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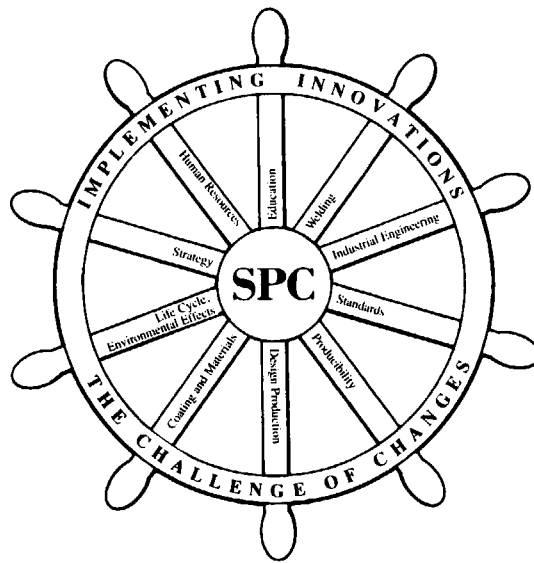
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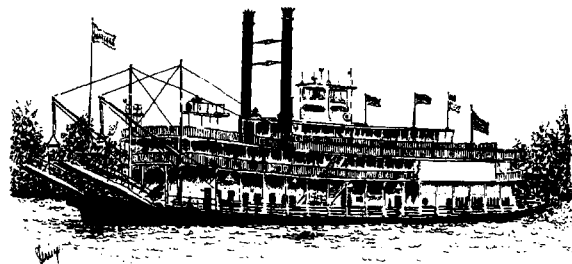
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THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

1992 SHIP PRODUCTION SYMPOSIUM



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Can U.S. Shipbuilders Become Competitive No. 3B-1 in the International Merchant Market?

Jorgen Andersen, Visitor, Burmeister & Wain Skibsaeft A/S, and **Cato F. Sverdrup**,
Visitor, Burmeister & Wain Holding A/S

God must have been a shipowner. He placed the raw materials far from where they were needed and covered two thirds of the earth with water.

[Erling Naess]

ABSTRACT

This paper begins with an assessment of the future shipbuilding market in order to evaluate if there is a basis for conducting attractive business.

Having concluded that the market forecast looks interesting, at least for the efficient shipbuilders, the paper goes on to evaluate if U.S. shipbuilders have the potential to become competitive.

Finally, specific suggestions are offered as to how U.S. shipbuilders can become competitive.

INTRODUCTION

It lies implicit in the title of this paper that U.S. shipbuilders are not competitive. This is evidenced by examining the meagre orderbooks of U.S. shipyards. The situation is serious and aggravated by the announced cuts in naval construction.

The first question that comes to mind is: Why are U.S. shipyards not competitive?

- is it due to subsidies?
- Is it low productivity?
- Is it the bureaucracy of the U.S. regulatory authorities?
- Is it too high prices for materials?

The list of questions can go on.

Answers to these questions have been and are presently being offered by many individuals

and organizations, and have been and will be widely published.

This paper will also address the questions, but in the context of proposing answers to a set of more fundamental questions concerning the future:

“Will the shipbuilding market be attractive?”

if the answer is affirmative:

“Have U.S. shipbuilders got the potential to become competitive?”

and if the potential is there:

“How do U.S. shipbuilders become competitive?”

THE MARKET FORECAST

If a man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties.

[Francis Bacon (1561-1626)]

As the purpose of building ships is to make money, let us look at the expected market for this Business Sector.

As in other industries, the balance of supply and demand determines price levels which in turn have a major influence on the potential profitability of shipbuilders.

The major factors influencing the demand/supply balance are shown in the following simplified model, figure 1.

economic growth	yard facilities
transport work	contraction/ expansion
existing fleet	productivity
age structure/ scrapping	subsidies
ships on order	perception of the long term future
fleet efficiency	financing availabi- lity
rules and regulations	political behaviour
shipowner behaviour	
political behaviour	



Fig. 1. Factors affecting the Demand and Supply for Yard Capacity

On *the demand* side, the following questions should be answered:

- how **big** is the demand?,
- how does the demand **vary over time**?,
- what types of ships will be in demand?, and
- in which **size ranges**?

The forecast future growth in industrial production in the Organization for Economic Cooperation and Development (OECD countries), is shown in figure 2.

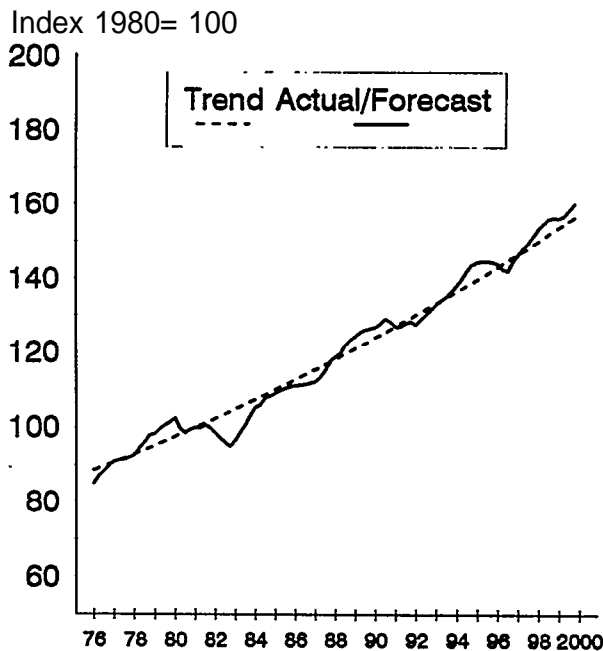


Fig. 2. Industrial Production, OECD (1)

The expected growth rate trend is 2,5 percent per annum.

The anticipated global seaborne transportation generated by the economic activity is shown in figure 3.

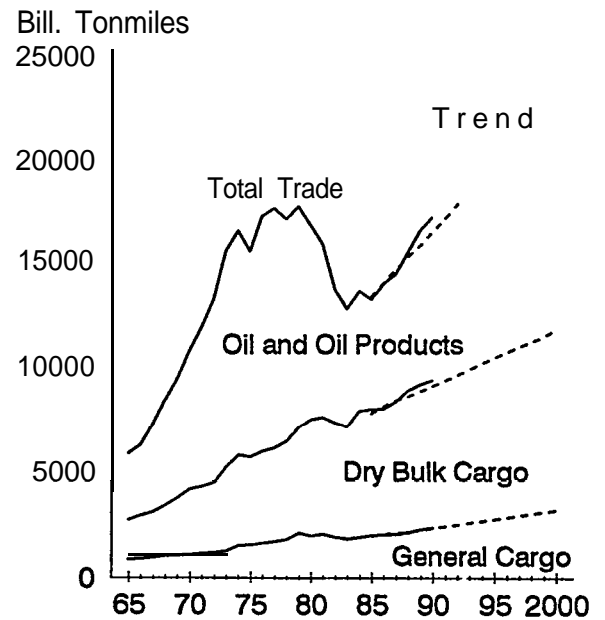


Fig. 3. Global Seaborne Transportation (1)

This transportation requirement, together with scrapping and trend towards larger ships, is expected to result in the following pattern of contracting and deliveries of newbuildings - figure 4.

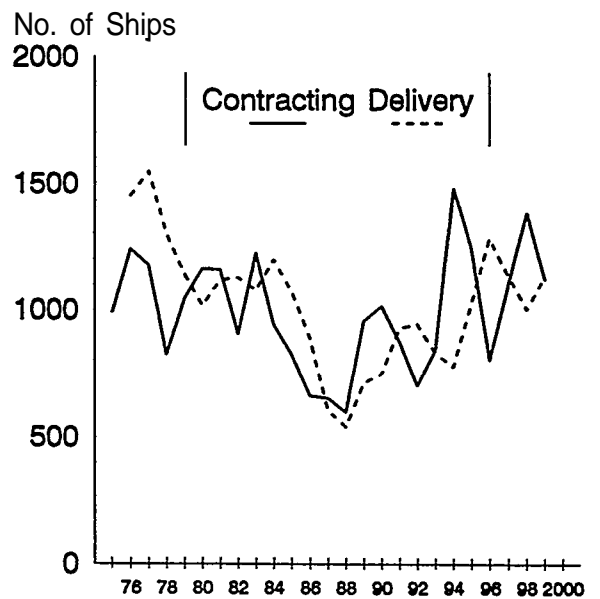


Fig. 4. Contracting and Deliveries of Ships above 2.000 DWT. (1)

It is estimated that the requirement for various types and sizes will be as shown in fig. 5.

	Aver. No. of ships per year
Tankers:	
Product	85
Crude < 150.000 dwt	
" > 150.000 dwt	90
Total	240
Dry bulk:	
104.000 dwt	125
40-80.000 dwt	80
>80.000 "	
Total	2
General cargo/container:	
<8.000 dwt	250
>8.000 "	200
Other types:	
	120
Total	1050

Fig. 5. Required No. of ships above 2.000 DWT during 1992-20tK1 (1)

The **supply** side of the shipbuilding industry has changed dramatically from 1977 to 1991, as shown in figure 6.

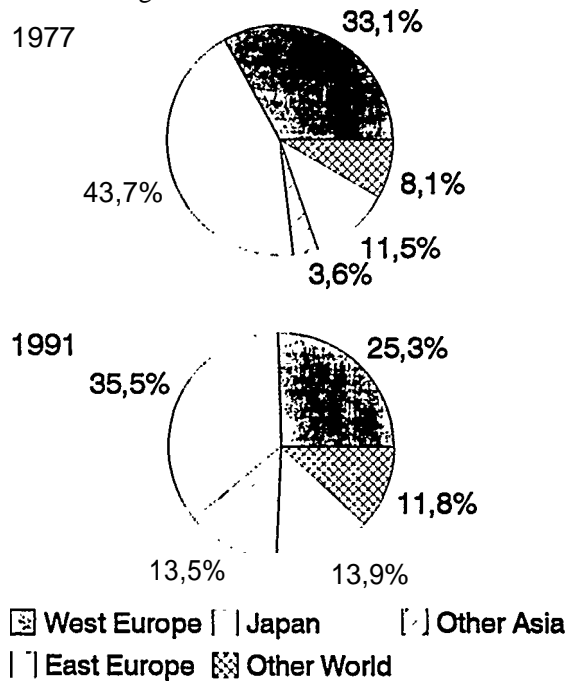


Fig. 6. Maximum Yard Capacity 1977 and 1991 (1)

The expected future capacity can only be a very rough estimate indeed, considering the following:

Japan has decided to eliminate the self-imposed "capacity ceiling".

Japan, S. Korea, Denmark and others are implementing massive investment programs to boost productivity.

Japan has big problems in attracting younger qualified people to the shipyards and may have to import labor.

The Japanese and S. Korean workers are demanding shorter working hours and better conditions, which may diminish improved productivity opportunities.

The impact of emerging shipbuilding nations like China, Russia, "East" Germany and Brazil is difficult to gauge.

The requirement for double hull tankers will increase the workload on the yards, and reduce output.

If prices increase to an attractive level then some yards will be tempted to increase capacity.

All together we expect the **supply/demand** balance for yard capacity is as shown in figure 7.

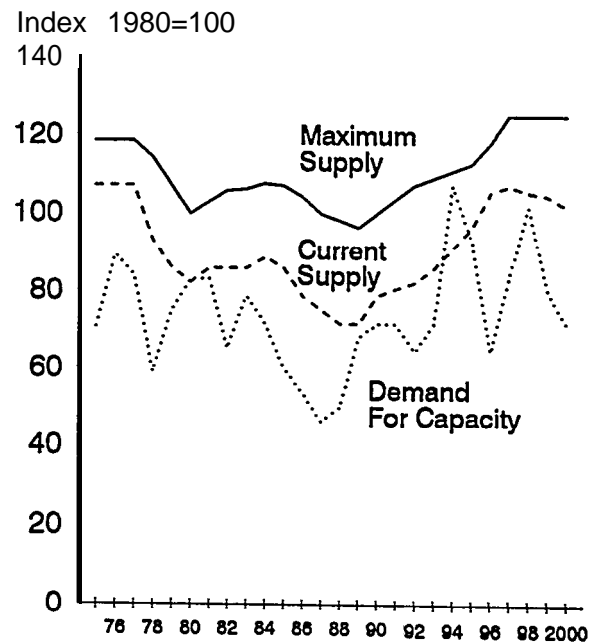


Fig. 7. Supply/Demand for Yard Capacity (1)

“Current supply” is the short term capacity which can fluctuate within a few years whereas the “maximum supply” is the potential capacity, which can only be changed over a longer time span.

The question of subsidies will also have an influence as to whom actually wins the orders.

No attempt will be made to answer this controversial and complicated issue here.

Not only is it impossible to accurately define and quantify the subsidies provided today in individual countries, but how should one evaluate the impact of:

The possible result of the current negotiations within the OECD working party No. 5;

- The “Gibbons Bill” (H.R.2056), if it is finally passed by the Senate and signed by the President;
- The approved subsidy to former East German yards of up to 36 percent until end '93; and

The future level of subsidy level within the EEC;

and other factors which will influence the level of subsidies?

One should not forget, however, that the subsidy level within the EEC has been reduced in recent years from almost 30 percent to the present level of 9 percent, and the elimination by the U.S. of its subsidies. We believe that this trend towards virtual elimination of subsidies will continue.

Based on all the above parameters, the estimated market price index for cargo ships, measured in current U.S. dollars, is as shown in figure 8.

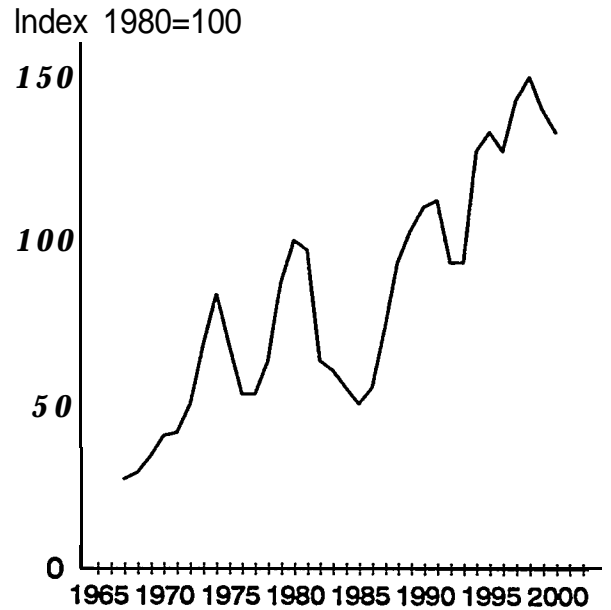


Fig. 8. Newbuilding Price Level - Past and Future (1)

In conclusion we believe that, at least for the next decade, the demand/supply situation will result in a price level which will be attractive to efficient shipbuilders.

THE POTENTIAL

Seen from the outside looking in, we can identify three reasons why U.S. shipbuilders have the potential to take advantage of these positive global market forecasts:

1. Low labor rates,
2. Neutrality to currency exchange rates, and
3. Ability to develop and adopt new technology.

U.S. shipbuilders have low gross hourly labor rates as can be seen in figure 9

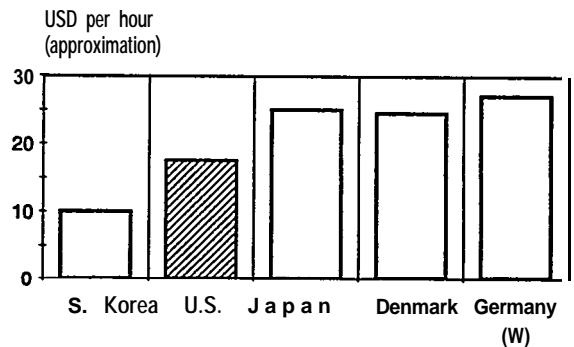


Fig. 9. Hourly Labor Rates

Japan, Germany (W) and Denmark, accounting for about 70% of the global output (in DWT), all have substantially higher (up to about 40% higher!) labor rates than the U.S.

As labor costs constitute about 15-20% of the total costs of building, this means that the U.S. shipbuilder will have a cost advantage of 6-8% if the comparison is made at the same productivity level.

Shipowners evaluate prices for ships in U.S. dollars, as most of their income and expenses are in U.S. dollars. This gives U.S. shipbuilders a great advantage since they are, by and large, neutral to the exchange rates of the U.S. dollar to other currencies. The only exceptions are the few instances where foreign equipment cannot be paid for in U.S. dollars.

The fluctuation of the U.S. dollar exchange rate in recent years can be seen from figure 10.

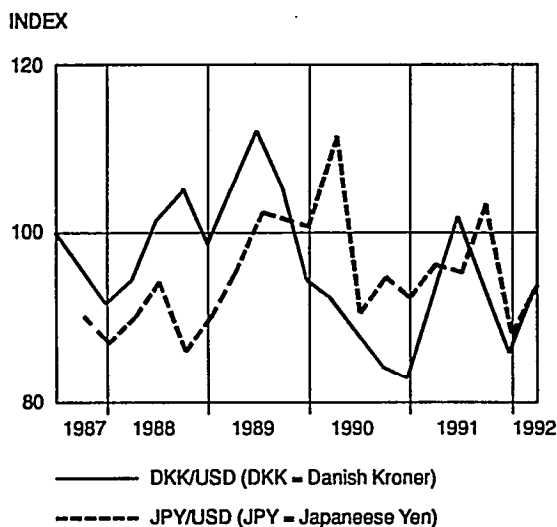


Fig. 10. Currency Exchange Rates

The exchange rate DKK/USD fell by 50 **percent** from January 1985 to January 1988.

These fluctuations mean that the prices quoted by yards not having a U.S. dollar based economy will fluctuate correspondingly. The following case from our own yard illustrates by how much at the present time:

Sales price of ship 60 million U.S. dollars.
 No money spent in U.S. dollars.
 Payment terms (month/year):

5%	6192	(contract)
15%	12192	
20%	2193	(start production)
20%	7193	(keel laying)
20%	10/93	(launch)
20%	12193	(delivery)

If we decided not to secure the U.S. dollar against Danish Kroner, we would, based on actual fluctuations within the last year, be running the risk of incurring a loss of up to about 12 m US Dollars equivalent to about 20 percent of the sales price.

As we are shipbuilders, not gamblers, it is our policy to secure the U.S. dollar, which can be done, but, depending on interest rate differentials, sometimes at a cost which comes off our bottom line.

Some non U.S. shipbuilders have solved the problem by only quoting in their own currency. Their success or otherwise depends on the price they are quoting and whether it is a buyer's or seller's market.

U.S. shipbuilders will not have these fluctuations and can enjoy a stable basis for their pricing.

Thirdly U.S. industry has a high ability to develop as well as to adopt new technology, concepts and ideas. The adoption of the Toyota "Lean Production" concept by some American automobile producers is a good example of this.

We conclude that U.S. shipbuilders have potential to become competitive.

HOW TO BECOME COMPETITIVE?

Annual income twenty pounds, annual expenditure nineteen ninety-six, result happiness.
 Annual income twenty pounds, annual expenditure twenty pounds and six pence, result misery.

[Mr. Micawber in
David Copperfield]

Having concluded that the market will be attractive and that U.S. shipbuilders have the potential to become competitive, how can U.S. shipbuilders *actually become* competitive?

The approach taken is to ask:

“What would we do if we were to run a shipbuilding company in the US. building ships for the international merchant market?”

First we would make some qualified statements in relation to each major area.

Business Approach

Shipbuilding must be viewed in the long term. It is crucial to ensure high productivity and thereby minimal costs as ships are sold primarily on price. To ensure high productivity, shipbuilding must be regarded as an *industrial operation*, and not as the conclusion of one or more one-off projects.

Marketing/Products Approach

Basically there are two types of shipbuilders.

One is the Seller of Capacity where an owner requires a ship defined specifically by that owner. The yard designs and builds that ship.

The other is *the* Seller of Products where the yard designs standard ships in accordance with expected requirements in the market and offers the standard designs to potential owners. Optional (but limited) extras are incorporated into the standard design for the individual owner, and the ship is built.

By being a Seller of Products, Series Production can be established, i.e.:

- A continuous production of a number of ships of the same type and size.

The minimum number of ships in a series should correspond to about the yearly number of launches from one building berth or dock.

Series production will ensure

Lower costs due to the repetition effect, rational industrial manufacturing and scale of production. Cost reductions, compared to one-off production, will result for material suppliers, sub-contractors and the yard itself.

Figures 1 la and 1 lb show the reduction in manhours (production and design) experienced at

Burmeister & Wain Skibsvarft A/S.

To ensure that the figures are comparable, adjustments for variations in specifications for different owners have been made.

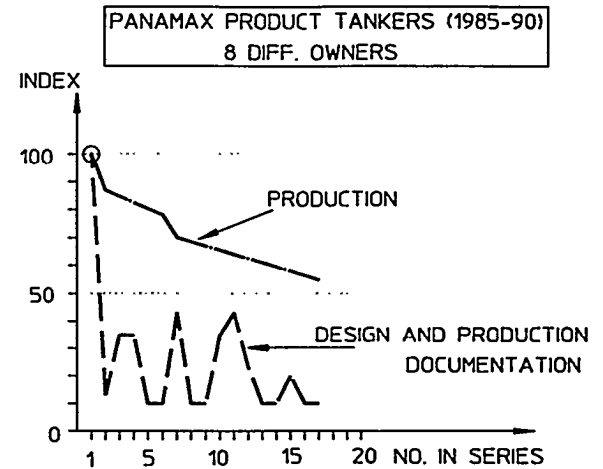


Fig. 11a. Manhour Curve-Series Production

These 17 product tankers were all double hull design.

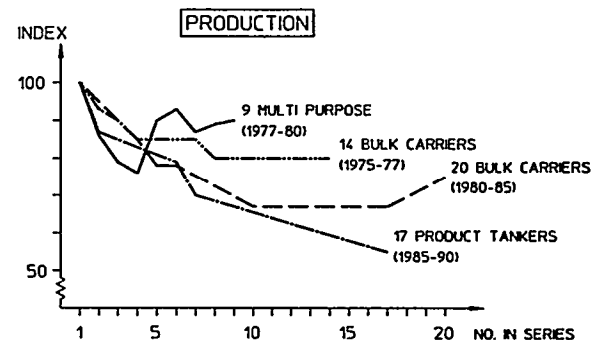


Fig. 1 lb. Manhour Curve-Series Production

The curve for the 9 multi purpose ships was heavily effected by special circumstances after ship No. 4 (the period 1979-80), as was the increase on the last ships in the series of 20 bulk carriers.

In a series of 10 ships, we would budget for the manhours on ship number 10 to be 30 percent less than the first ship.

Higher volume will be achieved through the same facilities using series production compared to one-off production.

Shorter throughput time and thereby less capital employed and consequently also reduced costs of financing.

Our U.S. company would be a *Seller of Products* and the Product Policy could read something like:

- to design standard ships required in the market in sufficient numbers for series production.

Marketing strategy would rest on a detailed knowledge of the world market's demand for ships. It is essential that this knowledge is constantly updated in order to anticipate and profit from future changes in the market. Market research and close cooperation between the Marketing/Sales functions and design will ensure that we have an advantage over the competition.

Present and future markets are characterized by a shortage of funds for buying ships. Few owners have the financial strength of the past, when often they were capable of paying cash for their vessels. It is therefore of vital importance to supply not only a good technical product, but also a financial package which ensures a competitive commercial product.

Our U.S. company would not undertake work for the Navy or repair/conversion work as this would have a negative influence on productivity.

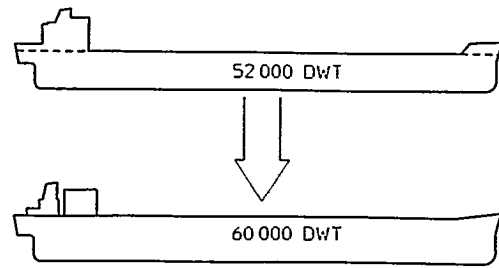
Design

The design function has the single biggest influence on productivity.

The design work will be carried out with great attention to ease of production and the utilisation of up-to-date Computer Aided Design (CAD) systems.

Simplification, standardization and production friendly design will be key words for the designers.

Examples of this are shown in figures 12a-12d.



	52.000 DWT	60.000 DWT
Forecastle	YES	NO
Poop	YES	NO
Box superstructures	NO	YES
Cargo hold length	SEVERAL	SAME
Cargo hatch sizes	SEVERAL	SAME
Double bottom height	SEVERAL	SAME
Modulized E.R.	NO	YES
No. of hull pieces	51.000	35.000
Weld length	248.000M	200.000M
Pipe length	38.000 M	26.000 M

Fig. 12a. Simplification of Bulk Carrier

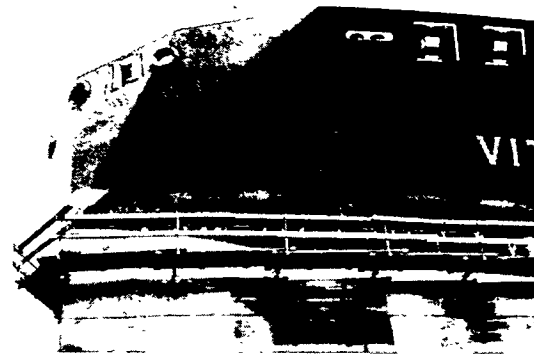


Fig. 12b. Simplification (bow)

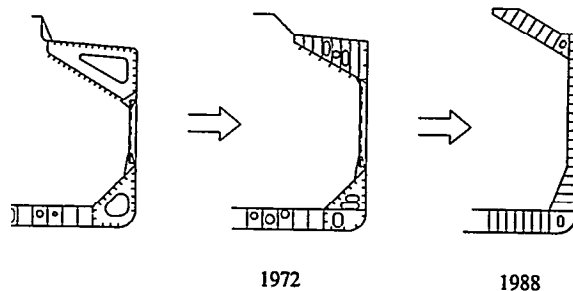


Fig. 12c. Standardization/Simplification



Fig. 12d. Production Friendly Curvature

Our U.S. company will employ its own designers, assisted from time to time by engineering companies in order to level out the work load.

Standards and Procedures

Our company will work for acceptance by the U.S. Coast Guard, and other U.S. authorities, of international standards and procedures in order to be able to procure equipment at international price levels and also to ensure speedy approval.

Some analyses have indicated that the additional costs of U.S. Flag Vessels, built outside the U.S., are on the level of 7-10 percent, and even higher figures have been suggested. Some Japanese yards have added 10 percent on the price to account for U.S. flag requirements.

Industrial Engineering

Industrial engineering disciplines will be applied in order to ensure:

1. efficient flow of materials,
2. selection of the most suited production equipment and processes, and
3. efficient design of flow-lines, jigs and fixtures etc.

Examples are seen in figures 13a-13d.

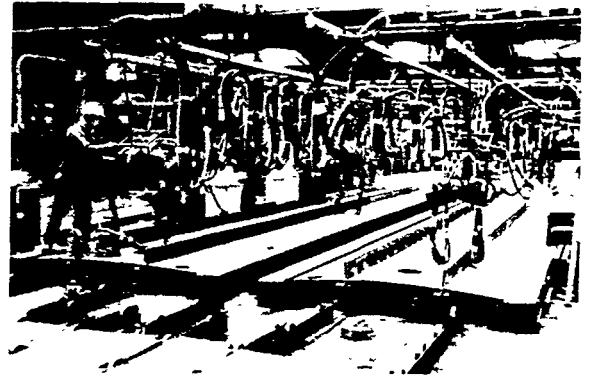


Fig. 13a. Flow-line for Sub-assemblies

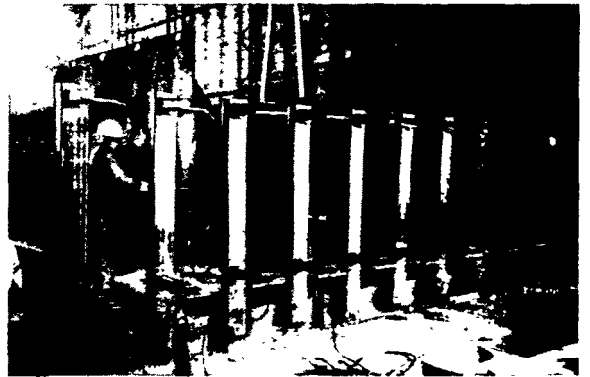


Fig. 13b. Jig for Double Bottom Blocks



Fig. 13c. Hydraulic Jig for Joining of Sub-blocks

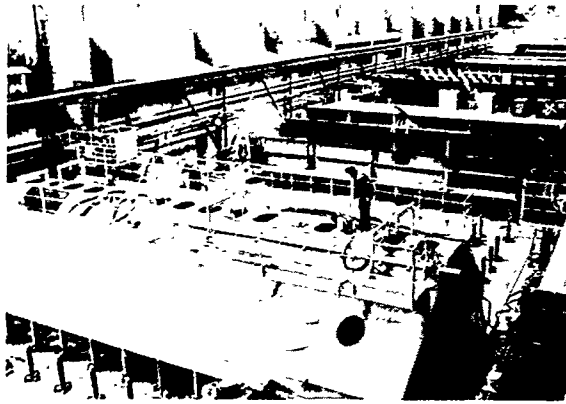


Fig. 13d. Flow-line for Block Fabrication

Our U.S. company will use the methods of shop fabrication of pipe and machinery packages as well as extensive early outfitting and surface treatment of hull blocks.

Incentives and Management/Employee Relations

Our U.S. company will apply Incentive Compensation Systems under the principle:

The higher the efficiency the higher the pay

and the management of our company will be conducted on the basis of "two way participation," informative and frank.

The above qualitative statements will be supplemented with the *quantified* productivity targets listed below.

What is required?

The required productivity is dictated by the competition in the market. The productivity target will consequently be to reach the level of the most productive competitors.

We will use two measures synonymous with productivity:

1. Manhour consumption
(measured as manhours per compensated gross tons, MH/CGT), and
2. throughput time.

The most productive yards can today achieve 10 MHICGT and *it will be our U.S. Company's target to achieve that figure within five years from start of operation.*

It should be recalled that U.S. yards today have a cost advantage of 6-8 percent at the same productivity level due to lower labor rates (ref. figure 9).

The target for throughput time is best illustrated by using a Panamax (dry) bulk carrier as a reference point.

For such a vessel, with LxBxD = 225m x 32m x 19m, and based on a volume of 5 vessels per year, the throughput time in production should be as shown in table 1.

Production phase	Duration (weeks)
Start steelcutting - keel laying	23
Keel laying - launch	10
Launch - seatrials	
Seatrials - handover	
Total	40

corresponding to abt. 9 months.

Table 1. Throughput time

A product tanker (double hull) with the same main dimensions should have a throughput time of about 10 months.

Due to the virtual non-existence of U.S. commercial shipbuilding since the early 1980s, it is not possible to make a reasonably accurate assessment of the present productivity level in U.S. shipyards. Therefore, it is not possible for us to evaluate exactly by how much U.S. yards have to improve in order to reach the levels of their most productive international competitors. Having said that, it is our belief that the gap is substantial.

There may be some U.S. shipbuilders reading this paper who can provide some statistics which we could use as a basis for comparison. We would welcome such a contribution to the debate. A debate which would be of great value to the U.S. shipbuilding industry.

Finally we believe *U.S. shipbuilders can become competitive - if they are determined!*

REFERENCES

- (1) MSR Consultants ApS., Denmark.

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