While the newly established repair enterprise might greatly reduce its equipment needs by purchasing instead of fabricating spare parts, this would result in greater operating expenses which could, in a highly competitive situation, make the facility less profitable or even unprofitable. Consequently, persons evaluating the feasibility of establishing a repair facility might wish to consider the acquisition of, **inter alia**, the following:

(i) Argon, MIG and stick welding, and propane gas cutting equipment;
(ii) Electric drills, hacksaw and disc grinder;
(iii) Twenty-ton hydraulic jacks and steam cleaner;
(iv) Portable lights, extension cords, rivet guns, ladders;
(v) Air compressor and air lines;
(vi) Steel cutting shear and bending press;
(vii) Fork-lift truck with adjustable spreader for empty 20 and 40 foot ISO containers;
(viii) Circular saw for wood; and
(ix) Truck tractor and trailers.

As the steel bending press, cutting shear, fork-lift truck, truck tractor and trailers require large capital expenditures for their acquisition, most Latin American repair enterprises have avoided such expenditures by sub-contracting the transport of containers to and from the facility and the fabrication of spare parts to other metal working shops, and by renting appropriate fork-lift trucks. For example, Multimodal, at Buenos Aires, Argentina, began repair operations in 1970 and has not, as yet, found it necessary to purchase a steel bending press and cutting shear. Likewise, Reparación do Contenedores of Santos, Brazil, contracts the movement of containers through a local truck owners' association and rents two of its fork-lift trucks.

The availability of spare parts is a critical problem for repairers. Many spares are difficult to obtain, especially for old containers or containers manu-

factured in remote locations. Repairers are often forced to purchase and cannibalize scrapped containers for spare parts or to fabricate spares themselves. For lack of parts, repairs can be held up for long periods of time. This means lost revenue to the repairer's customers, and chronic parts problems can cause customers to change repairers. In an effort to avoid this situation, many repair facilities have acquired steel bending and cutting equipment for the fabrication of needed spare parts.

As a container repair organization could hardly be expected to carry spare parts for every conceivable type of container likely to pass through its facility, it may contract depot services for one or more container leasing companies and thus know what types of spare parts to have available. While the repair industry has moved a long way towards becoming self-sufficient in the fabrication of container spare parts, it is still in many ways dependent on external sources of supply. This dependence is due to a number of factors, such as the insistence of container owners that damaged areas be repaired with specefic types of components, and the proliferation of container types has somewhat reduced the feasibility of container repairers fabricating all needed component parts. It is, then, important for repairers to keep in close contact with sources of supply for various types of components, and in particular those sources which can offer a fast delivery service.[79]

As a result, the newly established repair facility must determine the availability of needed supplies such as paints and steel plates in the national and international markets. If these suppliers are not available locally and can be imported at a reasonable price, the facility must then be assured that its sources of supply respond rapidly to requests, offer products of unvarying quality and utilize adequate packing for protection during transport.[80]

(d) Personnel skills

The repair facility must have a trained work force with a comprehensive range of skills. Moreover, repairers must provide continuity of service, which means a stable work force, administration and management capable of adapting quickly to varying work loads.

As seen by container repairers, container owners have four principal needs. First, a comprehensive range of container repair and maintenance services with the availability of additional services such as storage and transport. Second, flexibility of service. The types of service that owners need and expect are extensive and volumes vary considerably. The flexibility of service also includes other requirements such as personal contacts and repairs, if needed, outside normal working hours. Third, convenience of service. The requirements of container owners vary greatly but, as a general rule, repair facilities must be near their base of operations and sufficiently near the centres of freight movement. The reason is obvious – to reduce empty container transport costs. Finally, while most container owners have their own repair manuals, they need to be assured that repair work undertaken will be completed to desired standards. Further, one might add the overall requirements of repair work accomplished rapidly and at a reasonable price.

While skills needed by workers to repair dry cargo steel containers are many, some of the more important are experience with metalworking hand tools, bending and cutting sheet metal, gas, electric and inert gas welding systems, and familiarity with the use of blueprints and wiring diagrams. Furthermore, repair workers are usually assisted by specialists such as an electrician to service appropriate systems for tools, trailers, fork-lift trucks, etc., a maintenance man to service mechanical tools, engines, etc., a man to issue, store and order needed spare parts, an inspector to review containers upon arrival for damage and complete equipment interchange and damage reports, a foreman to schedule, inspect and approve repair work, and a carpenter to replace damaged flooring. While these specialists might seem to create a heavy monetary demand on the enterprise, it should be understood that many of these functions may be combined and are often performed by the repairmen themselves.

Although a repair enterprise relies upon the services of many skilled workers, the estimator occupies a pivotal role in the overall functioning of such a facility. If the estimator bids too low for certain repair work the possibility of a reasonable return on invested capital will be reduced or even eliminated, and if his bid is too high the facility runs the risk of not receiving such work. As candidates for this important function, many repairers select fabricators and welders, who have a good working knowledge of containers, and place them with an experienced estimator for about three months. While at the end of this period the newly-trained estimators can begin to work alone, an active dialogue should be maintained with their experienced counterparts to resolve any doubts, thereby ensuring that bids are neither too high nor too low.

As the newly-established facility will not have a pool of experienced repairmen from which estimators might be selected, the enterprise may wish to investigate the feasibility of training its estimators at other facilities in the region. Nonetheless, Mr. H. Haight, General Manager of Société Fosséenne d'Entretien de Containers, Fos-sur-Mer, France, was of the opinion that an estimator could be trained at an established repair facility by making use of industry standard work times and costs for effecting specific repairs. He indicated that the estimator could compare actual container damage with such standards to estimate the cost of repair work.

(e) Mobile repair units

In order to determine the circumstances under which mobile repair units would find their best application, it is necessary to evaluate the sources of container repair work and the way in which those sources normally seek repair services. The sources of container repair work are (a) leasing companies, (b) shipping lines, (c) port authorities, (d) interior cargo terminals (ICT), (e) major exporters and (f) freight forwarders. While leasing companies and shipping lines usually seek repair services from designated depots, ICTs, major exporters and freight forwarders could utilize mobile services at their facilities, as they may damage containers during stuffing or stripping operations. However, for countries which have not as yet established ICTs and where major exporters and freight forwarders do not make wide use of containers, the demand for mobile repair services would probably be limited to on-dock repair services (if such units are permitted in the port area).

When a sealed container is damaged during port handling operations, consideration should be given to whether the journey might be continued by effecting such repairs as will suffice to protect the contents until they reach their destination. It should be understood that having a container unsealed by the appropriate governmental authorities means delay, increased cargo handling costs, and the possibility of breakage and pilferage. Therefore, where containers are damaged during transit or transshipment operations –for example, between Salina Cruz and Coatzacoalcos, Mexico, and Jamaica– temporary repairs should be effected at such locations for protection of the cargo and to permit the on-carriage to be completed.

A mobile repair service must be prepared to operate on board ship, at dockside, and at depots. As some locations may have restrictions on welding, alternative means for effecting needed repairs must be available. According to Mr. R. Game of Overseas Containers Limited, 80% of their container repairs –50% by value– are effected by mobile units. It is interesting to note that such units permit the elimination of the transport and lifting costs involved in the transfer of containers to stationary facilities for all repairs other than major structural damage. Nonetheless, Dr. W. Greverath of REMAIN at Hamburg, Germany, indicated that mobile units lose their cost-effectiveness unless backed-up by a stationary facility with appropriate equipment for the fabrication of spare parts.

To profitably employ a mobile repair unit, the enterprise should be assured of enough work, such as a minimum of one day at each repair location. This means that mobile units do not provide emergency repair services but planned services to meet consistent demands. An emergency service can be, and often is, provided, but such services should be costed on a different basis. The work carried out by mobile units on containers has three main limiting factors:

(a) the lack of equipment to effect major structural repairs,

(b) the need for a control system which assures the same repair quality as for those effected at stationary facilities, and

(c) the need for special cost and time control systems, as mobile unit repair personnel function away from the stationary facility.

As a result, the person in charge of a mobile repair service must not only be a reliable technician but must also be able to work independently, have a good understanding of port and depot working requirements, and have a capacity to schedule work.

There are two principal types of mobile repair units: (i) a motor vehicle with a van body equipped as a workshop and (ii) a container similarly equipped, which can be transported on a trailer.[81]

(f) Specific operational aspects

As was stated in the preface, this book does not purport to be a manual of methods by which containers might be repaired. Nonetheless, during the collection of information from container repair facilities and their major customers as well as suppliers of spare parts and paints, certain working features came to light which those persons considering the establishment of such facilities might wish to evaluate. Of the many features encountered, some of the more important in-

clude (i) the nature of the container repairs, (ii) container inspection, (iii) documentation, (iv) surface preparation and painting, (v) container markings, (vi) worker productivity programmes, and (vii) cost control and profitability.

(i) **The nature of the container repairs.** As repair work on a particular container depends on the damage, the type of container, its construction material, standards of repair and the customer, each task must be tailored to fit the situation. Due to the unique nature of each repair and the consequent need for flexibility, repair work is very labour-intensive. Moreover, the work force must be moderately skilled and versatile. While some mechanization is possible with the use of hydraulic rams for straightening, automatic welding and painting and some jigs and fixtures, it must be understood that these devices are merely used as aids to an otherwise manual operation. Automation or assembly line techniques have little application in container repair. Only rarely will a task be repeated in exactly the same manner more than a few times. The design, construction, and condition of containers vary so much that jigs, fixtures, and special tools cannot be utilized to achieve assembly line repairs. Even containers of the same design and from the same manufacturers become unique after repeated damage and repair.

(ii) **Container inspection.** While container inspection involves an extensive range of human judgement and other factors such as varying commercial attitudes,[82] the importance of careful container inspections cannot be too strongly emphasized. The inspection, repair and storage needs of the container leasing industry differ from those of other container owners in that careful inspection and repair serve important commercial purposes. In fact, the interest of both the leasing industry and its customers require competent container inspections and repair. The industry recognizes two distinct situations in which responsibility for the condition of containers shifts between lessors and lessees. Until containers are accepted by lessees, lessors are, of course, responsible for all damage. If a container is not in proper condition on delivery, the lessee may reject it; if it is not in proper condition on return, the lease agreement provides that the lessee is financially responsible for repair costs. As a result, once containers are accepted by lessees they become responsible for all damage. Thus, the delivery of containers by lessors to lessees and redelivery to lessors are the recognized acts which shift legal responsibility for container damage.

Due to the worldwide nature of container leasing, it should be understood that repair enterprises, in carrying out container inspections, play a major role in determining responsibility for container damage. As lessors cannot themselves receive from and deliver to lessees their many thousands of containers, they have executed depot/storage agreements with repair enterprises for that purpose. In this situation, lessors must rely upon the inspections carried out by such enterprises with, of course, occasional checks by their own surveyors. The primary problem with the inspection of leased containers appears to lie not so much in failure to inspect such equipment as in the fundamental determination of when the damage occurred, thereby placing responsibility for its repair.

In order to assist with the execution of inspections, the IICL has prepared and published a Guide for Container Equipment Inspection which is applicable to both the leasing industry and its customers – the same inspection criteria apply for containers delivered to and returned by lessees. While lessees are encouraged

by leasing companies to conduct on-hire inspections to assure that containers received are in an undamaged condition, many repair facilities have indicated that off-hire inspections outnumber those for the on-hire situation 50 to 1. Moreover, off-hire inspections often involve negotiations between lessees and lessors with regard to the cost of repair, who is responsible, what is permissible "wear and tear", container repositioning costs, and those locations at which containers are regarded as off-hire.

All major leasing companies maintain a worldwide network of surveyors to verify damage estimates and approve repairs. While the managements of many repair facilities indicated that these surveyors provide useful technical advice concerning various methods by which damaged containers can be repaired, others considered their technical ability to be too limited to permit them to do more than verify the existence of damage and its subsequent repair. Nonetheless, newly established repair enterprises should make every effort to utilize the experience and technical skills of such surveyors.

While most leasing companies have their own inspectors for the review of repaired containers, the most important are those employed by the enterprise itself, since these inspectors normally determine what is to be done and the resulting quality of repairs before the leasing company inspectors have a chance to review the work.

As most containers are inspected at the inbound or outbound stage of transport operation, maintenance and repair of an individual container is an ongoing, continuous process. Regular inspection with a view to preventive maintenance and repair is essential, bearing in mind the financial implications of the extremes of container maintenance and repair versus replacement policies.

(iii) **Documentation.**The documentary aspects of container inspection, damage estimation, repair costing and administrative control, which make possible a frequent and accurate flow of information to customers, must be a priority concern of those enterprises which seek to provide repair services to leasing companies and many shipping lines. The documentation utilized by a repair facility is normally composed of the following elements:

Container receipt:
- **telex** or telephone message from owner to depot requesting acceptance of container;
- **gatehouse receipt** signed by driver delivering container, container number recorded in overall **master book** and given job number;

Container inspection:
- **equipment interchange receipt** (EIR) completed and sent to appropriate leasing company;
- **estimate of repair** (EOR) completed for all damaged containers and sent to owner or lessee depending on who under the terms of the lease is responsible for damages. In all cases an informational copy of the estimate is sent to the lessor;

Container repairs:
- **telex** from container owner authorizing repairs;
- copy of **EOR**;
- individual container **work card** for hours and materials used; **T-cards** for the job control board;

– repairmen's **time sheets**, and;
– repair **materials requisitions**;
Container billing:
– **invoice** for billing.

When a container arrives at the repair facility it should be checked for receipt against an "acceptance list". This list contains the numbers of the containers that each customer has requested the facility to receive. Thereafter an "acceptance note" is prepared and signed by the person delivering the container – usually the driver of a truck. The container is then unloaded and thoroughly inspected for damage. If undamaged, the container is placed in storage; if damaged, it should be placed in an "awaiting repair" location near the shop. In both situations the storage charges should start immediately after the inspection is completed.

The "acceptance note" is delivered to the repair facility office and the information contained thereon is transferred to the appropriate customer's equipment interchange receipt (EIR). The EIR is sent to the customer with, if the container is damaged, an estimate of repair (EOR) requesting authorization to commence repair work. Also, the container number and date received are entered in chronological order in a "master book". A "T-card" is then prepared with the customer's name and container number, and placed on the control board under "awaiting repair authorization".

In order to effectively programme the overall flow of work, most repairers utilize a job control board on which individual container T-cards are placed under the following appropriate headings:

1. awaiting inspection
2. awaiting repair authorization
3. repair authorization received
4. under repair
5. under refurbishment
6. completed and transferred to storage.

When authorization for repair is received, the details are entered in the "master book" and on the container control T-card. The authorized repair work can now commence and a "work card" is given to the repair crew. This card shows the repair work to be undertaken and the maximum hours allowed. Furthermore, time sheets and material requisitions are prepared to ensure correct costing and pricing for repair services rendered.

Upon completion of repair work the "work card" is returned to the facility office and dated. This date is also entered in the "master book". The customer is then notified that the container has been repaired and the date of notification is entered in the "master book". Finally, the container is placed in storage and the last entry in the "master book" occurs when the container leaves the facility.

The repair facility normally provides a daily repair completion report and weekly status report to its customers. In order to provide this information repair facilities must have ready access to telex and telephone services.

(iv) **Surface preparation and painting.** Modern marine paint technology is a very specialized field largely created by the introduction, in the late 1950s, of large oil tankers, followed a few years later by sophisticated container ships. As a result of the high capital investment involved, there was a pressing need at that time for improved protection against corrosion and fouling in order to ensure

that such vessels were kept at sea for longer periods. It should be understood that the first containers introduced in marine service were little more than standard highway trailers without chassis or wheels. As these trailers lacked surface preparation for the marine environment, steel members corroded rapidly.

During the last 30 years tremendous advances have been made in protective coating technology. These developments have brought about the availability of coating systems which, either by themselves or in combination with others, have potential service life expectancies of five, ten and even fifteen years –often under harsh environmental conditions.

Despite the availability of these materials, however, the common experience is that coating systems fail prematurely in service. In cases of premature coating failure the cause can seldom be attributed to the material employed. Almost invariably premature coating failure is due to inadequate regard for surface preparation and, somewhat less frequently, to poor workmanship in the application of a coating system, or to the application being carried out under adverse environmental conditions. It is now widely understood that the achievement of 100% coating system efficiency will depend 65% on surface preparation, 25% on quality of application –such as adequate coating thicknesses at sharp edges and angles, freedom from voids and misses in the coating, etc.– and only 10% on the actual coating material.[83]

In repair or minor maintenance situations other factors come into play to exert an influence over the success of a coating. Particularly notable is the fact that a coating used in this situation must be compatible with the original coating. The surface preparation and painting of repairs may be accomplished with an electric wire brush and disc sander, and the appropriate paint may be applied with a hand brush. Only when a repair facility also offers refurbishment of containers does it become necessary to utilize shot blasting for surface preparation and spray equipment for painting.

Many different types of coatings are used to protect containers from corrosion. While two coats are normally applied, a primer and a top coat, single-coat systems have given good results in some tests. Usually container owners select the paint system desired. The majority of paint companies such as Hempel's Marine Paints and Mander-Domolac provide free technical assistance to assure that their paint systems are correctly applied. Furthermore, many paint companies have prepared engineering drawings and other specifications for container construction and refurbishment plants which persons desiring to establish such facilities might be allowed to use, provided that these companies' products are utilized preferentially.[84]

(v) **Container markings.** Container owners mark their units to satisfy various legal requirements as well as for advertising purposes. To accomplish these purposes owners usually employ vinyl markings. There are two types of vinyl markings –cast and calendered. The former is produced in a liquified form and allowed to flow into a mould. Calendered markings, on the other hand, are produced by rolling a plastic material out until the desired thickness is obtained. Cast vinyl will not shrink after it has been applied to the container. However, calendered markings will sometimes shrink and curl. Most manufacturers indicate that their products will last from five to seven years.[85]

The application of container markings requires the indicated area to be free of oils, greases and silicones, the proper temperature, and a knowledge of the manufacturer's installation techniques. If a decal fails to stick, it is not usually because the product is unsatisfactory but rather because of improper surface preparation or the fact that the container is too cold or wet. Furthermore, a skilled applier may not have been available for the job. It should be understood that the need for a skilled applier is paramount, not simply because such a person can work faster, but because there will be less wastage. For example, an experienced applier might utilize a soap solution which permits markings to be slid into the proper position, after which the solution is pressed out.[86]

(vi)**Worker productivity programmes.** While it might appear that each repair enterprise is at liberty to determine the hours and materials needed to effect repairs, such is not the case. Within the container repair industry there are maximum allowable hours and repair standards which determine the materials needed for each type of repair. As repair enterprises in this situation can control their costs only through worker productivity, a few repairers have instituted programmes whereby employees are given a bonus for effecting repairs in less than the standard time. For example, Geoffrey Reyner (Container Repairs) Ltd., at Manchester, United Kingdom, employs a productivity programme in which "the total time for repair" of a container forms the basis. This factor is obtained by adding the individual times for repairs on a container. When the leasing company authorizes a certain container to be repaired, a copy of the "total time for repair" –without times for individual elements– is given to the workshop. Each week a ratio is produced which compares the "total time for repair" of all workers directly involved in repair work with their total attendance hours. This ratio is then expressed as shop performance:

$$\frac{\text{Total time for repair}}{\text{Attendance hours}} \times 100 = \text{Shop performance}$$

The management of Geoffrey Reyner Ltd. has found that, depending on the performance reached by the repair shop as a whole, this can result in the individual repair workers being paid an enhanced hourly rate which may, for an exceptional performance, double their earnings.

Of course, this productivity plan might be modified somewhat to include a quality control factor. In this situation the total time for repairs would be reduced by the time needed to rework any container. Thus, the repair workers should have an incentive not only to be productive but also to ensure that their work fully complies with industry standards.

$$\frac{\text{Total time for repair - time needed for rework (if any)}}{\text{Attendance hours}} \times 100 = \text{Shop performance}$$

(vii) **Cost control and profitability.** As container repair and maintenance facilities have only four sources of income –from inspection, repair, storage and transport of containers– each of these sources should be maximized to assure

the greatest overall profitability. While many customers will request free storage days for their containers, this request should be granted only when it is determined that such free days would make a greater contribution to profitability than storage income. Another factor to be taken into consideration is that many repair facilities offer substantial container storage space in order to protect themselves from the worst effects of varying repair volumes. For example, the management of Seashops at Colón, Panama, has found that when repair income has fallen, storage income as well as that from the repair of trailers has permitted the facility to remain profitable.

Although container lessors and shipping lines normally provide transport for a damaged unit to the selected repair facility, such facilities are often asked to transport containers for the performance of repairs or storage. For example, Geoffrey Reyner (Container Repairs) Ltd., REMAIN and REPCON all have appropriate container transport equipment, with the latter charging US$ 2.50/mile for this service.

In addition to maximizing the income from each of the above sources, it should be understood that the profitability of a repair facility can be enhanced and is often determined by effective cost control. Some of the measures which can be taken to control repair facility costs include:

1. Constant re-examination of container repair operations to determine where the use of jigs, fixtures and pre-fabrication of container sections would reduce repair times;
2. Minimizing the number of containers which must be returned to the workshop for "touch-up" work;
3. Keeping in touch with repairmen to determine repair "bottlenecks" and methods by which they might be reduced or eliminated;
4. Minimizing the number of times a container must be moved within the repair facility, and
5. Minimizing the administrative overhead –secretaries, accountants, messengers and management personnel.

NOTES

1 See III. Industrial Analysis, p. .
2 Cargo Systems, February 1979, p. .
3 Sepúlveda Whittle, Tomás, **International Maritime Transport in South America** (E/CEPAL/R. 213/Rev.1), Santiago, December 1979, p.33.
4 It is interesting to note that the law reserving ocean transport between any two or more USA ports to vessels constructed in that country as well as owned and crewed by its citizens was adopted in 1817 (3 Stat. 351) and is still in force (Title 46 USC section 11 et seq.).
5 **Transport 2000**, November/December 1980, p.48.
6 Title 49 USC section 901-923.
7 Federal Maritime Commission, **Puerto Rican–Virgin Islands Trade Study**, Washington, D.C., April 1970.
8 **Via Port of New York**, September 1970, p. 5.
9 **Fairplay International Shipping Weekly**, 18/25 December 1980, p.9.
10 **Fairplay International Shipping Weekly**, 1 January 1981, p.9.
11 **Ibid.**

12 The International Organization for Standardization's Technical Committee 104 (ISO/TC 104) published in 1970 ISO Recommendation R 688 and three years later that Recommendation was again published as an International Standard for freight containers. While ISO 688 encompasses three Series of containers, Series 1 inlcudes containers of 2 438mm x 2 438mm (8 feet x 8 feet) with uniform cross-section of nominal lengths from 1 500mm to 12 000mm (5 feet to 40 feet). Also included in Series 1 are 2 438mm x 2 591mm high (8 feet x 8 feet 6 inches) containers of 6 000mm, 9 000mm and 12 000mm (20, 30 and 40 feet) lengths. The ratings of the containers from 1 500mm to 12 000mm long are from 5 to 30 tons.

13 **Fairplay International Shipping Weekly**, 8 July 1982, p. 12.

14 **Cargo Systems**, February 1982, p.56.

15 Alexander Sir Lindsay, **The Challenges to British Shipping 1965-1990**, the 13th Blackadder Lecture 1979, published by North East Coast Institution of Engineers and Shipbuilders, Newcastle-upon-Tyne.

16 **Transport 2000**, September/October 1980, p.18.

17 Department of International Economic and Social Affairs, Office for Programme Planning and Co-ordination, United Nations, **Transport Newsletter**, Volume 3, No. 1, September 1980, p.6.

18 **Transport 2000**, January/February 1981, p.24.

19 International Chamber of Commerce, **The development of international container transport: its application in developing countries**, 1977, p.6.

20 **Ibid.**

21 **Container News**, October 1980, p. 17.

22 **Transport 2000**, January/February 1981, p.24.

23 **Container News**, October 1980, p. 17.

24 **Container News**, May 1980, p. 2.

25 ALAMAR, **Informativo** No. 293, 16-22 February 1981, p. 2.

26 **Seatrade**, March 1981, p.32; and **El Mercurio**, 22 April 1981.

27 ALAMAR, **Informativo** No. 320, 24-30 August 1981, p.3; and **Fairplay International Shipping Weekly**, 29 October 1981, p. 15.

28 **Fairplay International Shipping Weekly**, 24 July 1980, p. 11.

29 **Fairplay International Shipping Weekly**, 27 March 1980, p. 8.

30 **Fairplay International Shipping Weekly**, 9 April 1981, p. 11.

31 **Fairplay International Shipping Weekly**, 27 March 1980, p. 8.

32 **Fairplay International Shipping Weekly**, 18/25 December 1980, p. 11.

33 **Seatrade**, December 1981, p. 29.

34 Seatrade, **Latin American Shipping**, 1981, p. 61.

35 **Ibid**, pp. 61 and 63.

36 **Op. cit.**, p.65.

37 **Cargo Systems**, April 1981, p. 27.

38 **Seatrade**, March 1982, p. 32.

39 **Container News**, October 1980, p. 20, **Cargo Systems**, April 1981, p. 36, and Seatrade, **Latin American Shipping**, 1981, p. 65.

40 **Cargo Systems**, November 1980, p. 127.

41 Seatrade, **Latin American Shipping**, 1981, p. 45.

42 **Seatrade**, February 1981, p. 27.

43 **Seatrade**, December 1981, p.29.

44 ALAMAR, **Informativo** No. 313, 6-12 July 1981, p.4.

45 **Cargo Systems**, October 1980, p.25.

46 Under the master lease arrangement lessees guarantee to use a minimum number of TEUs for a specified number of years with the option to pick up and drop off as required. In the opinion of leasing companies, the pick-it-up and drop-it-there service is the most

useful one they perform for shipping lines. According to CTI, some of its customers would have to purchase 40-60% more containers if they had to do their own repositioning.

47 **Container News**, November 1980, p.50.
48 **Container News**, February 1981, p.14.
49 **Cargo Systems**, October 1980, p.29.
50 C.G.P. No. 14/80 of 16 April 1980.
51 **Cargo Systems**, October 1980, p.20.
52 **Cargo Systems**, April 1978, p.33.
53 **Cargo Systems**, January 1980, p.41.
54 Based on ECLA's interviews with Caribbean, European, Latin American and North American container repair enterprises.
55 **Cargo Systems**, September 1979, p.53.
56 For further discussion of container refurbishment see annex 1.
57 **Cargo Systems**, October 1979, p.53.
58 The **State of Containerisation** 1979, Flexi Van Corporation; and **Containerisation into the 1980's**; Cargo Systems Research Division.
59 **Container News**, May 1980, p.104.
60 **Transport Newsletter**, Volume 3, No. 1, September, p.19.
61 **Seatrade**, June 1980, p.129.
62 **Shipping World and Shipbuilder**, January 1968, p.34.
63 **Cargo Systems**, March 1981, p.34.
64 **Cargo Systems**, May 1977, p.27.
65 **Cargo Systems**, April 1981, p.55.
66 **Container News**, June 1980, p.20.
67 Ibid., p.14.
68 See IV (f) Specific Operational Aspects, (iii) Documentation, p. .
69 For further discussion of the special needs of the container leasing industry see annex 2.
70 The seven principal container lessors are Container Transport International (CTI), Flexi-Van, Interpool, Itel, Sea Containers, Transamerica ICS and Xtra.
71 See Annex 3 for a copy of a Transamerica ICS Depot Agency Agreement.
72 See Annex 3 for a copy of the Institute of International Container Lessors (IICL) "Conditions of Lease".
73 **Cargo Systems**, March 1980, p.29.
74 For a more complete discussion of container repair standards and the International Convention for Safe Containers (1972), see annex 4.
75 **Cargo Systems**, March 1980, p.29.
76 A **Study of Intermodal Container Safety**, Cushing, C., Kimball, P., and Higgins, M., prepared for the United States Coast Guard, Washington D.C., 1976.
77 For further discussion of the establishment and operation of a container repair enterprise, see annex 5.
78 At Buenos Aires, Argentina; Santos, Brazil; and Santos, São Paulo and Rio de Janeiro, Brazil, respectively.
79 **Cargo Systems**, March 1981, p.53.
80 For further evaluation of the physical plant requirements as well as those for equipment and spare parts, see annex 7.
81 For further discussion on the establishment and operation of mobile repair units see annex 5.
82 **Cargo Systems**, November 1979, p.101.
83 Cargo Systems Container Technology Conference, December 1978.
"Corrosion in containers –its causes and prevention", J. Dave Griffiths, Deputy Managing Director, R. J. P. Nickin & Co. Ltd., U.K.
84 For further discussion of surface preparation and painting requirements, see annex 8.
85 **Cargo Systems**, August 1977, p.23, and August 1979, p.41.
86 For further discussion of container markings, see annex 9.

ANNEX I

REFURBISHMENT

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As refurbishment involves the execution of five related processes on each container –blasting, masking, painting, drying and marking– it is a ready candidate for automation. However, the investments required for an automated refurbishment cycle can only be justified economically when assured of a high container throughput. Since the onset of this mode of transport technology, container, paint and appropriate handling equipment manufacturers have improved their respective products so that the amount of time between refurbishing units has greatly increased. This has in turn reduced the demand for such facilities and, hence, reduced the possibility of a high throughput to justify the needed capital expenditure.

Leasing companies usually do not relocate containers for the repair of damage, but such relocation can be easily justified for refurbishment, since a container in need for refurbishment is structurally sound and during relocation may be used to carry cargo. Therefore, although it is not essential that the refurbishment cycle be automated, persons who seek to offer container refurbishment must understand that they are in direct competition on a world-wide basis with the most efficient and least costly enterprises.

The distinction between repair and refurbishment lies in the production flow nature of the latter. The normal arrangement of a repair and refurbishment facility is a large area for repair work, with the refurbishment sequence on one side of the building. This sequence is composed of separate enclosed or semi-enclosed spaces for grit or sand blasting, masking, spray painting, drying and replacement of container markings. The materials required for refurbishment are mainly blasting grit, paint, masking tape and container markings, with relatively long runs of similar units being a desirable feature. On the other hand, as the repair function requires the matching of a varied work-load to equipment, worker skills and materials, constant planning is needed.

The physical differences between repair and refurbishment are apparent. The refurbishment process, with its grit recovery system, air conditioning and extensive use of equipment, together with its minimum team of specialists dependent on each other, is an indivisible cost structure. It relies on a regular uninterrupted volume as the key to economic pricing. An equipment breakdown anywhere in the refurbishment sequence would stop the entire process. Thus, the system is either functional or not. A container taken out of this process for further repair would create an additional cost far beyond the direct costs of handling. On the other hand, container repair requires a covered, uncluttered space for maximum flexibility of positioning within the organization.

These two processes normally come together, as all owners with refurbishment needs have repair requirements. Common siting is therefore a direct economy. Moreover, the integration of site handling, repair work and refurbishment affords economies of scale.

It is interesting to note that REMAIN of Hamburg, Germany, opened a fully automated refurbishment facility in which the services of three operators are utilized in a process requiring only six hours from start to finish. REMAIN opened this facility in order to provide a complete line of rapid and efficient container services, thereby seeking the repair work that must be effected prior to refurbishment. Nonetheless, Dr. H. Rust of REMAIN indicated that since the containers constructed today are better designed and protected with long-lasting durable paints, the refurbishment facility has, as yet, generated only sufficient income to pay for its operating expenses.

ANNEX II

SPECIAL NEEDS OF THE CONTAINER LEASING INDUSTRY

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Introduction

Container depots may be the least glamorous part of marine containerization, but without them international trade would still be wedded to cargo handling procedures that were old a century ago.

The container depot is one of the key elements of the entire containerization industry, one that enables the rest of the parts of that industry to function smoothly and precisely. In a sense, the depot is akin to the ground-support system of the aviation industry, where aircraft specialists, skilled mechanics and the like keep aircraft flying. At the container depot, expert mechanics, metal workers and fabricators, guided by astute administrators, make sure their clients' container fleet is kept floating.

At this time, hundreds of container depots are scattered throughout much of the world. Many of them are owned and operated by entrepreneurs determined to be a part of the containerization explosion that has rocked international transport for the past two or three decades. In many cases, the depots function as staging areas for containers awaiting transfer to the steamship line, as well as sites providing the necessary repair and maintenance services common in the industry. In the course of a year, they may handle hundreds of thousands of "boxes".

Despite the number of such depots, however, there is still a serious shortage of them. The expansion of containerization has caused, and will continue to cause, a shortage of depots.

It has been estimated that, largely because of a shortage of adequate repair facilities, the proportion of containers out of service in the world fleet has risen from 10°/o in 1978 to 12°/o in 1979. Based on an estimated fleet size of three million containers worldwide, that means that some 360 000 containers may have been out of service simply because adequate maintenance and repair (M & R) services were unavailable in sufficient places and at the right time. The cost to the owners of the containers has been enormous.

Of particular interest to you should be the fact that the shortage of depots is particularly severe in Latin America. Containerization here has been proceeding at a particularly rapid rate. Indeed, the growth could be described accurately as nothing short of "spectacular".

According to a recent study, the Latin American ports with the greatest increase in containerized cargo handling were Buenos Aires, Rio de Janeiro, and Valparaíso. From 1970 to 1979, their combined container handlings rose from 25 000 tons to more than one million tons. In addition, the imminent opening of new container ports in Mexico and Brazil is indicative of the awakening of all Latin America to the new transportation era.

Obviously, the container depot plays an exceptionally important role in international containerization. In order to understand how this all came about, a brief historical review may be in order.

Containerization: historical highlights

Containerization has become such an integral part of the world's transportation network that it is difficult to realize that it is little more than a quarter-century old. Although the precursor of modern containerization goes back in time at least to the days of the Phoenician traders, it was not until the 1950s that the modern concept of containerization finally took hold. A successful American trucking executive, Malcolm McLean, took the wheels off some of his highway trailers to create "containers". These units were palced on highway chassis and railroad flatcars for ultimate loading into especially constructed ships. McLean was able to demonstrate immediate and substantial reductions in labour costs, in-port time of ships, and loss and damages to cargo.

The maritime industry was impressed by these developments, but it was not until the mid-1960s that containerization began to become accepted in earnest. Experts representing all facets of the fledgling industry, working in concert with governments, set international standards for container sizes, design specifications, and strength characteristics. It was not until these prerequisites were completed that the "containerization revolution" was born.

A whole new industry was built around the intermodal cargo container, and the entire structure of foreign trade was permanently changed. As a result, the traditional ocean-going freighters have largely been replaced by sleek new containerships, which carry cargoes of raw materials and finished products in modular containers. Some vessels can carry 2 000 or more containers at a time. In addition, the evolution of the industry has resulted in the predominance of the 20- and 40-foot-long steel container over the other types.

Dramatic changes also took place in the ports themselves. Massive automated container-handling cranes now move containers on and off ships in minutes. In larger ports, hundreds of acres of paved area are filled with containers stacked in columns of three or four units high. To keep pace with the new high-speed technology, antiquated governmental and documentary procedures have been streamlined to a remarkable degree.

The basic reason marine containerization grew, of course, was the economic benefits generated. A cellular containership can load and unload cargo in hours, compared with the several days previously required for conventional, break-bulk vessels carrying the same cargo volume. Containers can be loaded on chassis or railroad flatcars and moved off the pier in minutes, compared with the hours or even days required to reload break-bulk cargo into trucks. The fast turnaround time of containerships not only meant speedier transit time for cargoes but immensely improved the earning capability of high cost mercantile fleets by increasing the number of sailings per year.

The role of the leasing industry

The conversion from break-bulk to containerization was not always a smooth one. One of the principal problems was that no one had expected containerization to grow so rapidly. Part of the difficulty lay in the fact that the

steamship lines, proceeding cautiously, had underinvested in container equipment, preferring to pass on the capital investment cost to a third party.

This is where the container leasing industry came into the picture, with its financial capacity and its ability to respond quickly to the needs of its clients. The first container leasing company was formed in 1956, but it was rapidly joined by others as containerization expanded. While most of the major container leasing companies were formed in the first dozen years of the container era, they have since been joined by a number of smaller companies throughout the world. In fact, over 50 such companies were listed in the 1980 issue of "Containerization International".

The leasing industry's contributions to the development of containerization have been impressive. Individually, and collectively through their trade organization (the Institute of International Container Lessors or IICL), container leasing companies have not only encouraged the growth of containerization, but also have been instrumental in the development and publication of container inspection and repair guidelines, as well as developing improvements in container design and maintenance.

Founded in London in 1971, the IICL now has its headquarters in New York and it comprises the companies owning most of the world's leased containers. Despite the fact that these leasing companies, individually and collectively, have stringent, well-supervised safety standards, they have co-operated and worked closely with the International Organization for Standardization (ISO) and the International Maritime Organization (IMO) as well as the American National Standards Institute in order to produce further standardization of equipment and adequate safety requirements for the benefit of those handling containers. One of the IICL's principal functions, in fact, is to collate and co-ordinate technical advice from members and publish concise inspection guides and repair manuals, aimed at ensuring safe container operation.

It is principally due to the presence of the leasing industry that two of the most serious problems inherent in the container business –trade imbalance and repositioning of empty containers– have been alleviated by a variety of sophisticated leasing arrangements which give the steamship lines the advantage of handling container movements economically. Whilst shipping lines generally operate on regular routes, leased containers will, through interchange arrangements, travel from route to route worldwide and virtually without restriction.

The container leasing industry today owns over 50% of the three-million-plus TEU in the world. (One TEU is the cargo-carrying equivalent of a 20-foot container; thus, a 40-foot container equals two TEU.) This is just one indication of the importance of the leasing industry in international trade. As containerization has grown, so have the leasing companies, which today are sophisticated, computerized high service business organizations.

It has been estimated that leasing companies will own about 61% of the world container fleet by the mid-1980s, and about 75% by the end of the decade. If the forecast of six million TEU in service by 1990 comes true, the leasing industry will own 4.5 million TEU. Obviously, the container leasing industry is growing at an enormous rate, and it is clear that the allied container depot and M & R services industry must share in this growth.

The leasing companies' interest in expediting and controlling the quality and cost of repairs has had an important effect on their customers, for in addition to preserving their own leasable container fleets they have improved the quality of containers available for leasing.

The depots are another important partner in these efforts, which result in the availability of containers in good condition in most areas of the world where shippers and steamship companies need them. The importance of this relationship cannot be overstated, since the economic and technical feasibility of containerized cargo handling is dependent upon the availability of safe containers.

Thus, you can easily see the importance of container depots within the structure of the international containerized cargo system. Now, let's take a look at how these depots function.

The role of the container depot

Judging by the rapid increase in container movements in Latin America in recent years, it is apparent that the maintenance and repair (M & R) of the containers will be a major growth industry in this region in the 1980s and beyond. Such a development will be in the interests of shippers, water carriers, leasing companies and other supporting enterprises.

The overriding goal of M & R depots, of course, is to ensure the maintenance of the container as a safe structure which will protect the cargo from damage. The first priority is the physical safety of the general public and personnel handling cargo, and the second priority is the protection of the contents of the container. Besides the leasing industry's own strong safety rules, the administration of the International Convention for Safe Containers (CSC), in which the leasing industry co-operates, helps to fulfil these goals. CSC requires stringent inspection procedures before containers can go into, or remain in, service. This convention, which has been ratified by over 30 nations (including three in Latin America), will go into full force on September 6 of this year. For the leasing industry, the principal effect of CSC will be to affix a safety approval plate upon each container, and to ensure that each undergoes a thorough physical safety check every two years. This in itself is no problem for leasing companies, because at interchange time strong codes, safety checks and maintenance standards which exceed CSC requirements are applied as normal practice by the industry.

Another goal of the depot operator is to ensure that repairs are made so as to preserve the economic life of the container. Every hour, every day, every week that the container is out of service means money lost to the depot operator's client – the container owner. Additionally, the depot operator has the responsibility to use only handling equipment that will allow the container to be moved with complete safety, without imparing its ability to remain an integral intermodal unit.

Recent studies show that most damage is due to mishandling at the terminals. Rail, highway, and sea transportation accounts for the second largest amount of damage, and improper stowage aboard ship accounts for the remainder.

Terminals must handle high volumes of container movement in order to justify their existence economically. In order to do this, highly qualified equipment operators are required for the safe transfer of the containers in these very active, often congested, facilities.

Estimates of expected damage range from 10% of a ship's consignment of containers being damaged in long-established, properly configured ships and terminals, to as high as 75% in situations associated with break-bulk shipping and substandard pier-side facilities.

Container repair costs have risen 9.2% annually on average for the past five years, according to one industry executive. This is fine news for depot operators, but something less exciting for the container owners and their lessees. IICL's inspection and repair publications recommend appropriate procedures for identifying and repairing damage. These alone are not enough to satisfy the service requirements of the leasing companies and ultimately their customers, the shippers and shipping lines. Depot operators must share in the final responsibility of ensuring that quality repairs are performed at fair prices by employing conscientious workers.

In summary, leasing companies are very interested in the establishment of high-quality depots, particularly in locations like Latin America where the shortage is especially great. Leasing company goals are rapid turnovers of equipment between customers, aided by quick and satisfactory container repair and reduced need to move containers due to lack of qualified repair, reconditioning or storage facilities.

How to organize a container depot

The leasing companies are a stable group that seek long-term arrangements with qualified depot operators. Once aligned with an M & R facility, they will not switch to another competitor without good cause. Maintaining the goodwill of the leasing industry will help ensure the business success of the would-be depot.

The steamship lines, in contrast, are of secondary importance to the potential depot operator as container owners rather than lessees. Only a small portion of their work is contracted out to independent repair depots, since many lines own their own depots. Moreover, shipping company-owned containers are not necessarily repaired with each interchange.

In setting up a container depot, there are a number of basic areas that the would-be entrepreneur should investigate and resolve, before making his final decision. This presumes that the entrepreneur is satisfied that the import/export activity and the market potential of the depot are sufficient to justify the investment.

It must also be remembered that the principal potential customer group is the leasing industry. This business group prefers depots which offer a full range of services, including repair, inspection, handling, storage and preferably refurbishment facilities. The last is vital, as almost two-thirds of the world's container fleet is built of steel and such containers are likely to require two refurbishments during their lifetime.

Refurbishment, which in effect is the restoration of a container to prespecified "acceptable" conditions, normally by means of abrasive blasting the external areas and then re-coating and re-marking in an exact prescribed manner, requires substantially more investment than does the less complicated M & R service, as well as more highly qualified personnel. Items to consider are the size

and structure of the blast room, quality of lighting, compressor and blast hose capacity, abrasive recovery system, painting equipment used, and pre-refurbishment repair quality. The control of quality is essential, but greatly rewarding to the careful refurbisher.

Other basic areas of investigation

1. Site selection

The location of any M & R depot should be "where the action is", namely, the busiest meeting point between steamship lines, leasing company offices, and the import/export trades. The worst mistake is to locate off the beaten track, like the ill-fated restaurant built on the nearby, but inaccessible, side road off the main highway.

The first objective is to find a site with a reasonably active import/export trade. However, beware of the port terminal proper, for that is often merely a transshipment point for cargo en route to other destinations, where storage costs are high for idle containers. At such points, damaged containers may only get temporary repairs, serving to get the container through to its final destination, where complete repairs will be made.

Since containers are being stored more frequently near the major leasing ports, start searching close by, but not at, the port proper. Here are some helpful suggestions:

First, look for a site preferably within a radius of approximately eight kilometers (five miles) from the port. This is close enough to reduce transfer costs but will avoid the congestion and high cost of the port itself.

Second, look for a site adjacent to a major highway, preferably not more than five kilometers (three miles) off the highway. Access to a railroad siding is another advantage.

Third, and most important, look for a site big enough to encompass adequate storage space, in addition to shop space. Do not forget that enough space is needed to manoeuvre container handling equipment so as to be able to store the containers safely and efficiently. Ideally, approximately 30% of the site area should be uncluttered by buildings and containers.

Locations near where cargo is "stuffed" (loaded) into and/or "stripped" (unloaded) from containers are desirable. These consolidation areas, which accomodate the cargoes of many different shippers, are prime demand areas for empty containers.

2. Depot design, equipment, and spare parts

The decision on design or layout of the depot depends largely on expected traffic volume, construction costs, prevailing weather conditions, and anticipated equipment to be provided in order to repair the various types of containers serviced. Statistics show that 58% of the world container fleet is steel, 35% aluminium and 7% glass reinforced plywood (GRP). Generally speaking both aluminium and GRP units require somewhat higher artisan skills than do steel containers. Refrigerated container repair requires very specialized equipment and

personnel, and usually some kind of authorization agreement with and training from the manufacturer of the refrigeration equipment.

Therefore, the equipment needed to repair steel containers (welding apparatus, painting equipment, bending rigs, lifting equipment, and hand tools, among others) is probably what the fledgling repair shop should first consider providing.

The drainage, climate, and terrain of the site are important determinants in selecting a proper location. Remember that the site must be able to accomodate the weight of heavy lifting equipment supporting empty containers and resist the concentrated load of three empty containers at four concentrated load centres (the corner fittings). Areas in rainy territory must be adequately drained to prevent destruction of the containers and handling equipment. Essentially, most leasing companies require that adequate covered areas, protected from the elements, be available to perform repairs, especially when using modern welding equipment and for paint and decal application. Cold areas, of course, require interior heating of the shop. The site must be reasonably flat and large, in order to be able to accomodate a reasonable number of containers and the pathways needs by handling equipment.

It is also desirable to be able to have adequate room to segregate containers by size (20- or 40-foot) and by ownership.

The depot operator must decide whether to fabricate or purchase from a third party the necessary replacement spare parts for containers. If the spare parts have to be imported, the operator must be familiar with customs requirements and duty charges. Remember, too, that some leasing companies may require the use of certain materials (such as a specific paint or decals) that **must** be imported. First find out if the importation and shipment of such parts poses a problem that has to be resolved.

Subcontracting the fabrication of steel parts to outside metal working shops should be reviewed carefully, because this tends to increase repair times and parts costs, and the quality of the material supplied may have to be constantly controlled to ensure that no substandard parts are used.

It is not the purpose here to debate the merits of own parts fabrication versus purchase. Nevertheless, it should be borne in mind that not only is it important to have handling and repair **equipment** on hand, but also to have spare **parts** on hand, or at least easily and quickly available.

For any one sincerely interested in depot operations, the leasing industry itself can supply more specific aids. The IICL in New York publishes technical manuals rich in valuable tips, and the technical departments of the leasing companies themselves will usually co-operate too.

The leasing industry employs technical surveyors who inspect and approve repairs around the world. The would-be depot operator would do well to tap the skills and experience of these persons.

3. Personnel and pricing

Naturally, the depot facility must have a trained work force with a wide range of skills. These skills include, for example, operating container-moving equipment (such as fork-lifts or cranes), welding, miscellaneous repair skills, cost estimating, and so forth. At the same time, the depot must provide a continuity of service which creates a stable work force, and an administration and management that can adapt quickly to changing workloads.

The inspector/estimator is a key figure, and careful attention must be paid to his selection. On his shoulders falls the responsability of determining repair costs. If he estimates too low, the facility looses money, if he estimates too high, the depot loses out on the opportunity to form a lasting business relationship with the client.

It should be noted here, however, that most leasing companies and established repair contractors have fixed repair cost schedules or guidelines for the most common repairs, based upon experience. Since the majority of repairs come under this category, much of the guesswork is taken out of the estimating, and the depot operator knows in advance what the client is willing to pay. It should also be noted that these schedules are not arbitrary documents, but rather are the result of a history of negotiations between individual leasing companies and individual depot operators. It is certainly to the benefit of the leasing industry to have depots which are profitable and operated efficiently. In this way, not only do the lessor and depot operator profit, but so does the ultimate customer, the shipping line.

To reach this point, however, an effective cost control system is a priority project for any depot operator, new or old. Here are just a few ideas on how a depot operator can control his costs:

1. Hire dependable skilled conscientious staff.
2. Make regular re-examinations of depot operations to discover new ways to reduce repair times.
3. Locate suppliers who will provide repair materials at the lowest cost.
4. Minimize the number of containers which must be returned to the repair shop for "touch-up" work.
5. Maintain a dialogue with the workers to determine repair "bottlenecks" and methods by which the work involved in repairs can be minimized.
6. Minimize the number of times a container must be moved within a repair facility.

These ideas represent only a small sample of the collective experience built up by the container leasing industry. The depot operator is urged to keep in close touch with the technical experts of the leasing companies and with other depot operators in order to share valuable experience.

The time for decision

Obviously, entry into the container repair business is not a decision to be taken lightly, and neither ICL or the leasing companies can guarantee your success. There is a challenge here that must be weighed carefully, bearing in mind the following facts:

1. The growth of containerization in Latin America has been spectacular in the past decade. Every sign points to an accelerated rate of expansion for the foreseeable future.
2. The growth, however, has not been accompanied by a corresponding development of a properly equipped M & R network in the region. As a result, this particular facet of the industry cannot help but grow substantially in the coming year. Demand for depot services is becoming stronger all the time.
3. Since the leasing industry is the major owner of containers, it is most concerned with the shortage not only of repair, but also of refurbishment facilities. At the present time, quality refurbishing is mostly available in high cost areas of the world, where container trade is already well established. Certain leasing companies might be willing to support the development of quality refurbishment facilities in Latin America, in order to save on costly repositioning of containers requiring immediate refurbishment. Advice can be obtained from IICL member companies.
4. The initial capital investment will depend on the extent of services the new depot intends to provide. A new depot need not try to offer a complete range of services all at once in order to be a successful enterprise.

Do not forget about the expert advice available through the leasing industry itself. It wants –and needs– the services the depot provides, so it is in the interest of the leasing industry as well as your own that your enterprise does not start off with unrealistic capitalization. They want you to be a success as much as you do!

One final reminder. Some years ago, it was popular to refer to the "container revolution" as a phenomenon peculiar to the 1950s and 1960s. In reality, that "revolution" is still in full swing, especially in such developing regions as Latin America. The container leasing industry is very much aware of the "explosion" of growth here, and fully intends to be a part of it. Without a firm co-operative partnership between the leasing industry and the depot operators, based on a mutuality of interest, respect and professionalism, this bright future may well be dulled. We are betting that this will not happen.

ANNEX III

CONDITIONS OF LEASE OF THE INSTITUTE OF INTERNATIONAL CONTAINER LESSORS AND TRANSAMERICA ICS INCORPORATED DEPOT AGENCY AGREEMENT

FORM. LT.2-73

Conditions of Lease

INSTITUTE OF INTERNATIONAL CONTAINER LESSORS

The IICL Conditions of Lease have been prepared for use as a form, in whole or in part, on a strictly voluntary basis by parties to leases of containers and related equipment. The Institute makes no recommendations or representations as to the content of leases, or with respect to these provisions; and these provisions are for use in conjunction with the advice of counsel only. The Conditions of Lease are not complete in themselves and reference should be made to the accompanying memorandum for instructions with respect to their use.

HCL CONDITIONS OF LEASE

THE FOLLOWING CONDITIONS are incorporated into the foregoing Lease, or any Lease which may adopt these Conditions, in consideration of LESSOR's promise to lease Equipment referred to in such Lease or Leases, LESSEE's promise to pay Rental Charges therefor and the following terms and conditions:

1. **Definitions.** The terms herein shall have the following meanings in these Conditions of Lease:

   (a) "LESSOR" shall mean ( ).*
   (b) "LESSEE" shall mean the other party or parties to the Lease or Leases which precede or adopt these Conditions.
   (c) "Conditions" shall mean the provisions of this document.
   (d) "Lease" shall mean any document which incorporates these Conditions by attachment, adoption, reference or otherwise, and, subject to paragraph 17(j), reference hereafter to "this Lease" shall mean such document as supplemented and modified by these Conditions.
   (e) "Equipment" shall mean all containers, chassis trailers and other equipment subject to the Lease together with any improvements, repairs, accessories and replacements thereto or thereof prior to return of the Equipment to LESSOR.
   (f) "Item of Equipment" shall mean any single piece of Equipment.
   (g) "Rental Charge" shall mean the amount computed as set forth in the Lease and payable by LESSEE for use of each item of Equipment during the term of the Lease.

2. **Rental Charge.** Except as otherwise herein provided, LESSEE shall pay the Rental Charge set forth in the Lease for each item of Equipment from the date on which the item of Equipment is delivered by LESSOR until the date on which such item of Equipment is returned, inclusive of both date of delivery and date of return. If the item of Equipment is not returned as required in this Lease or if it fails to meet the requirements of this Lease upon its return, LESSOR shall have such rights and remedies as are hereinafter provided, and LESSEE shall continue to pay rent at the rate payable during the term of the Lease or at such other rate as the Lease may provide.

* Name of leasing company.

The time for payment of each Rental Charge installment hereunder shall be of the essence and a condition of the Lease; without prejudice to the foregoing or to any other remedy LESSOR may have, payments not received on or before the date payable shall be subject to a service charge at the rate of % per month on the unpaid balance.

3. Term. Subject to the provisions of the Lease and of paragraphs 8 and 13 below, this Lease shall be binding upon the parties upon execution of the Lease by LESSOR and LESSEE and shall continue for a term expiring on the last date set forth in the Lease for return of any item of Equipment: provided that LESSOR's remedies and other rights and LESSEE's liabilities or obligations under other provisions of this Lease shall continue until such liabilities or obligations are discharged and until the last item of Equipment is returned.

4. Delivery of Equipment. LESSOR will use its best efforts to deliver the Equipment on the dates specified in the Lease to the locations designated, but LESSOR shall not be liable for any delays in delivery. LESSEE's return to LESSOR of LESSOR's Receipt and Equipment Report shall constitute conclusive evidence that all items of equipment to which the same relates have been delivered to LESSEE and that LESSEE has examined them and found them (except as described ortherwise in said Receipt and Equipment Report) to be complete, in good condition and fully satisfactory. Nothing entered in such Receipt and Equipment Report by LESSEE shall affect LESSEE's obligation to pay the full Rental Charge or any of LESSEE's other obligations under this Lease.

5. EXCLUSION OF WARRANTIES. ALL ITEMS OF EQUIPMENT ARE LEASED AS IS, AND THE LESSOR WARRANTS ONLY THAT THEY CORRESPOND WITH THE DESCRIPTION SET OUT IN THE LEASE (OR IN ANY FURTHER SUCH LEASES ATTACHED OR WHICH MAY HEREAFTER ADOPT THESE CONDITIONS), AND THAT THE LESSEE SHALL HAVE QUIET POSSESSION AS AGAINST ANY PERSON CLAIMING UNDER OR THROUGH THE LESSOR. SAVE AS AFORESAID, NO CONDITION OR WARRANTY WHATSOEVER OF ANY KIND HAS BEEN OR IS GIVEN BY THE LESSOR IN RELATION TO THE EQUIPMENT OR ANY ITEM THEREOF, AND ALL CONDITIONS AND WARRANTIES IN RELATION THERETO WHETHER EXPRESSED OR IMPLIED, WHETHER STATUTORY COLLATERAL HERETO OR OTHERWISE, WHETHER IN RELATION TO THE FITNESS OF THE EQUIPMENT OR ANY ITEM THEREOF FOR ANY PARTICULAR PURPOSE, OR TO COMPLIANCE WITH ANY CONVENTION, STATUTE REGULATION, ORDER OR OTHER PROVISION OF LAW OR STANDARD, OR WHETHER IN RELATION TO MERCHANTABILITY OR AS TO DESCRIPTION, STATE, QUALITY, OR CONDITION OF THE EQUIPMENT OR ANY ITEM THEREOF AT DELIVERY OR AT ANY OTHER TIME ARE HEREBY EXCLUDED AND EXTINGUISHED.

6. Operation, Maintenance and Repairs

(a) LESSEE shall use each item of Equipment properly and shall at its expense, maintain and return each item of Equipment in good and safe condition and make repairs, replace parts, touch up paint, etc. LESSEE shall be liable for any repairs wrongly made. LESSEE shall wash and clean each item of Equipment regularly inside and outside to prevent corrosion and other damage. LESSEE shall be liable for all expenses, costs and losses to LESSOR arising out of LESSEE's failure to maintain and return the Equipment in good and safe condition or to spot paint or make such repairs or replace such parts as may be necessary for such maintenance and return.

(b) LESSEE shall use each item of Equipment so as to comply with all loading limitations, handling procedures and operating instructions, and to prevent excessive impact, unbalanced loading, etc. LESSEE shall not use any item of Equipment for storage or transportation of unsuitable contents which may damage the Equipment, including without limitation unprotected corrosive substances, poorly secured materials or bulk commodities which may corrode, oxidize, puncture, contaminate, stain, severely dent or otherwise damge the Equipment.

(c) Except as otherwise provided herein, LESSEE shall be liable for all changes in the condition of each item of Equipment prior to its return to LESSOR, and such changes shall be deemed damage pursuant to paragraph 9 hereof. LESSEE shall not be responsible for (i) such normal wear and tear defined below as may reasonably be expected between delivery of the item of Equipment and the date of its return specified in the Lease, or the date of its actual return, if earlier, or for (ii) such changes as are shown to have been caused by LESSOR. Normal wear and tear may include light oxidation or light rust, random small dents and scratches, on any side of the item of Equipment, caused by normal handling, ground storage, ship storage and securing, transport, and loading and discharge, consistent with good practice and in accordance with any specifications, handling procedures and operating instructions as may have been given by LESSOR to LESSEE. Notwithstanding the two preceding sentences, changes which could have been prevented by routine washing, routine lubrication, spot painting, or other normal repair or maintenance, changes affecting security, water tightness, weather proof qualities, mechanical and/or electrical function of integral components, the integrity of design or structure, or regulatory, classification or certification requirements, or affecting the inside or outside dimensions or cubic content of an item of Equipment, whether or not such changes add thereto or subtract therefrom, or changes which may threaten the safety of person or property, shall not constitute normal wear and tear, and LESSEE shall be liable therefor.

(d) All improvements, repairs, accessories, replacements, etc., made or attached to any item of Equipment by LESSEE become fixtures, part of the item of Equipment and the property of LESSOR without LESSOR incurring any liability therefor. LESSEE shall make no modifications, improvements, repairs or replacements, nor attach accessories or additions to any item of Equipment, without the prior written consent of LESSOR, except as may be necessary for emergency purposes or to comply with other provisions of this Lease. Such written consent may include such conditions, including later restoration of the Equipment to its prior condition, as the LESSOR in its sole discretion may require.

(e) LESSEE shall not change or supplement any identification marks on the Equipment, including without limitation, letters and numbers, except as may be otherwise required under these Conditions or agreed upon in writing between LESSOR and LESSEE. Such agreement may include such conditions, including later restoration of the Equipment to its prior condition as LESSOR and LESSEE may provide. Subject to any such agreement, the LESSEE at its expense shall keep such marks and the color of each item of Equipment in good condition as long as such item of Equipment is under lease to it.

(f) LESSEE shall at its expense comply with all conventions, laws, regulations or orders of federal, state, foreign and local governments and agencies which in any way affect any item of Equipment or its use, operation or storage or which in any way affect this Lease and shall be liable for all fines, penalties, fees and interest thereon for failure to comply. LESSOR shall have no responsibility for compliance with any such conventions, laws, regulations or orders, including without limitation, all such conventions, laws, regulations or orders as may relate to customs, transportation, handling, safety, labor regulation, repair, standards, etc.

(g) LESSEE shall comply in all respects with the International Convention for Safe Containers (CSC) and shall have and exercise such responsibility as would otherwise be LESSOR's for maintenance and examination of each item of Equipment as shall be necessary to comply with such Convention. LESSEE shall also comply in all respects with de Customs Conventions on Containers, 1956 and 1972, including, without limitation, all obligations of the operator of an item of Equipment and all requirements relating to temporary admission, transport of goods under Customs seal and maintenance of records.

(h) LESSEE shall at its expense comply with all rules and practices of ports, depots, storage areas and transportation companies consistent with the other requirements of this paragraph 6.

(i) If the equipment passes into the possession of any party other than LESSEE or LESSOR prior to return by LESSEE, LESSEE shall take all additional actions necessary to assure that such other party accepts, handles and relinquishes the Equipment in a manner consistent with all of LESSEE's obligations and LESSOR's rights hereunder.

7. Taxes, Government Levies and Other Charges

(a) LESSEE shall pay all taxes (other than taxes on LESSOR's income), fees, penalties, and charges levied on or in connection with the Equipment subsequent to delivery, including without limitation property, sales, use and excise taxes, duties, customs charges, and all further government levies, fees or charges, including without limitation fines, penalties and interest thereon. Without limiting the foregoing, LESSEE shall pay all customs charges arising out of failure to comply with any instructions that LESSOR may furnish to LESSEE.

(b) LESSEE shall pay all charges incurred in ports, depots, storage areas or otherwise arising out of the use of the Equipment, including without limitation, lifting and loading, in and out, customs charges and wharf fees. LESSEE shall also pay all costs or other charges incurred in picking up and returning the Equipment.

8. Return of Equipment

(a) LESSEE shall, at its own expense, return each item of Equipment on the date and to the location specified for its return in the Lease. Time is of the essence.

(b) Should the term of the Lease be extended more than six months, LESSEE shall give LESSOR not less than 90 days' prior written notice of the date and place of return of each such item; should the term of the Lease be extended six months or less, LESSEE shall give 30 days' prior written notice.

(c) Upon return the LESSOR and LESSEE shall execute a Joint Condition Inspection Report identifying the Equipment as specified in the schedule of equipment and identifying and acknowledging any changes in the condition of the Equipment subsequent to delivery.

(d) With regard to chassis and trailer equipment, LESSEE shall return such Equipment with the identical brand of tires equal in value and condition to those delivered with the Equipment. The "normal wear and tear" provisions of these Conditions shall not apply to tires.

(e) In the event that without obtaining prior written consent of LESSOR, LESSEE shall return any item of Equipment on a date or to a location or agent different from that specified for its return in the Lease, such return shall be improper. Within a reasonable time of the discovery of such improper return, LESSOR may elect such of the following remedies (i)-(iii), separately or in combination or sequence, and without prejudice to any other remedies or rights under this Lease, or otherwise available to LESSOR, as in LESSOR's sole discretion it may deem necessary or desirable to meet its obligations to LESSEE or to others or to maintain adequate allocation and condition of its Equipment:

(i) to tender the same item of Equipment to LESSEE at the place of its improper return, or at such other place upon which LESSOR and LESSEE may agree.

(ii) in the event that such item of Equipment is not within possession and control of LESSOR, to tender another item of Equipment of equivalent type at the place of improper return, or at such other place upon which LESSOR and LESSEE may agree.

(iii) should LESSEE refuse, within five days of notice of LESSOR's election, to accept tender in accordance with (i) or (ii) above, LESSOR may elect to terminate the Lease forthwith with respect to such item of Equipment (but without prejudice to any other rights or remedies hereunder).

In the event that LESSOR shall elect (i), (ii), or (iii) above, all of LESSEE's obligations under the Lease shall continue, including without limitation the obligation to pay the Rental Charge without allowance for interruption as a result of the improper return, and in addition LESSEE shall pay any extra costs or charges for handling or services as a result of improper return including without limitation charges for shipping the item of Equipment or item of Equipment of equivalent type to the place of tender. In the event that LESSOR shall elect (iii) above, LESSOR shall use its best efforts to lease such equipment to others and, upon receipt of rent from such a lease to another, shall credit LESSEE with the amount thereof, after deducting the extra costs and charges above and such other reasonable costs as may be incurred in connection with such efforts to lease

to others. Improper return by LESSEE shall constitute full and sufficient notice to LESSEE of LESSOR's intention to exercise one or more of its rights hereunder, notwithstanding any other provision of these Conditions, providing that LESSOR shall notify LESSEE of its election under (i), (ii) or (iii) above within a reasonable time after such election. No such election of (i) or (ii) shall affect the term of the Lease except as otherwise permitted pursuant to these Conditions.

(f) In the event that without obtaining prior written consent of LESSOR, LESSEE shall fail to return any item of Equipment for more than 30 days after the return date specified in the Lease, LESSOR, without prejudice to any other rights hereunder, including, without limitation, claims relating to Rental Charges or breach of this Lease or later exercise of any right to repossession, may in its sole discretion elect to treat such item of Equipment as lost, and in that event LESSEE shall pay to LESSOR the replacement value of such item in accordance with the provisions of the Lease. LESSEE shall continue to pay rent at the rate set forth in the Lease for each such item of Equipment, or in the event that LESSOR so elects, LESSOR's standard rental charge for such item at the rate prevailing on each day after expiration of the aforesaid 30 days, until the date that payment of such replacement value is made. In the event that after payment of such replacement value, LESSOR shall elect and obtain repossession, LESSOR shall, after deducting LESSOR's expenses, return to LESSEE such portion of such replacement value as LESSOR shall reasonably deem to be the value of such item of Equipment on the date of repossession.

9. **Risk of Loss and Damage.** LESSEE is liable for all loss and damage to the Equipment subsequent to delivery and prior to return to LESSOR, regardless of when such damage may be discovered.

(a) *Damage.* If an item of Equipment is returned to LESSOR in damaged condition, LESSOR will so advise LESSEE upon discovery thereof. LESSOR shall in its sole discretion have the right to repair the Equipment or to require LESSEE to repair it. In the event that LESSOR elects to repair it, LESSEE hereby authorizes LESSOR to proceed with the repairs, or arrange for the repairs to be made, at any repair facility of LESSOR's choice. LESSEE will execute any further documents required to authorize the repair facility to proceed. All repairs shall be made at the cost and expense of LESSEE, and LESSEE shall have the right to inspect any repairs so made. LESSEE shall continue to pay rent at the rate set forth in the Lease until the date upon which LESSOR and LESSEE shall agree in writing upon the amount of the cost and expense of such repairs and thereafter until the date specified in such writing for completion of such repairs. Upon satisfactory completion of the repairs and restoration of the Equipment to good and safe condition, the LESSOR shall at the request of LESSEE, issue a second Condition Inspection Report so stating.

(b) *Loss and Total Damage.* LESSOR shall in its sole discretion determine whether it is feasible to repair an item of Equipment. If LESSOR determines that it is not feasible to repair an item of Equipment or if an item of Equipment is lost or stolen, the LESSEE shall pay to LESSOR the replacement value for such item in accordance with the provisions of the Lease. LESSEE shall pay Rental Charges pursuant hereto until the date that full settlement is made therefor. In the event that full settlement is not made within 30 days after the return

date specified in the Lease, LESSEE shall, if LESSOR so elects, pay LESSOR's standard rental charge for such item at the rate prevailing on each day after expiration of the aforesaid 30 days. Full settlement shall consist of proof of such loss satisfactory to LESSOR and full payment of the replacement value of the Equipment.

(c) *Replacement*. In the event of damage, loss or theft of Equipment, LESSOR may elect, but shall not be obliged, to deliver another item of Equipment, which it deems of similar type, and at LESSOR's option, this Lease shall apply to such replacement item of Equipment.

10. Interest in Lease, Subleasing and Other Encumbrances. Notwithstanding any other provisions of these Conditions, including without limitation the definitions and nomenclature used herein, this Lease shall not be deemed a sale or anything other than a lease for any purpose. LESSEE shall not sell, assign, sublease, hypothecate, mortgage or otherwise encumber any of the items of Equipment or any of its rights or interests under this Lease without the express written consent of LESSOR, which consent LESSOR may in its sole discretion withhold.

11. Indemnity. LESSEE shall indemnify and hold LESSOR harmless from all liability, damage or loss (including without limitation expenses in connection with any claim or suit, such as attorneys' fees, court costs and other expenses) arising out of (a) any failure to comply with LESSEE's obligations under this Lease; or attempt by any third party, whether private or governmental, to impose upon LESSOR liability for LESSEE's obligations; (b) any claim,whether private or governmental, for personal injury or death, and for loss or damage to person, property, cargo or vessels arising out of or incident to the ownership, selection, possession, leasing, operation, control, use, storage, loading, unloading, moving, maintenance, delivery, or return of any item of Equipment; and (c) any forfeiture, seizure or impounding of, or charge or lien on, any item of Equipment. In the event of the occurrence of (b) or (c), each party undertakes promptly to give notice to the other of claims against it, or action against it, with respect thereto. In the event of the occurrence of (c), LESSEE agrees not to settle any action relating to the Equipment without the consent of LESSOR.

12. Insurance. Without prejudice to any other liability under this Lease, LESSEE shall at its own expense maintain insurance policies satisfactory to the LESSOR with insurers satisfactory to LESSOR as follows:

(a) public liability, including property damage, with limitations of not less than $ for each person, $ for each ocurrence, and $ property damage for each accident.

(b) contractor's and cargo liability covering LESSEE's indemnity obligations hereunder.

(c) all risks physical damage insurance in an amount equal to the replacement value of the Equipment covering such Equipment while on land, afloat, in transit or at rest anywhere in the world, including Particular Average and General Average, and with a deductible from such value not exceeding $

(d) automobile liability and property damage with limitations not less than as provided in (a) of this paragraph above.

The Certificates, Policies and premium receipts shall be furnished to LESSOR when requested. The Policies shall contain loss payable clauses in favor of LESSOR and clauses prohibiting cancellation without 45 days' written notice to LESSOR. LESSEE hereby irrevocably appoints LESSOR as LESSEE's attorney in fact to make claims, receive payment and execute and endorse all documents, checks or drafts for payment of loss or damage under any insurance policy. Recovery under any such insurance shall be applied first to LESSEE's liability under paragraph 11 hereof and second to LESSEE's liability under paragraph 9 hereof. The LESSEE shall not use or allow the Equipment or any items thereof to be used for any purpose not permitted or covered by the terms and conditions of the said insurance policies or do or allow to be done any act or thing whereby the insurance thereunder may be invalidated. If the LESSEE shall default in the payment of any premium in respect of any such insurance policies, the LESSOR may, but shall not be obliged to pay such premium, and if the LESSOR does so, the LESSEE shall repay the amount thereof to the LESSOR on demand.

13. Further Remedies. The remedies and other rights set forth in this paragraph elsewhere in this Lease, or otherwise available to LESSOR, are cumulative and not alternative. Such remedies and rights may be exercised separately or in any combination or sequence, and the use of any remedy or right individually or in any combination or sequence shall be without prejudice to and shall not waive any others. The exercise of any such remedy or right, including without limitation, termination, shall not relieve LESSEE of any liability or obligation under this Lease incurred prior to the exercise thereof.

Termination. The LESSOR may (but without prejudice to any other rights under this Lease) forthwith by notice in writing to the LESSEE terminate this Lease with respect to all, or any, of the items of Equipment if:

(a) the LESSEE shall fail punctually to pay any Rental Charge installment on the date payable as set forth in the Lease, or

(b) within 10 days of prior notice from LESSOR thereof, (i) the LESSEE shall fail to pay any other sum becoming due under this Lease, or (ii) the LESSEE shall fail to cure any other breach of the provisions of this Lease, or (iii) the LESSEE shall fail to cure any condition or situation which may jeopardize the LESSOR's rights in the Equipment or any items thereof, or

(c) any distress, execution or other legal process shall be levied on the Equipment or any items thereof, or

(d) the LESSEE shall permit any judgement against it in excess of $ 1,000 to remain unsatisfied for 7 days or fail to comply with the order of any court for 7 days, or

(e) upon the filing of any petition in bankrupcy, assignment for benefit of creditors, appointment of a receiver of all or any of its assets, entry into any type of liquidation, whether compulsory or voluntary, or the initiation of any other bankrupcy or insolvency proceeding by or against LESSEE including, without limitation, any action by LESSEE to call a meeting of its creditors or to compound with or negotiate for any composition with its creditors, or

(f) upon the seizure or nationalization of LESSEE or any of LESSEE's assets by a government or governmental instrumentality.

Upon receipt of notice of termination, LESSEE promptly shall give LESSOR notice in writing of the location of each item of Equipment and, at its own expense, shall return each such item of Equipment as LESSOR shall direct.

Provisional Remedies and Summary Proceedings. In the event of the occurrence of any of (a), (b) (i)-(iii), (c), (d), (e) or (f), if LESSOR shall so elect by notice in writing to LESSEE, LESSOR may utilize such legal remedies as may be available to it, including without limitation, replevin, injuction, summary judgement, or any other provisional remedy or summary proceeding designed to obtain possession of or protect the Equipment or any items thereof. LESSEE hereby specifically waives any hearing with respect to any such provisional remedy.

Repossession Without Judicial Process. In the event of the occurrence of any of (a), (b) (i)-(iii), (c), (d), (e) or (f), LESSOR, upon notice in writing to LESSEE may retake possession of the Equipment or any items thereof without resort to judicial process and for such purpose may enter upon any premises belonging to or in the occupation or control of the LESSEE.

Acceleration. In the event that LESSEE shall fail punctually to pay any Rental Charges installment on the date payable, as set forth in the Lease, and if LESSOR shall so elect by notice in writing to the LESSEE, all Rental Charges for the full term of this Lease to and including the return dates set forth in the Lease shall become due and payable immediately for all Equipment or, if, in LESSOR's sole discretion, it shall specify that acceleration shall apply only to certain items of Equipment, then only for such items thereof as may be specified in such notice. In the event LESSOR so elects, LESSOR may, without further notice to LESSEE, retake possession of the Equipment or any items thereof. In that event the unpaid balance of the Rental Charge shall become due and payable immediately but LESSOR shall use its best efforts to lease such Equipment forthwith to others and shall credit LESSEE with the amount of the rent received by LESSOR from the leasing of such Equipment during the remaining portion of the term of the lease after deducting the reasonable costs incurred in connection with such efforts to repossess and lease to others.

14. Governing Law. This Lease shall be governed by and construed according to the law of * ( ).

15. Arbitration and Litigation. Institution of arbitration or litigation by any party shall not prejudice or waive LESSOR's rights to any of the remedies referred to in paragraphs 8, 13 or elsewhere in this Lease or otherwise available, including without limitation, termination, provisional remedies, repossession without judicial process or acceleration.

(a) Any controversy, dispute or claim arising out of or relating to this Lease, or to the breach thereof, in which the claim is for less than $, shall be settled by arbitration before a single arbitrator in accordance with the rules,

then obtaining of **( ), and such arbitration shall be held in*( ). Judgement upon any award may be entered in any court having jurisdiction thereof. Such arbitration and all documents and proceedings in connection therewith shall be held in the English language.

(b) Any such controversy, dispute or claim in which the claim is for $ or more, or seeking enforcement of an arbitral award, or seeking a form of relief other than money shall be litigated in the courts of *( ), and the parties hereby expressly confer jurisdiction upon such courts for such purpose, and consent to service of process for such litigation by registered mail (with return receipt requested) to the address referred to in paragraph 17(f) hereof.

16. Extent of Liabilities and Obligations. LESSEE shall not be excused from its liabilities or obligations hereunder by events beyond its control, including but not limited to fire, storm, flood, earthquake, explosion, accidents, acts of the public enemy, sabotage, riots, civil disorder, insurrection, war, strikes, lockouts, labor disputes, labor shortage, work stoppages, transportation embargoes or delays, failure or shortage of materials, equipment, fuel, electricity or other supplies, failure of suppliers to deliver as requested, failure of repair facilities to finish repairs, acts of God, and acts, orders, directions, or regulations or priorities of any government or its branches or agencies.

17. General

(a) This Lease is binding upon the parties and their respective heirs, legal representatives, successors and assigns.

(b) This Lease contains the entire agreement between the parties and may not be ammended, altered, modified or added to except by a writing signed by the party to be bound thereby.

(c) LESSOR may grant a security interest in this LEASE and/or assign all or any part of its obligations, rights, title or interest in this Lease, including all or any portion of the Rental Charge due or to become due. To the extent, if any, that this Lease constitutes chattel paper (as such term is defined in the Uniform Commercial Code as in effect in any applicable jurisdiction), no security interest in this Lease may be created through the transfer or possession of any counterpart other than the original counterpart which shall be so identified on the signature page of the Lease.

(d) LESSEE hereby waives any and all existing and future set-offs and counterclaims against the Rental Charge or any payments due under this Lease.

(e) The paragraph heading in these Conditions are for convenience only and shall not be deemed to alter or affect any provision hereof.

(f) Any notice required to be given under this Lease shall be effective upon dispatch to the party to whom such notice is directed at the address first above written, or at such other address as may have been communicated in writing to the other party or parties to this Lease in accordance with the provisions of this paragraph. All notices required to be given in writing shall be given either by hand delivery, by mail or by telex confirmed by mail. Such mail shall in all

* Country or State.

** National or international arbitration body.

cases be registered airmail unless the address for delivery is in the same country as that from which the notice emanates and the distance involved is less than 200 miles (in which case registered first-class surface mail shall suffice).

(g) In the event that any of the terms and conditions of this Lease are not completed by insertion of the necessary words and/or figures, the parties agree to adopt LESSOR's standard terms and conditions for comparable equipment, prevailing on the date on which LESSEE executes the Lease, including without limitation rental charges, penalties for improper return and replacement values.

(h) Where there are two or more persons parties to the Lease as LESSEE their liabilities under this Lease shall be joint and several.

(i) The provisions of this Lease are separable and any provisions found upon judicial interpretation or construction to be prohibited by law shall be ineffective to the exent of such prohibition without invalidating the remaining provisions hereof.

(j) These Conditions incorporate all the provisions of the Lease; the provisions of the Lease and these Conditions are to be construed in all cases so as to result in an effective and consistent agreement, but in the event of any conflict between the provisions of the Lease and of these Conditions, the provisions of the Lease shall control.

(k) No waiver of any remedy or other right under this Lease shall operate as a waiver of any other remedy or right, nor shall any single or partial exercise of any remedy or right preclude any other or further exercise thereof or of any other remedy or right.

(l) References in these Conditions to LESSEE shall be deemed to refer also to LESSEE's employees and to LESSEE's agents including without limitation shipping companies, depots and truckers under hire to it. Any action or agreement required by these Conditions of LESSEE may be performed by LESSEE's employees or such shipping companies, depots, truckers or other agents, and their actions or omissions to act shall be binding upon LESSEE.

USE OF IICL CONDITIONS OF LEASE

The following should be observed in the use of the IICL Conditions of Lease (LT 2-73). The IICL Conditions are intented to serve as a set of examples of provisions which may be adopted, in whole or in part, on a strictly voluntary basis by parties to long term leases of containers or related equipment (see paragraph 1 of Conditions (Definitions)). The IICL Conditions are not complete in themselves. The most essential provisions of the lease (i.e., those relating to the names of the lessor and lessee, number and identification of containers or equipment, rental charge, replacement value, dates of delivery and return, terms of invoicing and payment, and currency in which payment is to be made) do not appear in these conditions and must be set forth in the lease.

If the lease is to be a physically separate document, the IICL Conditions are examples of provisions which may be attached to the lease. If only one document is desired, such provisions as are deemed useful may be incorporated in such document. In addition, if paragraphs 1, 2, 12, 14 or 15 are used, the further provisions required in those paragraphs must be inserted.

It should be remembered at all times that the IICL Conditions of Lease are not standard provisions. It is important to draw this distinction from the point of view of the United States antitrust laws, the U.K. Restrictive Trade Practices Acts and other laws. The Institute does not expressly or impliedly recommend the use of these conditions in any way. Each leasing company is free to ignore them or use such parts as in its own individual discretion it may see fit. If use is made, there can be no compulsion in connection with such use. Nor can there be any agreement or understanding among members of the Institute that some or all of them will use them or any parts of them. Members are strongly advised not to communicate concerning the extent to which they are used. No information even remotely related to prices should be exchanged by members.

IICL CONDITIONS OF LEASE

Revision of Paragraph 6(g) Pursuant to Article II(10) of the International Convention for Safe Containers (CSC)

Paragraph 6(g) of the IICL Conditions of Lease issued in 1973 provided for compliance with the International Convention for Safe Containers (CSC) and the Customs Conventions on Containers, 1956 and 1972. Specifically it provided illustration of exercise of the opportunity under Article II(10) of the CSC for lessee to be deemed owner of the containers for purposes of the Convention.

With the entry into force of the CSC in September 1977, greater flexibility and specificity were required in connection with the several obligations imposed by the Convention. Accordingly, IICL has revised Paragraph 6(g) describing requirements relating to maintenance, examination and initial approval under the CSC with greater specificity. In view of the five-year transition period for existing containers and the five-year period prior to the first examination of new containers (CSC Safety Approval Plates will be applied to new containers at manufacture), the only requirement effective immediately is the obligation to maintain the containers in safe condition.

The revised Paragraph 6(g) is set forth below and is distributed, in accordance with the purposes of the original IICL Conditions of Lease, as an example of a provision which may be adopted, in whole or in part, on a strictly voluntary basis by parties to leases of containers or related equipment. It is not issued as a standard provision, and the Institute does not expressly or impliedly recommend its use. Its purpose is to indicate how obligations can be allocated, should the parties desire to take advantage of the opportunity to do so under Article II(10) of the Convention.

(g) It shall be the obligation of LESSEE to comply in all respects with the International Convention for Safe Containers (CSC), and LESSEE shall have and exercise owner's responsibilities for the purposes of the CSC, including, without limitation, such responsibilities as would otherwise be LESSOR's for maintenance, examination and repair of each container. Performance of such examinations shall include ascertaining that the container has no defects which could

place any person in danger, marking each container with the date before which it is next to be examined and complying with all other requirements imposed by LESSEE's country of domicile or head office. In the event that neither LESSEE's country of domicile nor of head office is a signatory to the CSC when an examination is due, LESSEE shall take such action as may be necessary to perform such examination in compliance with the regulations of a signatory permitting it to do so. Should approval and plating of any container become due prior to its return to LESSOR, application for approval, if not already made, shall be the obligation of LESSOR, but affixing the CSC Safety Approval Plate in accordance with applicable government or approval authority requirements (and performing the CSC examination required in connection therewith) shall be the obligation of LESSEE. In such event, LESSEE shall use LESSOR's CSC Safety Approval Plates, and Lessor shall supply LESSEE with such quantities thereof and instructions as may be necessary. It shall also be the obligation of LESSEE to comply in all respects with the Customs Conventions on Containers, 1956 and 1972, including, without limitation, all obligations of the operator of an item of Equipment and all requirements relating to temporary admission, transport of goods under Customs seal and maintenance of records.

Transamerica ICS

Depot Agency Agreement

This Agreement dated , 19 ("Effective Date") between TRANSAMERICA ICS INC., 522 Fifth Avenue, New York, N.Y. 10036 ("ICS") and _____

_____ ("Agent").

WHEREAS, ICS is engaged in the business of leasing its freight containers and related equipment to third parties ("Lessees"), and

WHEREAS, ICS has leasing plans whereby Lessees may obtain specific equipment from specified, authorized ICS depots and return said equipment to said depots or to other authorized ICS depots, and

WHEREAS, ICS desires to contract with Agent to perform certain services and afford certain facilities to ICS in furtherance of its leasing plans, and

WHEREAS, Agent has represented to ICS that it is duly authorized and qualified to perform the services and afford the facilities.

NOW, THEREFORE, it is mutually agreed as follows:

1. Agent agrees to receive, inspect, store and release equipment and provide maintenance and repair service to ICS and its Lessees, all as more fully provided for below, at its place or places of business located at _____

_____ (list addresses of depots where services will be performed).

*Included

( ) **Storage** – Agent shall provide facilities for the storage of _____ 20' containers or equivalent and _____ 20' chassis or equivalent. It is understood and agreed that Agent's liability to store said quantity is of the essence of this Agreement.

Agent shall use all reasonable care to protect the equipment of ICS in its possession from loss or damage and shall be liable for any such loss or damage resulting from Agent's lack of care or that of its employees, agents or servants.

( ) **Receipt, Release and Inspection of Equipment** – Agent shall, upon instruction from ICS (i) receive equipment from ICS' Lessees and perform an inspection thereof on behalf of ICS, and (ii) release equipment to ICS' Lessees. At the time of receipt and release of equipment, Agent shall execute on behalf of ICS such interchange forms as are from time to time provided by ICS. All of the foregoing services shall be performed in strict accordance with instructions for the operation of ICS depots, as are from time to time issued and delivered to the Agent by ICS. ICS shall have the right to amend such instructions at any time.

( ) **Maintenance** – Agent shall, at the specific request of ICS, perform routine maintenance work. At the time of inspection of equipment, Agent shall advise ICS of the necessity for such routine maintenance. The cost for routine maintenance shall be agreed upon between Agent and ICS at the time ICS gives instructions for the performance of such work, unless specified to the contrary in Schedule A hereof.

( ) **Repair** – Agent shall provide adequate facilities and maintain a stock of spare parts and materials necessary for the repair of ICS equipment. Agent agrees that it shall accept all orders for repairs made by ICS or its Lessees and shall perform such work without delay and in accordance with normal industry repair standards, including specific repair guidelines of ICS, as are from time to time issued and delivered to the Agent by ICS. ICS shall have the right to amend such guidelines at any time.

Agent agrees to perform repairs at prices competitive in the locale of Agent's place of business. Repair charges shall include all charges incidental thereto, such as necessary transportation charges. All damaged equipment shall not be subject to a storage charge until such equipment is repaired.

Agent acknowledges that, generally, the responsibility for repairs is, under the terms of ICS' agreements with Lessees, the obligation of such Lessees. Accordingly, unless specified to the contrary in Schedule A hereof, agreements for repairs shall be made and billed to the Lessees.

ICS shall have the right to contract directly with Agent for the repair of its equipment and in those cases, the cost of such repairs shall be the responsibility of ICS. All repair estimates shall have ICS' approval before the work commences.

Agent shall indemnify ICS and hold it harmless from any and all claims arising out of the negligence of Agent in the performance of repairs.

ICS reserves the right to obtain repair cost estimates from third parties

* Mark boxes with "Yes" or "No".

for all damaged equipment at any time and to contract out maintenance and repair work to such third parties. Agent agrees to permit such maintenance and repair work at the depot locations listed herein. Agent further agrees to permit said third parties to remove equipment from and to return it to said depot locations.

ICS shall have the right to advertise Agent as an ICS repair facility as well as an ICS depot. Agent consents to the use by ICS of its name in connection with any such advertisements and publications.

2. For its services in receiving, inspecting, storing and releasing ICS equipment, ICS shall pay to Agent the charges set forth in Schedule A hereof. Said charges shall be effective for the term of this Agreement, unless specified to the contrary in Schedule A or changed as hereinafter provided. In the event Agent desires to change the charges set forth in Schedule A during the term of this Agreement, Agent shall give ICS 90 days' prior written notice, and any changes to such charges may be made by mutual agreement between the Parties hereto.

3. Agent shall, at its own cost and expense, maintain public liability insurance, including "care, custody, and control" insurance, against claims for bodily injury or death or damage to property in an amount not less than $ 1,000,000 per accident or occurrence. Upon the request of ICS, Agent shall furnish ICS with copies of the policies or other proof that such insurance is in force. At the written request of ICS, Agent agrees to have ICS named as an additional insured on all such policies.

4. Agent shall indemnify and hold ICS harmless against all loss, damage, claim or liability by injury to persons or damage to property arising out of, on account of, or in connection with the services performed by Agent hereunder.

5. Agent acknowledges that all ICS equipment which comes into its possession pursuant to this Agreement is the property of ICS and shall, notwithstanding any other provision in this Agreement, be delivered over to ICS upon demand. Agent agrees that it shall not exert or make any claim or lien, and no lien shall attach against ICS or its property, for failure of any Lessee to pay Agent for charges due Agent from such Lessee.

6. This agreement shall continue in effect for one year from the Effective Date and shall continue thereafter for successive one-year terms. However, either Party may terminate this Agreeement on the last day of any one-year term provided 90 days prior written notice is given to the other Party. In the event of any termination of this Agreement, ICS shall have three months to remove its equipment from Agent's premises. During such three-month period, the terms and conditions of this Agreement shall remain in effect.

7. Agent shall permit access by ICS and its authorized agents to ICS equipment in its possession and the books and records relating thereto at all reasonable times.

8. This Agreement constitutes the entire agreement between ICS and Agent and no statement, representation or understanding not specifically contained herein shall be binding upon the Parties hereto, unless agreed to in writing and signed by the Party to be bound thereby.

9. This Agreement may not be assigned by Agent without the consent of ICS.

10. This Agreement shall be interpreted in accordance with the internal law of the State of New York, United States of America.

SCHEDULE A

Effective _____ for a minimum period of _____ Currency _____

		CONTAINERS 20'	40'	TEU	CHASSIS 20'	40'
1	Handling Rate* In _____ Out _____					
2	Storage Rate (fill in a or b) a. Fixed					
	b Volume Discount					
	Free Storage					
3	Inclusive Rate (fill in if handling-in, handling-out and storage are quoted as one rate)					
4	Labor Rate Per Hour (for repairs)					
5	Supplemental Provisions					

*Handling rate includes inspection, forklift or crane charges, preparation of interchange forms, oiling of hinges, sweep-out and removal of port and line stickers. If other services are to be included in handling rate, such services should be listed in Item 5.

Agent hereby agrees that the prices charged to ICS shall be the lowest prices charged by Agent to any customer for a similar service.

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement, including Schedule A, to be signed by their duly authorized officers as of the day and year first above written.

_____
Depot Agent (Type Name)

By: _____

Title: _____

TRANSAMERICA ICS INC.

By: _____

Title: _____

Transamerica ICS

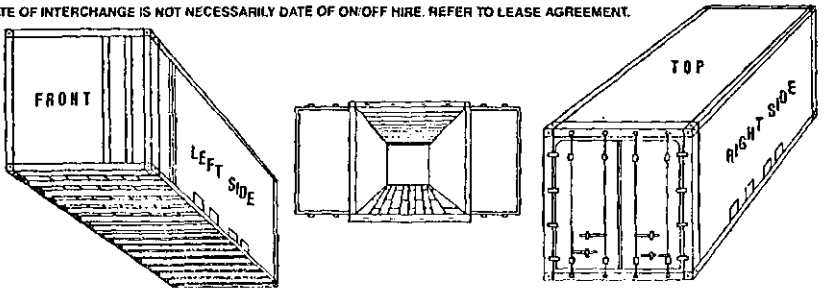
Equipment Interchange Receipt

EASTERN REGION

CONTAINER NUMBER	DATE OF INTERCHANGE	LOCATION	MOVEMENT	STATUS
I C S U			☐ IN OUT ☐	☐ DAMAGE GOOD ☐

CSC PLATE FITTED	RELEASE NO	RECEIPT NO	LESSEE NAME CODE	CARRIER NAME	VEHICLE NO
☐ YES NO ☐					

DATE OF INTERCHANGE IS NOT NECESSARILY DATE OF ON/OFF HIRE. REFER TO LEASE AGREEMENT.



INSPECTION REPORT: PLEASE INSPECT THE EQUIPMENT AND NOTE THE FOLLOWING AS APPROPRIATE.

CROSS MEMBERS

FORKLIFT POCKETS

SIDES

FRONT TUNNEL

DOORS HARDWARE

RAILS

END FRAMES CASTINGS

INSIDE WALLS LINING

FLOOR

ROOF/BOWS

MARKINGS

PAINT

OTHER

RECON NEEDED ☐ YES NO ☐

FOR DELIVERING CARRIER: THIS EQUIPMENT WAS DELIVERED IN SOUND CONDITION, EXCEPT AS NOTED ABOVE.	FOR RECEIVING CARRIER: THIS EQUIPMENT WAS RECEIVED IN SOUND CONDITION, EXCEPT AS NOTED ABOVE.
SIGNED	SIGNED
PRINT NAME	PRINT NAME

1

ANNEX IV

THE INTERNATIONAL CONVENTION FOR SAFE CONTAINERS AND ITS IMPACT ON CONTAINER REPAIR STANDARDS

Prepared by

S. E. Felding

Technical Officer

Cargoes Section

International Maritime Organization (IMO)

London, United Kingdom

IMO AND THE INTERNATIONAL CONVENTION FOR SAFE CONTAINERS (CSC) 1972[1]

GENERAL

The International Maritime Organization (IMO)[2] is a specialized agency of the United Nations composed of 122 member Governments and with its Headquarters in London. IMO's main objective is to facilitate co-operation among Governments on technical matters affecting International Maritime Transport in order to achieve the highest practical standards of safety and efficiency. The Organization has a special responsibility for safety at sea and for the protection of the marine environment through prevention of pollution of the sea caused by ships and other craft. IMO also deals with legal matters connected with International Shipping, with the facilitation of International Maritime Traffic and is responsible for providing technical assistance in maritime matters to developing countries. This latter activity has increased very substantially in recent years and IMO now has a team of advisory personnel as part of its technical co-operation programme. These consist of general regional advisers covering Africa, Latin America, Asia and the Pacific, as well as specialists interregional experts advising on particular subjects at the global level.

Turning to the Organization's responsibilities and activities as they relate to multimodal transport and containerization, it can be said the IMO is primarily concerned with safety and related technical aspects of multimodal transport where such transport includes a sea-leg (e.g., roll-on/roll-off, lash or container ships).

It is well recognized that there is an ever increasing trend towards through transport characterized by rapid vessel turn-around and increasing dependence by the ship's master and crew on the skills of individuals further and further removed from the vessel. This is especially true in container transport and roll-on/roll-off where pre-packed freight containers and vehicles are often rapidly loaded and secured in the vessel sometimes away from shore side supervision, and the condition of the cargo within has to be assumed safe. It is also true that the integration of transport highlights the interdependence of the transport modes and the indivisibility of safety in transport from origin to destination. With respect to containerization IMO, as the depositary of the International Convention for Safe Containers (CSC), is responsible for all safety aspects related to the application and amendment of this Convention.

THE INTERNATIONAL CONVENTION FOR SAFE CONTAINERS (CSC) 1972

In view of the rapid increase in the use of freight containers for the consignment of goods by sea and the development of dedicated container ships, the Organization undertook in 1967 to identify all the safety aspects of containerization in the marine transport environment and as the container represented the common denominator in the container transport system, the container itself emerged as the most important aspect to be considered. Consideration of this matter by the IMO Technical Sub-Committee on Containers and Cargoes resulted in the adoption of the International Convention for Safe Containers in 1972 at a World Conference convened by IMO and the United Nations. The Convention became effective in September 1977 and there are currently thirty-five Contracting States to the Convention, including the countries of the world's major container operators. At present Argentina, Bahamas and Chile of the Latin American and Carribean region have ratified the Convention. A list of Contracting States is attached as Annex 1.

The Convention more commonly known as the CSC is probably a case of where the vaccine has been discovered before the epidemic. It is indeed preventive medicine, the strength of which depends on the reader's point of view. Some consider that it is not stringent enough since it is possible to obtain CSC approval for containers built to less than the ISO strength standards. Others consider that the CSC possesses the necessary flexibility to enable it to apply to the largest number of containers used in all modes of international surface transport taking into account different operating conditions. For those who think that an International Convention is not necessary, one can only ask them to imagine trying to comply with widely different national regulations and procedures. One of the major reasons why the CSC was developed by interested Governments was to avoid the establishment of different national requirements. The other major motivating factor behind the creation of the CSC was that many Governments' experts wanted to ensure that the remarkably safe record of container transport would continue as containerization developed. For this reason it was considered desirable to formalize the then current safe practice to ensure its continuance. For example, it was found to be logical that the owners[3] of containers held responsible for maintaining containers in a safe condition and periodically inspecting them to ensure their safe condition.

The CSC, like any international agreement between countries with different political, legal and economic systems is a result of a compromise. Therefore some people may be of the opinion that it has imperfections and that it is not sufficiently stringent to achieve its purpose. It should, however, not be forgotten that an international agreement is not immutable and is subject to amendment and improvement where experience proves it necessary. The CSC unlike many international agreements, has a fairly simple procedure of amendment for its technical annexes, and this will facilitate the adoption of future amendments which may be required. Amendments were made in 1981 to the Convention by IMO's Maritime Safety Committee with respect to dates for plating and inspection of containers, a point which is covered below.

CONTENT OF THE CSC

The requirements of the Convention apply to the great majority of freight containers moving internationally by any mode of transport, excepting air. It was not intended that all types and sizes of containers, vans or re-usable packing boxes be affected, so the scope of the Convention is limited to re-usable containers having corner fittings – devices which permit handling, securing or stacking– and to those of a prescribed size, i.e., only those containers with a bottom area of at least 14 square metres, or 7 square metres if fitted with top as well as bottom corner fittings.

The Convention sets out procedures whereby containers used in international transport will be safety approved by an Administration of a Contracting State or an organization acting on its behalf (e.g., classification societies).[4] The Convention provides for approval of individual containers, those manufactured in a series and those containers which existed before the date the Convention came into force. Because of the difficulties involved in approving the thousands of containers manufactured before the Convention came into force (i.e., "existing containers"), less stringent transitional arrangements are provided as well as a period of grace (until 6 September 1982), during which owners of such containers have to apply for approval.

Upon being granted approval for a container, the owner has to arrange for its **examination** and **plating**. A model of the CSC safety approval plate is attached at Annex 2.

It is envisaged that this phase will involve getting physically hold of a given container, having it examined and plated at a depot or a repair establishment in accordance with the given provisions.

Approval evidence by the safety approval plate granted by one Contracting State is required to be recognized by other Contracting States. This principle of reciprocal acceptance of safety approved containers is the cornerstone of the Convention and, once approved and plated, it is expected that containers will move in international transport with the minimum of safety control formalities. To ensure this "free flow", the control of the movement of containers by inspectors or safety officers would normally be limited to verifing that each bears a valid safety approval plate. However if it is evident that the container is unsafe, the control officer is expected to ensure that the container is restored to a safe condition, before it continues in service. If the container can be safely moved (e.g., to a place where it can be restored to a safe condition, or to its destination) the officer exercising control may permit such a movement on such conditions as the officer may specify and with the proviso that the container be repaired as expeditiously as may be practicable and not reloaded before this has been done.

The owner is responsible for the maintenance of a safety approved container. Examination should be carried out at intervals appropriate to the operating conditions to ensure the continued safe condition of the container. The owner[5] is therefore required to have the container periodically examined according to the procedures set down in the country in which he is domiciled or has his head office, provided of course that the country is a Party to the Convention.

The technical Annex of the Convention requires that, where appropriate to the design of the container, it should be subjected to lifting, stacking, concentrated

roof and floor load, transverse racking, longitudinal restraint and end and side wall tests. These are internationally accepted tests which represent a combination of the safety requirements of both inland and maritime modes of transport. The test load values are intended to simulate the forces normally encountered in transport of containers by land and sea. A container may be made from any suitable material which allows it to meet the test requirements.

PARTICIPATION IN THE WORK OF THE INTERNATIONAL MARITIME ORGANIZATION

The Sub-Committee on Containers and Cargoes, being the Sub-Committee solely responsible for preparing proposals for amendment of the Convention, is open to participation by all IMO members. It is composed of Government delegations, which usually include industry advisers as well as governmental representatives. In addition there are numerous international non-governmental organizations which participate actively in the meetings of this Sub-Committee and often put forward industry views on the problems being discussed. International Cargo Handling Co-ordinationAssociation (ICHCA), International Association of Ports and Harbors (IAPH), International Chamber of Commerce (ICC), Institute of International Container Lessors (IICL), International Union of Marine Insurance (IUMI), International Chamber of Shipping (ICS), and International Organization for Standardization (ISO), are some of the relevant organizations which enjoy consultive status with IMO.

AMENDMENTS TO THE CONVENTION

In spring of 1981, the IMO Maritime Safety Committee[6] unanimously adopted proposals for the amendment of CSC prepared by the Sub-Committee on Containers and Cargoes to allow more time for the completion of the work of plating existing containers and new containers not approved and plated at time of manufacture.

The amendments were made because Governments were of the opinion that the process of examining and plating existing containers simply could not be completed by September 1982 as originally envisaged.

The amendments to the Convention have two main objectives:

1. Allowing about 2 1/4 additional years for container owners to complete the process of examining and plating existing containers and those new containers not approved at time of manufacture, by changing the deadline for the completion of this process from 6 September 1982 (i.e., five years after the date of entry into force of the Convention as a whole), to 1 January 1985;
2. Allowing as a transitional arrangement, a further two years, i.e., until 1 January 1987, during which the requirements for the marking of date of next examination (i.e., the latest date for the first examination of new containers and the latest date for the re-examination of existing containers and new containers not approved at time of manufacture)

will be waived. This transitional arrangement is subject to the proviso that an administration may make more stringent requirements to cover those containers which belong to its own national owners.

The waiving of requirements related to the marking of dates of examination, is intended to allow owners a reasonable degree of flexibility in their planning for the completion of the work of examination and plating containers and for the modification of such dates of such examination as may have already been marked on containers, so as to even out the re-examination work load. By 1 January 1987 all containers will display a future date for next examination.

During the course of work on the amendment to the Convention, it was agreed that two other minor amendments should be made to Regulation 2 of Annex 1, in order to draw a clearer distinction between the maintenance of a container, which is the responsibility of the owner of the container, and the examination of a container which must be arranged by the owner in accordance with a procedure prescribed or approved by a Government. These apparently minor amendments are of significance to owners of containers who have repeatedly insisted that they must be regarded as fully responsible for the maintenance of their own containers and for selecting the method by which this is done.

Recommendations on the Harmonized Interpretation and Implementation of the CSC, as amended and adopted by the Maritime Safety Committee in the Spring of 1981, is attached at Annex 3.

As may be seen from above, the previously mentioned simplified amendment procedure for the Convention Annexes makes it possible to adapt the test procedures and other technical requirement to any future requirements of international container traffic.

FUTURE AMENDMENTS TO THE CONVENTION

The Convention is constantly under review in order to accomodate future developments of containers. At present four amendments to the Convention are under consideration, in particular with regard to tank containers. It is emphasized that all of the amendments involve no economical expenditure, on the contrary, they will all mean financial savings whilst still maintaining the excellent safety record of containers.

CONTAINER STANDARDS

The shipping world has seen the emergence of e.g., 10ft, 20ft, 30ft, 40ft, and odd 35ft containers.

Although the 20 ft containers are the most dominant, at least in the maritime mode, even here we find different standards. In order to increase the payload, a growth in height from 8ft to 9ft 6 inches with the accordingly increased rating makes the choice of interface facilities difficult for developing ports.

One the one hand reluctance to change container standards should not be allowed to reduce flexibility to such an extent that progress in efficiency, safety and economy is impeded on international trade.

On the other hand it is believed that changes in the fundamental ISO container standards might have substantial technical and economic repercussions, not least in maritime transport and that changes which are not strictly or urgently required should be avoided.

Because of the fundamental impact on the shore-based as well as maritime industry of possible changes in container standards, the Sub-Committee on Containers and Cargoes has established a formal consultation arrangement within the United Nations system (in which the two organizations most immediately involved are UNCTAD and IMO) when changes to the basic accepted container standards are being proposed.

From the above it is readily seen that there are numerous container standards. The only common denominator is the safety standards covering all containers, set out in the Container Safety Convention.

STOWAGE OF CARGO IN CONTAINERS

Cargo should be stowed in a container in accordance with the recommended practices of the trade so as to avoid undue stress. Proper handling, carriage and loading of containers is of course essential to safety. The "IMO/ILO Guidelines for Training in the Packing of Cargo in Freight Containers" provides useful information to the essentials of safe packing for use as a training aid by those responsible for the packing and stowage in freight containers.

It should be borne in mind that there is an increasing trend to ship containers with expendable refrigerant gases for cooling purposes and also containers in the process of being fumigated. Therefore, such containers which are to be opened for inspection and repair should accordingly be treated with the utmost care and should not be opened in enclosed spaces.

CONTAINER MAINTENANCE AND REPAIR FACILITIES

Lack of adequate manufacturing capability, repair facilities and ready availability of containers can be a major constraint on full scale container operation since this would involve hauling on a large scale of empties from areas where they are in abundance.

From the large number of damaged containers that are left unused at terminals in ports without adequate repair and maintenance facilities for extended length of time, the impression is given that the repairs and maintenance of containers have not yet been given adequate consideration until now. This again implies unnecessary movement of empty damaged containers and consequent loss of revenue. As in the case of technical equipment, there are in all regions a need to have personnel adequately trained to carry out all repairs to containers which become necessary. The same is especially applicable whilst the containers are within or in the vicinity of a port. Unless this is tackled seriously, developing countries could continue to pay for new containers which are used is one direction only. The cost will be disturbing and would retard container use development. Concerning the safety aspect there is, however, also the possibility that some operators migh be tempted to ship unsafe containers in view of the fact that the chance of their return is remote.

Container owners, be they shipping lines or container leasing companies, tend to look to container depots for total service, and expect repairs, refurbishment and container storage. Planned maintenance and repairs serve to prolong the useful economic life of containers, thereby protecting owners' investment in the box, as well as reducing the number of "spare" boxes, they need to keep in their fleets.

REPAIR STANDARDS

Common repair standards are unfortunately rather rare, since even within the same operator's trading routes, there exists a considerable divergence of quality of workmanship and price. Many companies have found that it pays them to bring their damaged equipment back to a selected location, to ensure the standard of repair necessary to safeguard the unit's future. This particular approach is of course only practical when a considerable trade imbalance exits. Most companies, have produced their own repair manuals with detailed standards required from each repair workshop. Theory and practice, unfortunately, are sometimes worlds apart, and technical inspectors/supervisors are usually employed by individual owners/operators, be they surveyors from a classification society, other recognized bodies, or surveyors employed by the owner to ensure harmonization and adequate standard of repairs.

Some owners, like shipping lines require only that their containers have no structural defects which might render them unsafe to use or unable to handle and will therefore only approve the minimum of repairs regardless of the damage to the boxes. Other, like leasing companies, prefer to maintain their containers in "like new" condition and request that repairs be carried out in accordance with e.g., Institute of International Container Lessors (IICL) Guidelines. Otherwise endless discussions would take place on the termination of the lease on who is reponsible for repair and damage.

This does not make life easy for container repairers as they have to contend with different expectations and standards for each customer. In extreme cases a repairer may find himself in the invidious position of having to choose between lowering his standards or losing a customer.

In spite of the abundance of container repair standards, the repair industry has developed a general rule of thumb that whenever it is necessary to replace damaged material, it should be done with spare parts of the same type and characteristics. When this is not possible, the repairer should ensure that material of an equivalent standard is used to ensure that the structural strength of the unit is maintained. Certification of these materials and components are normally required by the administration/organization, and means of identifying the component throughout all stages of repair should be ensured.

The designers, manufacturers, quality control inspectors and purchasers of new containers, all have a profund impact on a container's capability to withstand damage and deterioration. However, there are no standards for wear and tear, handling equipment, etc., in the industry. The closest criteria that the purchaser and designer can come to in establishing norms for containers, are the ISO standards, and those established by classification societies and regulatory bodies, such as IMO. The ISO standards are merely design criteria which are meant to

facilitate interchange. ISO and related standards, do address themselves to a number of aspects of container strength, but they are not too detailed as they were intended to cover practical questions only.

The classification societies rules and governmental rules, directly consider container strength. However, the main thrust of their requirements is to prevent serious damage to the container, in order to avoid crew, shore-based personnel and ship being exposed to safety hazards. Only to a lesser extent do they consider container life, repairability, maintainability, etc. These are economic considerations and as such mainly left to the designer and purchaser. Even so, it helps to know and to understand each container owner's policy on container repairs. The variance in policies from owner to owner can be quite surprising.

Turning to the CSC Convention and how its introduction will affect the industry once its application becomes more widespread, it would be reasonable to expect that it will lead to some increase in operation costs. Nevertheless, the CSC is widely recognized as being beneficial to the industry as a whole. If properly interpreted, its requirements will ensure that all containers are inspected at least every two years, which again will help ensure them being maintained in an adequate state of repair, and will no doubt lengthen a containers' useful life.

Many shipowners have not only their ships classed by a classification society but have recently also had their container handling equipment classed by their society. It would not be surprising therefore, if, in the future, container owners might insist that repairs be effected at facilities approved by a body, e.g., classification society, duly authorized by an appropriate authority. In anticipation of such a move, repairers might wish to consider the advantages of up-grading their facilities and services, and having their repair workshops approved. This possible requirement would affect container repair facilities of both developed and developing countries.

On the subject of standards of repair and maintenance, it has been agreed within IMO that the development of detailed guidelines on standards of repair would create an unnecessary burden for administrations attempting to implement the Convention as well as on the owners. It has been recognized that the Convention provides that the owner is responsible for maintaining the container in a safe condition. It has been considered that the owner is responsible to the administration which approved his examination scheme. If the container is believed to be unsafe during a control verification, the owner would, of course, be subject to the authority of the control officer. In line with this way of thinking, IMO recently expressed the opinion that no further consideration should, for the time being, be given to the detailed operation of repair companies. In considering this subject, IMO identified the "revised IICL Guide for Container Equipment Inspection" as a useful guide for examination procedures.[7]

APPROVAL OF REPAIR ESTABLISHMENT

As mentioned earlier, more and more ship owners tend to look for repairers, having had their facilities approved by a recognized body, for their container and equipment repairs. There is little doubt that in the future, when all the provisions of the CSC have entered into force, the attachment of the prefix: "approved by

. . . register" or "approved by the Ministry of Transport" to the company's credentials will enhance the credibility of the (newly) established repair company.

The principal classification societies have produced schemes for the approval of repair companies which in many ways are similar.

The basis of the scheme for the approval of repair establishments is to ensure that the necessary facilities, personnel and quality control procedures exist to enable repair and refurbishment to be carried out in a satisfactory manner to acceptable standards, thus assuring a satisfactory degree of safety for the benefit of all concerned.

An approved container repair company is generally expected to have and to demonstrate the following:

1. adequate premises, clean and well illuminated, where repairs may be carried out under cover or if some repairs are conducted in the open, these should be done under reasonably sheltered conditions.
2. lifting equipment with which containers may be handled and transported safely during movements in the repair establishment;
3. an area with stands where a container may be thoroughly and effectively inspected, internally and externally including the underneath;
4. equipment for the cleaning and inspection of welds by means of "dye-penetrant" or "magnetic particle" as non-destructive welding testing;
5. a storage space with facilities for segregation of the stock of materials held, into the various material grades and thickness commonly used in the container industry;
6. when complete components such as main strength members i.e., corner posts, longitudinal and transverse members, already formed to the shapes used by the various manufacturers, are required and the repairer is not able to produce them himself, he should have access to appropriate container component manufacturers;
7. welding equipment must be adequate and well maintained and consumables should be kept in a suitable dry store. The provision of a heated storage oven on the shop floor is essential in warm and humid places;
8. the welding operation in a repair shop may be more complex than in the container factory, inasmuch as the former cannot benefit from planned construction progress and the use of component jigs to permit automatic welding or down-hand welding, for the majority of welds. In the repair of containers positional welding, i.e., vertical and overhead, is much more widely used since the work is being carried out on a completed container;
9. all welders should be qualified to the satisfaction of the competent authority in the various methods of welding required e.g., stick electrode or Argon/CO_2 continuous wire. The welders qualification should include capability in positional welding as referred to above.

TESTING OF REPAIRS

Whilst in most cases it will not be necessary for a repairer to have a test rig capable of performing all the ISO tests applicable to containers, he **must**, nevertheless, have access to a test rig considered by the appropriate authority to be capable of carrying out all tests **required** for his operation.

As a minimum, a repair company should be capable of lifting the container for CSC inspection purposes and for testing the welding of a replaced corner casting. This may be done with a simple frame over the container corner and capable of exerting a force of .5R where R is the maximum gross weight of the container.

Upon completion of a container repair, a test for weather tightness is paramount.

STAFF

It is important that management should display a responsible attitude to repairs both in adequacy and standards of workmanship.

The person responsible for recommending the extent of repairs should be fully knowledgeable in this field whilst the person responsible for quality of output and final inspection of completed repairs should have direct access to the overall management and not be unduly influenced by the necessity of maintainning quantity of output.

An inspector involved in container repairs should have a good background knowledge of the following:

1. sheet metal work including the forming of metal sections and welding;
2. the different grades of steel used and their strength characteristics and weldability;
3. the ISO recommendations on container construction and the applicable tests applied to a prototype.

Finally the inspector, whether employed by the repair company or the owner, should not be unduly influenced by speed of turn round of containers or the extent or costs of repairs. He should be expected to determine the extent of the damage and to give a reasonable recomendation for repairs sufficient to maintain the container in a safe working condition.

CERTIFICATION, DOCUMENTATION AND MARKING

A repair company must maintain a record keeping system whereby the results are recorded of initial inspection of damage, repairs recommended and those carried out and also the results of final acceptance inspection for each container passing through the establishment.

Records kept for CSC purposes are of course subject to approval by individual administrations, but will probably, as a minimum consist of the following records:

(a) Details to be entered on the safety approval plate to be fitted to existing containers and also the location of the plate on the container;

(b) CSC re-examination record (undamaged containers);

(c) CSC inspection record (damaged containers) (if applicable).

When structural damages are repaired by replacing structural members, certificates should be provided for the material used.

When a lift test is required a test certificate should be issued.

When use of de-infested timber is necessary, treated timber should be used and the appropriate certificate supplied to the container operator.

EPILOGUE

From the foregoing it is apparent that hard and fast rules concerning container repair standards are hard to come by, particularly if they aspire to be globally acceptable.

However, it is hoped that this presentation will have given a general insight into the pertinent safety aspects of containerization and that, particularly in its last section, it succeeded in giving guidance as to what is required to establish an efficient container repair service.

In the above respect, IMO stands ready through its technical co-operation programme, its Sub-Committee on Containers and Cargoes and other relevant technical bodies, to assist developing countries in the implementation of the CSC and recommendations concerning container traffic. IMO also can arrange for expert technical assistance in the overall field of maritime container transport and related handling operations, not least the establishment of container repair facilities.

NOTES

1 The interpretation of international instruments is the prerogative of the Contracting Parties or, in the case of recommendations, the Governments implementing them. The views expressed in this paper are not to be construed as being the views of the IMO Secretariat nor as official interpretations of the instruments cited.

2 With effect from 22 May 1982, the name of the Organization was changed to the International Maritime Organization.

3 For the purposes of the CSC, the term 'owner' also includes operators who have leased-in containers and have accepted responsibility for obtaining CSC approvals and for the examination and plating of these (see page).

4 Such organization in turn, may then authorize container repair establishments to carry out repair, maintenance and plating/remarking of containers, either in accordance with an approval scheme or to the satisfaction of the administration/organization. General criteria for the approval of a container repair company is dealt with on p. to p. .

5 An owner/operator may have leased-in containers, and may have accepted responsibility for the examining and plating of the containers he has leased (whether or not he was wise to accept such responsibility is irrelevant). This in turn means that the actual owner is relieved of his responsibility for maintenance and examination for CSC purposes.

6 Contracting States, not members of IMO were also invited to participate in the adoption of these amendments.

7 Further to this Guide the IICL has issued repair manuals for different types of containers, a refurbishment manual for steel containers, slide presentations on inspection and repair, and a damage and repair code.

APPENDIX 1

INTERNATIONAL CONVENTION FOR SAFE CONTAINERS

Deposit of an Instrument of Accession by the Government of South Africa

The Secretary-General of the International Maritime Organization has the honor to refer to the International Convention for Safe Containers, done at Geneva on 2 December 1972, and to state that an Instrument of Accession was deposited by the Government of the Republic of South Africa on 25 June 1982.

The Convention will enter into force for the Government of South Africa on 25 June 1983 in accordance with Article VIII(2).

A list of the thirty-five Contracting States to the Convention appears overleaf.

INTERNATIONAL CONVENTION FOR SAFE CONTAINERS

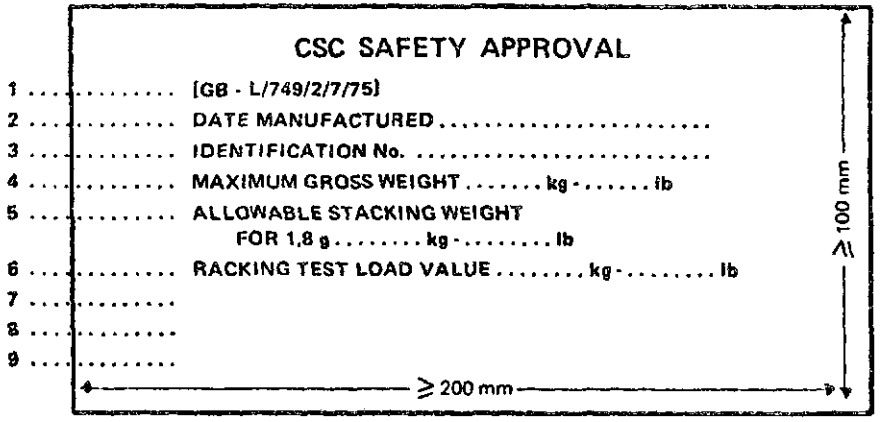
Contracting States

	Date of deposit of Instrument	Date of entry into force
Hungary (ratification)	9 January 1974	6 September 1977
Czechoslovakia (approval)[1]	8 May 1974	"
Spain (accession)	13 May 1974	"
German Democratic Republic (accession)[1]	27 September 1974	"
France (approval)[1]	21 October 1974	"
New Zealand (accession)[1]	23 December 1974	"
Romania (ratification)[1]	26 November 1975	"
Germany, Federal Republic of (ratification)[1]	27 July 1976	"
USSR (ratification)[1]	24 August 1976	"
Ukranian SSR (ratification)[1]	6 September 1976	"
Byelorussian SSR (ratification)	6 November 1976	"
Bulgaria (ratification)[1]	17 November 1976	17 November 1977
United States (ratification)	3 January 1978	3 January 1979
India (accession)	27 January 1978	27 January 1979
Liberia (accession)	14 February 1978	14 February 1979
United Kingdom (ratification)[1] [2]	8 March 1978	8 March 1979
Japan (accession)	12 June 1978	12 June 1979
Saudi Arabia (accession)	6 October 1978	6 October 1979
Republic of Korea (ratification)	18 December 1978	18 December 1979
Bahamas (accession)	16 February 1979	16 February 1980
Denmark (accession)[1]	2 March 1979	2 March 1980
Yemen Arab Republic (accession)	6 March 1979	6 March 1980
Argentina (accession)	11 September 1979	11 September 1980
Italy (accession)	31 October 1979	31 October 1980
Poland (ratification)	14 January 1980	14 January 1981
Australia (accession)	22 February 1980	22 February 1981
Chile (accession)[1]	28 March 1980	28 March 1981
Sweden (accession)	9 June 1980	9 June 1981
China (accession)	23 September 1980	23 September 1981
Luxembourg (accession)	13 November 1980	13 November 1981
Guinea (accession)	19 January 1981	19 January 1982
Canada (ratification)[1]	19 February 1981	19 February 1982
Israel (accession)	21 August 1981	21 August 1982
Belgium (accession)	16 September 1981	16 September 1982
South Africa (accession)	25 June 1982	25 June 1983

[1] Accompanied by a declaration/reservation/statement.

[2] Ratification by the United Kingdom was declared to be effective in respect to the Isle of Man on 19 June 1982.

APPENDIX 2



1. Country of Approval and Approval Reference as given in the example on line 1. (The country of Approval should be indicated by means of the distinguishing sign used to indicate country of registration of motor vehicles in international road traffic).

2. Date (month and year) of manufacture.

3. Manufacturer's identification number of the container or, in the case of existing containers for which that number is unknown, the number allotted by the Administration.

4. Maximum Operating Gross Weight (kilogrammes and lbs.).

5. Allowable Stacking Weight for 1.8 g (kilogrammes and lbs.).

6. Transverse Racking Test Load Value (kilogrammes and lbs.).

7. End Wall Strength to be indicated on plate only if end walls are designed to withstand a load of less or greater than 0.4 times the maximum permissible payload, i.e. 0.4 P.

8. Side Wall Strength to be indicated on plate only if the side walls are designed to withstand a load of less or greater than 0.6 times the maximum permissible payload, i.e. 0.6 P.

9. First maintenance examination date (month and year) for new containers and subsequent maintenance examination dates (month and year) if Plate used for this purpose.

APPENDIX 3

REVISED AND CONSOLIDATED RECOMMENDATION ON HARMONIZED INTERPRETATION AND IMPLEMENTATION OF THE INTERNATIONAL CONVENTION FOR SAFE CONTAINERS, 1972

1. GENERAL

1.1 The various points concerning harmonized interpretation and implementation of the International Convention for Safe Containers on which consensus has so far been reached are given below.

2. DEFINITIONS (Article II, paragraphs 8 and 9)

2.1 "New container" and "existing container". Where necessary, individual Administrations should determine the date on which the construction of a container shall be deemed to have commenced for purposes of determining whether a container should be considered as "new" or as "existing".

3. APPLICATION (Article III, paragraph 1)

3.1 "Swap Bodies/Demountables". It is agreed that the CSC Convention does not have to be applied to containers known as swap bodies/demountables and designed and used for carriage by road only or by rail and road only, and which are without stacking capability and top lift facilities. This agreement also applies to such swap bodies/demountables transported by sea on condition that they are mounted on road vehicle or rail wagon.
3.2 It does not, however, apply to swap bodies/demountables used in transoceanic services.

4. ENTRY INTO FORCE, TERMINATION OF PERIOD OF GRACE, TRANSITIONAL ARRANGEMENTS (Articles III and VIII)

4.1 Every effort should be made by all concerned to have all existing containers approved and plated as soon as possible.
4.2 Container owners are free to get their existing containers approved at any time before 6 September 1982. If an owner plates an existing container prior to 1 January 1983, or if he plated a new container prior to 1 January 1980, he would have to have it re-examined before the time at which existing containers will be plated and control exercised.
4.3 While the Convention is clear concerning the requirement that approved existing containers should be re-examined at intervals of not more than 24 months, it is of the utmost importance that owners be encouraged not to delay obtaining approval and commencing an examination and plating programme for both new and existing containers.
4.4 Container owners will have to organize the examination and plating of their approved existing containers and new containers not approved at time of manu-

facture before 1 January 1985, and they will need to obtain an approximately constant re-examination work-load thereafter.

4.5 In view of the above, it is accepted that Administrations may, at their discretion, allow owners of containers plated before 1 January 1985 to mark the date of the next examination as follows:

Date of initial plating	Latest date for subsequent examination
existing containers and new containers not approved at the time of manufacture plated before 1 October 1981)	12/1985
new containers plated before 1979)	
existing containers and new containers not approved at the time of manufacture plated from 1 October 1981 to 30 September 1982, inclusive)	4/1986
new containers plated in 1979)	
existing containers and new containers not approved at the time of manufacture plated from 1 October 1982 to 30 September 1983, inclusive)	8/1986
new containers plated in 1980)	
existing containers and new containers not approved at the time of manufacture plated from 1 October 1983 to 31 December 1984, inclusive)	12/1986
new containers plated in 1981)	

5. TESTING, INSPECTION AND APPROVAL (Article IV, paragraphs 1 and 2) SELECTION OF ORGANIZATION ENTRUSTED TO CARRY OUT THESE FUNCTIONS

5.1 Administrations will require a basic description of the organization to be entrusted with these functions, and evidence of their technical capability to carry out approvals, and will have to satisfy themselves as to the financial wellbeing of such organizations. The Administrations will furthermore have to satisfy themselves that the organizations are free from undue influence by container owners, operators, manufacturers, lessors, repairers and others concerned who may have a vested interest in obtaining container approval.

6. APPROVAL OF CONTAINERS FOR FOREIGN OWNERS OR MANUFACTURERS (Article IV, paragraph 3) AND RECIPROCITY

6.1 Where possible, Contracting Parties should make every effort to provide facilities or means to grant approvals to foreign container owners or manufacturers seeking approval of containers from them in accordance with the provisions of the Convention.

6.2 Approval of containers would be facilitated if classification societies or other organizations approved by one Contracting Party could be authorized to act for other Contracting Parties under arrangements acceptable to the parties involved.

7. MAINTENANCE (Article IV, paragraph 4)

7.1 Development of detailed guidelines on standards of maintenance will create an unnecessary burden for Administrations attempting to implement the Convention as well as for owners. The interpretation of the statement "the owner of the container shall be responsible for maintaining it in safe condition" (Annex I, Regulation 2, paragraph 1 of the Convention) should be that: the owner of a container (as defined in Article II, paragraph 10 of the Convention) should be held accountable to the Government of any territory on which the container is operated, for the safe condition of that container. The owner should be bound by the existing safety laws of such a territory and such law or regulation as may implement the control requirements of Article VI of the Convention. But the methods by which owners ahieve under the provisions of Article IV the safe condition of their containers, that is the appropriate combination of planned maintenance, procedures for refurbishment, refit and repair and the selection of organizations to perform this work, should be their own responsibility. If there is clear evidence for believing that an owner is repeatedly failing to achieve a satisfactory level of safety, the Government of the territory in which the owner has his Head Office or domicile should be requested to ensure that appropriate corrective action is taken. The responsibility of the owner to maintain his container in a safe condition should include the responsibility to ensure that any modifications carried out on an approved container would not adversely affect safety or render inaccurate the information recorded on the Safety Approval Plate.

8. WITHDRAWAL OF APPROVAL (Article IV, paragraph 5)

8.1 With regard to withdrawal of approval, the "Administration concerned" should be considered as the Administration which issued the approval. While any Contracting Party may exercise control over container movement pursuant to Article VI, only the Administration which approved the container has the right to withdraw its approval.

9. CONTROL (Article VI)

9.1 General

9.1.1 For the purposes of effecting control (as envisaged in Article VI of the Convention) Contracting Parties should only appoint government bodies.

9.2 Control up to 1 January 1985

9.2.1 It is agreed that Article VI applies only to containers which have been approved and which are now required to be plated by 1 January 1985 under Regulations 9 and 10. In so far as Administrations may wish to institute control measures before 1 January 1985, it is agreed that these measures shall be directed towards ensuring that containers are not in such a condition as to be unsafe (see 9.3.3 below for action to be taken for an unsafe container). Until 1 January 1985 no container should be stopped merely because it does not carry a Safety Approval Plate.

9.3 Control after 1 January 1985

9.3.1 Containers which are not defective but which have no Safety Approval Plate or which have an incorrectly completed Plate

9.3.1.1 Such containers should be stopped. However, where evidence can be produced either to the effect that such container has been approved under the terms of the Convention or to the effect that such container meets the standards of the Convention then the authority exercising control may permit the container to proceed to its destination for unloading, with the proviso that it shall be plated as expeditiously as may be practicable and not reloaded before it has been correctly plated under the Convention.

9.3.2 Containers which are "out-of-date"

9.3.2.1 From 1 January 1987 where a container is found to have an examination date marked on or near to its Safety Approval Plate which is a date in the past, the competent authority exercising control may permit the container to proceed to its destination for unloading with the proviso that it should be examined and updated as expeditiously as may be practicable and not reloaded before this has been done. Until 1 January 1987 such containers should not be stopped.

9.3.3 Unsafe containers (Article VI, paragraph 1, third sentence)

9.3.3.1 Where a container is found by the authority excercising control to have a defect which could place a person in danger then the container should be stopped. However, if the container can be safely moved (e.g., to a place where it can be restored to a safe condition, or to its destination) the officer exercising control may permit such a movement on such conditions as the officer may specify and with the proviso that the container be repaired as expeditiously as may be practicable and not reloaded before this has been done.

9.3.4 International movement of containers under control

9.3.4.1 It is recognized that in any of the cases set out in 9.3.1, 9.3.2 and 9.3.3 the owner may wish to move his container to another country where the appropriate corrective action can more conveniently be carried out. Control officers may permit such movements, in accordance with the provisions of 9.3.1, 9.3.2 and 9.3.3 as appropriate, but should take such action as may be reasonably practicable in order to ensure that the appropriate corrective action is indeed taken. In particular, the control officer permitting such a movement should consider whether it would be necessary to inform the control officer or officers in the

other country or countries through which the container will be moved. Further consideration of the practical aspects of this matter is needed.

9.4 **Notification concerning unsafe containers of a given approved series**

9.4.1 It is suggested that if in future a considerable number of containers in a given approved series are found to be unsafe as a result of defects which may have existed prior to such approval (Article VI, paragraph 2), it may be desirable for Administrations to notify the Organization as well as the Contracting Party concerned.

10. SAFETY APPROVAL PLATE (Regulation 1): USE OF OWNER'S IDENTIFICATION CODE

10.1 The following approach to comply with certain of the data requirements of the Convention shall be deemed to be in conformity therewith:

> "A single approval number may be assigned to each owner for all existing containers in a single application for approval which could be entered on line 1 of the Plate".

10.2 The example given in line 1 of the model Safety Approval Plate (see Appendix to Annex I of the Convention) should not be construed so as to require the inclusion of the date of approval in the approval reference.

10.3 The Appendix to Annex I of the Convention can be interpreted so as to allow the use of the owner's ISO alphanumeric identification codes, on either new or existing containers. This may be done even if the manufacturer's serial number is available, as long as the applicant keeps a record correlating his identification numbers with the manufacturer's serial numbers.

10.4 Where marking of the end-wall or side-wall strength on the Plate is not required (e.g., a container with an end-wall or side-wall strength equal to 0.4 P or 0.6 P, respectively) a blank space need not be retained on the Safety Approval Plate for such marking but can be used instead to meet other data requirements of the Convention, e.g., subsequent date marks.

10.5 Where end-wall or side-wall strength is required to be marked on the Safety Approval Plate, this should be done as follows:

- in the English language:
  END-WALL STRENGTH
  SIDE-WALL STRENGTH
- in the French language:
  RESISTANCE DE LA PAROI D'EXTREMITE
  RESISTANCE DE LA PAROI LATERALE

10.6 In cases where a higher or lower wall strength is to be marked on the Safety Approval Plate, this can be done briefly by reffering to the formula relating to the payload P.

Example: SIDE-WALL STRENGTH 0.5 P.

10.7 With respect to the material characteristics of the Safety Approval Plate (see Appendix to Annex I of the Convention), each Administration for purposes of approving containers may define "permanent", "non-corrosive" and "fireproof" in its own way or simply require that Safety Approval Plates be of a material which it feels meets this definition (e.g., a suitable metal).

11. MAINTENANCE (Regulation 2)
EXAMINATION PROCEDURES

11.1 Personnel carrying out examination

11.1.1 An examination scheme prescribed or submitted for approval should provide that the examination will be carried out by a person having such knowledge and experience of containers as will enable him to determine in accordance with 11.2.2 whether it has any defect which could place any person in danger.

11.2 Elements to be included in the examination

11.2.1 While Administrations may specify factors to be taken into account in a container examination scheme, at this time it should not be necessary to agree on a specific list of factors or minimum listing of parts of a container which should be included in an examination. However, each examination should include a detailed visual inspection for defects or other safety-related deficiencies or damage which will render the container unsafe.

11.2.2 It is accepted that a visual examination of the exterior of the container will normally be sufficient. However, an examination of the interior should also be performed if reasonably practicable (e.g., if the container is empty at the time). Furthermore, the underside of the container should be examined. This may be done either with the container supported on a skeletal chassis or, if the examiner considers it necessary, after the container has been lifted onto other supports.

11.2.3 The person performing the external examination should have the authority to require a more detailed examination of the container if the condition of the container apperars to warrant such examination.

11.3 Use of decals to indicate the date of the first examination and subsequent re-examination of containers.

11.3.1 The use of decals should be allowed, to indicate the date of the first examination and subsequent re-examination of the container, such decals preferably to be coloured in accordance with the standardized scheme given in paragraph 11.3.3 below, designating a colour for each year subject to the following conditions:

1. that the relevant date (month and year) is shown in internationally recognizable words and/or figures on the decals or on the plate itself;
2. that for new containers the date of the first examination is shown (whether by decals or otherwise) on the plate itself as Regulation 2.2 of Annex I of the CSC Convention requires.

11.3.2 The use of decals should remain optional and in no way derogate the relevant provisions of the Convention to which reference is made above. The responsibility for developing and introducing such a system should remain with owners.

11.3.3 Colour Scheme

BROWN	1986	1992	1998
BLUE	1987	1993	1999
YELLOW	1988	1994	2000
RED	1989	1995	etc.
BLACK	1990	1996	
GREEN	1991	1997	

12. RECORDS OF EXAMINATION

12.1 It will be desirable to require that owners keep an examination record, which should include in addition to identification of the containers a record of the date of last examination and a means of identifying the examiner. There is no need to standardize the method by which such records should be kept and existing record systems may be accepted at least for a transitional period. Such record should be made available within a reasonable time to the Administration on its specific request.

13. FREQUENCY OF EXAMINATION

13.1 The convention recognizes that it may be necessary to examine containers more frequently than every 24 months when they are subject to frequent handling and transshipment. It should be borne in mind, however, that any significant reduction in the 24 months interval between examinations would create severe examination control problems. It should be noted that where containers are subjected to frequent handling and transshipment they are also liable to be subjected to frequent checking.

13.2 Therefore, in determining whether it is acceptable that the interval between examinations under the Convention should be the maximum of 24 months, proper account should be taken of intermediate examinations, having regard to their extent and to the technical competence of the persons by whom they are performed.

14. MODIFICATIONS OF EXISTING CONTAINERS

14.1 Applicants for approval of existing containers might be required to certify that, to the best of their knowledge, any modifications previously carried out do not adversely affect safety or the relevance to those containers of the information presented with the application in accordance with Annex I, Regulation 9, paragraph 1(d) (ii) and (iii). Alternatively, applicants should submit details of the modification for consideration.

15. TEST METHODS AND REQUIREMENTS (Annex II)

15.1 Containers tested in accordance with the methods described in ISO Standard 1496 should be deemed to have been fully and sufficiently tested for the purposes of the Convention.

16. STACKING TEST (Annex II, 2)

16.1 The following can be used as guidance in interpreting paragraphs 1 and 2 of the stacking test:

> "For a 6-high stacking of 20-ton (20 320 kg) (44 800 lb) containers the weight on the bottom container would be 5 x 20 tons (20 320 kg) (44 800 lb) i.e., 100 tons (101 600 kg) (224 000 lb). Thus, in the case of a 20-ton container with 6-high stacking capability the plate should indicate: 'Allowable stacking weight for 1.8 g - 101 600 kg/224 000 lb'."

16.2 The following may be useful guidance for determining allowable stacking weight:

"The allowable stacking weight for 1.8 g may be calculated by assuming a uniform stack loading on the cornerport. The stacking test load applied to one corner of the container shall be multiplied by the factor $\frac{(4)}{(1.8)}$ and the result expressed in appropriate units ".

16.3 The following is a useful example of how the allowable stacking weight could be varied as prescribed in paragrapgh 1 of the stacking test:

"If on a particular journey the maximum vertical acceleration on a container can be reliably and effectively limited to 1.2 g, the allowable stacking weight permitted for that journey would be the allowable stacking weight stamped on the plate multiplied by the ratio of 1.8 to 1.2 (allowable stacking weight on the plate x $\frac{1.8}{1.2}$ = stacking weight permitted for the journey)".

ANNEX V

ESTABLISHMENT AND OPERATION OF A CONTAINER REPAIR ENTERPRISE:

A CASE STUDY

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INTRODUCTION

Any specialized field, by its very nature, has not only a terminology and characteristics of its own, but also procedures and even a philosophy that clearly differentiates it from other disciplines. Moreover, if such an activity involves trade among nations and constitutes the principal means for effecting such trade, it takes on a unique dimension. In this sense, the container and the complex field of activities surrounding it have generated an irreversible process having many facets, each of which is constantly changing.

One of these facets, i.e., container repair and maintenance, is discussed in this paper. Although what has been learned to date on the subject is important, much remains to be done. It would be impossible in the next few pages to review all the experience that has been gained over the last ten years with regard to container repair. Nor is it possible in this limited space to examine the infinite number of variations and technical details that might be of interest to persons considering the possibility of engaging in this specialized activity, although such a study could be carried out later if necessary. Nonetheless, it is hoped that this paper will contribute to the work of the Economic Commission for Latin America in connection with the project on economic co-operation among Latin American and Caribbean countries for the establishment of container repair and maintenance enterprises.

A. GENERAL CONSIDERATIONS ON THE FEASIBILITY OF ESTABLISHING CONTAINER REPAIR AND MAINTENANCE ENTERPRISES

The frame of reference for this study is limited to the experience gained in Latin America and, more specifically, the port of Buenos Aires, Argentina, and its related hinterland. It has only been slightly more than 10 years since the first container arrived in Argentina and thus the elements on which one might judge the feasibility of establishing such enterprises as well as levels of profitability are quite recent.

There are no more than six repair enterprises in the area surrounding the port of Buenos Aires and half of them do not render services on a large enough scale to qualify as container repair workshops. The others which make up the universe examined in this paper were established at different times, while the oldest is Multimodal. Although there are a number of factors which should be taken into consideration to determine the feasibility of establishing such enterprises, some of the more important are (1) traffic, (2) rotation, (3) location, (4) complementary activities, (5) real exchange parity and (6) financial costs.

1. TRAFFIC

The number of containers circulating in a trade zone, i.e., a port and its hinterland, should be large enough to ensure that there will always be a minimum number of units in transit at the enterprise. It should be understood that the amounts of manufactured products imported and exported through any trade zone as well as other factors such as world recessions determine the demand for and hence, the number of TEUs[1] in circulation. The volume of container traffic, in turn, determines the size of the container workshop and storage area. Moreover, a flow of containers in a trade zone must be related to the domestic commerce of that zone, i.e., the origin for export cargoes and destination for import cargoes; otherwise, the containers are merely in transit and, if damaged, require only temporary repairs so that on-carriage operations to individual destinations might be completed.

2. ROTATION

As was alluded to in the prior section, the fact that a large number of containers may enter a trade zone does not, in itself, justify the establishment of a repair enterprise. That is, approximately the same number of containers entering a trade zone with import cargoes should leave with export cargoes; otherwise, container storage areas will become overcrowded, creating all kinds of serious problems and detracting from the profitability of the enterprise. An imbalance in the opposite direction –more units going out than coming in– is also detrimental, as storage areas are unused and empty containers transported to the zone for export usage are governed by different repair terms. There must therefore be a constant rotation of containers in order that all concerned may benefit.

3. LOCATION

Any damage to a container represents a double loss to the owner. In the first place, there is the cost of repairs and, in the second place, there is the loss due to the time the unit remains idle, i.e., not earning revenue, awaiting approval of repairs, repairs per se, and so forth. Since containers must be transported for repair or storage after use, the cost of transport may also be added as a third negative factor. The container owner will therefore try to minimize these costs by having the unit repaired as close as possible to the place where damaged. As most container damage occurs at ports and during stuffing and stripping operations, a workshop and storage area should be located near such activities.

4. COMPLEMENTARY ACTIVITIES

As most containers in Argentine trades are currently stuffed and stripped at the port of Buenos Aires, all repair enterprises and attendant storage areas are located directly adjacent to that port. Due to the proximity of these enterprises to the port area and in an effort to reduce the work-flow fluctuations of damaged containers, most engage in related activities. In this sense, during a period of reduced volume for container repairs, workshop personnel may be kept busy

with repairs to cargo handling and transport equipment. By way of comparison, certain Argentine land transport companies that offer container repair and storage services did not expand into related activities and have largely been unsuccessful.

The experience of Multimodal during the last ten years leads to the conclusion that work-flow stability cannot be guaranteed by offering only container repair and storage services. While the enterprise can engage in related activities in an attempt to smooth out work-flow fluctuations, the situation has become more complicated, as a number of competitors, both large and small, have appeared on the scene, thus reducing the potential market.

5. REAL EXCHANGE PARITY

Since container lessors and other owners seek to avoid empty container movements as they are unremunerative, damaged units are normally repaired as close as possible to the place where the damage occurred. In this situation it should be undestood that price competition for rapairers usually occurs only among those enterprises serving tha same trade zone. However, any distortion of the relation between a local currency and the United States dollar has a definite effect on the demand for and prices of repair services. The reason for this is that an overvalued local currency will raise the price of that country's products in international markets thereby reducing the demand for such products and their transport. When this situation occurs, the demand for repair services will also be reduced and provide enterprises with an incentive to maintain their earnings by cutting prices to obtain a larger share of a smaller repair volume. As a result, special attention must be given to the relation between the applicable local currency and the United States dollar when negotiating the prices to be charged for repair and storage services with container leasing companies.

6. FINANCIAL COSTS

Aside from the solvency, efficiency and goodwill of container owners, payments for repair services take time because repair bills must be analysed, verified, approved and go through other procedures before payments are made. The experience of Multimodal shows that the time required for payment of invoices in a country other than that in which the container owner is domiciled takes no less than fifty days from the date of issue of the invoice and in some cases this time period can reach seventy days. This factor is most important, as delays in the receipt of funds must be borne in mind when determining the capital requirements for establishment and operation of an enterprise.

B. MULTIMODAL S.A.

1. ORIGIN AND DEVELOPMENT

The container repair enterprise known as Multimodal S.A. was established as the result of a corporate growth process which was begun by Empresa Murchison S.A. de Estibajes y Cargas in the late 1960. In April 1967 the latter company, which for seventy years had been providing stevedore services at the Argentine

port of Buenos Aires as well as others along its coast, received the first container to arrive in that country. At that time Murchison only handled such units in the port of Buenos Aires.

Between 1969 and 1970 Murchison became the commercial representative of a container leasing company and also its depot agent. Some time later, using a container as a makeshift workshop, it began to repair some units in order to deliver them in good condition. Murchison had storage capacity for no more than one hundred containers on a small 1 000 square metre lot. During 1972 this small storage space proved impractical and a lot next to the existing one, on which there was an old shed belonging to the port authority, was reconditioned so that the property was expanded to 2 000 square metres, of which 200 square metres are covered. Also, the group performing container repairs within Murchison began to expand. As a result, the container department was established, statistical records were started and part of the staff travelled abroad for training.

In view of the large number of customers utilizing the depot and workshop, during 1974 Murchison stopped acting as commercial representative for a container leasing company and concentrated on providing container storage and repair services. At that time the workshop was utilized by five of the seven container leasing companies operating through the port of Buenos Aires. The covered facilities were then enlarged to encompass shotblasting, painting and drying sections as well as container testing equipment and, in 1975, container refurbishment services were offered. During this same period a truck was acquired and fitted out as a mobile workshop for repair of minor and medium-scale container damage which occurred at the port and at various industrial plants. However, as there was little inland movement of containers at that time, by 1979 it became evident that the workshop located directly adjacent to the port could provide all needed services and the truck was dismantled.

In December 1975, as the result of a corporate spin-off, the container department of Murchison became a separate entity known as Multimodal S.A. Based upon a growing demand for its container storage and repair services, by 1977 Multimodal was moved to its current location within the Buenos Aires port areas and has, since that time, actively offered such services. The enterprise now occupies a total of 19 000 square metres, with 800 square metres devoted to the workshop. Of the latter, 260 square metres have been set aside for shotblasting and painting. The administrative and operational offices, locker rooms and cafeteria total 280 square metres and are in a two-story building which has a complete communications system, including telex, telephones, and walkie-talkies for use within the yard. The workshop has air-powered and hydraulic tools, and inert-gas welding equipment. Each operator has been provided with a mobile cabinet which contains 30 tools in addition to safety equipment. Moreover, during 1978 Multimodal acquired chassis and yard commando-type tractors to facilitate the movement of containers. At that time the enterprise was depot agent for three large leasing companies and began to receive containers from shipping lines which call at the port of Buenos Aires.

The movement and storage of containers in the Multimodal yard is controlled by means of a "T" card activity board which is backed up by the Murchison computer centre. The information on the activity board is fed daily into the computer. The same process is utilized for the billing and administrative control system.

While the repair staff is small, each of the key technical and operational functions of the enterprise is carried out by persons who have received special training. In this sense it should be understood that in addition to the physical infrastructure, Multimodal views an experienced staff as an essential element in ensuring overall profitability.

In addition to the usual certificates Multimodal has received through its services to various companies, the enterprise has been granted by the Société Générale de Surveillance of Geneva, Switzerland, International Certificate number 60492/1, qualifying it as a container repair and refurbishment shop.

As a result of a government policy to open up the Argentine economy, in 1979 there was a considerable increase in imports of manufactured goods. Since these goods were largely imported in containers, storage areas such as that at Multimodal rapidly became overcrowded. As the peso/dollar ratio was kept at a level which reduced and, in some cases, even eliminated the competitive price advantage enjoyed by domestic manufacturers in world markets, only a small part of the container inflow was utilized for the export of Argentine manufactured goods. This situation led to an increase in the number of idle units (not rotating) and a decrease in the demand for repair services. During this period certain workshops were partially dismantled, and services such as refurbishment and major repairs were temporarily suspended. There were also many problems with container owners who were not able to store their empty units because of the unavailability of space. However, by 1981 this situation began to improve. Since that time, the yard has gradually been cleared of stored containers and it would appear safe to say that the situation will return to normal within a relatively short period of time.

2. PRODUCTION

While the repair activities of Multimodal began in 1970, statistical information is available only from 1972 up to the present, as may be seen in the following table.

The containers repaired by Multimodal belong, in different proportions, to the following enterprises: Transamérica ICS (ICSU); Container Transport International Inc. (CTIU); Moore Mc Cormack Lines (MMLU); Interpool (INTU); Uniflex (UFCU); Sea Containers Inc. (SCIU); SSI Container Corporation (SSIU); Ivarans Rederi A/S (IVLU); Transportes Vidal S.A. (TVSA); José Callegari e Hijos S.A. (JC); Nic Leasing Inc. (NICU-NICA-NICB-NICC); Blue Star Line (BSLU); CATU Containers S.A.(CATU); Contrans (CONU); Ferrocarriles Argentinos (FACU); Compagnia Italiana (ICCU); Johnson Line (JLCU); Lloyd Brasileiro (LLBU); Royal Mail Lines Ltd. (RMLU); Mitsui Osk Lines (MOLU).

Containers have been refurbished for the following companies: Transamérica ICS (ICSU); Container Transport International Inc. (CTIU); Sea Containers Inc. (SCIU); Interpool (INTU); Contrans (CONU).

The shop does the following types of work on containers: repair, maintenance, washing, remodelling, remarking, refurbishing and post-repair testing. Repairs range from minor to structural rebuilding. Maintenance includes replacement of roofs and doors as well as all parts corroded by rust. Washing includes different types of surface treatments with special solutions. Remodelling consists

of replacing parts which have, for example, manufacturing defects. Refurbishment includes effecting needed repairs, removal of old paint and corrosion by airless shotblasting, spray painting the surface and placement of new markings.

There are several lengths of containers (10, 20 and 40 foot) and types (box, open top and platform). Also, there are tank containers, which are usually tested after repairs, and refrigerated units. The materials utilized in the construction of containers may be aluminium, steel and glass reinforced plywood (GRP). Because the demand for GRP containers and hence their repair is small, Multimodal has not specialized in that type of repair work.

Repairs are carried out according to individual owner instructions. The manuals of the Institute of International Container Lessors (IICL), as well as those provided by individual leasing companies, are used widely. The inspection of containers is also governed by IICL and individual company manuals. The experience of Multimodal shows that in all cases an authorization must be obtained before repairs can be effected and in 60% of the cases an inspection will be carried out by the container owner or his representative before such authorization is granted. Finally, it should be understood that equipment interchange receipts must be completed in English and daily status reports, also in English, must be transmitted to the regional manager of each leasing company and shipping line which has containers at the depot.

CONTAINER AND CHASSIS DEPOT AND SERVICE CENTER, 1972 - 1981[a,b]

	1972	1973	1974	1975	1976	1977	1978	1979 c	1980 c	1981 c	Total	Flow
Flow of containers												
In	445	595	757	820	716	1 259	1 341	4 342	4 066	3 028	17 367	
Out	382	614	667	593	930	1 056	1 481	3 497	3 717	3 563	16 500	33 867
Percentages for materials												
Iron (%)	55	60	58	69	68	70	80	88	90	92	-	
Al. (%)	45	40	42	31	31	28	18	10	8	6	-	
GRP (%)	-	-	-	-	1	2	2	2	2	2	-	
Percentages damaged (Annual) (%)[d]	100	99	88	88	87	88	85	68	60	50	-	
Quantity repaired	580	870	718	764	804	801	1 150	1 909	1 064	276	8 146	
Monthly average	48	72	60	64	67	67	96	159	89	46	-	
Refurbishment	-	-	-	32	38	54	98	103	22[e]	-	347	

Source: Multimodal S.A.

[a] First semester.

[b] No information available for 1970-1971.

[c] Includes container leasing companies and shipping lines.

[d] The decrease in the percentage is due to improvements in handling and transport equipment and increased experience of operators.

[e] Refurbishing was done up to May 1980.

C. OPERATION OF THE ENTERPRISE

1. SIZE

The size of the area to be used for the repair and storage of containers is directly related to the potential volume of work. In order to determine what that volume might be, a study must be made which takes into account the following:

(a) what leasing companies will be the future users?

(b) how much traffic does each of the companies have in the area? How many containers enter and leave the trade zone?

(c) how many depots are currently in operation?

(d) what is the damage ratio for each leasing company in the area?

At the beginning it is necessary to decide if the facility should operate both as a storage depot for empty units and as a repair shop or limit itself to the latter. This decision is important because it will determine whether a small lot is chosen for the repair of damaged units or whether a much larger lot will be needed for container storage and repair operations. It should be highlighted that even a large storage area can become overcrowded should a container imbalance arise.

There are, of course, differences of a commercial nature between having only a repair shop and having such a shop with storage space. It is important to consider elements (b) and (c) together in order to determine how many units would need repair services and the potential demand for such services. It should be understood that element (d) is important because there are container owners whose fleets are old or in bad condition, while others have new equipment which is less likely to be affected by negligent handling. Nonetheless, some of the companies with very old units are in the process of renewing the fleets and in a short period of time will have corrected the situation. It is interesting to note that once such companies have renewed their fleets they will be in a better situation than those whose fleets are now in relatively good condition. In view of these brief considerations and the unique situation prevailing in different regions, the suggested market study must be thorough and should not neglect aspects that might be suggested by intuition or other clues, concerning market trends.

By way of an example, it might be supposed that 100 damages units will be entering the repairshop each month. Taking into consideration that the minimum time between receipt of a unit and its dispatch is approximately 14 days, after one month the workshop would have . . . . . units undergoing repairs. Moreover, in addition to those units, other damaged containers will be arriving which could double the inventory of units at the yard. The 14 days mentioned earlier can be broken down as follows: inspection – 1 day; approval – 7 days; repairs – 2 days; and storage after repair – 4 days. The estimated time a unit would be in the workshop is a minimum and could easily be longer thereby increasing the number of units at the premises. Therefore, it would be advisable to consider having sufficient space to store a number of units equal to 2.5 times the average monthly inflow.

If the monthly inflow of containers is estimated at 100 TEUs, space should be available for 250 TEUs. If these units are stacked three high, five deep and with 8 metres between each row, the surface area required would be 7.02 square metres/TEU and for 100 TEUs 850 square metres would be required. Moreover, for 240 TEUs, the space required would be 1 700 square metres. There are, of

course, limitations as regards the configuration of the property. It should be noted that these space requirements include a single access lane between two blocks of containers. When the storage area becomes overcrowded, containers can be grouped in blocks and the number of access lanes reduced. Obviously, such measures create problems. Nonetheless, in Buenos Aires there are no cases where a depot has refused to receive units for reasons of convenience of movement as long as some space could be found. To these area calculations must be added the space required for a workshop with a capacity for simultaneously repairing 4 TEUs. While containers can be repaired during bad weather without protection, the availability of a covered workshop guarantees the continuity and efficiency of a minimum amount of work. If it should become necessary to shelter more than four units, the workshop should be enlarged. Nonetheless, it is considered that a workshop which permits four containers to be repaired simultaneously is a good point of departure. As 60 square metres are required for each TEU, the area would be 240 square metres. Further, to this should be added a space equivalent to two 40-foot containers for an office, lockers, toilets and spare parts storage.

Assuming the facility would have chassis for moving units to and from the yard, sufficient space must be allowed for ten 40-foot chassis and tractors. Taking into account their turning radius, it is estimated that 800 square metres should be sufficient for parking and manoeuvring. If each of these area estimates is added, the total is 2 500 square metres. However, an additional 30% must be provided as reserve space for unforeseen situations, parking of vehicles and forklift trucks, etc. Thus, the minimum space to repair and store 240 TEUs would be 3 250 square metres.

The above example is based on the assumption that the property would be rectangular, which is not always the case. In reality, the container storage area and stacking arrangement would have to be adapted to the surface and shape of the property as well as to the lifting equipment available.

There are formulas to determine the area needed for storing containers based on the number of units, the projected area per container and the utilization factor. The latter is variable, as it depends on what equipment is available (sideloader, crane, chassis, etc.) for stacking units and the height stacked. In general, however, this type of estimate is utilized for terminals with loaded containers. The situation is simplified for empty units, as they are usually stored in blocks.

2. SURFACE OF STORAGE AREAS

The impressive sight of large numbers of loaded containers at ports and terminals can easily lead to the belief that such units must rest on an even surface of reinforced concrete or similar material. Nonetheless, empty containers, which weigh from 1.8 to 3.8 tons in the case of 20 and 40-foot units, do not require such elaborate surfaces. On the other hand, because containers are constructed of metal and have a low relative weight and a solid appearance, they are often placed in wholly unsuitable places because of the erroneous belief that it is not worth while to incur expenses to prepare the surface of a container storage area.

Actually, the solution is to have a surface of intermediate strength. A reinforced concrete surface or one of coarse soil and cement treated with an

asphalt spray has the disadvantage of being very costly with slow investment recovery. However, it has the following advantages (a) it allows the stacking of more than three units, (b) it ensures that the basic structure of the container will not become deformed bacause of an uneven ground surface, (c) it protects units from standing-water damage, (d) it allows for unit identification by floor markings, (e) it permits the use of equipment such as straddle carriers, and (f) it facilitates cleaning such as the removal of metal cuttings ans other sharp objects that might damage handling equipment.

The least suitable surface is unimproved earth, which quickly turns into mud when it rains. Such surfaces do not allow for the stacking of more than two units, can cause deformities in container structures and often causes damage to the wood floors of containers. Handling equipment, of course, cannot be utilized for several days after a rain. The only advantage of the unimproved earth surface is that it requires no investment whatsoever.

An intermediate solution between the two alternatives is a dirt surface improved with gravel or similar material (cinder, etc.) that permits units to be stacked and moved in all weather conditions. At times different surface preparations can be combined. For example, the access lanes where handling equipment moves may be improved as indicated above while storage areas can be left unimproved. However, since access lanes are usually arched, rain water will drain towards the sides flooding the adjacent ground and thus exposing container floors to water damage. As a result, in this situation special measures would have to be taken to ensure adequate drainage or the land would have to be self-draining. Finally, it should be understood that all improved surfaces require regular maintenance.

3. PURCHASING OR LEASING

With respect to the question of whether land should be purchased or leased, it is difficult to give advice because of the countless factors that must be evaluated. Some of the more important are the value of the land in the country concerned, the profit margin of the enterprise and container movement through the area. In the specific case of Argentina, 80% of the shops are located on land in the port area and are leased for periods of up to ten years. The period of a lease is very important when buildings must be constructed and other improvements are required. As a result, such period will depend on a careful evaluation of the above-mentioned factors as well as on projections of the demand for repair services.

It should be understood that a container repair enterprise must be near areas where cargoes are consolidated and disconsolidated and containers are loaded on and discharged from ships. It may be said that for Buenos Aires, the maximum radius of operation for an enterprise is 20 kilometres from the port. Nonetheless, there are importers who receive cargo from greater distances, but the units are returned empty to depots within that radius. Most of the area within that radius is occupied by the city and the only open spaces available for container storage and repair are under port jurisdiction. In this sense, container operators and others seeking to enter this business without owning land for their enterprises must lease a site from the port authority.

4. DESIGN

As was the case with regard to size, the design of the yard will depend on several factors. There are, however, some aspects that may be considered fundamental to the efficient running of the business. One of these is the location of the workshop. If it is inappropriate, it may become a serious obstacle to orderly container storage, in view of the fact that repair work is often done in the surrounding area outside the workshop. Consequently, in speaking of the workshop one must bear in mind that it does not only consist of the space enclosed by walls but that it also includes an area of influence no less than 15 metres on each side. This space must be available for placement of containers that are being repaired, those awaiting inspection, and for receipt of materials and assorted tools and equipment that can only be utilized in open spaces.

If the workshop is located near the entrance or in the middle of the yard, it will take away a critical percentage of the useful storage and manoeuvring space. It is therefore recommended that the workshop be located to one side of the property or at the far end of the entrance, taking into account needed space around the shop. While the workshop might also consist of a roof with no walls, climatic conditions would have to be taken into account. Nonetheless, the roof should have a minimum height of 4 metres, which is sufficient for raising containers and placing them on stands when repairs must be made to floors and other structural members.

There are enterprises which utilize large cranes to move containers over other units, but in the case at hand, we are concerned with areas having a small rotation with little justification for investing in complex equipment that is better suited for quasi-industrial plants. The experience of Multimodal shows that containers may be brought to the workshop on chassis, rolling platforms and various types of fork-lift trucks. In this sense it is important to understand that the types of equipment utilized for moving containers within the storage area as well as in and out of the workshop will determine the size, locations and number of access points for an enterprise.

With reference to refurbishment of containers, the shotblasting and painting areas should not be located within the workshop. The reason for this is that these functions are independent tasks which to a large extent, because of their generation of suspended particles of sand, metal and enamels, deteriorate tools and equipment.

One of the fundamental rules of a container repair enterprise is that work must be accomplished in the same order that it arrives. Likewise, containers should be stored in such a way that when one unit is taken out of storage, as few containers as possible should have to be moved. The ideal arrangement would be to have containers stacked two high in double rows, but that would require extra access lanes with a resulting loss of storage space. It should be understood that the easier access is to stored units, the greater is the space required for each container and vice versa. The worst arrangement for storing containers would be to have units in stacks of four or more and in rows of five. An intermediate solution would be to stack units three high, in rows of five, with an access lane on either side. In the case of 40-foot containers, the situation is more difficult because access lanes must be wider than for 20-foot units unless the lifting equipment is of sufficient size to move containers over stacked units.

It is recommended that the yard have only one access. The reason for this is that personnel manning the control boards and handling customs documentation may see units as they enter and leave the yard. Likewise, it is recommended that the yard be of sufficient size to store containers that were acquired as scrap. Without such space large amounts of revenue earning storage capacity can be taken up by scrap units.

5. EQUIPMENT

One question often raised is whether container handling equipment should be purchased or leased. The experience in Latin America –at least that gained in the southern region– shows that a moderate flow of containers is not in itself enough to amortize the investment that would have to be made in this type of equipment. On the other hand, it is obvious that the equipment must be available at all times, i.e., that it cannot be rented by the day or month but must remain in the yard during the entire time the workshop is in operation. As a result, it is recommended that container handling equipment be considered part of the permanent capital of the enterprise and either long-term leased or purchased on a used basis.

With respect to the question of what type of container handling equipment is appropriate for a repair shop, the answer would be that capable of stacking containers three high and easily moved, operated and maintained. It should be borne in mind that for an enterprise of this nature, safety and time are vital in the handling of units. In this sense it is instructive to note that from the time a unit enters the yard until it leaves, it will normally be moved at least seven times, as follows:

(a) removed from the transport equipment and inspected upon arrival,
(b) transported to the storage area,
(c) removed from storage for verification by inspectors,
(d) returned to the storage area,
(e) removed from the storage area for repair,
(f) returned to the storage area after repair, and
(g) removed from the storage area and placed on transport equipment for delivery to user.

To these seven movements must be added various indirect ones involved in the removing of other closely placed units in the storage area. Of the above seven movements, only the first and last generate income. The cost of the other movements must be absorbed by the enterprise and therefore its profitability will be increased by reducing them to a minimum.

The most common container handling equipment is the fork-lift truck with a capacity of 7 1/2 or 15 tons that has devices for picking up 40-foot units from the top corner fittings. The majority of such equipment is designed for the movement of loaded containers and therefore a medium-size fork-lift truck is best for empty units. It should be pointed out that the proportion of 20-foot to 40-foot units varies from region to region, but in Argentine trades it can be safely stated that the former outnumbers the latter three-to-one.

6. ADMINISTRATIVE AND OPERATIONAL INFRASTRUCTURE

An ordinary repair shop –for automobiles, refrigerators, etc.– has separate systems for its administrative and operational procedures. In the case at hand, a third aspect should be considered which has features of both, i.e., inspection, which, while a part of operations also has important administrative elements. Moreover, the prestige of the workshop and, to a large extent, the success of the enterprise depend on the inspector.

The number of repair workers to be hired will depend on production estimates for the workshop. In this sense it should be borne in mind that a container is serviced, on the average, by one and a half workers. In other words, it cannot be programmed that four repair workers will service four units; rather, they will only service three. Due to the nature of the materials, repair work is not overly complex but a certain amount of manual strength is required, e.g., to straighten metals and weld. Further, repair workers must be able to judge the importance of work on structural members and the future effect of a poor repair on other parts of the container.

Workshops generally have two types of repair workers: welders and their assistants. Each of these workers must, in addition to their principal tasks, utilize percussion and hydraulic tools to straighten metal. The workshop foreman, who must co-ordinate workshop functions closely with the inspector, is in charge of recording the time spent on each part of a task in order to compare actual and estimated repair times and make necessary adjustments for similar work in the future. Finally, each workshop must have one or more persons who can safely and efficiently operate container handling equipment such as fork-lift trucks.

With regard to the administration of a container repair workshop, there must be one or two persons in charge of bookkeeping, billings and collections. The chief administrator of an enterprise does not necessarily have to be a technical expert, but he should be familiar enough with repair operations to corroborate technical and financial appraisals of the work. If such a person does not have a complete knowledge of those matters, he should be assisted by someone who does, e.g., the foreman or an inspector. The reason for this is that the chief administrator will often have to justify quotations for repair work to container leasing company inspectors and insurance company adjustors.

7. INSPECTION

The importance of this function has already been indicated. Unfortunately, it is only recently in Latin America that attention has begun to be paid to container damage inspection. There is a conceptual misunderstanding with regard to the classification of container damage and wear-and-tear among those who have recently undertaken this speciality and even among many who have been working in it for some time. It is not within the scope of this study to define what is damage as compared with wear-and-tear but rather to point out the need for persons who will be acting as inspectors to receive adequate instruction in order to minimize the problems that currently arise in this connection.

The best way to acquire an adequate level of knowledge concerning container inspection, aside from learning through manuals and information provided by container leasing companies, is to keep constantly in touch with the workshop

and be thoroughly familiar with all aspects of container design, materials of construction and repair techniques. The reason for this is that while there are basic rules on the subject, inspection requirements change because container designs and materials of construction are constantly being improved. It should be understood that the qualifications of an inspector depend on the number and types of containers inspected as well as on his own personal judgement. For example, anyone can describe a dent in a panel or a hole in the roof of a container without being a specialist, but when there is a combination of minor damage and corrosion, it is difficult to determine which is damage and which is wear-and-tear. This differentiation is important in that if the container had received adequate maintenance there would have been no corrosion and, consequently, defective handling might not have caused the minor damage that now makes it necessary to undertake repairs.

Where both damage and wear-and-tear exist, the distinction between the user's and the owner's liability is not clear. An inspector should be able to differentiate each in his report so that the workshop does not mistakenly repair some damage on which no quotation has been made or have to inspect the unit again because of uncertainity regarding its condition. This case often arises where a particular repair is ordered which in turn, without its actually being specified, involves the performance of other complementary work such as dismantling parts or replacing sections around the damaged area. If this is not clearly set forth in the equipment interchange receipt, the enterprise will have to do the repair without charging for it.

Another aspect that must be borne in mind by the person in charge of inspections is the level of verification. The amount of inspection required for the termination of a lease will not be the same as that performed on a unit belonging to a shipping line which is sent to the workshop only for minor repairs (holes, cuts, etc.). The inspector must be aware of these differences in order to not make the mistake of either performing an inadequate inspection and neglecting some of the damage or performing too thorough an inspection and noting details that shipping lines do not classify as damage. Finally, the inspector will be responsible for detecting and indicating in the appropriate record any inadequate repairs on other parts of the unit in question.

It can be seen from the above that inspectors must know how container repair work is accomplished. A critical approach to the work of other enterprises might give rise to certain difficulties with such enterprises, increase administrative costs and sometimes create tensions that are detrimental to business relations. Nonetheless, the experience of Multimodal shows that such observations (with respect to inadequate repairs) cannot be omitted. Finally, it should be understood that inspectors will usually have to complete equipment interchange receipts in English.

8. QUOTATIONS

It is not easy to estimate the monetary value of repair work. Repair estimates have always given rise to conflicts and, although a great deal of progress has been made, such conflicts will continue to occur. The subdivision of repair work into separate elements has helped to clarify the picture. These elements are: manpower, materials and incremental costs. Sometimes a percentage of overhead

cost is added to manpower, thus creating the "labour" category, which is more complete than "manpower". Sometimes included are factors relating to the time that a container remains idle in the shop awaiting approval of repairs, removal for inspection by the relevant specialist and transfer before and after repair.

Repair time plays an important role in the "labour" category. International experience has made it possible to tabulate repair tasks according to size and location on the container. Nonetheless, there are still differences between the leasing companies with regard to the amount of time assigned to certain repairs.

Several different methods are used to arrive at an actual quotation. One is to separate materials and labour, another includes the relevant materials as a part of labour costs and there is an assignment of a fixed value per container independent of damages. Each alternative has advantages and disadvantages. If a quotation includes only labour, it is assumed that the cost of materials represents, on average, a certain percentage of manpower. In this case, there is a risk, when damage is serious and the total for materials is higher than the amount estimated on the basis of statistics, of underestimating repair costs. The incremental cost is made up of all those functions which are complementary to the repair work. These costs are usually quoted separately but are included in labour or materials.

No single system can be recommended, since much depends on workers' qualifications, the availability of materials, the flow of units through a port, age of containers, requirements of the companies contracting repair services and the lack of uniformity among customers. Nonetheless, the persons responsible for preparation of repair quotations should make use of reliable international information regarding repair times and should be aware of the possibilities of obtaining container parts locally.

D. FACTORS BEYOND THE CONTROL OF THE ENTERPRISE

1. THE ECONOMIC SITUATION

The utilization of containers normally involves the movement of goods internationally, where there is much competition. As a result, the trends in the domestic economy of each country have a considerable effect on the demand for repair services. Most of the western countries apply a series of taxes to support various government activities. These include taxes on capital, on profits, on gross income and on value-added to manufactured goods. The basis for applying each of these taxes may vary from country to country. In Argentina, only three of these taxes are levied on container repairs. The extent to which such taxes affect an enterprise depends on how profitable it is; consequently, in this study it is difficult to make any generalizations on the subject.

Another factor that affects repair enterprises and is in turn affected by economic policies and market trends, is the exchange parity with respect to the United States dollar. If the dollar is undervalued, the dollar value of the local currency price of a repair will increase proportionately to the extent that the dollar is undervalued. For example, a repair that is worth US$ 100 when the parity with a local currency is normal (where there is neither over nor undervaluation) becomes US$ 300 when the dollar is undervalued in a ratio of 3:1 with respect to that national currency. While the variation of repair prices may not seem sig-

nificant, on the international scene the distortion at the local level completely changes the value of quotations. This leads to the cancellation of work orders and the removal from the country of unrepaired units. The industry in any given country could disappear because of such a situation. Container repair entrepreneurs can do little or nothing to solve this problem unless they have sound financial backing from other sources and can work at a loss while waiting for a change in the situation, thus making it possible for them to subsequently regain previous levels of profitability.

Local financial support for this type of business undertaking include prefinancing and export services financing granted by banking institutions in compliance with government regulations. Repair, maintenance and refurbishment services benefit from such provisions. For the purposes of banking control, however, the latter offers the greatest possibilities. The special nature of refurbishment, as well as major maintenance work (replacement of roofs and doors), allows for systematic verification of the materials used. Because of their complexity, repairs are more difficult to verify. In some cases, prefinancing provides the best way of offsetting substantial drops in profitability. However, when interest rates are positive in relation to the rate of inflation, this is not the best recourse. A similar measure, although different in some regards, is the system of reimbursement granted by countries to promote export activities, which is actually a tax rebate. This option has not yet been utilized as much as it should because there is no specific legislation regarding container repairs. Nevertheless, because it is a non-traditional service using domestic materials and manpower, it could fall within the category of exports of goods processed in a country.

2. AVAILABILITY OF SPARE PARTS AND OTHER REPAIR MATERIALS

This is directly related to requirements of workshop customers and to local fabrication capacity to provide the necessary materials. As the experience of Multimodal has shown, the possibility for production of such materials in Argentina is different from that in North America. In Argentina large quantities of complete container parts are not available simply because the industry that might fill possible orders does not exist. It is likely that once container manufacturing is reactivated and a reasonable production continuity is established, such parts would be available in the necessary amounts; but in the meantime, it will not be easy to obtain them. The most important of those materials are rails, main and side vertical supports, and complete fronts and sides. Since there are differences in the design of sections, thickness of materials, paints and adhesive compounds used in the construction of containers, it is practically impossible to keep stocks of most of the various materials used.

In the early 1970s, a large percentage of the fleet consisted of aluminium units most of which were of similar design. At that time, it was possible, for example, to have side vertical supports or sheets for patches available at the workshop. Subsequently with the gradual replacement of aluminium with steel containers, the situation has become more complicated. There are container spare parts, such as weather stripping, which vary not only from one manufacturer to another but also from one year to another, for the same product. As a result, it is impossible to keep stocks of many container components.

How can these problems be solved? Up to now, in the Latin American region, there have been three options. The first one is to use the damaged part as a pattern (for example, a rail) and have another one made to order. In addition to being more expensive than mass production, this alternative involves a waiting period. Another alternative is to import the materials. While importation of needed spare parts involves extra costs and a waiting period, it also requires the purchase of substantial quantities. A third possibility is to make use of materials that are still in satisfactory condition which were taken from containers sold to the enterprise as scrap. While this is not a sophisticated response, it does sometimes allow the workshop to make up for the lack of necessary spare parts. This is possible, of course, for those workshops which also operate as depots and where there are enough scrapped containers. In countries such as Brazil, where containers are now manufactured, it is possible to obtain needed spare parts. In the specific case of Argentina, where containers were manufactured during the 1970s, when domestic manufacturing ceased, spare parts disappeared.

Up to now this discussion has focused on the supply of major spare parts. In the case of minor parts, corrugated sheet, smooth sheet, floor beams, etc., the problem is somewhat easier to solve, as it is possible to make a drawing of the needed spare part and fabricate it in the workshop or have it made by third parties. In such cases, the thickness and type of materials must be considered, as these are required to meet the standards established by leasing companies. Based upon the experience of Multimodal, it is believed that container repairshops in areas such as ours should keep only minimum stocks of spare parts and other repair materials.

With reference to protective coating materials such as enamels, anticorrosive bases and bituminous coatings, strict priority must be given to the protective treatment of containers and this is included in the basic agreement between the owner and the workshop. The necessary paints may be purchased locally or imported, but in either case, prior approval of the container owner is required. In practice, this requirement is more strictly applied to container refurbishment than for retouching after repairs. Nonetheless, experience shows that the same standard should be applied to both.

3. ALTERNATIVES TO THE IMPORTATION OF SPARE PARTS AND OTHER REPAIR MATERIALS

There are advantages and disadvantages to the importation of container spare parts. One advantage might be that the workshop would be able to locate the best parts suppliers in any area of the world and purchase items of good quality that should satisfy container owners. While the prices of such parts might be slightly higher than that of those supplied locally, container owners would be sure of the quality of the materials used in maintaining their units. The disadvantages of buying spare parts abroad lies precisely in the differences in technical characteristics for containers. For example, one might import handles for closing bars, but how many? Of what specifications? One must not buy five or ten, but many more. The same is true in the case of a bottom rail. How thick or what shape should it be? What will be the shape or thickness of the rails on containers brought into the workshop in the future? And when they do arrive, will

they actually have to be replaced or will they be repaired? These questions point to one of the problems involved in maintaining an adequate stock of spare parts and other repair materials. The second one concerns the delay in getting the part. It should be understood that import procedures are not simple or rapid and thus a repair might be delayed with the resulting commercial risks. In the third place, the instability of government regulations governing trade flows, quotas and import tariffs must be borne in mind.

The orientation of trade policies of a country tend to change according to the situation of its industry, balance of payments, etc. Consequently, a price that is considered reasonable for spare parts and other repair materials at one point in time might later become prohibitive. The management of a container workshop cannot allow its efficiency to depend on government changes in trade policies. Further, such changes would not be sufficient justification for price variations in repairs to its customers.

With reference to enamels and antirust coverings, these items are easy to choose, in view of their physical characteristics and specific colours. The only difficulty would lie in the above-mentioned possibility that a government might change its import regulations. Another material which, like paints, might be imported is wood for flooring. While such wood may be obtained locally, the possibility of importing it at lower prices should not be discarded; this is true in general for all types of wooden container floors. In this regard, application of the treatment to wood floors recommended by the Ministry of Health of Australia should be borne in mind. Finally, as a general rule, it is suggested that every effort should be made first to acquire materials locally and that major spare parts which are difficult to obtain domestically should be imported.

4. CONTRACTUAL RELATIONSHIP WITH LEASING COMPANIES

A depot may be defined as a place used for the storage of empty containers and where various types of repairs might be undertaken. Nonetheless, container owners usually request many other services from a depot. Such services include: (a) receipt and delivery of empty units, (b) information on movements, (c) storage, (d) repairs, (e) maintenance, (f) refurbishment, (g) technical changes of various types, and (h) transport. Once a workshop has demonstrated it capacity and suitability for providing leasing companies all or any of the services mentioned above, agreements may be signed with one or more of such companies. These depot agency agreements usually have a duration of six months or one year and may be cancelled by mutual agreement.

In addition to having local and/or international certifications, a depot must complete a questionnaire which leasing companies address to enterprises desiring to provide container storage, repair and refurbishment services. These questionnaires include aspects such as characteristics of the surrounding area (residential, industrial, etc.), type of workshop floor available, type of storage surface covering, drainage system, type of lighting, distribution method to be used in the yard for container storage and the type, capacity and specifications of equipment to be used. Questions regarding personnel refer not only to the number of workers and their special qualifications but also to their years of experience. The part of the questionnaire applicable to container repairs asks for in-

formation on personnel and equipment available, as well as on the individual certifications of welders, the type of materials kept in stock and descriptions of covered and open air operating areas. With regard to refurbishment, the questionnaire covers a range of matters, from the size of the shotblasting nozzle to waiting times between application of antirust base, the painting system used, and drying and humidity control procedures. It should be highlighted that while there may be cases where, pressed by circumstances, a leasing company might begin to use a depot without thoroughly investigating its qualifications, in the end the depot must offer a full range of services or lose customers.

The depot agency agreement is executed between a leasing company and its chosen depot and includes certain provisions which vary depending on the policy of each container lessor. As a result, no reference is made to any specific company but rather to the principal requirements utilized by the majority of such companies. The maximum number of units to be stored by a depot is stated in the depot agency agreement, but not the minimum. A depot must have insurance to cover civil liability, damages to property and to containers, and even total loss of containers. The leasing companies set the amounts for such insurance. The depot must inspect the units when they arrive and prepare appropriate documentation in accordance with the company's instructions. The rate charged by a depot for receipt of a unit should include interior sweeping and removal of any outside markings which belong to the former user. The depot is required to provide daily, weekly and monthly reports to container owners and, if the agreement so stipulates, reports on various operational aspects. Such reports include areas as inventories, physical descriptions of units and other miscellaneous information. The workshop must have adequate facilities and repairs must be made without delay, pursuant to industrial standards and those provided by leasing companies or associations of leasing companies.

In general, leasing companies stipulate in the depot agency agreement that the price agreed with a workshop, e.g., for labour will be the lowest price currently charged to any of its customers for repairs. If not, such price will be extended to the appropriate leasing company. Further, various clauses require that repairs be made with materials of the same or similar characteristics to those used in its construction and the workshop must have prior approval from leasing companies before undertaking repairs. Sometimes leasing companies ask for a six-month or one-year guarantee on repairs and the workshop is required to pay compensation for defective work. Leasing companies have the option of reviewing a workshop's books at any time and if the workshop decides to sub-contract any part of the repair work, the depot must have the prior approval of the appropriate company. Depots are not allowed to lease containers, as that would create a conflict of interest. There are other clauses, such as provisions relieving leasing companies from any claim by the workshop in the event a container user does not pay for repairs. Finally, the companies reserve the right to request quotations from third parties if the price quoted by the workshop under contract is not satisfactory.

Actually, all the aforementioned terms would appear to favour the interests of only one party and seem to have little or no regard for the interests of the depot. However, if a depot operates efficiently and lives up to a certain standard of conduct, these clauses do not hinder the growth of the business. On the other hand, there are other circumstances that sometimes conspire against the normal development of relations. These latter factors are discussed in the following section.

5. DYNAMICS OF RELATIONS BETWEEN LEASING COMPANIES AND DEPOTS

Each container owner acts according to his own policies, which are not always in harmony with the aspirations and needs of the container depot and repairshop, particularly when the market shows intense rotation activity. The policies followed by a container owner depend on its experience, number of containers owned and region of operation. In this regard, it should be noted that its requirements also depend on the technical requirements and commercial characteristics of the region where its activities are carried out. It should be stressed that, in principle, no leasing company is able to give a guarantee that it will have a certain amount of repair work for a depot, simply because it is not possible to know when, where and how many units will be damaged. On the other hand, a commitment can be made to deliver for repair a percentage of the units entering the country.

There are two extreme situations in which a workshop such as Multimodal might find itself. One of these occurs when only a small number of damaged containers come and idle workers become a financial burden to the enterprise, with all the obvious consequences. A leasing company can do little or nothing about such a situation as it is caused, for example, by a lack of import traffic or by the fact that the leasing company's fleet is in good condition. The other situation arises when there is a constant and massive flow of damaged containers but no outflow. In this case, there is less pressure on leasing companies to repair their units due to the reduced demand for containers by lessees. The workshop becomes crowded with units, many with no repair requirements, and when approved repairs are finished, additional units must be rejected due to the lack of storage space. These situations have arisen during the past decade and have taught important lessons to both leasing companies and repair enterprises with regard to their relations.

During the period from 1970 to 1974, the demand for units increased and there was an imbalance between the number of units leaving depots and those coming in, so that workshops in Argentina had very little repair work. After the world recession of 1974 and up to 1976, the inflow increased, overcrowding depots and workshops. Based upon this situation, leasing companies reduced their repair, maintenance and refurbishment programmes, except in special cases. After an extended period of critical decline of activity at workshops, technical and human resources were cut back, with the resulting negative implications for members of this particular group. The leasing companies, in recognition of this situation, should consider absorbing a series of additional expenses, including those entailed in defective inspections, excessive handling, overtime labour, deterioration of units during idle periods and, finally, problems with workshops due to disagreements regarding liability for the physical deterioration of containers.

So far we have presented the extreme situations, but now let us look at the relations between repair enterprises and their customers when conditions are normal. A workshop usually seeks to provide services to more than one container owner and the curious situation arises that sometimes an owner will first seek to find out which other owners are customers of a workshop before deciding whether to use its services. The reason for this is that each container owner wishes to have a favoured position with regard to having its units repaired first.

The depot agency agreement between the parties usually establishes prices for storage, handling, materials and labour. Some leasing companies only enter into agreements with regard to labour while others establish maximum repair times and prices for materials. Further, there are agreements establishing fixed prices for each container, independent of damage, provided the damage does not exceed a certain amount. In other words, there are many alternatives as regards the rates charged for services between workshops and leasing companies. However, for special services such as refurbishment or total replacement of roofs and doors, fixed sums may be agreed which are relatively independent of the value of labour established for other work. In the specific case of refurbishment, prices may also vary according to the number of units received.

On the basis of the depot agency agrrement, billing may take two forms. If the container is returned by a user who has a damage protection plan, the container owner is billed directly. Otherwise the workshop deals directly with the user. The second alternative causes quite a few problems for the workshop, particularly if the user is not familiar with the operation of the system and only wishes to return the unit. In such cases, the workshop must maintain a delicate balance between its services to leasing companies and to container users in order not to jeopardize commercial relations between them. There have been many cases in which a user presents a document showing that a unit has been received in damaged condition and therefore, upon returning it, does not accept liability for such damage. The solutions for such problems are varied and not always easy. Nonetheless, if there is mutual trust between leasing companies and workshops, these problems can be settled without serious consequences. In the last few years, container owners have gathered sufficient information to set repair standards with a certain technological base. As a result, leasing companies have established strict repair programmes and this has been reflected in an improvement in the services provided by workshops and the elimination of many inefficient ones.

In the beginning, independent of whether approval was required for repairs, operations were based on good faith on the part of container leasing companies. This led to not a few unpleasant surprises. Currently, most of the leasing companies have a regional or local inspector or both, who inspect the units before and after repair work is effected. With this system, the previous defficiencies have gradually been overcome. Consequently, workshops now function under a principle by virtue of which no unit is approved for repair until it has been inspected by a representative of the appropriate leasing company and any unit may be inspected after repair. If the post-repair inspection is not carried out, that of the user before the container leaves the depot will indicate whether the repairs are satisfactory. There are of course other options for leasing companies. For example, they may have their own workshops or be associated with independent depots. The former is usually viable in areas where a leasing company has its headquarters and control is more effective. In remote areas, it is easier for a leasing company to subcontract the services of a workshop and exercise control through an inspector.

In view of the fact that repair volume fluctuates and depends on many factors over which the enterprise has no control, the invesment must be made rationally and the number of persons working at the facility should be kept to a minimum. When container traffic is normal, there may be one week when no units come in and another week when fifty damaged containers might be received

within two days' time for repair and delivery to the leasing company three days later. To handle such a situation, a workshop must be dynamic enough to have the necessary materials available, schedule its time, and have its staff ready to finish at least fifteen units per day. Overtime and non-working days are often utilized to take care of repairs such as these. Otherwise, the workshop would have to have a large staff which would be partially idle during slow periods. It should also be remembered that a leasing company requires prompt service and normally does not agree to its request being delayed because of other competing companies being in a similar situation. Consequently, the enterprise must treat each leasing company as if it were a priority customer. It is very difficult to achieve a balance under such circumstances. The situation may be partially solved if (a) the workshop engages in a complementary activity (chassis, ship and tractor repairs) that keeps the staff busy during the inevitable slow periods, and (b) the workshop does not have many customers. All these aspects should be fully discussed if there is a possibility of starting a container repair business.

It is important to point out that pressure has no place in this relationship. In other words, the workshop cannot ask for a minimum quota of units to repair because the company does not know how many units will be damaged nor can it set unreasonable prices as container lessors will simply choose another workshop. Another factor of importance is that there will always be other workshops willing to make discounts, either because its services are inferior, it needs the work, it has less infrastructure and hence overhead costs, or simply because it wishes to get more business.

NOTES

1 TEU - twenty-foot equivalent unit.

ANNEX VI

MOBILE REPAIR UNITS

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I. INTRODUCTION AND BRIEF HISTORY

In the United Kingdom during the mid 1960s, International Organization for Standardization (ISO) freight containers were beginning to emerge as a major means of transporting goods by road, rail and sea in cellular vessels. This meant that containers arriving at dockside which had been damaged in transit would have to be unloaded and repairs carried out by dock workers before the units could be transported to their final destinations. The skills available from dock workers, together with their lack of suitable equipment, were not conducive to the repair of containers. This situation caused many problems, not the least of which were the quality, speed and cost of repairs.

Union work rules in force at that time meant that a container requiring, for example, just a patch, entailed three different operators: a fabricator, a welder and a painter. This practice was extremely costly and time consuming. Eventually, specialized companies, such as REPCON (U.K.) Ltd., started to emerge. In this sense, there are two main types of non-stationary repair units being operated by REPCON in the U.K. One is the motor vehicle, with a box and van body, the interior equipped as a small compact workshop, and the other is the container modified to serve as a workshop, which can be transported to various sites on road trailers. These units will be referred to as **mobile** (vans) and **moveable** (one, or a combination of modified containers) for clarity of presentation.

While most repair enterprises utilize stationary workshops, some equipped mobile vans undertake any type of repair at locations where containers were stored or landed. These vans had the advantage that personnel operating them were skilled in various aspects of repair work, and that the above-mentioned union work rules were avoided. Although mobile vans have many advantages, such as the elimination of most container lifting and transport costs, it was determined early that needed spare parts could not be fabricated utilizing van equipment. As a result, spare parts had to be ordered in advance from general fabrication shops. This would sometimes cause delays due to parts only being fabricated in order of priority. The need for a back-up to the mobile facility quickly followed, resulting in the setting up of moveable workshops (containers modified to serve as workshops) capable of fabricating commonly used spare parts. Other spare parts were obtained from alternative manufacturers and suppliers.

The evolution from mobile van to moveable workshop and then to a stationary facility is largely based upon the volume of repair work. The experience in the U.K. shows that as volumes of repairs increased in specific areas, containers were modified to serve as workshops. These units could support a larger number of workers, more equipment and permit the fabrication of a wider variety of spare parts. This development resolved the problem of communications

between repair workers and administrative staff, and made available office accomodations, now required because of the additional documentation. As repair volumes increased still further, comprehensive stationary repair workshops began to emerge as the most prominent type of facility, thus providing covered premises for repair operations.

At the present time in the U.K., stationary workshops exist alongside the mobile and moveable units, each having its own part to play in providing fast, efficient and quality repair services to the container industry. Mobile and moveable repair units are designed to meet freight container repair demands away from the base workshop. Both types are equipped to enable virtually any major repair to be undertaken, dependent only upon materials and, in some cases, container lifting equipment being available.

II. DESCRIPTIONS

1. Mobile

The vans utilized for this type of workshop should normally have the following specifications:

(a) Engine capacity	2.5 litre diesel engine
(b) Minimum carrying capacity	2 tonnes
(c) Internal dimensions of the workshop	approximately 3.5m long, 2.0m wide, 1.8m high.

The workshop section has a metal work bench secured to the floor, with an engineer's vice fitted. The equipment and tools are stored in a tidy manner, as shown in figures 1 and 2. The complete list of equipment and tools will be described later.

2. Moveable

This type of unit makes use of a standard 40-foot ISO freight container adapted internally to offer compact workshop facilities. The layout is generally the same as the mobile unit, with work benches, equipment and a small material stock. The front end of the container can be utilized as an administrative office with a partition between the workshop section, or as a power generating area, where an electrical generator and air compressor can be installed.

There is basically little difference between the capabilities of the units. The determining factors when deciding which one to use are basically:

(a) Workload - sufficient volume for a minimum period of time.
(b) Location - sufficient area to effect repairs.

Figure 1

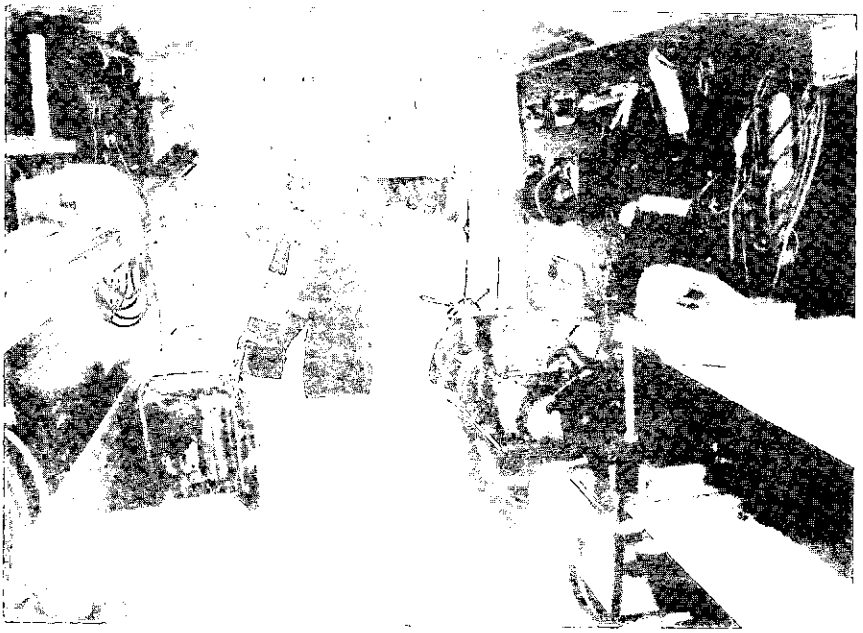


Figure 2

III. ECONOMIC ENVIRONMENT

1. Costs

(a) Mobile (van)

The basic cost of recommended type of vehicles in the U.K. are approximately £ 10 000 including painting and signwriting with the company name, and fitting-out with pegboard walls and a metal bench with a 100mm engineer's vice. The cost of the portable items, as listed later, would total £ 6 000 giving an overall cost of £ 16 000.

(b) Moveable (container)

The cost for this type of unit would be as follows:

Purchase of a second-hand 40-foot steel container	£ 600
Equipment as above, with the addition of extra benches and material racks, and administrative office at front end	£ 7 000
Total	£ 7 600

It should be noted that this cost excludes charges levied by the owners of the land on which the moveable is temporarily located. This cost in the U.K. can be up to £ 1 250 per annum.

2. The volume of repair work necessary to justify investment

The volume of repair work necessary to justify an investment in either type of unit has to be sufficient to cover depreciation of vehicle and equipment, labour, materials and operating costs, and to give a return on capital in the region of 20%.

To profitably employ a mobile repair unit, the enterprise should be assured of, for example, a minimum of one day's work at each repair location. This means that mobile units are not intended to provide emergency repair services but planned services to meet consistent demands. Nonetheless, an emergency service can be, and often is, provided. Such service should be costed on a different basis, consideration being given to the distance travelled and amount of work available at destination. For example, to travel 20 miles for repair work which takes four hours would have to be costed to recover one day's normal earnings.

3. Rates

Compared to the operating costs and overhead expenses of stationary container workshops, repair rates for the services of mobile and moveable units can be more competitive. To achieve profitability, REPCON has found that it is not necessary to stipulate a minimum hourly rate, but that such rate should be determined by work volume levels, plus a predetermined travel time/distance cost. The following is an example of a typical mobile or moveable rate based on a 40-hour week for six repairmen:

REVENUE	Productive hours: 210 (6 x 35)				
	Average earnings per hour:	£ 10.00	(Labour:	£	8.00)
			(Material:	£	2.00)
	Productive sales:	£ 2 100.00	(Labour:	£	1 680.00)
			(Material:	£	420.00)

From this £ 2 100, subtract:

VARIABLE PRODUCTION COSTS	Direct repair labour Material (33⅓ mark-up on sale of £ 420.00) Fuel Vehicle Repair Rent and rates (moveable only) Plant maintenance Tools Consumables Protective Clothing Hire of Equipment.

This leaves the GROSS MARGIN. To determine the net margin, subtract:

VARIABLE ADMINISTRATIVE COSTS	Supervisor's or manager's salary Office costs (accounts, invoicing, etc.) Telephones. Printing and Stationery General expenses (audit fees, bank charges, etc.) Sundry trade expenses (canteen, welfare).

This leaves the NET MARGIN. To determine earnings before tax, subtract:

FIXED COSTS	Depreciation (normally four years) Insurance. Property and licence taxes.

This leaves EARNINGS BEFORE TAX.

4. Locations where mobile and moveable repair units might be utilized

(a) Mobile units

These units are suited for situation such as:

(*i*) where the volume of repair work does not justify the placement of a more permanent workshop,

(ii) where containers are distributed over a large area and repairs may be performed at each individual location,
(iii) where containers must be repaired without being moved (this may entail the contents of the container being removed and replaced if the goods might be damaged during repair operations),
(iv) at container storage yards and interior cargo terminals (ICTs), where many small and varying types of repairs are required, and
(v) at container stuffing and stripping areas, i.e., docksides, ICTs, rail terminals, high volume warehouses, major exporting plants, etc.

(b) Moveable units

This type of unit would be most advantageously utilized where the volume of repairs can support the investment, but cannot justify a permanent workshop. Adequate space must be obtained for the siting of a moveable facility and repair area. This space must be a safe distance from the container stuffing and stripping operations. The ideal location for such a unit would be at an ICT that belongs to either a major shipping company or to a container consortium in which all participating companies contribute toward the costs of operation. In this situation there is the advantage that any necessary stuffing and stripping of containers in order to carry out repairs can be dealt with immediately.

IV. INDUSTRIAL ENVIRONMENT

1. Customers

For both mobile and moveable repair units, the major demand for services comes from customers such as:
(a) shipping and container leasing companies,
(b) forwarders and agents,
(c) road haulage companies, and
(d) industrial container users.

2. Repair standards

Repair work which is undertaken outside the control and supervision of quality inspection procedures at a stationary workshop is obviously subject to less stringent reviews. Therefore, in order to maintain high-quality repair standards, the following measures should be adopted:
(a) Instruct the staff operating mobile units to always give conscientious service and carry out repairs to the desired quality standard. This is essential to ensure that the repair unit is operating efficiently and effectively.
(b) Assign an experienced foreman to control mobile unit repair operations.
(c) Make random quality checks to ensure repair standards are being maintained. The use of the repair quality report is a useful means of verifying the level of workmanship (see figure 3).
(d) Maintain close contact between container owners and the staff oper-

REPAIR QUALITY REPORT

Figure 3

DATE 8.12.81

TYPE OF WORK TO BE CARRIED OUT
INSERT INFRONT SILL
NEW CORNER POST. RENEW F/BEARER

LOCATION
CHURCH ST
LIVERPOOL

OWNER A.C.E. (AFRICAN CONTAINER EXPRESS)

MAKE YORK

TYPE STEEL

SIZE 20 FT

NUMBER ACEU 1605526

SHOTBLAST —

PAINT O.K.

WELDING GOOD

SEALS —

CLEANLINESS TIDY FINISHED JOB. BOX SWEPT CLEAN ON COMPLETION

UNDERSIDE EXTRA UNDERSEAL REQUIRED TO NEW BEARERS

REPAIR COMPLETED ON TIME TO REQUIRED STANDARD

MISCELLANEOUS —

JEM

ating mobile units to ensure that repair times and standards are satisfactory to their requirements.

(e) Ensure that repair personnel are aware of and utilize equipment innovations and new repair techniques.

(f) Make available to all mobile unit repair workers container manufacturers' manuals, lessors' repair instructions and standards, and other appropriate technical instructions.

It should be understood that container owners usually have repair manuals issued by container manufacturers. Many also employ their own engineers to monitor repair standards. Where such manuals are not available or non-existent, each repair unit should endeavour to obtain identical replacement parts where possible, in order to ensure that repairs are made with the correct specifications and materials. Finally, it is also advisable to prepare a company **method of repair manual** and a **code of practice**, and to keep informed of the latest Customs regulations concerning containers.

3. Types of repairs

Virtually any type of repair can be undertaken by mobile and moveable units if suitably equipped. Such repairs normally include all those except major structural damage. As examples, the following would be considered representative: corrugated and flat panel replacement and straightening, corner post renewal and patching, top and botton rail renewal and straightening, floor bearer replacement, roof bow replacement and various door repairs. Some programmed maintenance is also carried out (mainly routine), e.g., sweep-out, oiling and greasing, etc.

V. OPERATIONAL ENVIRONMENT

1. Equipment

The repair equipment most commonly carried by both mobile and moveable repair units depends mainly on the trend of repairs which develop for individual units. These trends occur because units may find that perhaps only aluminium or glass-reinforced plywood containers are utilized in the areas in which they operate and, therefore, equipment need only be capable of coping with the types of materials presented. The majority of units, however, should be equipped to facilitate repairs for most types of containers and materials of construction. The following equipment is, therefore, comprehensive and includes items which may be required only infrequently:

(a) Steel workbench (dimensions 2m long x 1m high x 0.5m deep) with an engineer's vice having 100mm jaws.

(b) Petrol-driven generator, 115 to 230 volts alternating current of 3.5 KVA (3 500 watts) capacity.

(c) Petrol-driven air compressor, 100 p.s.i. and 15 c.f.m. minimum.

(d) Petrol-driven welding equipment, range 20-200 ampres A.C.

(e) Oxy-acetylene bottles with pressure valves and hoses.

(f) Small burning equipment bottles with heating and welding torches.

Note: The above equipment should be firmly secured within the unit.

Hand tools	Approximate cost (£)
2 electric drills, 3/8" chucks, 2 speed	200.00
1 small hand grinder	100.00
1 hot-air plastic-welding gun	150.00
1 rubber roller for use with the above gun	5.00
1 jig saw (wood)	35.00
1 hand-held metal cutter	100.00
1 "Avdel" pop-rivet gun and oil actuator	100.00
1 impact rivit gun	80.00
1 sealant applicator	20.00
1 grease gun	10.00
Sledge hammer and 7 pound hammer	40.00
Case of "Snap-on" tools (1/4" - 1 1/4")	150.00
Wide-edge chisel	80.00
Set of taper punches	20.00
Impact screw-driver	20.00
2 18" Stillson wrenches	100.00
2 3" Stillson wrenches	50.00
Hacksaw	5.00
Wire brush	5.00
2 hand lamps, 110 volts	20.00
Oil can	
Knife with replaceable blade	
Wood saws (cross cut and rip)	5.00
2 air drills	80.00
Manual pop-rivit gun	45.00
Other items of equipment	
2 electric junction boxes	10.00
2 welding masks	10.00
2 electric cable leads	10.00
2 tripod stands for chassis axels	10.00
TIR Convention rope kit	20.00
Mechanical ratchet-type block and tackel	40.00
Hydraulic ram with extension tubes to 8 feet	300.00
Small jack (hydraulic bottle type)	40.00
Crowbar	10.00
Airline	10.00
Ramps for elevating chassis, etc.	20.00
2 "C" clamps	10.00
Paint application trays (15"x10"x3")	10.00
Fire extinguishers, 5 kg (PSKS or Chubb BCF)	40.00
Paint brush rack	20.00
First-aid kit	20.00
Gas-welding goggles	10.00
2 safety helmets	10.00

Other items of Equipment	Approximate cost (£)
2 ear muffs	10.00
Various tote bins and racks	50.00
2 pairs of welding gloves	10.00
Extension ladder with self-stand attachment	40.00
Sweeping brush	
Stowage locker	20.00
Paint locker	30.00

2. Spare parts carried

The spare parts inventory for a moveable unit differs only marginally from that of a mobile unit. It would be possible, however, to stock a more varied supply of repair materials in the moveable, basically due to its larger size. The spare parts normally stocked include:

(a) **Patch materials** of various thicknesses, including steel sheets, alloy sheets and treated timber.
(b) **Sections** of steel and alloy for common container equipment encountered (rectangular hollow sections, angles, etc.).
(c) **Roof bows and floor bearers.**
(d) **Fastenings**, including a variety of rivets, screws and bolts.
(e) **A selection of items** which include retaining wires for canvas and plastic sheeting, patching materials for canvas and plastic sheeting, locking gear components, handles, hinges, door-locking cams, rubber door seals, sealer, tapes, adhesive and a variety of brush-on paints.

These items are carried at all times and are available for repairs of a minor nature.

It should be understood that if a mobile unit is correctly informed as to the repairs desired, needed spare parts can be fabricated at the stationary workshop or taken from its inventory. In this sense, formed panels, corner posts, side rails, headers, sills and other special items which are needed for the more complicated and specialized repairs can be carried.

3. Number of workers employed and skills required

Together with the capital investment, a labour force capable of performing various tasks to the desired standard must be employed to operate both mobile and movable repair units. With regard to the mobile unit, it is standard procedure to have a two or three-man team per vehicle. The person in charge must not only be a reliable technician but must also be able to work independently, have a capacity to schedule work and possess a good understanding of port and depot operations. A moveable unit's work force is determined by the volume of repairs availabe. Normally, moveable units employ six men, with one as foreman. The two basic skills required of workers for both types of repair units would be:

(a) Vehicle body building experience, including workshop procedure knowledge, and
(b) Welding skills.

The system used by REPCON for personnel selection involves prospective employees completing the form shown in figure 4, which lists various skills re-

quired and the level of experience currently possessed. It should be understood that no prospective employee is expected to have experience in each item but care must be taken to ensure that they are familiar with a wide range of welding techniques, such as the use of CO_2, electric arc and inert gas on various metals, including mild steel, Corten steel, and possibly stainless steel and aluminium. The form can also be used as a record for training purposes and as an inventory of skills available.

4. Work procedures

The person in charge of a mobile or moveable repair unit is responsible for:

(a) identifying repair requirements for or on behalf of the customer,
(b) preparing and presenting repair quotations, verbally or in writing (generally during discussions with customers), and
(c) obtaining approval of repair quotations from customers and complying with their repair standards.

The repair quotation form utilized by REPCON, shown in figure 5, indicates the work required and the cost estimate. It is prepared in four copies:

(a) First copy –yellow– retained by the operator carrying out the repair.
(b) Second copy –white, with the standard trading conditions printed on the reverse– is presented to the customer.
(c) Third copy –blue– given to the accounts department for billing purposes.
(d) Fourth copy –pink– given to the stores department for replenishing spare parts.

It should be highlighted that the repair quotation system can be modified to suit different types of operations. The approval of a quotation is given either directly at the repair site or is confirmed by telex from the customer's main office. Obviously, certain types of repairs, i.e., roof bow replacement, small steel patches, etc., have been carried out many times and the prices (man/hours and material costs) determined. Such times and prices are known as tariff costs and principal customers should have cost sheets on which they appear. Therefore, it is a normal practice for such repairs to be carried out immediately, without waiting for customer approval. Repair authorizations can also be made through a pre-arranged agreement with the customer, i.e., automatic approval with a pre-set cash limit, agreed price tariffs, routine reporting system and billing invoices presented individually or in groups.

5. Documentation

Both mobile and moveable repair units employ essentially the same documentation as the stationary workshop. Such documentation includes:

(a) Quotation form (as previously described).
(b) Mobile work card (see figures 6 and 7).
(c) Daily time sheet (see figure 8).
(d) In the case of a mobile unit, a vehicle operation sheet (U.K. requirement) to record mileage covered, fuel used, maintenance services performed and replacement items fitted, i.e., new tyres, exhausts, etc.

Figure 4

EXPERIENCE

We require competent employees who are skilled in the following duties, or who are prepared to undergo training to the required level. Please fill in the table to show your levels of experience:

SKILL	EXPERIENCED	SOME WORKING EXPERIENCE	LITTLE OR NO EXPERIENCE
Woodwork			
Fibreglass			
Sheet Metal Work (steel)			
Sheet Metal Work (aluminium)			
Welding (gas)			
Welding (arc)			
Welding (MIG and TIG)			
Industrial Painting			
Tilt Repairs			
Trailer Servicing			
Trailer Repairs			
Reading Engineering Drawings			
Fan Insulation			
Fridge Unit Servicing			
Fridge Unit Repairs			
Industrial Safety			
Firefighting			
Use of Normal Hand Tools			
Supervision			
Use of air or electric power tools for drilling, sawing, grinding, pop riveting or screwdriving.			

DECLARATION

I certify that the information given by me in this application is correct.

Signed ..... Date .....

FOR OFFICE USE ONLY

Interview Notes

Figure 5

repcon[UK] Ltd.

CONTAINER QUOTATION No. _____

PLEASE REPLY TO

HEAD OFFICE
CANAL STREET
BOOTLE L20 8NP
Telephone: 051-922 8761/8
Telex: REPCON [UK] Lpool 627808

1 PRINCIPAL AFRICAN CONTAINER EXPRESS

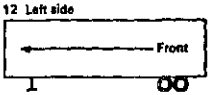
2 YOUR REF. _____ 3 OUR REF. TPM/SB 4 DATE 6-12-81

5 ADDRESS 148 NEW STRAND ROAD BOOTLE

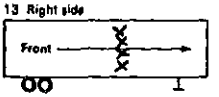
6 Container No.	7 Location	8 Type
ACEU 1605526	CHURCH STREET YARD	20' STEEL
9 Manufacturer	**10 Date of Inspection**	**11 Inspected by**
YORK	6-12-81	T. P. MULCAHY

INSPECTION REPORT:– b/B – Bent or Bruised, br/BR – Broken, c/C – Cut or Cracked, d/D – Dented, h/H – Hole, M – Missing.

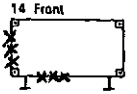
12 Left side



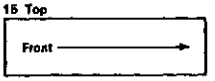
13 Right side



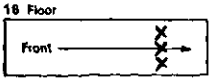
14 Front



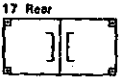
15 Top



16 Floor



17 Rear



TSAS 7162

OIA. No.	SUMMARY OF DAMAGE AND REQUIRED REPAIR	ESTIMATED COST OF REPAIR					
		Material		Labour		Total	
		£	p	£	p	£	p
	RENEW N°4 SIDE PANEL R/H. SIDE	32	00	48	00	80	00
	FIT 12" INSERT TO FRONT SILL	1	50	12	00	13	50
	RENEW R/H FRONT CORNER POST	45	00	96	00	141	00
	RENEW N° 4 FLOOR BEARER	12	00	24	00	36	00
	PAINT WORKED AND NEW PARTS	7	55	16	00	23	55
	TOTAL	98	05	196	00	294	05

COMMENTS _____

Signed J P Mulcahy

PLEASE NOTE: Trading terms and Conditions detailed overleaf

Figure 5 (conc.)

REPCON (U.K.) LIMITED
STANDARD TRADING CONDITIONS

1. All contracts are subject to Repcon (U.K.) Limited's Standard Trading Conditions. In these Conditions the "Client" means the party with whom the contract is made. All terms, whether conditions or warranties which would otherwise be implied are hereby excluded. These Conditions may only be omitted, varied or waived by the written authority of the Company.

2. By contracting with the Company the Client undertakes:-
   (a) that he or it is and will at all material times remain either the owner or the authorised agent of the owner of, and all other (if any) persons interested in the goods or any part of them.
   (b) that he or it is authorised to and does accept these Conditions including (but not limited to) the settlement of accounts for and as binding upon itself and all other interested parties.
   (c) in any event to indemnify the Company and keep it indemnified against all claims or demands whatsoever by third parties in respect of any loss, detention, delay, misdelivery or damage however caused whether or not by the negligence of the Company or its servants, agents, subcontractors or others for whom it may be responsible.

3. Quotations, which may be withdrawn at any time before acceptance, and in any event become invalidated in the absence of acceptance 30 day after they are dated, are subject to variation in accordance with any changes in the price of materials and parts or in wage rates.

4. Unless instructions to the contrary are received in writing prior to the commencement of the work, every endeavour will be made to use manufacturers recommended spare parts.

5. Transport costs to and from our repair bases are additional to the quoted repair or maintenance charges unless otherwise stated.

6. The Client undertakes to notify the Company of any contaminating substances where containers and/or boxes are presented for cleaning and shall indemnify the Company against all claims of whatsoever nature arising out of or in way connected with any breach of this Condition."

7. The Company will not be responsible for any loss or damage due to or arising from:
   (a) Act of God, invasion or other action of foreign enemy, hostilities (whether war be declared or not), civil war, civil commotion, riot, rebellion, looting, insurrection, politically inspired disturbance, military or usurped power, confiscation, requisition, destruction of or theft or damage to property by or under the order of any government or public or local authority.
   (b) Combinations, industrial action, lockouts, general partial stoppage or restraint of labour from whatever cause or official or unofficial strikes of any persons in the Company's employment or in the employment of others.

8. The Company shall not be liable for any consequential loss or loss of profits, directly or indirectly caused by or contributed to or arising from its failure to perform or its defective or delayed performance of any services which it undertakes to perform (including but not in any way limited to delay arising in whole or in part from combinations, industrial action, lockouts or official or unofficial strikes of any persons in the Company's employment or in the employment of others) and whether or not resulting from its act default or negligence or that of its servants, agents or subcontractors or of others for whom it may be responsible.

9. The Company shall be entitled to arrange for the performance of or any part of the contracted services by subcontractors who shall be under no liability whatsoever to the Client in respect of the goods in addition to or separately from that of the Company.

10. The Company shall be discharged from all liability and any claim shall be deemed to be waived and absolutely barred unless the claim shall be made in writing and notified to the Company at the earliest possible time and in any case within 28 days of the facts giving rise to the claim first coming to the notice of the Client its servants or agents. Any claim by the Client shall be limited to the market value of the goods under service or repair.

11. All goods shall be subject to a particular and general lien for monies due either in respect of such goods or for any particular or general balance or other monies due to the Company from the Client and/or any other person interested in the goods. If any monies due to the Company are not paid within 28 days after notice has been given to the Client that such goods are detained, they may be sold by auction or otherwise at the sole discretion of the Company and at the expense of the Client and the proceeds applied in or towards the satisfaction of such particular or general lien.

12. Settlement terms are net cash, payment being due 28 days following the date of invoice. Notwithstanding that the Client may have a claim against the Company the Client shall not be entitled to set off any such claim against any monies due to the Company.

This documentation system is considered a minimum and is designed to keep records for audits, payments and invoicing.

6. Back-up facility

In the U.K., mobile and moveable repair units are sometimes provided as an additional service to a stationary workshop (as is the case with REPCON) and sometimes as a private enterprise venture by individuals. In both cases, the acquisition of spare parts and equipment does not pose a problem. Many sources of materials and pressings are available in Europe.

While it is not absolutely necessary to have a base workshop capable of fabricating spare parts, the lack of one can make it very difficult to operate and control costs. As an alternative, customers might maintain stocks of spare parts, or spares might be purchased (from abroad if necessary) with a consequent effect on inventory levels and repair times. In these circumstances, the willingness of customers to accept increased repair material costs would, to a large extent, determine the economic viability of such units.

As there are many variations in individual container manufacturers' design configurations, it is impossible to be specific about which spare parts and what quantities should be fabricated and purchased. As a result, the newly established container repair enterprise might wish to divide its needs for spare parts into the following categories:

(a) those where a local source is vital –e.g., steel corner posts, corrugated panels, steel top rails and floor bearers,
(b) those which are vital but may be taken from high-quality scrap containers –e.g., door gear, corner castings, floor timbers, alloy floor bearers and angle corner post patches, and
(c) those which would probably have to be imported –e.g., specific aluminium and alloy components such as top rails, side posts and roof bows.

It should be emphasized that REPCON does not follow these procedures, as it has a fabrication shop and is close to many European sources. Nonetheless, for a newly established repair enterprise in a developing region, such guidelines may provide useful insights into obtaining spare parts for the operation of mobile and moveable repair units.

7. Problems

Various problems are encountered when operating mobile and moveable repair units. The main problem areas are as follows:

(a) **Lack of or excess volume, i.e., fluctuating work load.** This situation, on the one hand causes loss of profitability and idle time and, on the other, dissatisfaction of customers in not having their containers returned to service quickly enough.
(b) **Equipment reliability.** Repairs may not be completed on time due to failure of, for example, welding equipment or an air compressor. Therefore, maintenance of all items of equipment, including the vehicle for mobile repair units, is imperative.
(c) **Parts availability.** It must be possible to obtain the correct spare parts

promptly, in order to complete repairs on time and to the customer's satisfaction.

(d) **Suitable personnel with adequate skills.** It is important to have a reliable, conscientious and skilled work force employed in these units.

(e) **Price levels.** Rates for repair services must be structured to give a fair return on capital investment.

(f) **Weather Conditions.** In the U.K., bad weather in the winter months can cause disruptions to repair operations. Obviously, rain makes any form of welding or painting impractical unless some cover is provided. In this sense it should be understood that during the winter of 1981, weather conditions in the U.K. were the worst in many years. Nonetheless, the experience of REPCON shows that mobile unit repair volume decreased only 20% in that period.

VI. CONCLUSION

This annex has endeavoured to evaluate the emergence of mobile and moveable repair units and show that, given an adequate volume of work and operated by moderately skilled workers, they can provide a good profit margin while offering first-class repair services to customers.

Figure 6

repcon [UK] Ltd.

MOBILE WORK CARD

Branch No 57 Job No 150125

Owner A.C.E. Container/Trailer No ACEU 1605526

Customer to be Invoiced A.C.E. Date Started 7-12-81

Address 148 NEW STRAND Date Completed

BOOTLE, LIVERPOOL Customer Order/Authorization 6485

Material Used			Cost Price		Selling Price	
Repcon No	Description	Quantity				
	BEARER	1	9	00	12	00
	5" x 2" x 10 SWG ANGLE	12"	1	18	1	50
	CORNER POST	1	33	75	45	00
	8' x 4' CORRUGATED PANEL	1	24	00	32	00
	PAINT	3 Litres	5	66	7	55
		TOTAL			98	05

Form No PF 119 Signed Foreman/Chargehand

Figure 6 (conc.)

JOB DESCRIPTION
RENEW N°4 PANEL R/H SIDE
FIT 12" INSERT TO FRONT SILL
RENEW R/H FRONT CORNER POST
RENEW N°4 FLOOR BEARER
PAINT WORKED AND NEW PARTS
D. SPEED 4 HRS. 7.12.81

Comments :–

Figure 7

repcon [UK] Ltd.

MOBILE WORK CARD

Branch No 57 Job No 150126

Owner B·H·L·R Container/ Trailer No. BSLU 3010323

Customer to be Invoiced B·H·L·R Date Started 7·12·81

Address CHURCH ST Date Completed 8·12·81

LIVERPOOL L20 8NP Customer Order/ Authorization B·H·L·R 6974

Material Used			Cost Price		Selling Price	
Repcon No	Description	Quantity				
1496	BEARERS	5	37	50	50	00
2845	UNDERSEAL	2 litre	1	88	2	50
1996	WELDING ROD 3.5 mm	100	3	75	5	00
		TOTAL	43	13	57	50

Form No P/119 Signed _____ Foreman/Chargehand

Figure 7 (conc.)

JOB DESCRIPTION

RENEW N° 4, 6, 8, 10 & 11 BEARERS
FAIR AND STRAIGHTEN L/H. BOTTOM RAIL
REFASTEN FLOOR

D. SPEED 4 HRS 7.12.81

Comments :-

Figure 8

REPCON (UK) LIMITED Branch No. 57

DAILY WORK SHEET

Day MONDAY Date 7-12-81

Name D. SPEED Works No. 369

Job No. (if any)	Equipment No.	Location No.	CAT.	Hours		
				Basic	Overtime	
150125	ACEU 1605526			4		
150126	BSLU 3010323			4		
			TOTAL	8		

* Enter 'T' if Trainer

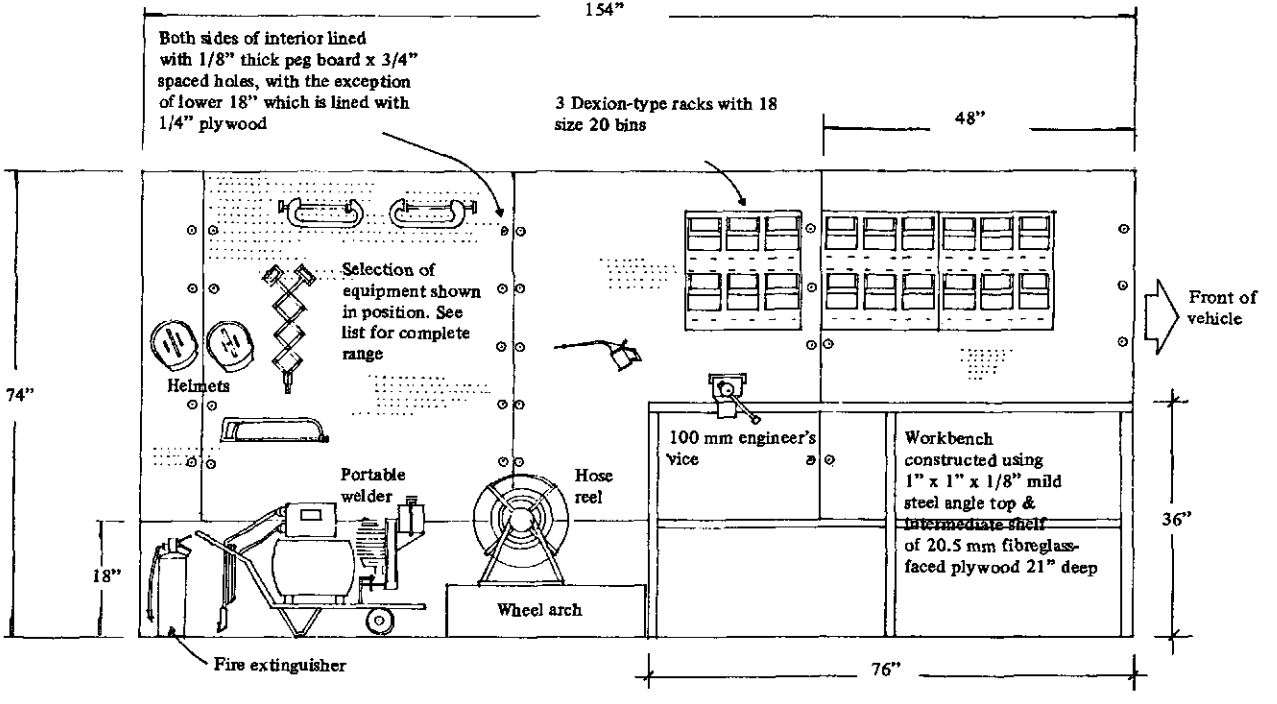
Authorised Signature .....

x 1½ x 2

Form No P1 (17 Dec 74)
R.2.

Figure 9

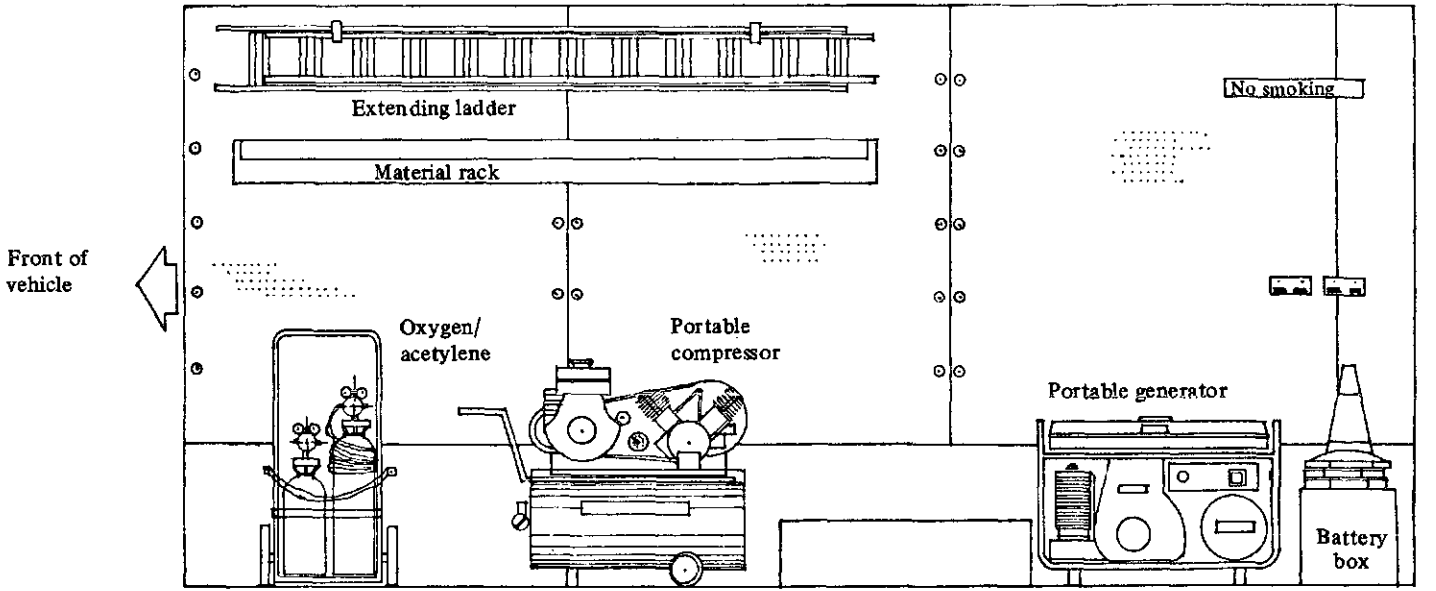
MOBILE CONTAINER REPAIR UNIT



Left hand side of vehicle

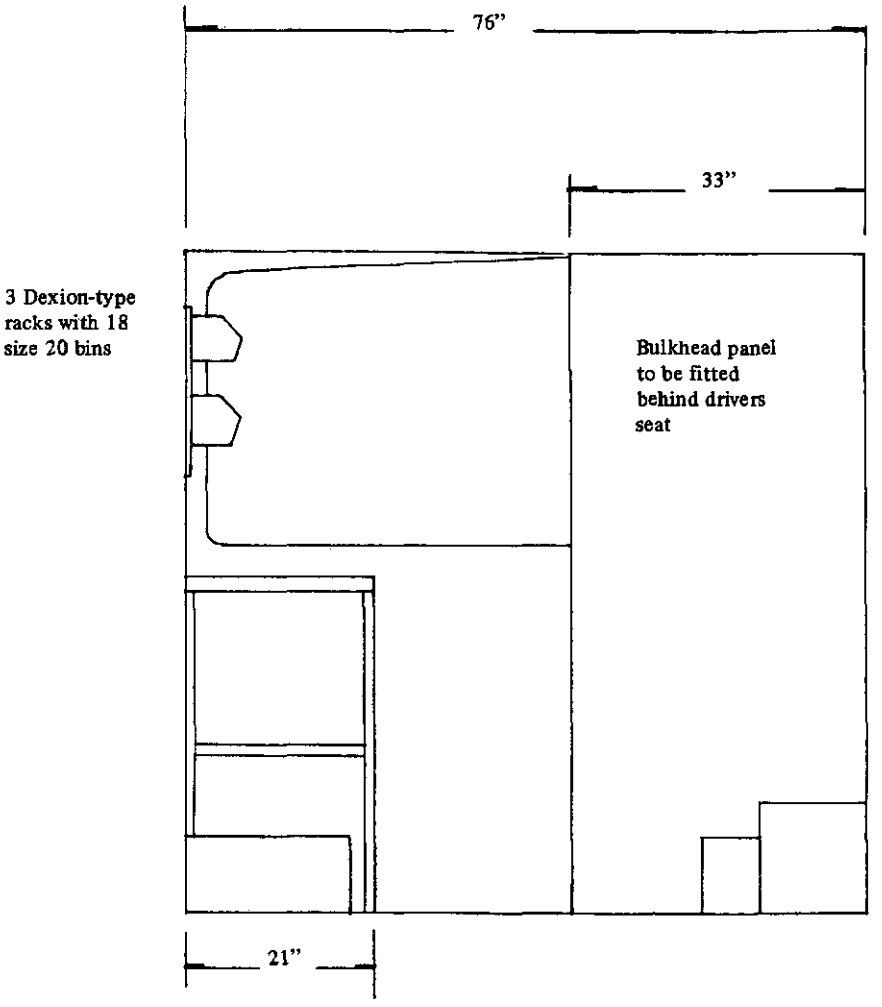
Source: REPCON (UK) Ltd.

Figure 9 (cont.)



Right hand side of vehicle

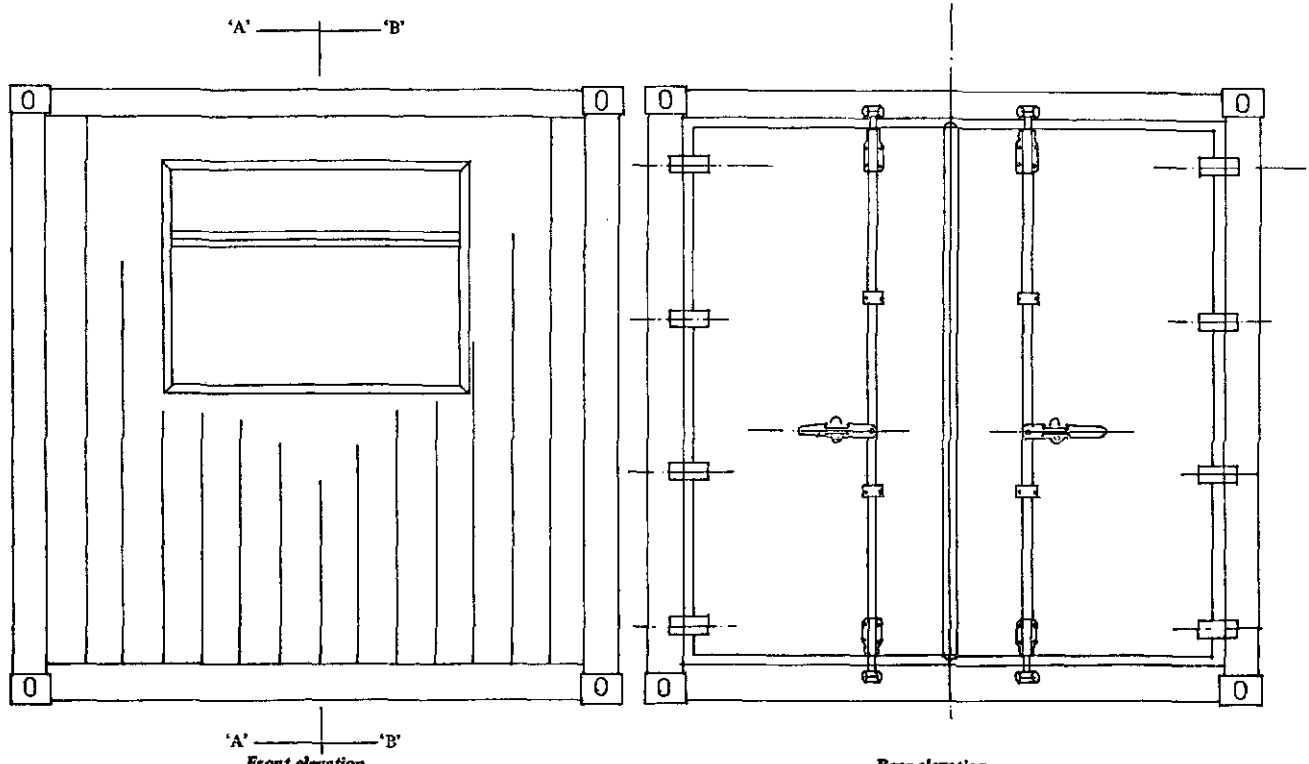
Figure 9 (Concluded)



Rear view

Notes: Stowage lockers, roof-bow racks and paint lockers fitted as required.
Electrical equipment: Primary source comes from generator wired through heavy-duty cable to a bank of 4 wall sockets as shown.
A yellow beacon is fitted to roof and wired through to vehicle dash.
In addition, 2 interior lights (fluorescent fittings) are located over the work bench and wired into vehicle electric circuit.

Figure 10
20-FOOT MOVEABLE CONTAINER REPAIR UNIT

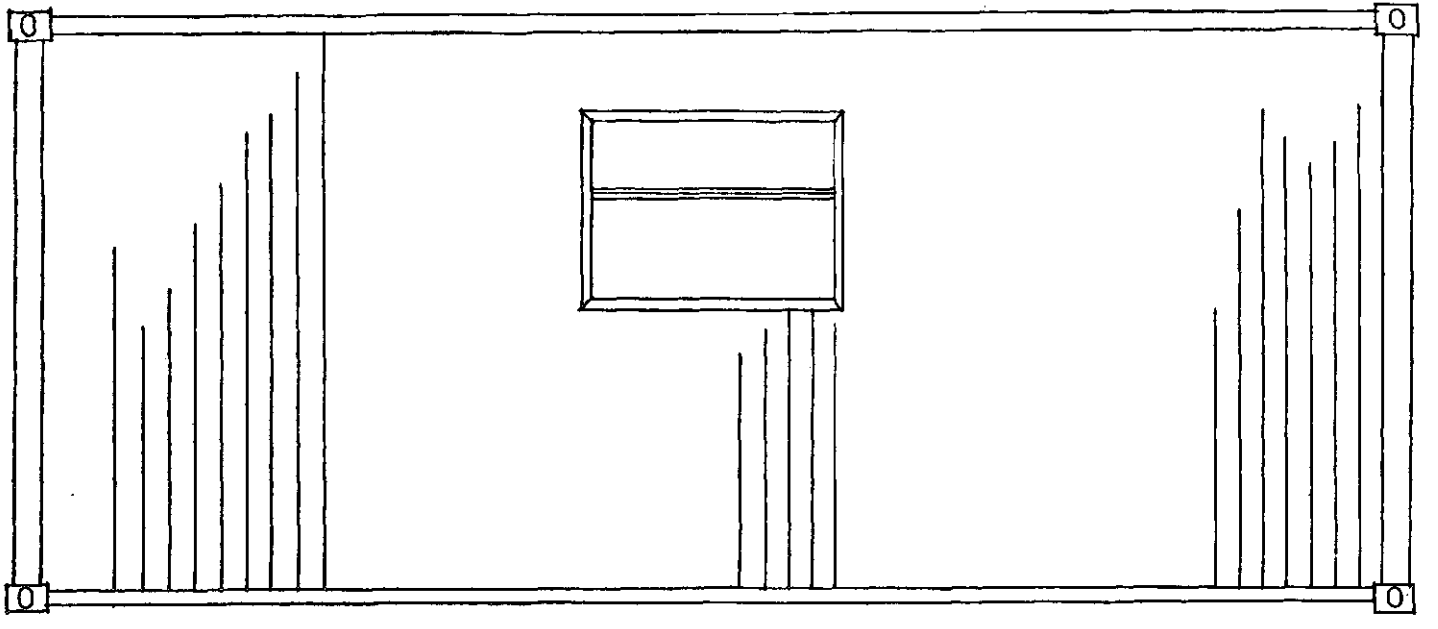


Front elevation

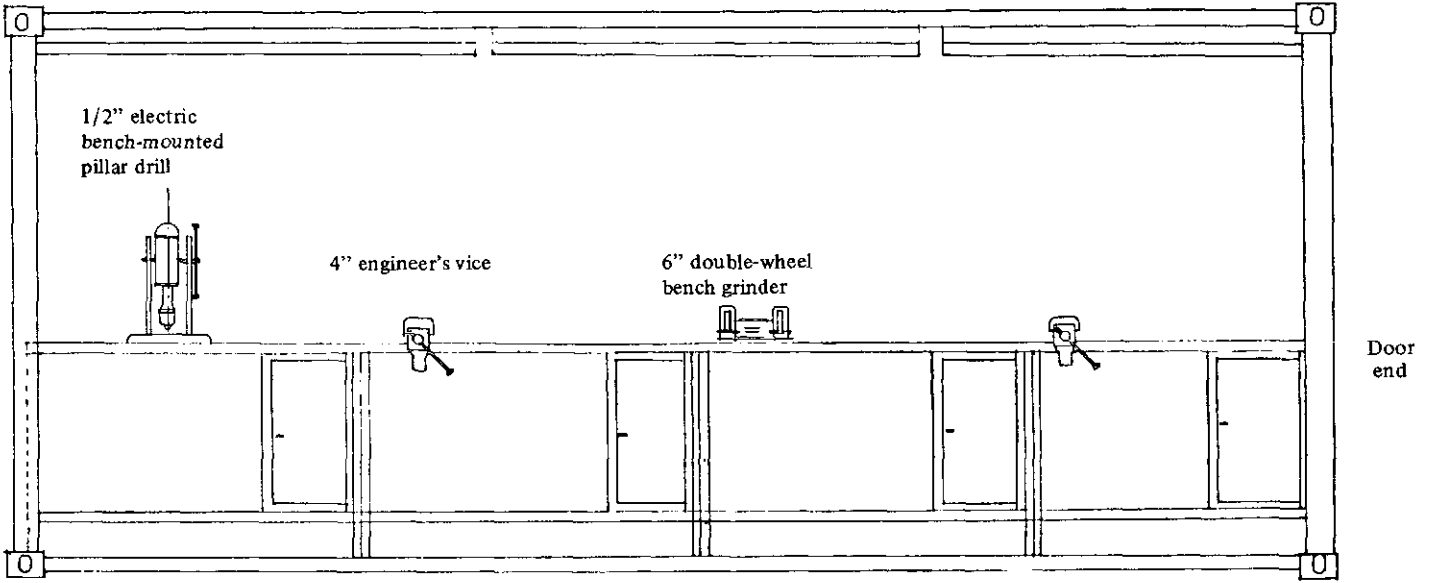
Rear elevation

Source: REPCON (UK) Ltd.

Figure 10 (cont.)

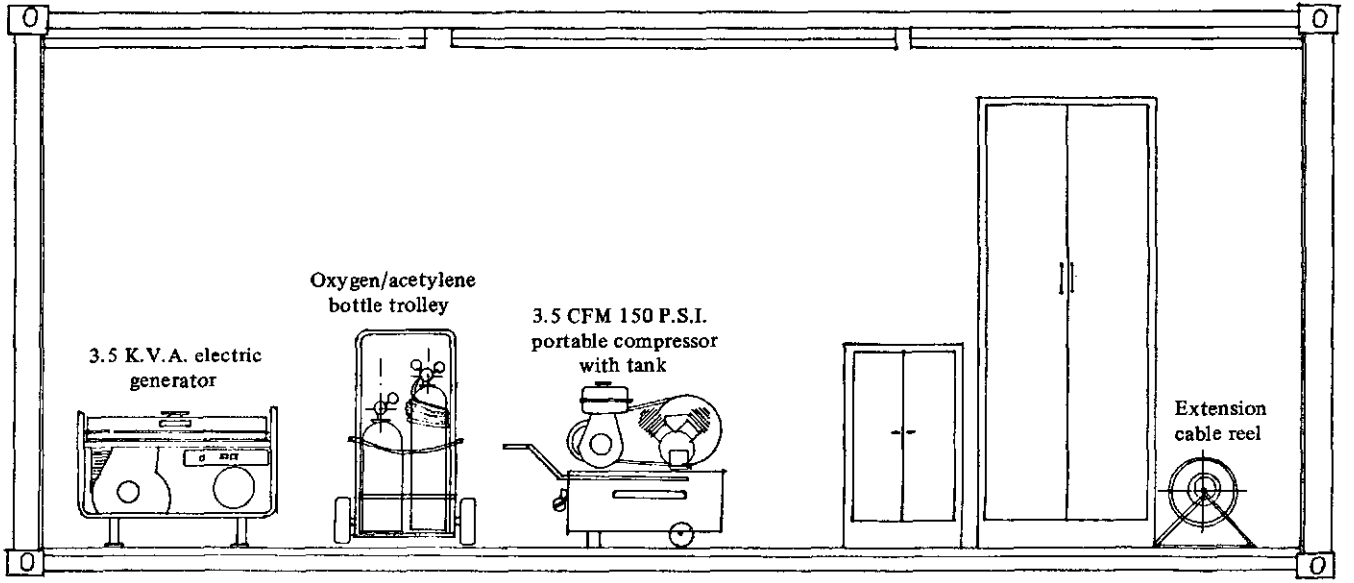


Side elevation


1/2" electric
bench-mounted
pillar drill
4" engineer's vice
6" double-wheel
bench grinder
Door
end

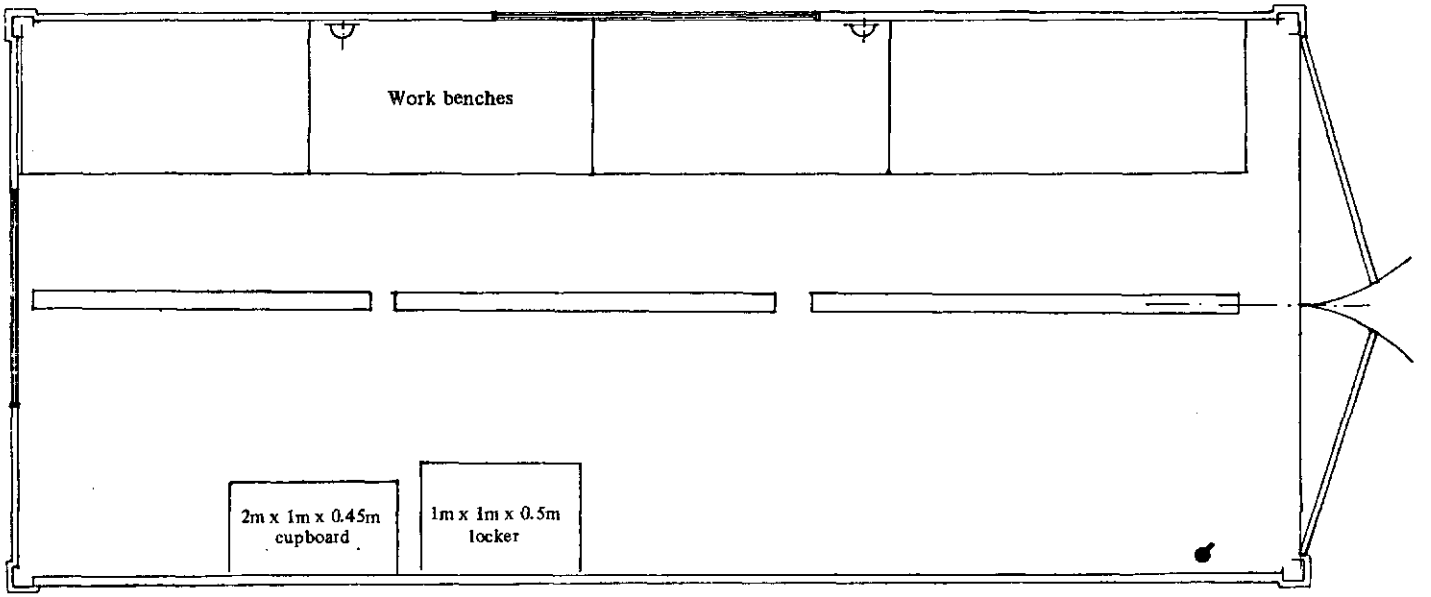
Section 'A' — 'A'

Figure 10 (cont.)



Section 'B' – 'B'

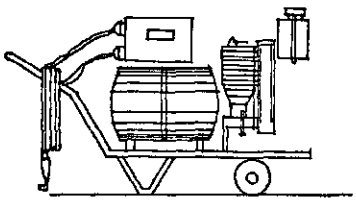
Figure 10 (cont.)



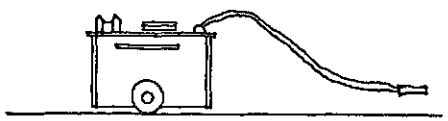
Plan

Figure 10 (Concluded)

Additional equipment not shown in container



220 amp. inert-gas welding set



Oxford stick welding set

Key:

13 amp. twin socket outlets

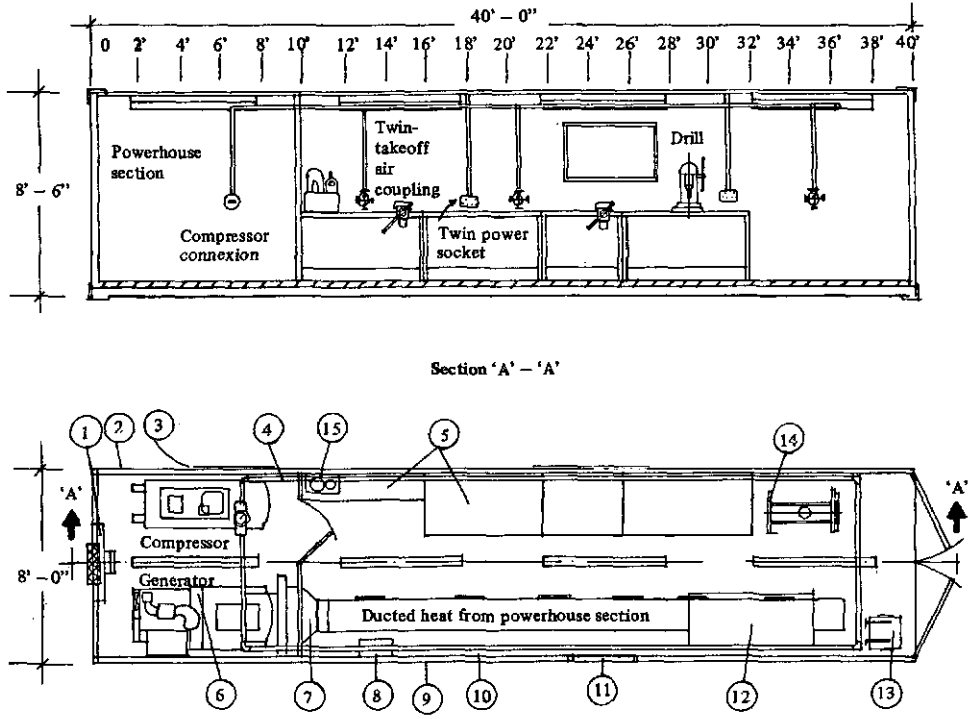
Light switch

Fluorescent light fitting

Note: Installed in a standard 20-foot freight container

Figure 11

40-FOOT MOVEABLE CONTAINER REPAIR UNIT (with powerhouse)



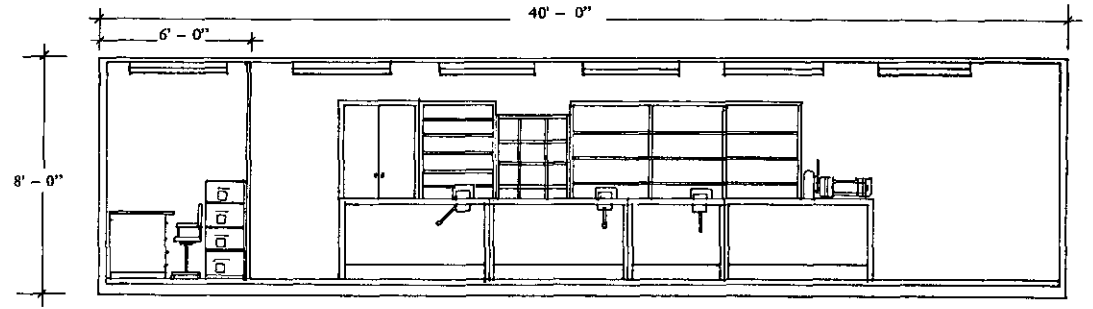
NO	PART	Quan.
15	Fuel injector test rig	1
14	Hydraulic press	1
13	Welding rectifier	1
12	Folding machine	1
11	Double-skin transparent perspex	2
10	Electrical trunking	1
9	6' fluorescent lights	4
8	Electrical distribution board	1
7	Extractor and filter	1
6	Power generator	1
5	Fitters benches	4
4	Air ring main	1
3	Bolt-on hatch cover	2
2	Air compressor	1
1	Ventilation intake fan	1

WORKSHOP COMPONENT LIST

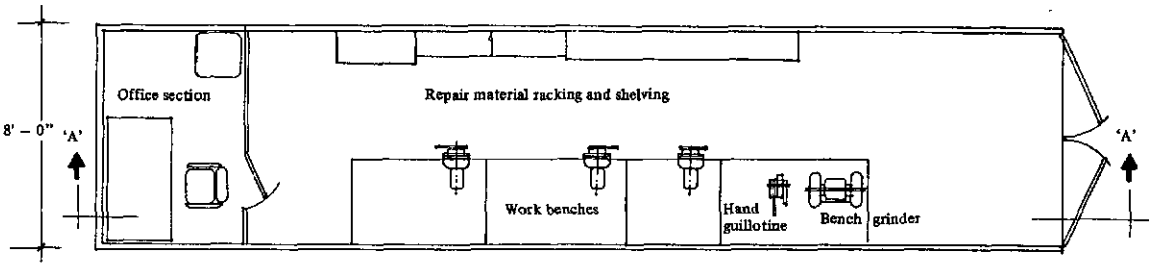
Note: Installed in a standard 40-foot freight container
Source: REPCON (UK) Ltd.

Figure 12

40-FOOT MOVEABLE CONTAINER REPAIR UNIT (with office)



Section 'A' – 'A'



Plan

Note: Installed in a standard 40-foot freight container
Source: REPCON (UK) Ltd.

ANNEX VII

MODULES FOR THE ESTABLISHMENT OF CONTAINER REPAIR ENTERPRISES

Prepared by

Bruno Sarti

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Container Comércio e Indústria S.A.

Rio de Janeiro, Brazil

INTRODUCTION

As the demand for container repair and maintenance services is expanding all over the world, port authorities, carriers, major exporters and others are giving serious consideration to the establishment of enterprises for this purpose. To properly evaluate the feasibility of establishing such enterprises, one must carefully match the service demand –i.e., type, quality and speed– with an appropriate level of investment in order to assure a profitable operation.

Bearing in mind that the establishment of such enterprises will occur in places where the climate, the availability of various factors of production, and the type of manpower are completely different, it was considered necessary to design an initial container repair and maintenence shop as a nucleus or matrix which might be expanded according to demand. As a result, it was decided that the most useful, simple and economic way to enter this new and growing industry would be to create a standard module for a self-supporting repair operation. This module, basic in design, can be utilized by any country or region with, obviously, adaptations for differences in the kind and availability of construction materials and facilities encountered locally for the fabrication of doors, windows, roofing, etc. Further, this module was designed as a complete and moveable unit so that it might be located and later relocated in response to changes in service demand patterns.

The principal idea behind the design of container repair modules was to combine in one place those factors –plant, equipment, spare parts and personnel skills– needed to start a sound operation and penetrate a certain market. Initially, it was decided that two modules would be designed, with throughputs of 30 and 100 TEU repaired per month, respectively, and all required installations, personnel skills, tools and spare parts for an operation of 45 days. According to our experience and as a practical rule, installations based upon these modules and operated by experienced management personnel can offer quality repair services without major difficulties.

If the demand for repair services increases, thereby calling for the expansion of shop facilities, these modules can be utilized as a reference point which can be enlarged depending on the extent of such demand. For example, if more space is needed for spare parts or offices or sanitary facilities, additional containers can be easily joined, horizontally or vertically as desired, to the existing installations. However, it must be emphasized that to increase the repair throughput from 30 to 90 TEU/month does not mean that we have to triple the original module. While some items of the module would have to be increased more than others or in different proportions, such as personnel, the basic module has sufficient flexibility for intensive utilization, at least in the short term. Nonetheless, for certain

items it would be imperative to increase capacity to meet the additional demand. These items might include the hiring of additional mechanics or welders and the purchase of more tools. The shop owner should therefore carefully evaluate the additional demand for container repair services and expand those items of the module which are needed to meet that demand.

As can be seen in figure 1, five to seven used containers which have been repaired and modified by shop personnel are employed to create the needed storage, sanitary and office space. It should be understood that these modules represent initial self-supporting shops which were designed with reference to prudent financial and economic standards. For this reason, only open areas for container repair operations were considered. Tables 1 and 2 list the equipment, tools, personnel and installations necessary for the two modules.

When choosing a site for a workshop module, it is important to consider the availability of the following essential public services: water supply, electricity, sewage, trash collection, telephone, telex and transportation. Consideration must also be given to site preparation, including requirements for leveling, compacting, paving and drainage. These factors in turn are related to the type of equipment – forklift trucks, cranes, etc.– that will be used for handling empty containers in the shop yard.

Table 1

OUTDOOR WORKSHOP MODULE FOR REPAIR
OF 30 CONTAINERS PER MONTH

WELDING EQUIPMENT

Arc Welding
One set, consisting of:
Portable coil transformer, cables, ground clamps and electrode holders
Approximate total value – US$ 2 310

Oxy-acetylene welding and cutting
One set, consisting of:
1 cylinder acetylene
2 cylinders oxygen
1 cylinder dolly
Related equipment
Approximate value – US$ 2 500

BASIC EQUIPMENT AND TOOLS

1 pointed "geologist" hammer for determining rust under paint
1 steel wire brush
1 hammer
1 mallet
2 steel chisels
1 mechanical metal-bending machine, 2.5m long

Table 1 *(continued 1)*

1 portable electric drill, 1/2"
2 portable electric grinders, 4 1/2" discs
1 jigsaw (wood)
1 hacksaw (steel)
1 wood chisel
1 manual "pop" rivet gun
1 "impact" rivet gun
1 five-ton hydraulic jack
8 sawhorses, 1.7m
2 wooden ladders, long
2 wooden ladders, short
1 portable spray-paint air compressor, 1/2 horsepower, 100 p.s.i.
1 stationary general-purpose air compressor, 5-6 horsepower, 165 p.s.i.
2 spray guns for painting
1 applicator for caulking compound
1 putty knife
1 screwdriver set (standard: 3x60mm, 6x38mm and 8x150mm; Phillips: 6x125mm)
1 set open-end wrenches (8: 1/4"–2")
1 "universal" cutting pliers (7")
1 impact rivet block
5 arc welding safety goggles
5 arc welding masks
5 welding aprons and gloves
1 stationary electric grinder – two discs 6" in diameter
5 safety helmets
5 earmuffs
1 engineer's vise (120mm x 106mm)
3 brooms, water hose and spouts for floor cleaning
3 tool chests for welders, each containing:
  hammer
  pointed "geologist" hammer for determining rust under paint
  "universal" cutting pliers (7")
  "electrical" cutting pliers (5")
  screwdriver set (standard: 3x60mm, 6x38mm and 8x150mm; Phillips: 6x125mm)
  pipe wrench (24"x2 1/2")
  open-end wrench set (8: 1/4"–2")
  steel wire brush
2 tool chests for helpers, each containing:
  mallet
  hammer
  steel chisel
  pointed "geologist" hammer for determining rust under paint
  tape measure
  lighter for gas welder

steel wire brush
needle kit for cleaning gas welder tips
chalk
putty knife
punch
set square
scribe (marker)
Approximate total value – US$ 6 405

CONTAINER HANDLING EQUIPMENT

one seven ton fork-lift truck (FLT), diesel powered with 5.55m of telescopic height for stacking containers three high and a manual top-lift spreader for handling 40-foot units.
approximate purchase price (new) US$ 40 000

one small (90 horsepower) diesel truck for container movements between the repair enterprise and users.

In order to maintain overall investment requirements for such equipment at a minimum, various alternatives must be thoroughly investigated. For example, as most stevedore and trucking companies have the above equipment, a joint venture might be formed with one or both to carry out container repairs. Further, such companies might have equipment which is underutilized or recently replaced and would consider its rental or sale.

MATERIALS (Supply for approximately 30 to 45 days)

Bolts with nuts and washers

150 3/8"x2"
150 3/8"x1 1/2"
150 5/16"x1 1/2"
300 1/4"x1 3/4"
500 1/4"x2", countersunk heads

Screws, self-threading

500 3/16"x1 5/8"
500 1/4"x1 3/4"

"Pop" rivets

500 1/4", long
500 3/16", short
500 3/16", medium
500 3/16", long

"Impact" rivets

500 3/16"x1/2", flat heads
500 1/4"x1", button heads

Table 1 *(continued 3)*

Caulking compound

2 boxes or cartridges for applicators

Metal profiles

30 2.40m x 30mm x50mm x 1.5mm
20 2.50m x 6" x 2" x 3/16" "L" profiles
20 2.50m x 2" x 1" x 3/16" "L" profiles
50 2.50m x 1/4" x 2" x 2" x 5/32" "C" profiles
40 2.50m x 5" x 2" x 2" x 5/32" "C" profiles
10 2.40m "⌐¬" or "I" profiles for aluminium roofs

Plates

8 3.00m x 1.22m x No. 16, steel
3 3.00m x 1.22m x 1/8", steel
2 3.00m x 1.22m x 3/16", steel
1 2.40m x 2mm x available length (6m or 10m roll), aluminium
2 2.40m x 1.20m x No. 19, steel, for door panels

Marine plywood

3 3.00m x 1.20m x 3mm sheets

Lumber

8 6.0m x 30cm x 3cm, pine

Drill bits (high-speed steel)

10 1/8"
10 3/6"
10 7/32"
10 1/4"
5 5/16"
5 3/8"
5 1/2"

Sandpaper discs

20 discs 4 1/2"

Nails and screws

200 "17 x 17" door stiffeners
200 self-taping screws

Paint (naval grade)

8 gallons gray
10 gallons blue
10 gallons of primer
10 gallons black underseal
50 litres paint thinner
approximate total value, all materials US$ 10 100

Table 1 *(concluded)*

PERSONNEL

1 foreman
1 welder
1 metal worker
2 helpers
1 clerk
approximate total monthly cost – US$ 1 950

Work clothes

trousers, shirts and boots for all personnel
approximate total value – US$ 340

STRUCTURES

five used containers, repaired and modified for office, warehouse, depot, dining hall and dressing unit: Approximate total cost – US$ 4 500
water and sanitary installations: estimated cost – US$ 2 400
electrical installations: estimated cost – US$ 1 500
Note: The costs of furniture, air conditioning, windows, doors, stairs, supports, etc., are not included, nor are rental charges for the property on which the workshop module is set up.

Table 2

OUTDOOR WORKSHOP MODULE FOR REPAIR OF 100 CONTAINERS PER MONTH

WELDING EQUIPMENT

Inert-gas welding (MIG)

one set, consisting of:
1 power source
1 wire feeder
1 MIG torch
1 pressure regulator for carbonic acid gas
1 pressure regulator for argon
1 feeder roller
1 outlet guide spout
1 guide insert
1 conduit
1 supporting conduit
1 gas hose
1 pressure roller
20 contact tubes for aluminium
10 contact tubes for steel

Table 2 *(continued 1)*

1 internal conduit
1 cylinder carrying device, 45 kg MIG 0.80m wire for steel
1 cylinder carrying device, 15 kg MIG 0.76m wire for aluminium
4 cylinders oxygen
4 cylinders acetylene
approximate total value – US$ 6 540

Arc welding

five sets, each consisting of:
portable coil transformer, cables, ground clamps and electrode holders
approximate total value – US$ 11 300

Oxy-acetylene welding and cutting

four sets, each consisting of:
1 cylinder of acetylene
2 cylinders of oxygen
welding torches
cutting torches
extension for welding
cylinder dolly
green hose for oxygen
red hose for acetylene
pressure regulator for oxygen
pressure regulator for acetylene
retention valves for oxygen and acetylene
needle kit for cleaning welding tips
lighter for gas welder
hoops for holding hoses together
approximate total value – US$ 9 620

EQUIPMENT AND TOOLS

Basic

3 electric drills, 1/2"
3 Jigsaws (wood)
4 hand-held electric wire wheels with discs (4 1/2" and 7")
5 manual "pop" rivet guns
1 portable spray-paint air compressor, 1/2 horsepower, 100 p.s.i.
4 spray guns for paint
1 electric screwdriver (2" screws)
1 hand-held electric metal shears
3 five-ton hydraulic jacks
1 ten-ton gear jack for chassis
2 "impact" rivet guns
1 mechanical metal bending machine, 2.5m long
5 tool chests for welders, each containing:
hammer

Table 2 *(continued 2)*

pointed "geologist" hammer for determining rust under paint
"universal" cutting pliers (7")
"electrical" cutting pliers (5")
screwdriver set (standard: 3x60mm, 6x38mm and 8x150; Phillips: 6x125mm)
pipe wrench (24" x 2 1/2")
open-end wrench set (8:1/4"–2")
steel wire brush

4 tool chests for helpers, each containing:
mallet
hammer
steel chisel
pointed "geologist" hammer for determining rust under paint
tape measure
lighter for gas welder
steel wire brush
needle kit for cleaning gas welder tips
chalk
putty knife
punch
set square
scribe (marker)

approximate total value – US$ 10 580

General

1 pointed "geologist" hammer for determining rust under paint
1 steel wire brush
1 hammer
1 mallet
2 steel chisels
1 hacksaw (steel)
2 wood chisels
8 sawhorses, 1.7m high
8 wooden ladders, long
4 wooden ladders, short
3 applicators for caulking compound
1 putty knife
1 screwdriver set (standard: 3x60mm, 6x38mm and 8x150mm; Phillips: 6x125mm)
1 open-end wrench set (8:1/4"–2")
1 "universal" cutting pliers (7")
1 "impact" rivet block
5 arc welding safety goggles
5 arc welding masks
10 welding aprons and gloves
11 safety helmets

10 earmuffs
2 vises (151mm x 155mm)
approximate total value – US$ 920

CONTAINER HANDLING EQUIPMENT

one seven-ton fork-lift truck (FLT), diesel powered with 5.55m of telescopic height for stacking containers three high and a manual top-lift spreader for handling 40-foot units.
approximate purchase price (new) US$ 40 000

one small (90 horsepower) diesel truck for container movements between the repair enterprise and users.

In order to maintain overall investment requirements for such equipment at a minimum, various alternatives must be thoroughly investigated. For example, as most stevedore and trucking companies have the above equipment, a joint venture might be formed with one or both to carry out container repairs. Further, such companies might have equipment which is underutilized or recently replaced and would consider its rental or sale.

MATERIALS (Supply for approximately 45 days)

Bolts with nuts and washers
300 3/8" x 2"
300 3/8" x 1 1/2"
300 5/16" x 1 1/2"
1000 1/4" x 1 3/4"
1500 1/4" x 2", countersunk heads

Screws, self-threading
2000 3/16" x 1 5/8"
2000 1/4" x 1 3/4"

"Pop" rivets
2000 1/4", long
2000 3/16", short
2000 3/16", medium
2000 3/16", long

"Impact" rivets
2000 1/16" x 1/2", flat heads
1000 1/4" x 1", button heads

Caulking compound
2 boxes of cartridges for applicators

Table 2 *(continued 4)*

Metal profiles

50 2.40m x 30mm x 50mm x 1.5mm
50 2.50m x 6" x 2" x 3/16" "L" profiles
50 2.50m x 2" x 1" x 3/16" "L" profiles
60 2.50m x 4 1/2" x 2" x 2" x 5/32" "C" profiles
50 2.50m x 5" x 2" x 2" x 5/32" "C" profiles
30 2.40m " ⌊‾‾⌋ " or "I" profiles for aluminium roofs
25 2.50m x 2" x 1" x 3/16" "L" profiles for door gutters, steel
2 6m aluminium bars for door gutters in aluminium containers
4 Tubes for 6m door-locking rods, 1 1/2" diameter
10 2.40m x 30mm x 30mm x 60mm x 4mm aluminium side columns

Plates

25 3.00m x 1.22m x No. 16, steel
5 3.00m x 1.22m x 1/8", steel
5 3.00m x 1.22m x 3/16", steel
2 2.40m x 2mm x available length (6m or 10m roll), aluminium
4 2.40m x 1.20m x No. 19, steel, for door panels

Marine plywood

6 3.00m x 1.20m x 3mm sheets

Lumber

24 6.0m x 30cm x 3 cm, pine

Drill bits (high speed steel)

10 1/8"
10 3/16"
10 7/32"
10 1/4"
5 5/16"
5 3/8"
5 1/2"

Sandpaper discs

40 discs 4 1/2"
40 discs 7"

Nails

400 "17 x 17" door stiffeners
400 self-taping screws

Paint (naval grade)

16 gallons gray
20 gallons blue
12 gallons black underseal

Table 2 *(concluded)*

20 gallons primer
50 litres paint thinner
Approximate total value, all materials – US$ 14 600

PERSONNEL

1 chief of shop
1 foreman (also in charge of inspection and complete equipment interchange receipts)
1 welder
4 metal workers
4 helpers
1 painter/helper
1 clerk
approximate total monthly cost – US$ 4 000

Work clothes

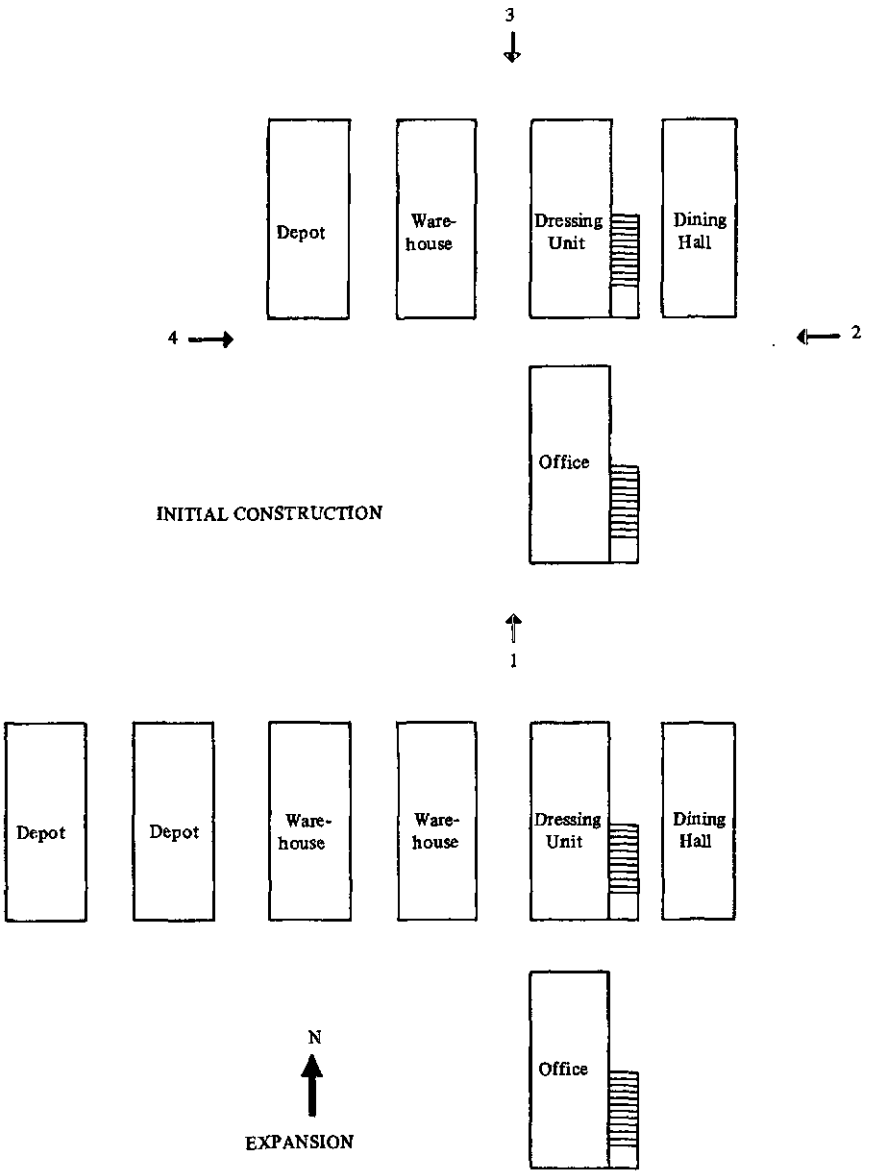
Trousers, shirts and boots for all personnel
approximate total value – US$ 2 000

STRUCTURES

Five used containers, repaired, for office, warehouse, depot, dinning hall and dressing unit. Total cost – US$ 4 500
Water and sanitary installations. Estimated cost – US$ 2 400
Electrical installations. Estimated cost – US$ 1 500
(Note that costs of furniture, air conditioning, windows, doors, stairs, supports, etc., are not included, nor are rental charges for the property on which the workshop module is set up.)

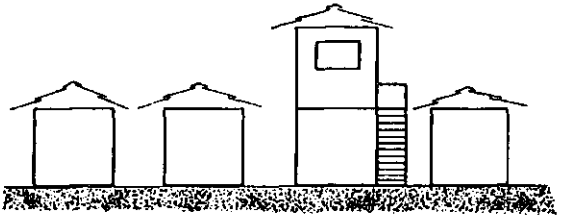
Figure 1

ERECTION OF OUTDOOR CONTAINER WORKSHOP BY MODULES

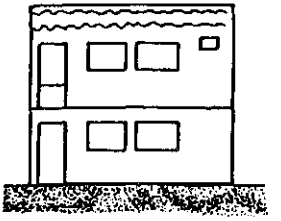


Source: Container Comércio e Indústria S.A.

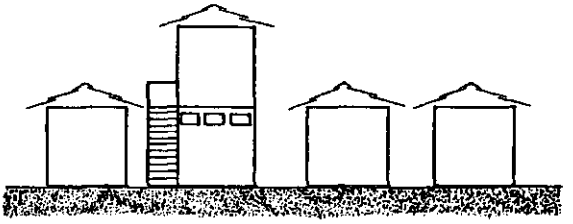
Figure 1 (cont.)



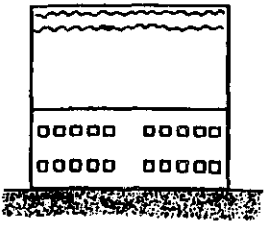
Elevation 1



Elevation 2



Elevation 3



Elevation 4

ANNEX VIII

CONTAINER MARKINGS

Prepared by

Richard Plath

Vice-President

Selecto-Flash, Incorporated

West Orange, New Jersey, U.S.A.

INTRODUCTION

The use of external markings on mobile equipment such as vehicles, containers, airplanes, construction plants, etc., has increased dramatically over the last 25 years for advertising, legal and public relations purposes. To meet this demand, a whole new industry based on pressure-sensitive films has grown up, offering high performance products. The self-adhesive film is, as a result, occupying an increasingly dominant part of the market at the expense of earlier methods such as hand-painted lettering, stencils and transfers.

CRITERIA FOR SELECTING A MARKING SYSTEM

Containers encounter by far the most rigorous weather conditions of any type of transport equipment. They may travel from areas such as Saudi Arabia, with air temperatures as high as 130°F, to areas such as Alaska, where temperatures may be as low as -50°F. Extremes in temperatures, ultraviolet rays, salt spray and moisture are the major reasons for aging and deterioration of both coatings and markings on sea containers. For this reason many inks and base materials have been investigated through the past 18 years to determine which of these materials would be most successful.

In selection of a marking system, potential users should consult with their technical departments to establish a realistic life cycle for the container between refurbishments. It is important to note that the development of CORTEN steel and new and improved exterior coating systems have greatly extended the refurbishment cycle. Most container owners today hope to achieve a seven-year cycle before refurbishing their steel units. It is of the utmost importance that the marking system chosen should perform for that period as a minimum without serious discoloration, and that it should not raise, crack, peel or delaminate within the warranted period. Not only are the markings on a container extremely important for the identification of the unit, but also for ensuring observance of the maximum load capacity and for safety in handling. The next important area of consideration for the buyer should be the surface to which the marking will be applied. The marking supplier should be completely familiar with the various coating systems used on steel containers, and should have tested them to ensure that they are compatible with his films and adhesives. For example, many coating systems contain exotic solvents and additives such as plasticizers which could have an effect on the marking system in the long term.

The marking supplier should be able to direct the buyer as to the best adhesive systems to use on steel, aluminium, fiber-glass and other container construction materials. It is also important to note that containers which have never

been refurbished generally have a smoother surface than those that have been sandblasted during refurbishment. The rougher surface on the latter creates a need for a flow-type adhesive to fill in the hills and valleys left by the blasting.

It is also important that the marking supplier be familiar with the plant conditions under which the marking is to be applied. As an example, many container manufacturers in the colder regions of the world operate at low ambient temperatures. Some factories have inside air temperatures close to 0°C, and this creates potential problems in the preparation of the steel for priming and coating and also affects the application of markings. In this situation the supplier should provide a cold weather-type adhesive. In warmer climates, where the inside temperature of a container factory may be considerably higher, the marking supplier should recommend a type of adhesive especially adapted to such conditions.

The marking supplier should offer a minimum warranty period on his product that coincides with the refurbishment cycle of the container owner. If for any reason the markings should fail during this period, the supplier should be expected to determine the cause of the failure and recommend a satisfactory solution so that markings are replaced without cost to the container owner. However, it should be noted that an imbalance in coating additives, improper drying of coatings at the time of manufacture, and improper application are in almost all cases the reason for marking failures. In these latter cases, the container owner should look to the manufacturer for replacement.

TYPES OF MARKINGS

Container markings may be classified as follows:

(a) Transfers, and

(b) Pressure-sensitive films.

Transfers are a type of marking which consists of a film of paint and/or ink carried on a paper backing or carrier from which it is separated by a water-soluble solution. The sheet is generally soaked in water or a solvent which activates the release agent and separates the transfer from the paper carrier. The marking is usually slid off the paper carrier onto the container surface and an adhesive system activated by the same water and/or solvent cures and anchors the paint or ink transfer on that surface.

Pressure sensitive markings are a self-adhesive film or plastic. The most common used plastic, vinyl, has a pressure-sensitive adhesive which is protected by backing paper. To apply this type of marking no water or solvent is required. One simply removes the backing paper, affixes the marking to the container surface and smooths out the marking by use of a plastic squeegee.

PRODUCTION METHODS

The method of producing both transfers and pressure-sensitive markings is silk screen printing. Silk screening enables the manufacturer to deposit a heavy layer of ink or paint onto the marking substrate to achieve durability on exterior surfaces. Any other printing method leaves a very thin layer of ink which rapidly deteriorates when exposed to the weather.

In the case of transfers, the marking release agent and adhesive are screened onto the paper substrate. Normally, it is necessary to screen a white coating underneath darker pigments as white reflects light rather than absorbs it. The use of darker pigments will lead to the rapid deterioration of the marking when exposed to the weather. After the colours are screened, a final clear coat is put over the transfer and the marking is ready for application. On the other hand, pressure-sensitive decals utilize a base material or plastic which is normally white and/or clear. As a result, the desired colours are simply screened onto the substrate and a final clear protection coat is added to assure durability of exterior surfaces.

ADVANTAGES AND DISADVANTAGES OF TRANSFER MARKINGS

The only relative advantage of a transfer is the fact that irregular design shapes can be silk screened onto the transfer substrate of the paper carrier. Use of a die for cutting this irregular shape is not necessary. However, the disadvantages are quite numerous:

1. A transfer is extremely difficult to apply to any surface.
2. Application of a transfer in cold weather is virtually impossible unless a solvent similar to anti-freeze is used to prevent freezing.
3. The use of a solvent and/or water as a release agent requires a long drying cycle. Normally, overnight drying is required.
4. The durability of the transfer is not as good as that of a pressure-sensitive system. The durability of transfers is normally 3-5 years at the most, and they will not last any longer than a relatively inexpensive paint system.

ADVANTAGES AND DISADVANTAGES OF PRESSURE-SENSITIVE MARKINGS

The only disadvantage of the pressure-sensitive system is that its cost is slightly higher than that of a transfer. This cost difference is easily overcome, however, when we consider all the major advantages.

1. A pressure-sensitive marking can be applied in cooler weather with the assistance of some external form of heat such as a heat gun and/or by activating the adhesive with alcohol, which makes it a little stickier in cold weather.
2. The pressure-sensitive vinyl can be applied over irregular surfaces, including corrugations, rivets and weld seams. This system conforms easily to irregular surfaces whereas a transfer would have to be cut around the irregular surface and paint applied to make up for the void areas.

A pressure-sensitive marking manufactured from quality inks and clearcoated for protection has an average durability of 7-9 years. Nonetheless, many Selecto-Flash markings have been in service for over 12 years with some of the major container leasing and shipping companies.

The overnight drying required for transfers is completely unnecessary with pressure-sensitive markings. Once the marking is applied to the substrate it is permanently affixed. There is a cure period of approximately 72 hours in which

the adhesive bond builds up to about a 6-7½ pound peel strength. This cure period is considered necessary in order to permit applicators to reposition markings, if necessary. The initial contact strength of the marking is normally about 3 pounds, which is considered sufficient for a permanent anchorage to the container surface, but this does give the applicator the opportunity to reposition if necessary.

The relative ease with which a pressure-sensitive marking can be applied is a vey favourable point compared with water or solvent-based transfers. It has been noted by some container manufacturers who utilize transfers that the waste factor, at the time of application is 5-10% whereas in the case of pressure-sensitive markings the waste factor is only 0-1/2%. This is primarily due to the fact that pressure-sensitive markings can be removed and repositioned during the application procedure whereas once a water or solvent-activated marking is put into place, it is extremely difficult to effect such removal without puncturing the thin film of paint and/or ink, thereby rendering the transfer useless. As a result, transfers create many problems for the applicator and there has to be a supply of spares on hand.

APPLICATION

The application of both pressure-sensitive markings and solvent or water-based transfers requires the same surface preparation. It is imperative that the surface upon which the marking is to be applied should be clean and free of oil, grease, or any other contaminates. It should be understood that in the production of steel containers, paint overspray, which is often present in the air, settles on the sides and roof of a container and must be removed prior to application of either type of marking. The principal requirement for the application of markings is cleanliness.

The application of pressure-sensitive markings requires very little training and skill. However, it should be noted that different shapes and sizes of markings normally require different skills. It is for this reason that from time to time it has been found necessary to give some guidance and assistance to applicators at the various container plants throughout the world. Another reason for visiting container plants is that the turn-over of labour sometimes necessitates the training of new people. However, training for the application of pressure-sensitive adhesive markings is normally done through a technical bulletin issued by the marking manufacturer.

By way of comparison, the application of transfers requires skills which can only be obtained through constant practice. From our experience we have noted that the only people who are consistently successful in applying transfers are the Japanese. As a marking system in a factory which has a normal labour turn-over rate, transfers may be very impractical.

It is worth noting that certain container shipping companies previously used another marking system. This was the rigid sign system, which normally utilized aluminium signs. This system is highly impractical, however, as maintenance costs are extremely high since the rigid system is very prone to puncture and damage in dock areas, particularly when a container is being handled on and off the ship.

TEMPERATURE

The temperature at which markings should be applied vary for pressure-sensitive adhesives. Some of the adhesive manufactured by companies such as 3M require a minimum application temperature of 60°F, while others, such as MACtac adhesives, are warranted at 40°F, and MACtac films can even be applied at temperatures as low as 32°F. Nonetheless, it should be understood that below 32°F ice crystals are always present in the pores of the steel and/or aluminium. In applying decals at 32°F or slightly below, it is suggested that the surface first be wiped down with alcohol to eliminate these ice crystals. Immediately the alcohol has evaporated, the surface is ready for application.

FILM COMPOSITION

In the manufacture of vinyl films a number of chemical ingredients must be blended together to achieve the desired properties. It is this blend of different types and amounts of chemicals that imparts such useful characteristics as flexibility, conformability and strength to the film.

PVC resin is the basis or backbone of the film, but additional chemicals must be added to the resin to produce a film with the desired properties. Most vinyl films contain such materials as stabilizers for protection against degradation from heat, light and other chemicals. Processing aids or lubricants may also be used to assist in the manufacturing process. Filler and extender pigments provide opacity and help reduce the total cost of the product. Various colour additives may be used to achieve the wide variety of colours currently available.

Although all of the aforementioned materials may be used to modify the basic PVC resin, it is the family of chemicals known as plasticizers that frequently exert the greatest influence on the physical properties of the vinyl film. The type and amount of plasticizer dictates the degree of softening action that will occur in the film. This in turn affects the flexibility, strength and stability of the final product.

VINYL CLASSES OF FLEXIBILITY

Rigid vinyls are products which contain no plasticizers and are consequently quite hard and brittle. This characteristic is a limiting factor in the usefulness of this grade of vinyl as a thin film.

Conversely, soft vinyl contains a considerable quantity of plasticizer, resulting in excellent flexibility, conformability, drape or hang. This class of vinyl film is perhaps the most widely used.

Semi-rigid vinyl lies somewhere between rigid and soft. Although a sufficient amount of plasticizer is used to prevent brittleness, its level is kept relatively low so as to prevent the plasticizer from interfering with properties such as ease of printing, dimensional stability, and adhesive compatibility.

It should be understood that there are many levels of plasticizer usage and corresponding flexibility within the two broad classes of soft and semi-rigid vinyl.

PLASTICIZER TYPES

Along with having the option of using varying quantities of plasticizer to achieve the desired flexibility, this characteristic as well as others, can be greatly influenced by the type of plasticizer selected.

In general, there are two broad categories of plasticizers –"monomeric" and "polymeric". The former is a chemical whose molecules are rather small and quite mobile. As a consequence, this type of plasticizer migrates easily within the vinyl film and often comes to the surface or volatilizes. In extreme cases, where large amounts are used, its migration to the surface imparts a slippery or oily feel to the film, and this concentration on the film surface can inhibit the adhesion of paints, inks or adhesives.

Polymeric plasticizers are chemicals that have been polymerized (individual molecules chemically bonded together to form longer and often branched chains) and are physically large in size. This larger size and more complex configuration limits their mobility. As a result, there is less potential plasticizer migration, volatilization and compatibility problems.

Why aren't polymeric plasticizers used exclusively in vinyl films? The major reason is that they are more costly and sometimes less efficient. It is, therefore a delicate balance between cost and desired properties which must be considered in satisfying the total product requirement.

MANUFACTURING PROCESSES

Another important factor to be considered in product selection is the type of manufacturing process used to produce the film. There are two basic methods of manufacturing –"calendering" and "casting". These methods have inherent advantages and disadvantages which directly affect the final cost and performance of the films.

In its simplest form, the calendering process is a procedure in which the vinyl formulation is heated and passed between hot metal rolls. These rolls squeeze the vinyl into a film of the desired thickness and impart the required texture (gloss or matte) to the surface. This is a very cost-effective process for manufacturing very large quantities of film having an identical formula, thickness, surface texture, etc. However, it is both costly and impractical for small quantities.

The casting process consists of applying a uniform coating of a liquid solution or suspension of the vinyl formulation onto a casting sheet having the desired surface texture. The solvent is then evaporated leaving a uniform, stress-free film of vinyl. This manufacturing technique is generally more expensive than calendering, due to the fact that expensive solvents must be used and production speeds are much slower. However, this higher cost is offset by the flexibility to produce small quantities of film which possess other inherent advantages that will be discussed later.

Another difference between these two processes is that vinyl formulations for calendering normally require high levels of plasticizer, lubricants or other processing aids. When these plasticizers are monomeric, which is generally the case, the compatibility and dimensional stability of the film are decreased. In

contrast, the amount and type of plasticizer used in vynil formulations for the casting process is not a function of the manufacturing process. As a result, the selection of a vinyl formulation for casting can be made solely in the light of the requirements for the intended application.

A very important distinction between calendering and casting is that a tremendous amount of stress is put into the film as the vinyl formulation is squeezed and pulled through the hot calender rolls. At some future date, when conditions are right, the built-in stress will relieve itself, resulting in a dimensional change (shrinkage) in the film. The casting process, however, deposits an unstressed solution of vinyl onto a casting sheet and the resulting cast film has essentially no stress to relieve. Hence, cast films are very stable dimensionally.

The film thickness range and control varies with each process. Calendering has the capability of producing thick films, since there is no solvent to evaporate. However, it becomes increasingly difficult to produce and control thicknesses in the .002"–.003" range. On the other hand, the casting process is well suited to the thinner gage films and can produce them with exacting uniformity. Because of the need to evaporate solvent from casting formulations, the degree of difficulty and cost increases as the film thickness increases. Since the intended application normally dictates the thickness of the film required, the choice of manufacturing method is thus often predetermined. For those ranges of thickness that can be produced by both processes, one must consider carefully the other factors which were previously mentioned.

SUMMARY

After a number of years in the manufacture of external markings, we would recommend to all buyers of markings that they should observe the following rules if they want a high quality, value for money, long life marking:

1. Specify a cast vinyl marking. This will overcome almost all likely application and adhesion problems.
2. Specify that any inks used are vinyl or acrylic based, overprinted with a protective clear covering. This is essential, particularly if long life is desired.
3. Ask for the required life warranty in writing from the marking manufacturer, the film supplier and the ink supplier.

HOW TO SELECT A SUPPLIER OF MARKINGS

The selection of a marking supplier is as important as the markings themselves. The container industry is a worldwide industry, and once they have been manufactured containers travel to the four corners of the world. If there is a problem with the marking system, the supplier should (1) honour his product warranties and (2) provide service to determine the cause of problems anywhere in the world. In order to do this it is obvious that the supplier should be a worldwide company with representation in all the major shipping areas.

Second, the supplier should be a company large enough to financially back-up its warranty commitments, with capacity to produce container markings in sufficient quantities to keep its representatives anywhere in the world supplied.

Third, the supplier of markings should have in-house testing equipment. Certain manufacturers often make broad warranty statements which they cannot support by testing data. It is therefore important that the marking supplier selected is a company which has in-house testing procedures and knows the durability of its products.

Fourth, the availability of technical assistance is a very important factor. As mentioned earlier, special application techniques are often required for certain types of markings. Moreover, technical assistance should include, if necessary, Customs clearance and transport from seaport area or airport to the container repair facility.

Technical assistance also requires the marking supplier to have knowledge of the paints and coatings systems used on containers, since markings are applied to container coatings and not to base metals, and unless the supplier has a good knowledge of the coatings the marking system and adhesive may fail.

MARKING REQUIREMENTS

The marking requirements for containers can be divided as follows:

1. *Mandatory markings*

These represent the legal requirements if containers comply with ISO and UIC standards. If we take a standard 20ft x 8ft x 8ft 6ins dry freight container, then the minimum mandatory markings requirements is:

Total number of markings per container	
6	Owner's Identification Code, followed by a six figure serial number of the owner's choice, followed by a check digit in a box, e.g., CTIU 000000 (0). These are usually 100mm high digits but some operators use 150mm high and other sizes. They are positioned one per side of container plus two on the roof. The check digit is calculated using a formula provided by ISO.
3	Country of Origin and Container Type consists of three letters (it is possible that only two will be necessary soon) indicating the country of the owners' registered office, e.g., USA – United States of America, GBX – United Kingdom, CHX – Switzerland, followed by four numbers indicating the type of container. For example, 2200 is a standard 20ft x 8ft x 8ft 6ins container: the first 2 indicates that the container is 20ft in length, the second 2 that it is 8ft 6ins tall, and the two 0s that the container has no extras. If small ventilation openings were put on each side of container then the number would be 2210.

1 Gross and Tare Weight Specifications. The minimum requirement is for the Gross Weight and the Tare Weight to be shown in pounds and the metric equivalent.

e.g. GROSS WEIGHT 44800 lbs
20320 kgs
TARE WEIGHT 39290 lbs
18000 kgs

The minimum height requirement of each letter or number is 50mm. Many operators also show the Payload (or Net Capacity) and Cubic Capacity.

2 UIC Marking. This standard marking, used throughout the world, consists of an 'IC', printed each letter in a separate box side by side, with a number beneath in a larger box. This number is decided basically by the country of manufacture of the container, providing that country is listed. For example, the British Railways code number is 70, Swedish State Railways is 74, and French National Railways is 87.

2 Height marking. If a container is over 8ft high then a marking must show the container height. For 8ft 6ins this again is a standard marking used throughout the world, consisting of a black printed 2-6 above an 8 1/2 with a yellow background on all containers of this size.

NOTE: It is also possible that the height for a standard container not requiring a marking may be raised to 8ft 6ins, thus eliminating the two 2.6/8 1/2 markings.

The above are the minimum requirements, but naturally, as in any other business, extra markings are used for many reasons,e.g., if the containers are built to a higher specification and therefore can carry more weight in certain countries. Examples of these extra markings are as follows:

(1) A USA Department of Labour marking is used on 20 ft containers to show that they can carry increased payload in the USA.

(2) When containers have empty lift fork lift pockets fitted, a marking is usually applied each side reading 'EMPTY LIFT ONLY' or similar.

(3) If a ladder is fixed to any of the sides or even any equipment to make possible easy climbing onto the roof of the container is fitted, then a warning symbol is used for overhead electrical danger.

There are many more but the ones listed make up the majority.

2. Company name and address

Most container owners also take the opportunity to advertise their name on their containers. This can take the form of the complete name on two or three sides or a symbol representing the company.

A marking showing the address (usually just the company name, town or city and country) is applied to one of the doors.

ANNEX IX

REFURBISHMENT AND REPAIR OF CONTAINERS SURFACE PREPARATION AND PAINTING

Prepared by

HEMPEL'S INDUSTRIAL COATINGS

(a Division of Hempel's Marine Paints)

Copenhagen, Denmark

TABLE OF CONTENTS

SURFACE PREPARATION AND PAINTING

1. Introduction and objective of the paper

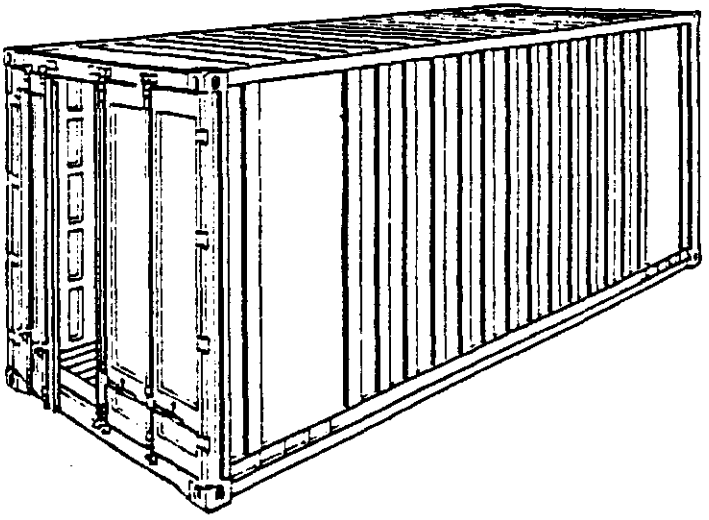
When looking at the tremendous impact a systematic containerization in Latin America and the Caribbean Countries will have on transportation of goods and the requirements for container availability and maintenance, the vital importance of corrosion protection cannot be stressed too much.

Efficient corrosion protection can only be obtained by a high paint quality together with a good application on a clean and well prepared surface.

The objective of this paper is to clarify and enlighten many aspects which must be considered for the refurbishing of containers and to give the reader a basic knowledge of the procedures.

However, many subjects, such as plant layout, welding, ventilation, blasting, equipment, painting facilities, painting, etc., should be treated in details with suppliers of the equipment in question to obtain the most rational economical production line.

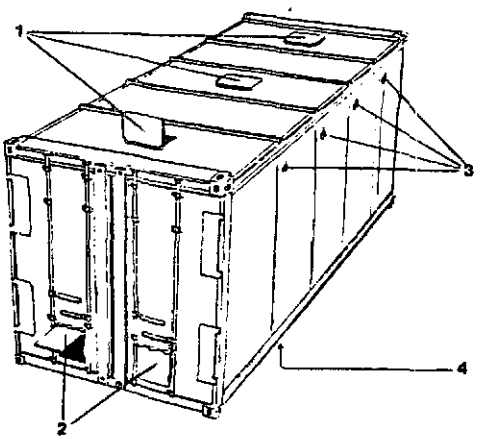
2. Typical container types



DRY CARGO

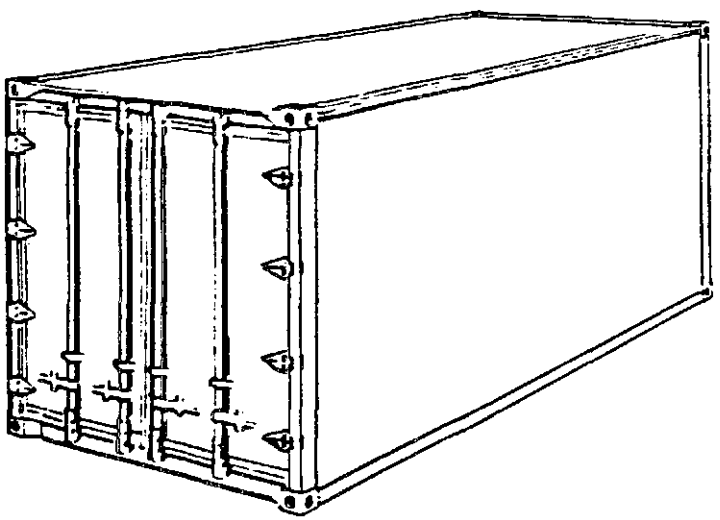
Most common container type used for a great variety of commodities of normal shape and size. Such commodities are generally packed in cases, cartons, bags, drums, or in bales.

1. Roof hatches for bulk loading
2. Discharge openings in doors *for bulk discharge*
3. Ventilation openings in the sides
4. Ventilation openings in the floor

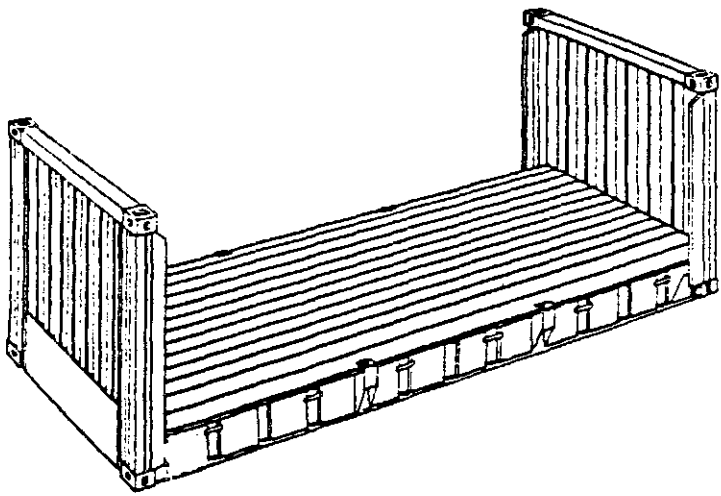


BULK CONTAINER

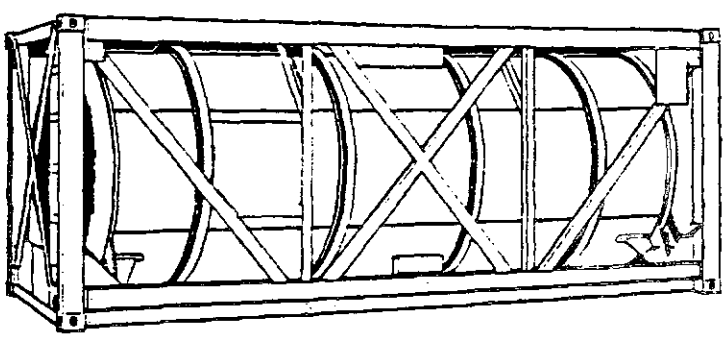
Produce in bulk or bagged, other cargoes which are liable to sweat damage, and cargoes to be shipped in bulk. It should be noted that the ventilated bulk can also be used to carry same variety of commodities as mentioned under dry cargo units with exception of IMO and dirty cargoes.



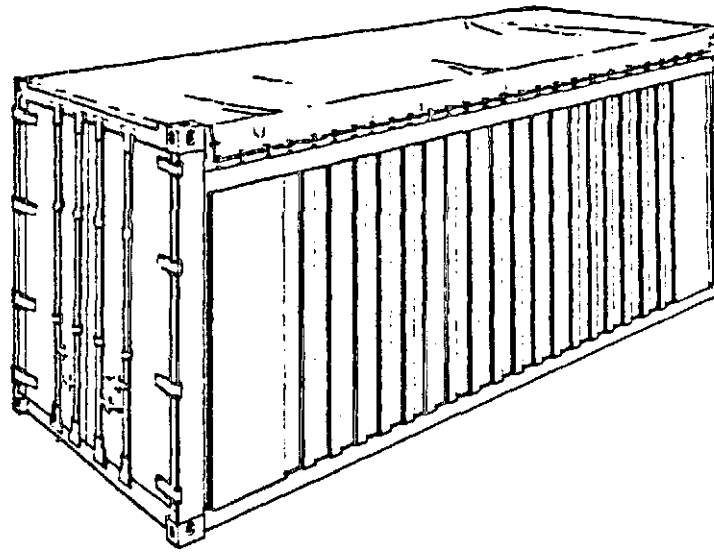
REEFER
Frozen fish/meat, fruits and vegetables, dairy products, pharmaceuticals and other commodities requiring refrigeration during transport.



FLAT RACK
Machinery, project cargoes, heavy industrial equipment, timber/plywood, and other cargoes of odd size and dimension occasionally overheight and overwidth unstuffing through toplifting or side removal.



TANK CONTAINER
A steel tank built into container frame.



OPEN TOP CONTAINER
Machinery, project cargoes of odd size and dimensions (e.g., overheight), glassware necessitating unstuffing by means of toplifting.

PLATFORM
Exclusively designed to accomodate tanks and similar large and bulky items.

3. Surface preparation

As mild steel and corten A steel are the all dominating container materials to be protected against corrosion, this chapter is devoted only to the manual surface preparation of steel. This being hand or tool cleaning or dry or wet abrasive blasting.

Surface preparation is the most important single area to deal with correctly if an, otherwise correctly chosen, protective coating system is to perform as designed and anticipated. Both tests and actual experience have shown that there is a direct relationship between the degree of surface preparation and the effective life of the coating system.

3.1 Hand Tool Cleaning

Hand tool cleaning is one of the oldest processes in use for preparing or cleaning surfaces prior to painting. As a general rule, hand cleaning is employed only when power operated equipment is not available, where the job is inaccessible to power tools, or where the job is too small to warrant bringing in power tools.

Hand tool cleaning is one of the methods of preparing metal surfaces for painting by removing loose millscale, loose rust, and loose paint by hand brushing, hand sanding, hand scraping, or hand chipping. It is not intended that all millscale, rust and paint be removed by this process but all loose millscale, loose rust, and loose paint as well as other detrimental foreign matter present shall be removed.

3.2 Power Tool Cleaning

Power tool cleaning is also a method of preparing metal surfaces for painting by removing loose millscale, loose rust, and loose paint but here we use power wire brushes, power impact tools, power grinders, power sanders, or a combination of these methods.

It is not intended that all millscale, rust and paint be removed by this process, but the degree of cleaning is significantly better than that of the hand tool cleaning.

Power tool cleaning with steel brushes: can be used to obtain what is defined as St degrees of cleanliness. Mechanical steel or wire brush cleaning involves the risk that the steel surface will be polished rather than cleaned, and will contain big amounts of corrosion products (rust).

Power tool cleaning with abrasive disc: (mechanical disc sanding or mechanical disc grinding). Mechanical disc sanding usually provides a very good result and it is the only method other than blast cleaning which can be said to give a metallic clean surface. It is relatively easy to obtain an St 3 degrees of cleanliness. Best suited for plain surfaces. Use of too coarse a disc results in too rough a surface while the use of too fine a disc naturally may result in a polished surface.

3.3 Manual Abrasive Blasting (Open)

Blast cleaning, where we in this section only will deal with manual blasting or open nozzle blasting, consists of cutting, chipping and abrasing the surface through the high velocity impact of abrasive particles against the surface. In preparing steel surfaces for painting by blast cleaning, rust, millscale and old paint are removed along with some of the base metal.

In open blasting the abrasive is discharged in a stream of high pressure air.

In blast cleaning the impact velocity of the abrasive against the metal must correspond to its most effective abrasion level which depends upon the particle size, shape, hardness, and its break-down rate. For instance sand with a higher break-down rate will do its best work when used at a lower pressure than would be recommended when using a metal abrasive.

ESSENTIAL COMPONENTS FOR A SUCCESSFUL ABRASIVE BLASTING OPERATION ARE:

1. Large Compressor
2. Large Air Hose and Couplings
3. High Production Blasting Machines
4. Large Size Blasting Hose with External Couplings
5. Large Orifice Venturi Nozzle
6. Remote Control Valves
7. Moisture Separators
8. High Nozzle Air Pressure
9. Proper Sandblasting Abrasive
10. Safety Air Fed Helmet
11. Training of Operators

1. Compressed Air Supply

This is the most critical part of a sandblasting operation. Work will be done in direct proportion to the volume and pressure of air passing through the nozzle. Abrasive blasting, to be economically feasible, requires both high pressure, 7 kg/cm^2 (90-100 p.s.i.) and high volumes of air, 140-575m^3/h (82-338 cfm).

Blasting on steel plate should be done in the 90 to 100 p.s.i. range, on masonry structures or glass in the 40 to 50 p.s.i. range. The larger the compressor, the larger the nozzle it can operate. The larger the nozzle operating at the proper pressure, the faster the job will be completed.

Compressed air is available from two sources: either a stationary electric or engine drive compressor, or a portable gas or diesel engine compressor. Stationary compressors are used in fixed blasting locations such as within a factory. These compressors can usually maintain the high pressures required provided the nozzle size is matched to the cfm output of the compressor. A quick rule of thumb is, that for each electric horsepower available about 4.5 cfm of air is produced. (For example, a 40 HP compressor produces about 196 cfm of air.)

Portable compressors are generally used for field blasting operations. Abrasive blasting is one of the most demanding jobs for a compressor, and only the best compressors should be used for this purpose. Most other air equipment works on an intermittent basis allowing the compressor to idle in between jobs; sandblasting requires a constant high volume, high pressure air stream for hours at a time.

2. Air Supply Hose and Couplings

Large I.D. air lines and shortest practical distance from the compressor to the blasting machine, plus the use of universal claw type couplings on all air lines, provide for minimum loss of pressure. The reason for large lines is to eliminate friction loss through the air hose. A loss of one pound in pressure means a reduction in production of 1 1/2%, or a ten pound loss will mean a 15% loss in production.

3. Abrasive Blasting

Careful consideration should be given to the selection of the proper blasting machine. There are several types available, one operating on a suction or eductor principle where the air is used not only for the blast force, but also for moving the material from the hopper to the nozzle. These do not hold the sand under pressure. Secondly, the vacuum type machine where the abrasive is blasted forth and recovered instantly and completely by vacuum. Thirdly, the direct pressure machines. Like all tools, each machine has its proper usage. The suction machine is frequently used for light duty cleaning, such as frosting glass, cleaning welds, cleaning auto bodies, cleaning light gauge materials, removal of paint or light coatings from surfaces, etc. The vacuum type machine is normally used where no flying abrasives can be tolerated. Both these types are quite slow compared to pressure units.

The direct pressure machine is the high production blasting machine used extensively in shipyards, refineries, chemical plants, cleaning of railroad cars, cleaning of buildings, or other large or complicated structures.

Many sizes of pressure equipment in the field of abrasive blasting are available. Sizes are generally determined by the sand or abrasive capacity of the machine. The only difference between machines of a like manufactured in different sizes is the fact that a smaller machine obviously must be filled more frequently than a large machine. Anyone doing extensive areas should have a machine that will permit them to operate from 30 to 40 minutes without the necessity of stopping the machine to refill it with abrasive.

In the pressure category of sandblast machines there are two types manufactured. One, which is basically a gravity flow machine, wherein there is equal pressure on top of the abrasive and underneath it, and the other which employs a jet feed blowing the abrasive into a sand-pipe and out through an elbow into the sandblast hose. Approximately 95% of the machines in use on large cleaning jobs are of the gravity type.

In selecting the proper machine for your job, the following features are extremely desirable:

1. Lightweight portable machine mounted on wheels that can easily be moved from job to job, or around an area on a specific job.
2. A blasting machine should be built to recognized standards, e.g., the National Board or ASME Building Code. On a machine of this type the manufacturer certifies that it has been built to rigid standards using a certain grade of steel, welded by certified welders, hydrostatically tested to twice the expected working pressure and inspected by state or insurance company inspectors.
3. The piping on the sandblast machine should be of a very simple design, having as few pipe fittings or turns as possible. Minimum size of piping should be 1", and if high production sandblasting is to be done, the machine should be factory piped with 1 1/4" piping.
4. The machine should operate equally well with any of the common abrasives (described in this chapter).
5. The machine should be equipped with an automatic, self-closing, rubber coated abrasive filling valve (manually operated filling valves are both slow and cumbersome).
6. The sandblast machine should be equipped with a concave head. If several machines are being operated on a job with one pot tender, the pot tender can place in the concave head of the machine approximately 60% of the rated abrasive capacity of the machine so that this material is instantly ready to feed into the machine once the air is exhausted.
7. The blasting machine should be equipped with an abrasive carburettor valve that will accurately measure the amount of abrasive being fed into the sandblast hose.
8. The blasting machine should also be equipped with an easily opened hand hole. Both for the inspection of the inside of the sandblast machine, and to enable the operator to quickly remove any foreign object that may have fallen into the machine.
9. The machine should have a conical bottom with at least a 35° slope to ensure free flow of the abrasive.

10. If the machine is to be used out of doors where there is a possibility of overnight rain, or condensation collecting within the machine, a cover should be provided.
11. Where continuous blasting is required the highest production machine available would be a continuous action unit, which allows blasting to continue while the pot is being refilled. This type of unit requires several machines. The units are basically two pressure pots, one mounted above the other. All blasting is done out of the lower compartment, and while blasting is going on from the lower compartment, the upper compartment can be depressurized and refilled with abrasive. Once the upper chamber is again pressurized there will be an automatic transfer of abrasive from that chamber into the lower chamber.

4. Remote Control Deadman Valves for Abrasive Blasting

Remote control valves eliminate the need of the pot tender and provide safety to the man doing the blasting by operating on a Deadman Control principle.

In the past many of these valves were electrically controlled which made them impossible to use in refineries or any areas where explosive hazards existed. Now pneumatic valves are available which require no electrical source but use only the same air that is being used for blasting to activate these safety valves.

5. Abrasive Metering Valve

This is the heart of the blasting machine. As the carburettor on a car controls the air and gas mixture to the engine, this valve meters the proper balance of abrasive to available air supply.

The blaster makes the initial setting and by his experience determines the flow of abrasive to the volume and pressure of the available air at the nozzle. Generally operators tend to use too much abrasive which cuts down the speed of blasting, creates excessive dust, and also increases clean-up cost. The air stream from the nozzle should be blue in colour with just a slight discolouration due to abrasive being carried. Usually this indicates proper abrasive mixture.

6. Abrasive Blasting Hose

The blasting hose should be equipped with a natural gum tube treated with carbon black to prevent electrical shock to the operator. It should be of adequate inside diameter to reduce friction and maintain high capacity/production rate. Rule of thumb is that the I.D. of the hose should be three to four times the orifice size of the nozzle.

7. Coupling of the hose

Only externally fitted quick couplings should be used; on the internal type fitting reduces the I.D. by fitting itself internally into the hose. Interfering with the air carrying qualities and setting up turbulent conditions where the air and abrasive will strike the leading edge of the nipple of the hose. This creates tremendous pressure drops and heavy wear conditions.

8. Selection of the Proper Nozzle

This is as important as the selection of the proper golf club. There are many different types of nozzles manufactured, each with a specific application. They should be looked upon as a tool, and as a good mechanic has more than one size of Wrench, so should a sandblaster have more than one size of nozzle in his selection.

The orifice size would be determined by the available air supply. Consult the manufacturer's selection chart. As a rule the largest possible nozzle should be used to fit the available air supply. Work will be done in direct proportion to the volume of air pushed through the nozzle at high pressure.

9. Blasting Helmets

There are two types of helmets commonly used in the blasting industry. One would be just a slip-over protective device against ricocheting abrasive; the second type would be the air fed helmet which is a completely contained safety helmet wherein a separate supply of air is fed to the helmet to be sure that no dust can enter the area of the operator's respiratory tract.

10. Nozzle Air Pressure

There is only one way to determine the pressure at the nozzle and this is by using a hypodermic needle gauge inserted into the sandblast hose (while operating).

These gauges are available from most of the blasting equipment manufacturers and from all of the compressor manufacturers; it is simply a small dial gauge to which a hypodermic needle is attached. The needle is then carefully inserted through the sandblast hose so that it sticks into the air and abrasive passage and an instant reading is obtained.

Low pressure reading at the nozzle should lead to checks on:

1. whether or not the compressor is functioning properly.
2. size of air lines,
3. size of piping on sandblast machine,
4. size of sandblast hose,
5. whether or not sandblast hose has external or internal couplings,
6. size of nozzle and its relationship to compressor output.

The importance of nozzle pressure can quickly be seen by the chart shown below indicating production on a certain point with identical equipment with the exception of nozzle pressure.

Nozzle Blasting at 100 PSI Nozzle
Pressure = 100% of Area

Nozzle Blasting at 80 PSI Nozzle
Pressure = 66%

Nozzle Blasing at 60 PSI Nozzle
Pressure = 50%

To repeat, work will be done in direct proportion to the amount of air and pressure passing through the nozzle.

11. Training of Operators

A training programme should be instituted for all sandblasting operators. Most manufacturers of equipment run regular or **ad hoc** training courses, or would be prepared to supply basis material (manuals, etc.) for such training.

12. Selection of Abrasives

In the selection of abrasives the following should be considered:

1. The kind of surface to be cleaned, including the type of metal.
2. Size and shape of the surface to be cleaned, and why the cleaning job is to be performed. Whether it is to be done within a cabinet, a sandblast room, a wet hone machine, a vacuum type machine, or in the open.
3. The surface condition before cleaning.
4. The surface condition desired after cleaning.
5. The type of coating to be applied and the anchor pattern required to give it perfect bonding.

Abrasives are classified in several ways:

1. By hardness – the harder the abrasive, the faster and deeper the cutting action. Hardness is generally measured either on the Moh's or Rockwell scale.
2. Classification by size – the larger the abrasive particle, the greater the impact of the particle on the surface. Uniformity in the size of abrasive is very important for proper anchor pattern.
3. Classification by shape:
   (a) Spherical or nearly round abrasive particles clean by impact and will produce uniform cleaning effects on the surface.
   (b) Sharply angular abrasive particles clean by gouging or cutting into the surface. These produce a deeper etch or deeper anchor patterns.
   (c) Sub-angular abrasive particles clean with a combination of impact and gouge. These abrasives will clean with a semi-etched effect with a smoother result than that achieved by sharply angular abrasives.
4. Classification by source:

   Natural abrasives are those taken from nature, washed, dried, and in some cases crushed. This group of abrasives is the most commonly used because of local availability. These would include beach sands, lake sands, dune sands, and silica sands.

   (a) Joplin Flint of Flint abrasives is a crushed flint rock.
   (b) Ground decomposed silica is an extremely fine mesh abrasive marketed under several names frequently referred to as Novaculite.
   (c) Garnet sand is a hard natural abrasive, most of which comes out of Idaho.
   (d) Zircon and Emery are natural abrasives but with very limited use.
   (e) Agricultural abrasives are by-products of agricultural products. They are soft, slow-cutting and specifically designed for use on soft surfaces. These would include black walnut shells, crushed fruit pits, ground corn cobs, ground rice hulls, etc. They are used extensively in the aircraft industry for cleaning of aircraft pistons to remove the carbon deposits.

(f) Manufactured abrasives are by-products of ore reductions, or other manufacturing processes. These are generally fast cutting, friable with medium durability and are readily available. They would include mineral slag, which is either copper or lead slag by-product, utility slag, which is produced by coke burning furnaces of a certain type, mineral shot, which is a by-product of rock wool manufacturing process.

(g) Manufactured non-metallic abrasives are fast cutting, durable, uniform and available in a great range of sizes. These would include silicon carbide and aluminium oxide, also glass beads for use in honing equipment.

(h) Manufactured abrasives – metallic, are durable, uniform, available for many specific uses and available in many sizes. These come in either a short or grit and are available in chilled iron, cast steel, malleable or heat treated aluminium, brass or copper shot. Also used in this category would be cut steel wire, nail wiskers, etc.

Most commonly used are:
Different sorts of sand
Aluminium oxide (korund)
Aluminium silicate
Copper slag
Steel sand (shot and grit).

Quartz sand. This has in the past been the most commonly used blasting media but it is now being prohibited to use it in more and more countries as the dust can cause an illness called silicose.

Aluminium oxide (korund) is a very hard material with great efficiency. The surface profile is deeper and sharper than with the sand. It can be recirculated and therefore used several times which makes it quite economic.

Aluminium silicate is a slag product also with great efficiency. It gives a deeper and sharper surface profile than sand and it also gives a steel surface a darker colour.

Copper slag is found in several qualities but all less efficient than the previous three abrasive media. The slag is usually black and leaves a darker and more dusty surface than the other abrasives.

Olivin sand has a lower efficiency than sand. Olivin sand consists of several different minerals which will leave the surface spotted. These spots are very difficult to remove. It is not established whether these spots decrease the durability of the paint.

Steel sand is available in two major types: with rounded particles (steel shot) and with sharp edged particles (steel grit). Good efficiency and low dust formation. To be economical steel sand must be reused.

13. Two problems are common when blast cleaning:

1. The specified cleanliness is not obtained.
2. The specified roughness is not obtained.

Remedy to 1:

(a) Reduce the blasting speed.

If this does not help:

(b) Check the equipment and procedure and adjust.

If there is still rust in the bottom of pits:

(c) Mix the abrasive 1: 1 with a finer abrasive with particles sizes ranging from 0.2 to 0.5 mm.

Remedy to 2:

(a) Grade the abrasive in order to separate the smallest particles i.e., those smaller than 0.5 mm, from the abrasive.

If this does not help:

(b) Check the equipment (and adjust, if necessary):

(i) Is the air pressure on the compressor over 8 kg/cm^2 (110 p.s.i.)?

(ii) Is the air pressure in the hose at the nozzle 6 kg/cm^2 (85 p.s.i.), or more?

(iii) Is the internal diameter of the air hose 3 times as big as the diameter of the nozzle?

(iv) Does the operator hold the nozzle at the correct distance from the surface (20 cm)?

(v) Does he hold the nozzle at the correct angle to the surface (70°-80°)?

If the above is adjusted to correct values, and the specified roughness is still not obtained:

(c) Change to another (harder) abrasive.

3.4 Vacuum Blasting

Vacuum blasting works almost dust free in a completely closed system. The blasting media is e.g., steel sand which can be used several times. The method is mainly used to finish welding areas, damages, etc., and is limited in its use partly because the blasting orifice must fit tightly to the surface which is to be treated and partly due to very low working capacity.

The working capacity for the small equipment can be up to 10m per minute at a width of 3 cm. The pressure is usually 6-7kg/cm^2 (100 p.s.i.) and the air requirement 1-2 m^3 per minute (55 cfm). A vacuum is created around the blasting jet and this sucks the blasting media back into the machine together with the loose impurities and contaminants. These are then separated and the blasting media goes back for reuse.

3.5 Sweep Blasting or Brush-off Blasting

A brush-off blast cleaned surface finish is defined as one from which all oil, grease, dirt, rust scale, loose millscale, loose rust, loose paint or coatings are removed completely. But tight millscale and tightly adhering rust, paint and coatings are permitted to remain provided that all millscale and rust have been exposed to the abrasive blast patter sufficiently to expose numerous flecks of the underlying metal very uniformly distributed over the entire surface.

As the name indicates the blasting jet is swept over the surface on undamaged areas while damaged and corroded areas are blasted to the required degree of cleanliness.

Except as above defined, there are no norms or standards for sweep blasting.

3.6 Wet Blasting

Wet blasting is open blasting to which water is added to the blasting jet outside the nozzle. The objective is to stop the dust from contaminating the surroundings. The working pressure is 6-8 kg/cm^2.

When water is used together with blasting it is possible to add a corrosion inhibitor to the last rinsing water to minimize and slow the formation of flash rust on the clean steel surface. Prior to spraying the water containing the inhibitor on to the surface, it must be carefully cleaned and free from residual blasting media and rust particles.

According to the wet abrasive blasting requirements of the I.I.C.L.'s (Institute of International Container Lessors) any of the following rust inhibitors must be used (2°/o by weight solution):

chromic acid
sodium chromate
sodium dichromate
potassium dichromate

3.7 Degree of Cleanliness

Approved and internationally recognized standards exist for detemining the cleanliness of substrates prior to painting.

Most widely known and used references are:

1. SIS 055 900 SWEDISH STANDARD
2. BS 4232 BRITISH STANDARD
3. SSPC – SP U.S. STANDARD

They compare as follows:

SIS 055 900	BS 4232	SSPC SP
Sa 3	First Quality	SP-5 "White Metal"
Sa 2 1/2	Second Quality	SP-10 "Near White"
Sa 2	Third Quality	SP "Commercial"
Sa 1	None	SP-7 "Brush-Off"
St 3	None	SP-3 "Power Tool Cleaning"
St 2	None	SP-2 "Hand Tool Cleaning"

The Swedish Standard is a visual standard with pictorial representation of the defined cleaning degrees, the other two are verbally descriptive. The Swedish Standard also takes into consideration the state of the surface prior to cleaning.

Bare steel surfaces should be prepared by one of the following methods:

(a).**White metal blast cleaning:** (Sa 3, BS 4232, first quality, SSPC-SP-5). The jet of abrasive is passed over the surface long enough to remove all millscale, rust and foreign matter. Finally, the surface is cleaned with a

vacuum cleaner or clean and dry compressed air. It should then have a uniform metallic colour. A white metal surface should receive the first coat of paint as quickly as possible, preferably within one hour and always while the steel temperature is 3°C or more above dew point and before any rusting occurs.

(b) **Near white metal blast cleaning:** (Sa 2 1/2, BS 4232, second quality, SSPC-SP-10). Very thorough blast cleaning. Millscale, rust and foreign matter shall be removed to the extent that the only traces remaining are light stains in the form of spots or stripes. Finally, the surface is cleaned with a vacuum cleaner or clean, dry compressed air.

(c) **Commercial blast cleaning:** (Sa 2, BS 4232, third quality, SSPC-SP-6). Thorough blast cleaning. Almost all millscale, rust and foreign matter shall be removed. Finally, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush.

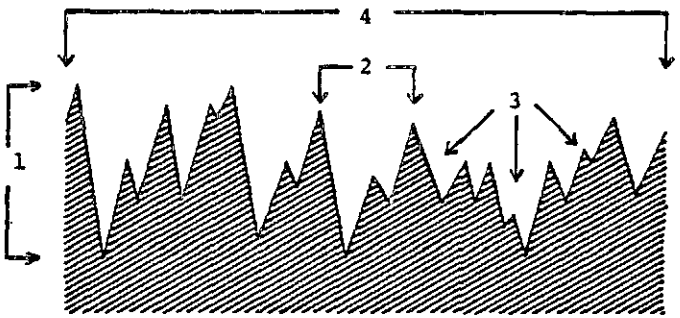
(d) **Mechanical scraping and wire brushing:** (St 3, SSPC-SP-3). Extremely thorough scraping (with hard metal scraper) and wire brushing. The scraping is performed first in one direction and then at right angles. The surface is then wire brushed vigorously.
Loosened material should be removed during the operation so that the result can be checked. Finally, the surface is cleaned with a vacuum cleaner, clean and dry compressed air or a clean brush. It should then have a pronounced metallic sheen.

(e) **Hand scraping and wire brushing:** The requirements for manual cleaning are basically the same as for mechanical cleaning. It is slow and expensive, and mainly used for cleaning of small patches for touch up, maintenance priming and painting.
Again referring to IICL's requirements, the steel surface to be refurbished must be grit blast cleaned to a near white (SP-10), Sa 2 1/2, Second Quality surface finish using steel grit, crushed slag or quartz sand. For the understructure and cross members of the containers IICL require a commercial (SP-6), Sa 2, Third Quality surface finish.

3.8 Surface Roughness – Anchor Profile – Anchor Pattern

In addition to the cleanliness of the surface its texture is also of great importance for the durability and performance of the coating system.

Drawing: ANCHOR PATTERN PARAMETERS



At least four parameters must be used in the description of an anchor pattern, if that description is to be exhaustible:

1. Peak to valley depth
2. Horizontal dimensions of craters
3. Shape of craters
4. Number of craters per linear inch or centimetre

In determining, recording or communicating surface roughness and profile, internationally recognised standards and references are used. Most common are the RUGOTEST No. 3 and the KEANE–TATOR Surface Profile Comparator.

Where larger cleaning and surface preparation projects are undertaken, it is not uncommon that special reference panels are being prepared and used as reference and standard. This, obviously must be agreed between refurbisher, paint supplier, and the leasing company representative.

In relation to surface profile IICL requires between 25 to 35 microns (1 to 1.5 mil) unless otherwise specified by the approved supplier of the protective coating material to be used. As a result of blasting, the thickness of metal at any location, especially the side, end and roof panels, shall not be reduced by more than 5%.

4. Paint application

General Considerations

A good result of paint application requires planning. A time schedule reflecting the progress of surface preparation and paint application should be established on basis of the painting specification. Adequate allowances must be made for the erection and moving of scaffolding; drying, curing, and recoating intervals; expected air, surface and paint temperatures must be considered, as must the general weather conditions expected. Allowance should be made for possible construction or cleaning work which may cause damage to, or contamination of the painted surface. Also the pot-life of mixed two-pack products should be considered in the schedule.

4.1 Brush Application

With so many new and speedy methods of applying paint, and with the need for high production rates using a minimum of manpower, one tends to regard brush application as being old-fashioned and uneconomical, if not obsolete. This is not so, and a considerable amount of brush application is still being carried out.

For container repair and refurbishment brush application is only made for repair/touch up of small areas and edge striping.

Brush application still gives the best results for application of protective primers to steel, since the action of brushing tends to assist penetration into the surface, and this gives improved adhesion.

Advantages

1. The brush is a versatile tool; easy to move, independent of power sources, and low equipment cost is involved.

2. Brush application tends to displace dust, and to some extent even moisture, from the surface being painted, and is therefore particularly well suited for application of first coat of primer.
3. The method is clean, and involves little or no masking of adjacent areas, or the surroundings. It is suitable for narrow and restricted areas, such as lattice and rod structures.
4. For rough or pitted surfaces, the penetration offered by brush application (by an experienced and conscientious operator) is equalled only by airless spray application.
5. In many countries safety regulations stipulate that lead based paints must always be applied by brush.

Limitations

1. Not all paint types lend themselves to brush application; high builds, especially physically drying, being particularly unsuited.
2. The quality of work depends almost entirely on the skill of the applicator, and the method requires greater skill than any other application method.
3. Brush application is of necessity a relatively slow operation and is, therefore, costly in labour.

4.2 Paint Roller

The paint rollers used on structural metalwork today are essentially larger versions of the rollers used for home decorating.

The quality and finish of paint roller application depend less on the applicator than on the covering or sleeve of the roller; this may be either lambs wool, mohair, nylon, dynel or synthetic plastic foam.

Lambs wool has a long pile and is well suited for rough surfaces.

Mohair has a shorter pile and is generally used on smooth surfaces, where it leaves less of an "orange peel" finish than does lambs wool.

Nylon and Dynel are comparatively low cost synthetic substitutes for lambs wool and mohair. They are hard wearing and well suited for most roller application work.

Plastic foam is cheap, but not very stable; it tends to mis-apply paint and is not recommended fot the application of protective coatings.

Advantages

1. Low equipment costs, mobility, and independence of power sources, are advantages that the roller has in common with the brush.
2. The roller is cleaner in use than the spraygun, particularly in outdoor conditions with some wind.
3. The rate of work is higher than that obtainable by brush.
4. Roller application is particularly advantageous on wire fences and broad surfaces of limited size.

Limitations

1. Not very well suited for irregular surfaces lattice structures, small dimension pipes, etc. (this rules out the roller for almost all container applications).

2. Tends to apply paints in an uneven and thin coat, often with many misses and pinholes.
3. Does not penetrate very well, and therefore not recommended for application of first coats of primers.
4. Unsuited for application of high build products (this also rules out the roller for most container applications).

Paints for Brush and Roller Application

The paints that lend themselves best to brush or paint roller application are those of oleoresinous long oil type and long oil alkyds, the reasons being:

(a) They have very good flow, i.e., elimination of brush marks.
(b) The viscosity of the solid medium is such that it will still flow, i.e., "joining up" is still possible after the bulk of the solvent has evaporated.
(c) White spirit is a suitable solvent since it is low in odour and has no effect on previous coats.

Polyamide modified long oil alkyds, in which the medium itself has a thixotropic structure, yield paints which often have good brushing properties.

Paints containing more than 5% soluble lead are generally applied by brush, as regulations in most countries do not permit spray application.

Types of paints which do not brush or roll very well are:

1. Those with quick solvents and viscous media, e.g. stoving enamels and quick air drying enamels, since these exhibit a rapid and marked increase in viscosity on loss of some solvent and hence cannot be joined up satisfactorily.
2. Certain physically drying types, e.g., vinyl or chlorinated rubber which suffer from:
   - viscosity having to be low initially in order to apply; therefore sagging on heavy film occurs.
   - Poor joining up since solvent normally evaporates quickly, leaving highly viscous polymer.
   - Second coat dissolving the first, which renders brushing and roller application extremely difficult.

NOTE: Efforts have been made to mechanise brush and paint roller application, but with little success. For example, brush and paint rollers with a fluid line feed have been developed, but have not been popular. The reason for the comparative failure of these attempts is due to the fact that brush and paint roller application owe their success to the versatility of the methods, and the fact that the methods can be used under unlimited variable conditions and situations, and the applicator is in complete control of movement and quantity of paint being applied.

4.3 Spray Application

All spray systems are related in that the liquid paint is first atomized, i.e., broken up into minute droplets, before it is applied to the surface to be coated. The energy to accomplish this atomization may be provided by any of three sources, leading to the recognition of two basic methods of paint spraying:

1. Conventional or air atomization systems, where atomization is by intersecting jets of compressed air.
2. Airless or hydraulic systems where the sudden release of high pressure, as the paint is ejected through a small orifice, results in atomization.

Air Spray

Fundamentally the spray gun operates on the principle of a jet of fluid paint being subjected to a stream of air; the correct balance between air and paint being essential for successful spraying. The paint is metered into the air stream through the fluid tip, the quantity passing being governed by the size of the orifice in the fluid tip, the type and viscosity of the paint used, the air pressure exerted on it, and the extent to which the operator withdraws the needle valve.

In order to atomize a given quantity of paint a definite volume of air is necessary, and the supply of this is determined by the particular type of air cap, the number of air capholes, and their size and position relative to the paint orifice. Air caps and fluid tips are complementary, the air cap being designed to pass a sufficient volume of air necessary to atomize the amount of paint passed by the corresponding fluid tip.

The application of protective coatings and decorative finishes by air spray involves relatively few choices in equipment, however. These are concerned with choice of paint-feed method (siphon or pressure feed, by pressure tanks or pumps), and choice of atomization (by external or internal mix nozzles).

Selection of air cap and fluid tip is governed essentially by the type of paint, and required spraying rate and the size of fan required.

Advantages

1. High quality finish can be obtained.
2. An even thickness can easily be obtained.
3 Adjustment of paintflow and spray pattern is easy.
4. Low equipment costs compared to airless spray equipment.
5. Higher rate of work than with brush or roller.
6. May be used for application of water-borne zinc silicates.

Limitations

1. Much "paint fog" and loss of material. Also protective mask and possibly goggles must be worn by applicator.
2. Higher equipment cost than for brush or roller.
3. Not very well suited for outdoor work, and certainly not when windy.
4. Not very well penetrating, and on imperfectly cleaned surfaces tends to leave the paintfilm on top of dust and moisture, rather than on the substrate.
5. In the hands of an unskilled operator there is considerable possibility of overspray (dry-spray).
6. Less mobile than brush and roller, and dependent on a power source.

Paints for Application by Conventional Spray

Most types of paint can be applied by spray guns, but certain types require special nozzles. If paints containing highly volatile solvents are sprayed, the solvents will evaporate before the paint particles reach the surface, and dry-spray and poor film properties will result; if the solvents are too slow, then the paint will be too wet and sagging will occur.

Considering the mechanics of spraying, a paint in bulk when atomized has to undergo an enormous increase in surface area; consequently it is reasonable to expect paints of low surface tension to atomize better than paints of high surface tension.

Airless

Airless spraying is a method of paint application that does not use compressed air to atomize the paint or coating material. Hydraulic pressure alone is used to atomize the fluid by discharging it at high pressure (up to about 5 000 p.s.i., 360 kg/cm^2), through a small orifice in the spray nozzle. As the fluid is suddenly released at these pressures it breaks up into small droplets, resulting in a fine atomized spray. The fluid is discharged at such high velocity that after atomization sufficient momentum remains to carry the minute particles to the surface being painted.

The fluid pressure required for proper atomizing depends primarily upon the viscosity of the material being applied, and also to some extent upon its cohesive nature. Very thin fluids may atomize successfully at around 400 to 800 p.s.i. (28-56kg/cm^2), most paints and protective coatings require 1 500-2 000 p.s.i. (100-150 kg/cm^2), and some heavy coating materials may require pressures in the region of 3 000 p.s.i. (210 kg/cm^2) or more before atomization is achieved.

The equipment employed in airless spraying is much less complex than that required for air spraying. Airless spray equipment essentially consists of a high pressure pump with high pressure and volume capacities, a source of compressed air to operate the pump, high pressure fluid hose, and the airless gun.

The airless nozzle determines both the volume which can be sprayed and the spray pattern width. In selecting the nozzle it is necessary first to consider the fluid viscosity and application rates desired, in order to determine the proper nozzle orifice size.

The quantity of fluid sprayed is determined by the size of the orifice; the film thickness applied is determined both by the orifice size and the fan angle. Two nozzles having the same orifice size but different fan angles will deposit the same amount of paint, but over a different area. Note that orifices are not circular but are elliptical in shape; the diameters referred to are equivalent to a circular diameter having the same flow capacity. A good rule is to determine the largest fan angle and the smallest orifice that is practical for the specific fluid and application method.

Advantages

1. Very high rate of work.
2. Good atomization without the paint being carried on a jet of compressed air; therefore negligible "paint fog".
3. Thick coats obtainable, even with single pass.
4. Awkward places can be reached by utilizing a pole gun.
5. Best suited application method for most high build products.
6. Very well penetrating.

Limitations

1. High equipment costs.
2. Dependent on power source.

3. Less mobile than brush or roller.
4 Some danger of dry-spray (overspray) when used by inexperienced or careless operator.

Paints for Airless Spraying

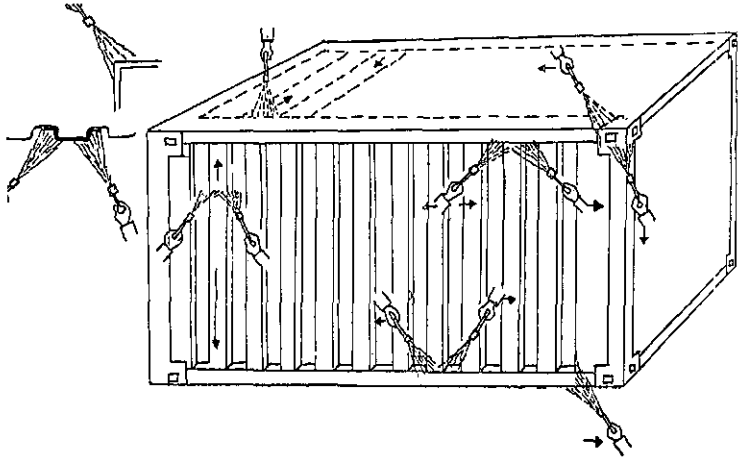
The protective coatings designed for use on structural steel, concrete, etc., are especially formulated for airless spray application and, therefore, show the best properties when applied by this method.

However, most paints can be applied by airless spray without difficulty. Owing to the very fine orifice sizes, it is, of course, essential that all airless spray paints are free from bits, skin and other extraneous matter.

Since atomization of the paint applied by airless spray is partly due to the rapid evaporation of solvents at the spray head, the vapour pressure of these solvents has a bearing on the atomization. In general, low boiling solvents are desirable, together with a small proportion of a high boiling true solvent to improve flow properties. Should the high boiling fraction of the solvent blend not be a true solvent, i.e., only a diluent, then the defect known as "tailing" can occur.

The absence of the fast stream of atomizing air, characteristic of conventional air spray, means that the solvents are not so rapidly removed from the paint film and so, if a paint with a conventional solvent blend is used, runs and sags can possibly occur. Consequently, glossy finishing coats are generally formulated with a fast solvent combination and a degree of thixotropic structure in order to develop adequate atomization and give the necessary "hold-up" properties.

Highly pigmented undercoats and primers do not normally have to be especially formulated. This is because atomization more readily occurs with low viscosity fluids, and these highly pigmented paints are generally thixotropic giving low viscosities at the high rates of shear which occur due to the high speed flow through the tiny orifice of the airless tip. Owing to the superior atomization of heavily pigmented paints, they generally give a wider fan, using the same tip, than the corresponding finishing coats.



5. Purpose

The inspection or supervision carried out in connection with the application of protective coatings, can have only one purpose:

To ensure optimum performance of the coating system chosen.

Since the protective value of a coating system depends upon a number of factors, many of which have little to do with the paint itself, the paint coating inspector must have knowledge of, and be experienced in, not only paint technology but also a wide range of allied technologies in order for him to fulfill the purpose of his job.

While some would claim that with the instruments available today, experience is of little consequence; others hold forth that the really experienced paint coating inspector functions quite well without all that "electronic gadgetry".

The truth of the matter is that only the experienced inspector with adequate inspection equipment at his disposal, has any hope of detecting flaws and mistakes early enough to have them corrected before their effect becomes detrimental to the performance of the protective coating system.

Duties

Briefly, the duty of the paint coating inspector is to ensure that the work is carried out in accordance with the painting specification, and that the general standard of craftmanship is satisfactory. This would normally include supervising the storage and issue of paints, surface preparation, paint application, and drying/curing; checking the ambient conditions (microclimate) during painting; and compiling records of the work.

The following details will need the inspector's attention:

Storage and Issue of Paint

1. Proper conditions and a good standard of cleanliness in the paint store.
2. Systematic use of the paint according to delivery, i.e., different batches should be issued in the same order as they were received. No paint should be issued after the storage period stipulated by the manufacturer has expired.
3. The issue of the correct paint for each purpose. The paint should be completely mixed and, for two-pack products, in the correct proportions. Paints for spray application may often have to be strained before use. Any two-pack paint not used within its specified "pot-life" should be discarded.

   During the progress of the work only the minimum number of containers needed should be open at any time, and partly-full containers should be temporarily sealed.
4. Prevention of adulteration of the paint. No adjustment in the paint should be made that conflicts with the manufacturer's instructions or with specification requirements.

   All paints should be supplied from the store to the painters ready for application, and the addition of thinners or of any other material should not be permitted.

Surface Preparation

1. The quality of the surface preparation should conform to the specified standard, both as regards cleanliness and surface profile (roughness).
2. Welding slag and spatter should be removed from the runs of welds and the adjacent steel. Care should be taken to clean these areas thoroughly and to remove oxide scale, welding slag, spatter and flux residues.
3. No prepared area should be left unpainted for longer than the specified time. A time schedule should have been previously agreed between the inspector and the contractor to ensure this.
4. The prepared surfaces should be inspected before any coating is applied. Any unacceptable work should be treated again as considered necessary by the inspector; when approved, paint should be applied without delay.

Paint Application

1. The quality of the workmanship. All paint should be applied in accordance with the painting specification and/or the manufacturer's instructions.
2. The adequacy of any spray painting equipment used.
3. No two-pack products should be used after the expiration of its stipulated pot-life under the current conditions, of which the paint manufacturer should have been informed.
4. Sharp edges, contact surfaces, rivets, and runs of welds should be properly treated. An extra stripe coat applied by brush to edges, corners, crevices, bolt and rivet heads may be required.
   Crevices, e.g., between intermittent welds, should be sealed with paint or hard stopping.
5. Each coat should have reached a suitable state before it is overcoated, or the steelwork handled. Any cleaning or touching up should be done before the next coat is applied.
6. Measurement of the wet paint film thickness and the dry paint film thickness for each coat, and the dry film thickness of the complete system.

Drying and the Dry Painting System

1. Observance of required flash-off time before initiating force drying.
2. Check the oven temperature not only on the oven thermometer but also in all areas of the oven.
3. Check that the flash off and oven ventilation systems function and have defects remedied.
4. Secure that the paint is not exposed to undue temperature fluctuations and humidity condensation before it is sufficiently cured/dry.
5. Convince himself that the final colour and the visual appearance of the coating system are as specified.

Control Procedure

The wet film thickness of the coat applied by each painter should be checked during application and steps should be taken to rectify any deficiencies at once.

Additional control was achieved by keeping a check on the quantities used. The film thickness can be calculated roughly from the spreading rate and loss factor.

Ambient Conditions

Work on the protective scheme should be suspended during adverse ambient conditions as defined in the painting specification or the paint manufacturer's handbook.

Should the contractor and the inspector disagree about the ambient conditions, the decision to continue or stop work should rest with the resident engineer.

Records

The quantities of paint used and the areas covered during each working day should be recorded. All records should be entered in a log-book or a report form arranged to suit the work in hand.

In addition to the above-mentioned information, the records should include the timetable of operations, notes on the ambient conditions at least at four-hourly intervals throughout the duration of the work.

Notes on cleaning degree, roughness and other measures, should also be recorded, as should all facts relating to the work.

Inspector's Equipment

The paint coating inspector should have the following basic equipment:

1. Standard for determining surface cleanliness.
2. Standard for determining surface roughness.
3. A maximum and a minimum thermometer.
4. A surface thermometer.
5. A wet and dry bulb hygrometer or other instrument for measuring humidity.
6. Wet film thickness gauge.
7. Dry film thickness gauge.
8. An electric torch and mirror.
9. Flashlight magnifier.
10. Containers for paint and other samples.

Inspecting for Surface Cleanliness

Freedom from oil and grease on the surface is tested by sprinkling the surface with fresh water. If the water collects in droplets, beads or pearls, the surface is still contaminated with oil, grease, or other fatty substances.

Freedom from dust and other loosely adhering contaminants is tested by pressing a piece of adhesive tape on to the substrate and pulling it off again. Loose contaminants will adhere to the tape.

Degree of cleanliness of hand/power tool cleaned or abrasive blasted surfaces is determined by visual comparison with mutually agreed reference panel or internationally recognized standard, such as Swedish Standard SIS 05 59 00, which is a collection of photographic representations of various grades of cleaning.

Inspecting Surface Profile (Roughness)

The roughness of blast cleaned steel should be within defined limits. It may be measured in any of the four ways:

(a) Visual (or finger-touch) comparison with recognized standard (or especially prepared specimen). Internationally recognized surface profile comparators are:

Rugotest No. 3, and
Keane-Tator.

The visual method is the most widely used.

(b) Instruments employing a stylus of suitable dimension in the form of a depth gauge.

(c) A replica-forming tape; the undulations and profile produced by pressing the tape on to the substrate being subsequently measured by microscope.

(d) An optical instrument in which the surface profile is projected on to a screen where its amplitude and geometry can be evaluated.

A visual scan of the entire work surface is always essential, and the number of measurements taken should be sufficient to give the necessary assurance of uniformity of profile and its conformity with the painting specification.

Checking Ambient Conditions

The most frequent cause of bad paint adhesion (peeling, flaking) is application to damp, wet or frosty surface. Moreover, exposure of the wet paint film to frost, rain, fog or dew, before it has dried properly, has a most damaging effect on the performance of the paint system. It is therefore of the utmost importance that protective coatings are applied only under favourable ambient conditions.

The ideal temperature for painting lies within the range 13-32°C. However, some paints are more sensitive, others less sensitive to variations in temperature, and the manufacturer's technical data sheet for the paint in question should always be consulted.

Ideally the ambient relative humidity should be below 80%, and certainly not above 90% (consult manufacturer's technical data sheet for paint in question).

The surface should be clean and dry, and its temperature over and above the dew point (see dew point table p.9).

A simple method to establish without instruments whether or not the surface temperature is above the dew point is to moisten the surface with a wet rag; if the wet spot dries completely within 10-15 minutes, the surface temperature is over and above the dew point.

Measuring Wet Film Thickness

Two main forms are in common use: the comb gauge and the wheel gauge.

(a) The comb gauge is pressed on the wet paint surface and one or more of the teeth (of graduate lengths) will take up the paint. The thickness of the coating is recorded as that of the shortest tooth to be wetted.

(b) The wheel gauge which takes the form of a disc with a circumferencial groove of varying depth is rolled along the painted surface. When the gauge is subsequently examined, it will be found that paint has been picked up on the central groove at some point and the thickness of the paint film is read from the graduation marked on the sides of the gauge.

DEW POINT TABLE

AIR TEMPERATURE ° C

RH%	50	45	40	35	30	25	20	15	10	5	0	-5	-10
100	50	45	40	35	30	25	20	15	10	5	0	-5	-10
95	49	44	39	34	29	24	19	14	9	4	-1	-6	-11
90	48	43	38	33	28	23	18	13	9	4	-1	-6	-11
85	47	42	37	32	27	22	17	12	8	3	-2	-7	-12
80	46	41	36	31	26	21	16	11	7	2	-2	-7	-12
75	45	40	35	30	25	20	15	10	6	1	-3	-8	-13
70	44	39	33	29	23	19	14	9	5	0	-4	-9	-14
65	43	37	32	28	22	18	13	8	4	-1	-5	-10	-15
60	41	36	31	27	21	17	12	7	2	-2	-6	-11	-16
55	39	35	29	25	20	16	11	6	1	-3	-7	-12	
50	37	33	28	23	19	14	9	5	0	-4	-8		
45	35	31	26	21	17	13	8	4	-1	-6			
40	33	29	24	19	15	11	6	2	-3	-7			
35	31	27	22	17	13	9	5	0	-5				
30	28	23	19	15	11	7	2	-3	-7				
25	25	20	16	12	8	4	0	-4					
20	21	17	13	9	4	1	-4	-9					
15	17	13	8	3	-1	-3	-8						
10	10	7	3	-8	-5	-9							

NOTE: Wet film measurements must be taken within seconds of the application of the paint.

Measuring Dry Film Thickness

There is a great variety of dry paint film thickness gauges. These may be divided into two main categories, non-destructive and destructive.

Non-destructive methods are preferred in the construction industry, and these instruments operate on the magnetic pull-off, magnetic flex or eddy current principle for steel substrates.

The accuracy of the instruments used in the field is probably equal to the ∓ 10 % claimed for them and, provided they are used by practiced inspectors, the reproducibility and repeatability of the methods is fair.

The significance of individual readings can only be assessed in the context of a systematic survey of the area involved, which demands considerable skill and experience.

Examples of non-destructive field instruments are: The Inspector Thickness Gauge, the Microtest, and the Smaltometer, which all employ the magnetic pull-off principle. They are handy, pocket size instruments, used by paint coating inspectors over the world.

Destructive measuring methods are normally employed only where repairs can be made; they may be used to resolve controversy over the accuracy of dry film thickness measurements.

The best known instrument in this category is probably the Paint Inspector Gauge (P.I.G.) which cuts a V-shaped notch in the coating with a precision ground cutter blade. The V-cut is then measured geometrically by viewing through an illuminated calibrated part of the gauge.

Inspecting for Continuity

Paint film thickness gauges do not detect discontinuities in the film, for this purpose instruments known as pore detectors, paint-flow detectors or pin-hole detectors are available. However, for container inspection a lamp with a magnifying glass suffices for all practical purposes.

Inspection for Adhesion

Three methods are commonly employed for adhesion testing in the field:

(a) The razor-knife test provides a rough check on adhesion. It consists of cutting through the coating with a sharp razor-knife and attempting to lift the coating by inserting the blade of the knife under the coating.

(b) The crosshatch test. In this test paralled cuts are made through the film with a specially designed multiblade cutter, or with the side of a die at carefully selected distances apart. The behaviour of the paint within the squares so formed is recorded as well as the amount of damages suffered at the edges of the cuts.

(c) Pull off tests, in which the force needed to remove a test piece adhering to the paint surface with a suitable adhesive is measured. In one such test the force is applied at right angles to the surface while another test employs a suitably designed and calibrated torque wrench to remove the test piece.

NOTE: None of the testing methods here mentioned, which are all designed for use by the paint coating inspector in the field, can compare in accuracy to laboratory measurements and tests.

6. Typical steps in container refurbishment

We have now discussed the refurbishing questions which are most important to a good corrosion protection and cosmetic result and will briefly list and discuss the steps which are typically included in the refurbishment process:

1. Pre-refurbishment Inspection
2. Repairs
3. Surface Preparation
4. Priming
5. Post-priming Inspection
6. Top Coating
7. Undercoating
8. Decal Application
9. Quality Control

The size, lay out and installations of the premises where these operations are to be carried out naturally vary extensively with the planned daily capacity as well as the climatic conditions. Ample space must be allocated to the storing of containers to be refurbished, to the handling of the containers, to the storing of the refurbished containers and to spare part stocks.

6.1 Pre-refurbishment Inspection

The objective of the pre-refurbishment inspection which all containers should undergo is, before any work takes place, to determine whether at all the container can be refurbished and, if that is so, what steel components must be changed and what other repairs it has to undergo before it is blast cleaned and painted.

6.2 Repairs

Provided the owner approves that work is being started the repairs decided upon during the pre-refurbishment inspection can take place. These include cutting out of damages steel parts, welding new steel parts in place, grinding welds, replacement or repair of floor boards and possible interior linings, etc.

6.3 Surface Preparation

Before the surface preparation starts, door gaskets and other items which may be damaged and are not to be blasted must be masked off to protect them against the blasting and all surface impurities removed. This surface preparation is carried out as already discussed and the degree of cleanliness should be a Sa 2 1/2, near white metal, second quality, for all exterior surfaces except the understructure and the cross members where Sa 2, commercial blast, third quality, is acceptable. All residual grit, dust and other material must then be removed from the surface before it is primed.

6.4 Priming

The prime which in most cases will be a two-pack zinc epoxy primer should be applied by airless spraying and will dry to touch in above 30 minutes at 20°C/68°F.

6.5 Post-priming Inspection

The objective of this inspection is to determine if the blasting operation has damaged any of the panels so that they now have to be repaired/replaced. If this is the case, repair must take place and the repaired area including the welding areas are then to be surface prepared and primed as the rest of the container.

6.6 Topcoating

The topcoat which naturally is to be applied in the owner's house colour should be applied to the prime within 1-8 hours after the priming operation took place. It is to be applied by airless spray and typical product is a high build acrylic or chlorinated rubber or PVC coating. Such a product dries in about 4 hours at 20°C/68°F.

6.7 Undercoating

The cross members, interior bottom side rails, flooring, etc. are to be coated with a heavy soft corrosion protective material, usually a bituminous black material.

6.8 Decal Application

When a topcoat has fully cured, new identifying decals are to be applied to the container instead of the decals which were removed at the beginning of the refurbishment operation. Some owners approve silk streaming stenciling or similar means instead of decals.

6.9 Quality Control

Before delivering the refurbished container to the owner the refurbisher has to control the final result as per the owner's specification.

The refurbisher must maintain records of this inspection.

7. Typical painting specifications for containers

7.1 Introduction

This section is intended as an easy reference to paint systems used on containers for Maintenance and Repair companies as well as for Owner's Inspectors.

Emphasis has been put on obtaining long-range protection and subsequent easy maintenance and repair with advanced generic paint types, e.g., two-pack zinc epoxy, primer, acrylic/chlorinated rubber/high builds and PVC.

Please observe that this paper distinguishes between

- full refurbishment (i.e., total blasting and repainting of container)
- touch-up and repair (i.e., repair and painting of minor damages)
- cosmetic topcoating (where colour of topcoat has faded).

Finally you will find examples of painting systems as well as relevant data sheets on the specified products attached. It is advisable to check these data sheets for complete technical details prior to application of the specified products.

7.2 SURFACE PREPARATION

2.1 Steel

It is required that all steel which is to be subsequently painted be abrasive blast cleaned to minimum Sa 2 1/2 according to Swedish Standard SIS 055900-1967, equal to American Standard SSPC-SP-1C, near white metal.

It is indicated on each individual specification sheet which **minimum** cleaning degree is required.

2.2 Galvanized Steel

It is required that all traces of oil, grease and other impurities be removed before subsequent coats are applied, e.g., by thorough cleaning with thinners or detergents, followed by freshwater washings.

2.3 Aluminium

It is required that all aluminium surfaces which are to be subsequently painted be freed from al kinds of impurities by thorough degreasing, followed by freshwater washing.

2.4 Fiberglass or Reinforced Plywood

This material requires careful sweeping with fine abrasive (or power tool sandpapering) to roughen the surface and remove defective gel coat areas.

Then high pressure hosing down with freshwater to remove salts and other contaminants. All deeper surface blisters, areas of poorly consolidated laminate to be repaired prior to painting.

2.5 Surface Roughness

Unless otherwise specified, it is required that the average surface anchor pattern (profile and density be as Rugotest No. 3 N10Bb - N11Bb (Ra = 12.5-25 micron).

7.3 APPLICATION OF COATING SYSTEMS

3.1 The primer must be applied within one hour of completion of blasting. (And after **all** abrasive and dust has been removed.) Outside storage or storage in humid conditions of containers prior to priming will reduce this period.

3.2 Application Method

Is is indicated on the data sheets which application method is possible.

It is recommended, however, that all painting of containers be done by airless spray. The given airless data are those with which an acceptable spray pattern is obtained and are subject to adjustment, depending on equipment and weather conditions. Brush or spray to be used on local areas, provided that first class painting work is performed. However, the minimum dry film thickness must be obtained, regardless of method of application.

The specified film thickness for high-build coatings is in general only obtainable by airless spray application.

3 3 Mixing of Two-Component Paints

Mixing must only be made in the proportion indicated in the specification.

As a general rule, two-component paints should be mixed half an hour before use.

The two components must never be thinned separately, but only after mixing.

3.4 Thinning

Thinning of paints should always be kept at a minimum and only the correct type of thinner must be used, according to specifications.

3.5 Overcoating Intervals

The minimum and maximum intervals are given for an average temperature of 20°C/68°F and may be increased or decreased with lower or higher temperatures.

7.4 INTRODUCTION TO PAINTING SPECIFICATIONS

4.1 System Information

Specification indicates the number and order of coatings to be applied.

4.2 Film Thickness – Wet

Indicates the absolute minimum of wet film to be applied to reach the specified dry film thickness.

4.3 Film Thickness – Dry

The specified dry film thickness will be regarded as the minimum film thickness for both individual coats and complete systems.

The number of instrument readings should be taken in the range of 20 readings per 20 ft. container side.

Tolerances: At least 85% of the film thickness readings shall be at or above the specified minimum film thickness and the remaining 15% of the film thickness shall not be less than 90% of the specified film thickness.

4.4 Spreading Rate

The theoretical spreading rate is solely based on the solids volume ratio of the paint and the specified dry film thickness on a smooth surface without losses.

The practical spreading rate can be estimated from the theoretical spreading rate, with the following reductions taken into consideration:

First Coat

Extra consumption to fill the "dead volume", corresponding to the average surface roughness to obtain the overpeak protection, plus an extra consumption of 20-30% for spillage.

Following Coats

20-30% extra for sansumtion spillage.

4.5 Specification All Steel DC Containers

A – Full Refurbishment

For full refurbishment a system consisting of a zinc rich epoxy primer followed by a thermoplastic high build can be recommended, such as HEMPADUR ZINC 1535 followed by HEMPATEX HI-BUILD 4637. (Painting specification sheet attached.)

Where a PVC finish is desired HEMPATEX HI-BUILD 4637 can be repalced by HEMPANYL 4661.

For marginal surfaces (i.e., where a cleaning degree of only St 3-Sa 2 can be obtained) HEMPADUR ZINC 1535 should be replaced by HEMPATEX PRIMER 1632. (Painting specification sheet attached.)

B – Touch-up and Repair

As a touch-up and repair coating for minor damages on HEMPATEX HI-BUILD 4637, a coat such as HEMPEL'S ACRYLIC 4641 with anti-corrosive pigments can be recommended. (Specification sheet attached.)

C – Cosmetic Topcoating

If the finishing coat on a container has discolourated or faded in service, it may be desired to paint the container for cosmetic reasons. For this purpose a coat of HEMPATEX HI-BUILD 4637 or HEMPEL'S ACRYLIC 4641 can be applied to a dry film thickness of 50-75 micron after degreasing, if necessary, and hosing down with freshwater.

8. Conclusion

The paper has covered subjects such as surface preparation, paint application, a typical procedure for refurbishment, and paint specifications and should give, together with owners or leasing company specifications (specifications for Steel Container Refurbishing, edited by Institue of International Container Lessors Ltd., New York) a thorough knowledge of container refurbishment and the requirements which will be demanded of surface preparation and paint systems.

It is recommended that specific questions directly related to the refurbishing plant project in mind should be further discussed with the respective equipment manufacturers and/or a container consultant as well as with the paint manufacturers such as HEMPEL'S MARINE PAINTS.

HEMPEL

Hempel's Industrial Coatings

AREA: SPECIALS

OPEN TOP CONTAINERS

m²/sq feet:

PAINTING SPECIFICATION

SYSTEM: HEMPADUR - EPOXY ESTER

Pretreatment: Abrasive blast cleaning to Sa 2½ according to Swedish Standard, SIS 055900-1967

SYSTEM INFORMATION

	Colour shade	Colour no.	Film thickness in micron (mil) Wet	Dry	Spreading Rate m²/ltr (sq feet/US gall.) Theoretical	Recoating Interval at 20°C/68°F and ample ventilation Min.	Max.	Method of Application Brush (B) Roller (R) Spray (S) B	R	S	Recommended Nozzle orifice	Nozzle pressure
												bar/p.s.i.
HEMPADUR ZINC 1535	grey	1983	75	30	16 (652)	15 min.				x	.017"-.021"	150/2100
HEMPEL'S TOPCOAT EE 5343	owner's colour*	200	75	5.6 (224)	when dry					x	.019"	180/2610
		min	Total d.f.t. 105									

PRODUCT INFORMATION

	Solids by vol. (%)	Curing Agent	Mixing Ratio Vol.	Potlife Hours	Drying Time at 20°C/68°F	Flash Point °C/°F	Thinner	Restrictions Min. Temp. °C/°F	Max. R.H. %
				20°C/68°F					
HEMPADUR ZINC 1535	48	9535	4 : 1	8	40-60 min.	25/77	845	10/50	
HEMPEL'S TOPCOAT EE 5343	42	-	-	-	2 hrs	25/77	808		

Surface temperature must be above dew point

Remarks:

* Physical data of topcoat slightly depending on colour

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HEMPEL

Hempel's Industrial Coatings

AREA: SPECIALS

BULK CONTAINERS - INTERIOR

(EXTERIOR DEPENDING ON CONTAINER TYPE)

m²/sq feet:

PAINTING SPECIFICATION

SYSTEM: EPOXY

Pretreatment: Abrasive blast cleaning to Sa 2½ according to Swedish Standard, SIS 055900-1967

SYSTEM INFORMATION	Colour shade	Colour no.	Film thickness in micron (mil) Wet	Dry	Spreading Rate m²/ltr (sq feet/US gall.) Theoretical	Recoating Interval at 20°C/68°F and ample ventilation Min.	Max.	Method of Application Brush (B) Roller (R) Spray (S) B	R	S	Recommended Nozzle orifice	Nozzle pressure
												bar/p.s.i.
Raw hides:	e.g.											
HEMPADUR LIGHT TAR 4563 °	grey		175	125	6.1 (248)	8 hrs.				x	.019"-.025"	200/2800
Beans, e.g. palm kernels:												
HEMPADUR 1540 °°	light red		275	120	5.8 (231)	10 hrs.				x	.021"	200/2800
	Total d.f.t.											

PRODUCT INFORMATION	Solids by vol. (%)	Curing Agent	Mixing Ratio Vol.	Potlife Hours	Drying Time at 20°C/68°F	Flash Point °C/°F	Thinner	Restrictions Min. Temp. °C/°F	Max. R.H. %
				20°C/68°F					
HEMPADUR LIGHT TAR 4563	76	9519	4 : 1	2	8-10 hrs.	25/77	845	10/50	
HEMPADUR 1540	46	9510	4 : 1	2	8-10 hrs.	26/79	845	10/50	
								Surface temperature must be above dew point	

Remarks:

° Alternative: HEMPADUR HI-BUILD 4520 in two coats

°° Alternative: 1 x HEMPADUR PRIMER 1530 + 1 x HEMPADUR HI-BUILD 4520

Both 4563 and 1540 to be applied in two coats.

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HEMPEL

Hempel's Industrial Coatings

AREA: SPECIALS

INTERIOR ROOF OF BULK CONTAINERS, AND OF DC CONTAINERS CARRYING GREEN CARGOES (e.g. cocoa beans)

m²/sq feet:

PAINTING SPECIFICATION

SYSTEM: WATER BASED

Pretreatment:

SYSTEM INFORMATION

	Colour		Film thickness (microns)		Spreading Rate m²/ltr (sq feet/US gall.)	Recoating interval at 20°C/68°F and ample ventilation		Method of Application Brush (B) Roller (R) Spray (S)				
	shade	colour no.	Wet	Dry	Theoretical	Min.	Max.	B	R	S	Recommended Nozzle orifice	Recommended Nozzle pressure
HEMPEL'S ANTI-CONDENS 6890	white		1.5	1.5	0.7 (27)	none				x	.25"	bar/p.s.i. 3.5/50
		Total d.f.t.		1.5								

PRODUCT INFORMATION

	Solids by vol (%)	Curing Agent	Mixing Ratio Vol.	Potlife Hours	Drying Time at 20°C/68°F	Flash Point °C/°F	Thinner	Restrictions Min. Temp. °C/°F	Restrictions Max. R.H. %
HEMPEL'S ANTI-CONDENS 6890	50	-	-	-	1 hour	none	water*	5/40	Surface temperature must be above dew point

Remarks:

* Normally not necessary. Excessive thinning will decrease viscosity and reduce water absorbing properties.
Through dry: 8 hours at 55% R.H. and 20°C/68°F.

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Hempel's Industrial Coatings

AREA: SPECIALS

TANK CONTAINERS (FRAME ONLY)

m²/sq feet:

PAINTING SPECIFICATION

SYSTEM:

Pretreatment: Abrasive blast cleaning to Sa 2½ according to Swedish Standard, SIS 055900-1967

SYSTEM INFORMATION

Colour		Film thickness in micron (mil)		Spreading Rate m²/ltr (sq feet/US gall.)	Recoating Interval at 20° C/68° F and ample ventilation		Method of Application Brush (B) Roller (R) Spray (S)				
shade	colour no.	Wet	Dry	Theoretical	Min.	Max.	B	R	S	Recommended Nozzle orifice	Nozzle pressure
Total d.f.t.											

COATING SYSTEM:

Often same as for DRY CARGO all steel but considerations for splashes may indicate a more chemically or solvent resistant system.

PRODUCT INFORMATION

Solids by vol. (%)	Curing Agent	Mixing Ratio Vol.	Potlife Hours	Drying Time at 20 °C/68° F	Flash Point °C/°F	Thinner	Restrictions Min. Temp. °C/°F	Max. R.H. %

Surface temperature must be above dew point

Remarks:

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Hempel's Industrial Coatings

AREA: SPECIALS

CHASSIS

m²/sq feet:

PAINTING SPECIFICATION

SYSTEM: ACRYLIC

Pretreatment: Abrasive blast cleaning to Sa 2½ according to Swedish Standard, SIS 055900-1967

SYSTEM INFORMATION

	Colour shade	Colour no.	Film thickness in micron (mil) Wet	Dry	Spreading Rate m²/ltr (sq feet/US gall.) Theoretical	Recoating Interval at 20° C/68° F and ample ventilation Min.	Max.	Method of Application Brush (B) Roller (R) Spray (S) B	R	S	Recommended Nozzle orifice	Nozzle pressure
HEMPEL'S ACRYLIC 4641	owner's colour*		300	120	3.3 (134)	12 hrs.				x	.017"-.021"	bar/p.s.i. 150/2100
		min	Total d.f.t.	120								

PRODUCT INFORMATION

	Solids by vol. (%)	Curing Agent	Mixing Ratio Vol.	Potlife Hours	Drying Time at 20 °C/68° F	Flash Point °C/°F	Thinner	Restrictions Min. Temp. °C/°F	Max. R.H. %
HEMPEL'S ACRYLIC 4641	40 *	-	-	-	4 hrs.	30/88	809		

Surface temperature must be above dew point

Remarks:

* Physical data of topcoat slightly depending on colour

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