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# SOME OBSERVATIONS ON SHIP MANNING DEVELOPMENTS IN NORTHERN EUROPE, AND IMPLICATIONS FOR DESIGN

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## ABSTRACT

In this report you will find a summary of the interwoven economic, technical, and social factors that are forcing change in the management of merchant fleets of northern Europe. The cumulative effect upon seafaring life and seafaring careers has been nothing short of profound.

Human factors have in the past been relatively neglected in comparison to the attention given to technical and economic factors. If the national fleets of high-wage nations are to survive in international competition, ways must be found to increase the productivity of crew members to a level commensurate with their earnings. This can only be achieved through a strategy of design and operation that thoroughly intertwines social, economic and technical considerations into an integrated unity. This is my primary conclusion. From it follow recommendations, some general, some specific. These are directed to fleet managers, seafarers, ship designers, and the appropriate centers of education and training. The main emphasis, however, is directed to the fraternity of naval architects and marine engineers.

# PREFACE

During the half-year period of March through August 1983 I was privileged to serve as a visiting professor at the Technical University of Berlin. In addition to my teaching duties I was encouraged to undertake a research project of my own choosing. My decision to investigate current manning developments in northern Europe -- and their interactive effects on design -- arose from my long-held interest in improving shipboard operations, coupled with Berlin's proximity to those elements of the industry where so much progress is being achieved.

Because of time limitations I was able to visit and interview only a fraction of the most knowledgeable experts in the field. I did, however, manage to sit down with more than fifty individuals representing some thirty different organizations in eight different countries of northern Europe. These were not only fleet managers, but researchers, directors of owners' associations, and (of course) ships' officers as well.

In addition to my travels in northern Europe, I had occasion to visit Spain, Italy, and Yugoslavia. In those countries I took the opportunity of interviewing an additional dozen members of the industry representing eight different organizations. Although southern European shipowners seem more inclined to cling to conventional manning practices, their views on future developments and their somewhat different perspectives made valuable additions to my notes.

The list of references at the end of the report includes the various organizations and individuals who were kind enough to contribute time and advice. I wish to acknowledge my most sincere appreciation for their help and for their patience in answering my rather naive questions.

On another topic, the question will naturally arise: How applicable are these findings to the merchant fleets of other parts of the world with their considerable economic, political, and cultural differences? My reply is that certain principles that are now emerging in northern Europe are universally applicable. Moreover, all of the ideas that have been proposed (and perhaps tried) are at least worth consideration, and so provide a stimulus to creative thought anywhere. In Einar Thorsrud's words, "the methods and the results of scientific research are not defined by national boundaries."

I want to express my thanks to the administrators of the Technical University of Berlin for their generous support that made my work possible. This came at a time of financial difficulty at the institution and is therefore all the more appreciated. A few individuals merit particular thanks: Horst Nowacki, who served as my chief liaison; Günter and Gunhild Grossmann, who served as chief host and hostess; and Frau Kujanek and Frau Schiepan, who transformed my handwritten manuscript into the initial, tentative version of this report, which was circulated through the hands of all the individuals who had contributed their thoughts.

The inimitable Paula Bousley deserves credit for typing this final version, which incorporates the many suggestions received after reviews of the initial version.

A final word of thanks is owed my good wife, Betty. She made all the travel arrangements, a time-consuming task indeed. Some idea of the scale of this assignment may be inferred from the fact that we laid our heads to rest in fifty different rooms during our seven months abroad.

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# I. INTRODUCTION

In the 1970s a chronic shortage of seafarers, particularly licensed officers, forced European shipowners to grant evermore attractive financial incentives to their crews. They simultaneously entered a competition to see which fleet could offer the most comfortable accommodations and most attractive rotation schemes. Today, the depressed market has removed the shortage of seafarers; and yet there is no backing down on the level of financial support or on the recent advances in the quality of life and work aboard ship. At the same time severe economic pressure is felt, particularly in the openly competitive bulk trades. Here, the low-wage nations of the orient and the politically supported fleets of the Eastern Bloc are forcing change on the shipowners of northern Europe.

Highly-paid mariners must be highly productive if their fleets are to survive. Impressive strides in productivity have been achieved through making ships bigger and faster both in sea speed and (more significantly) in port turnaround time. But, that is not good enough; the fleets of low-wage nations can, and do, make equal progress. Fortunately, there remain ways to meet the competition. Among the most potent of these is to increase crew productivity by introducing changes in technology and management leading to a rational decrease in crew numbers. And that is exactly what has been happening in the fleets of northern Europe. Whereas twenty years ago a typical new Panamax bulk carrier might have a crew of 40 men, today it might have only half that number. Moreover, the trend is steadily downward and predictions of a twelve-man crew are not uncommon. Owners of low labor cost fleets could, of course, reduce shipboard personnel, too. They would be unwise to do so, however, because the potential for savings in wages would not be enough to match the greater capital cost.

Curtailing crew numbers helps the economic situation, but it brings with it psychological problems of loneliness and greater susceptibility to social problems with misfits and excessive drinking. This comes at a time when changes in technology and trading patterns have made life on board at times more boring and at times more nerve-wracking. Other technical changes have eliminated the seafarer's traditional emotional release of prolonged periods of relaxation in a variety of exotic ports.

Today, throughout northern Europe there is a groundswell development toward greater democracy in the work place. Increasingly, workers on shore are being allowed a greater voice in the management of their companies and in the detailed planning of their own work. Seafarers want, and now expect, similar treatment. Some north European shipowners are accordingly making radical experiments in this direction as part of their efforts to solve managerial as well as social problems.

Labor-saving concepts are of course being built into the new ships while, at the same time, seafarers' training is being modified to suit the demands of a rapidly changing technology. We are also seeing the emergence of greater individual versatility, allowing each member of the crew to shift his service to whatever phase of operation is for the moment most in need of help.

As is apparent from what I have written above, maritime economic, technical, and social conditions are in a state of flux; and changes in any one factor induce inescapable changes in the others. Efforts to meet competition from low-wage fleets can succeed only if the interrelatedness of all factors is recognized and -- I need hardly add -- if teamwork can be established between all those cantankerous human beings (and between their even more cantankerous associations, unions, and bureaucracies).

David Moreby (22)* is one of the marine industry's more astute and

*Numbers in parentheses refer to the appendix

experienced observers. He put it to me in words to the following effect: To succeed in meeting low-wage competition an integrated program is needed, one that will splice these six strands:

1. Ships designed for ease of operation and maintenance.
2. Changes in training and education for ship's personnel and ship designers.
3. Maximum versatility of shipboard personnel.
4. Smooth labor-management relations.
5. Intelligent government (including international) controls.
6. Better quality of seafaring life.

These six points will be expanded upon in later chapters of this report. Chapters II and III deal with recent changes in ship types and services and why they have tended to make life unpleasant for the seafarer. Chapter IV discusses what managerial and design changes are being tried as means of improving life aboard ships. Chapter V talks of the need for changes in the training of seafarers. Chapter VI takes up the need for changes in how we go about designing ships, particularly the accommodations and working spaces. Chapter VII is the big one; it compiles all the good advice I could find on what a ship designer needs to know about how to maximize crew productivity while at the same time improving the quality of life aboard. Chapter VIII gets into the need for changes in the education of naval architects and marine engineers. Chapter IX inevitably brings up some questions left unanswered in my studies; while Chapter X summarizes some overall conclusions, the central message being that high-wage fleets <u>can</u> compete if everyone concerned cooperates in making the ships well-managed well-designed capital-intensive enterprises.

In closing this introduction a few incidental remarks are in order.

First, a matter of definitions. By <u>crew</u>, I mean all of the regular

working personnel aboard. That excludes trainees (cadets), family members, owner's guests, pilots, temporary work squads, hardware suppliers' personnel, and so forth. By officers I include all licensed personnel from mates, assistant engineers, radio operator, and chief steward on up through captain. The rest of the crew I shall call by the convenient British term ratings.

Finally, another matter of word usage. Women are increasingly finding shipboard employment, a practice that I personally applaud. It does tend, however, to lead fair-minded writers to fatten their pages with references to "him/her," or a "40-man/woman crew." Throughout this report, please interpret any specific reference to the male sex as really applying to women as well.

## II. TRENDS AFFECTING SEAFARING CAREERS

David Moreby (56) calls attention to the way merchant ships have over recent decades become more specialized in service and more sophisticated in technology. Specialization in service translates into few ports of call. The combination of specialization and sophistication translates into special training requirements; hence difficulty in switching an officer from one kind of ship to another.

One of the major improvements we have seen in marine transport technology is the recent advent of containerships, ro/ro ships, and other systems dedicated to quick turnaround in port. That this has been an admirable development no one can deny. It has, however, had a serious effect on the seafarer. The monotony or pressures of ocean crossings used to be relieved by prolonged periods in foreign ports. Now, port times are reduced to a matter of hours, and -- indeed -- the crew may find those hours to be the busiest and most demanding of the entire voyage.

To worsen the situation, modern ports tend to be remote from the centers of urban life. Moreover, they may be found in a part of the world where local culture stands between the seafarer and his usual procedures for relieving the tensions of shipboard life. In some Persian Gulf ports, for example, the crew is all but forbidden to go ashore. Worse yet, the authorities board the ship, inventory the liquor supply, and seal the bar (25).

The concurrent trend toward reduced crew size has brought with it important secondary effects on the quality of seafaring life. Some of these have been beneficial, others quite the opposite. These will be discussed in the next chapter. What needs to be said here is that these developments are being influenced by what is going on among the seafarer's shoreside brethren. There, throughout northern Europe, the idea of industrial democracy is fairly

well established. This concept, aimed at improving the quality of working life, is best achieved with small, homogeneous teams of workers. It involves a degree of autonomy for the team, individual responsibility, and an escape from narrow specialization (37).

Developments in satellite communication, shipboard telex, and other marvels of modern technology have increased the potential for stronger centralized control of ships from the home office. At the same time, however, they have also strengthened the case for devolution, the decentralization of authority -- in keeping with the trend toward industrial democracy. This debate is taken up again in Chapter IV.

## III. EFFECTS ON SEAFARERS

As economic pressures and technological developments have induced important changes in ships, business managers and naval architects have often overlooked the effect of those changes on shipboard existence. New technologies and new operating methods offer the possibility of improving seafaring careers. Yet, on the whole, because the social effects of change have often been overlooked, seafaring life has actually become degraded. This is highlighted by the finding (88) that murders and suicides on board ships equal in number all deaths from accidents or ship casualties -- a finding, that, needless to say, is hardly typical of every fleet (24).

If shipowners want to attract and retain good crews, they must recognize what is happening. Young workers today want something more out of work than money and security (62,92). The old call of the sea with romantic notions about extended calls in exotic ports is now fraudulent (56). Highly automated ships combine the boredom of nothing to do when the devices are working, with the frustration of being unable to fix them when they are not. Any normal man needs a full day's work (53), and it is not surprising to find the happiest crews are on ships in short, stressful trades (3,21) or on older ships that require continuing attention and repair (56). This is not an argument in favor of artificially induced risk or lessened reliability. It is, however, a recognition that on long ocean voyages the watch-stander's number one problem is sheer unadulterated mind-numbing boredom (3,80). Boredom with nothing to do, boredom with looking at the same old faces, and boredom that leads to accidents.

Automation has its virtues. The relief of boredom is not among them.

Recent successes in reducing crew size have brought an accentuation of other human problems. Chief among these is loneliness, an effect that is

especially pronounced in ships where the traditional lines of authority are still enforced.

Smaller numbers aboard worsen the problem of misfits. In a crew of forty or fifty a single malcontent or alcoholic can more or less be ignored. In a crew of twelve he cannot (22). On the other hand, one of the requirements of minimum crew size is that each man must be called upon to do a variety of tasks. What surer way to avoid boredom? But, having relieved boredom, we may find ourselves at the other extreme: stress. What about being in lone control, if only for a few hours, of a 200,000 DWT tanker with a nine-man crew (55)?

In short, recent shipboard developments have tended to increase the psychological pressures endured by seagoing personnel. For the ambitious young officer on a long ocean voyage this may be exacerbated by an inability to apply his newly learned skills or demonstrate his competence (22).

To be fair, of course, we must admit that most shoreside jobs also induce psychological tensions for one reason or another. It would be a dull world, indeed, if this were not true. The important difference is that the office worker, the factory worker, or the farmer can relieve his tension when off the job. He switches roles upon returning home. He puts himself in new surroundings and can find a wide choice of diversions to help him forget the pressures of his work (22,56,92). The seafarer, however, is a prisoner of his ship. He sees the same faces on the job and off, and no longer enjoys the pressure-relieving privilege of relaxing in interesting ports. It is an unnatural life, and there is no cause to wonder that social tensions may become acute. The most trivial irritants can get blown up out of all proportion, and normally reasonable adults engage in childish spats (80,92).

In order to improve the quality of life aboard ship, and to see that ships are operated most economically, shipowners are now being forced to

introduce changes, some of them radical, in the management of their ships. What these changes are forms the subject of the next chapter.

## IV. ADAPTIVE DEVELOPMENTS IN MANAGEMENT AND LIFE ABOARD SHIP

Throughout northern Europe different fleet managers are trying different methods to overcome the human problems discussed in the previous chapter. What these various methods have in common is an intent to improve the quality of life for seagoing people while at the same time reducing the numbers required. This is simply a matter of enlightened self-interest for both management and labor. Unless shipowners succeed in attracting and retaining well-qualified crews, all the advances in managerial methods and sophisticated technology will be wasted. Moreover, a well-qualified crew must be given incentives to work at peak efficiency. They must be given physical and social environments that will keep them interested in their work and in good trim physically and psychologically. Crews, for their part, must be educated as to the virtues of reduced complements, the alternative to fewer jobs being no jobs.

What you will find in this chapter, then, is a sketch of new managerial methods that are being tried in the fleets of northern Europe. These are for convenience placed in various categories; but one must always keep in mind the strong interactions that exist between them.

### Reorganized Work and Lines of Authority

One of the earliest successes in reducing crew size was to lower the walls between departments. This allowed ratings to be shifted temporarily from one department to another. During peak loads on deck (mooring, for example) the machinery ratings could be called upon for assistance. When engine repairs were called for, the deck crew could repay the favor. This came to be called rationalization, or -- more accurately -- interdepartmental flexibility.

Where interdepartmental flexibility is given a fair chance it works well. The ratings enjoy the variety it brings to their work, and the ship's esprit de corps benefits as well (25,36). In some instances the concept has failed because the unions convinced the ratings they were being exploited and as a consequence bonus pay was demanded for crossing departmental lines (14,21,37).

The next step in interdepartmental flexibility was to employ general purpose (G.P.) ratings, who worked either "deck or engine" as the occasion required. These G.P. ratings were in some instances used exclusively for maintenance work and were so-called day workers. To overcome competition between deck and engine officers for their services, some owners gave some individual, often the chief engineer, complete responsibility for all maintenance, and the ship tended to develop a new wall: that between day workers doing maintenance, and watch standers driving the ship (19).

Then some owner asked himself the question: Are we doing maintenance with our own crew because it needs to be done or because we need to keep the men busy? This led to the plan of carrying a minimum number of maintenance workers (largely for emergencies), and circulating crews of maintenance specialists who rode the ships only as required. This works well, although there is something of a morale problem when the regular crew comes to feel that it is no business of theirs to keep the ship looking fit. It also raises the question of relative standards for maintenance crew cabins. The Germans have concluded that traveling work crews are technically and legally seafarers; as such, they merit cabins equal to those of the regular crew and fully integrated with them (97).

The concept of G.P. ratings naturally suggested dual-purpose (polyvalent) officers capable of alternating their attentions between bridge and engine room. This has been taken up most enthusiastically in France, but the results

to date are not encouraging (22). To be fair, it must be admitted that it has not been given a proper trial because the French unions will not permit an officer to play two roles during the course of any given voyage. This of course negates the principal reason for developing dual competence. The idea is still much alive, however, and at least one French company operates medium size liners with polyvalent officers (who are company-trained), and total complements of about twenty (97).

Despite its slowness in catching hold, some observers (8,12,31) believe that dual-purpose officers will eventually take over. As has been noted, when and if crew numbers are reduced to a dozen or fewer, everyone on board will have to be general purpose (55). It is also a matter of crew morale. Modern navigation aids leave watch-standing mates with little to do. To ask a bored mate to learn enough about electronics to maintain some of the equipment is little short of merciful. At the same time, to take a perhaps overworked engineer and allow him a relaxing daily watch on the bridge (while the mate is effecting electronic repairs) is also doing him a favor.

There are, unfortunately, serious problems in developing dual-purpose officers. Principal among these is the obstructions that may be placed in their professional development. Under current laws in most nations, promotions in rank require certain minimum periods of service in either deck or engine departments, but not both.

If developing fully-qualified dual purpose officers proves impractical, a good compromise may be the so-called matrix system (37,49,66). In this, no attempt is made to develop complete competence in every officer. Each individual would, however, be trained for real expertise in one area and for a lower level of competence in one or two others. That is half the story. The other is that each individual would be willing to switch roles -- giving directions or accepting directions -- as the occasion demanded. That would,

indeed, be teamwork at its best; it would relieve boredom; and it would promote mutual respect (66).

Autonomy

While shipboard organization is being altered, related changes area being tried in several fleets. These involve either or both of two downward transfers of responsibility for decision making. In one case the owner transfers a large share of responsibility from the home office to the ship's officers. In the other case the ship's officers transfer a certain amount of responsibility to the ratings. These two layers of decentralization, giving more autonomy to the ships, are sometimes called devolution. Whatever the concept is called, it is being vigorously debated and has met with some initial, but by no means total, success (12,14,15,24,31,32,36,60,63,85,98).

Two arguments are advanced in favor of devolution: it improves the quality of shipboard life (8,22,60,77,85), and it improves the ship's economic efficiency (8,37,60). It does, however, require the right sorts of talents and right sorts of attitudes in the home office and on board the ship (9,14, 15,32,36).

How does decentralization work? In the typical case the owner gives the senior officers of the ship collective authority to make budgets and control purchases necessary to the operation of the ship. This may include bunkers, victuals, stores, spare parts, and overtime pay. The officers may also be free to decide on dry docking schedules and specifications for shipyard maintenance and repair. They may have a controlling hand in hiring and crew rotation. The owner treats the ship as an independent business venture, and the officers (and perhaps ratings) are given financial incentive to maximize its profitability (9,60,63).

The second layer of devolution (either of the two can be used

independently) places more responsibility in the hands of the maintenance crew -- who are usually general purpose ratings. Once a week (usually) the senior officers meet and agree upon a priority list for the maintenance work that should be done during the following week. The list is turned over to the maintenance team. These individuals decide among themselves who will be responsible for each task. They are free to use whatever tools and materials they think proper, and each is allowed to work overtime or not as he pleases (36,37,61).

One of the most successful innovators in all this has been the Broström Shipping Company, of Gothenburg. In a recent paper (98) one of their spokesmen spelled out the following principles that they follow in operating their liners with crews of only 16 men:

Maintenance principles

With a reduced crew, attention has to be paid to finding systems with minimum paperwork and much flexibility, in order to allow the men on board to adjust it according to actual experience.

Some of our guide lines are given below.

* The maintenance planning should be done on board.
* The planning should be based on a combination of running hours and condition monitoring and revised according to actual experience.
* Sufficient man-hours shall be available to allow for preventive maintenance.
* Priority is given to equipment which can cause offhire in case of failure.
* Touch up of paint damages to be done at earliest convenience but general overpainting (cosmetics) should be avoided.

* Only failures (or deviations from normal operation) are reported to head office.
* Annual budget to be made up in close cooperation between senior officers and superintendent.
* Copies of all bills to be sent to the ship.
* Actual budget results to be sent each month to the ship.

* * *

Obviously, there is much potential in devolution for making shipboard life more interesting as well as making the operation more profitable. Potentials are not always achieved, of course, and some owners who had earlier given the ship officers more autonomy have since reverted to home-office control (13).

Devolution is usually accompanied by some major managerial changes in the home offices. A ship superintendent may serve as the liaison contact with half a dozen ships, and his authority may be almost entirely advisory. (In traditional organizations the ship officers have to report to managers in several departments.) One of the great benefits claimed for decentralization is the savings that arise from the reduction of shore staff. In one instance their numbers were reduced from about 600 to about 200 (22). That such changes are likely to cause home office distress, and resistance, need hardly be said.

With all sorts of new computer-aided managerial tools coming on the market, some owners argue that control should be centered in the home office (11,22). Others reply that those same computer-aids could be placed on board the ship, or joined to the ship by satellite communication (22,26).

Some compromises have been reached between ship autonomy and office control. In some instances the ship officers are given responsible work at headquarters during parts of their shoreside leave (4,49). Another approach

is to ask one or more ship officers to sit on the company's board of directors (7). Parallel to this is the member of the maintenance crew who is asked to join the officers who are planning the week's work (37). In some companies essential business control remains on shore, but the officers are called upon to help prepare budgets (21).

Several conclusions have arisen from recent experiments with devolution:

* A stable labor force is needed if the method is to succeed. Attention must be given to shore rotation schemes and methods of keeping teams intact (9,30). More on this later.
* Maintenance planning by the senior officers is a necessary prerequisite to the efficient use of general purpose ratings.
* Maintenance planning can be done most effectively if a properly equipped conference room is provided. This will be reflected in Chapter VII.
* Best results can be obtained if the senior officers have a strong hand in hiring (61), and if they can be seen to have strong influence with the home office in other matters (56).
* The problem of loneliness mentioned in Chapter III can be attenuated by getting away from the traditional authoritarian hierarchy of shipboard management (8).
* Even if devolution is not adopted, inviting officers to occasional meetings with top management is good for their morale. The officers can voice their complaints, make their suggestions, and come away convinced that management cares.
* The officer who has had a role in managing the business affairs of his ship is better able to provide a useful service ashore after he retires from the sea.

* Given equal training and background information, decisions made on the spot are likely to be better than those made anywhere else (28,37, 56). The lesson here is that ship officers should be given better training (8) and continually supplied with pertinent up-to-date information.
* In some instances devolution has failed because the officers or ratings simply did not want to shoulder the responsibility (3). This offers one more proof that human institutions resist change except in all but the most gradual degree.
* In addition to deciding for themselves who is to do what, self-managing work crews should be given some voice in their own membership, and should be made self-disciplining.

If current trends toward crew reductions continue, we may expect ever-stronger pressures to develop toward autonomous operation. Small working groups need a high degree of cohesiveness, mutual support, and tolerance; and each must bear a share of the responsibility (61).

Whether crews are reduced or not, decentralization is likely to take hold simply because it is but a part of a bigger development in northern European culture. Moreover, as Eric Heirung puts it, decentralization leads to "a mobilization of human resources and a liberation of initiative that to a large extent was only latent in the past" (60).

## Crew Rotation

While one set of developments aims to improve the seafarer's working life, another aims simply to let him get away from it all. Whereas in former times the mariner relieved his tensions in ports of call, he now is given greater freedom (often at full pay) to spend time at home (67). In northern European fleets today, the typical officer receives a day's paid vacation for

each two days of work (4,19,23,24,30,36). In some cases the work and vacation times are equal (3,5,11,14,15,17,21,25,51,55) and the generally held belief is that equal time ashore and afloat will become standard practice before long (56).

There seems no unanimity of opinion as to the ideal split between time afloat and time ashore. One unmarried individual (29) averred that four or five months ashore each year was really more than he cared for. Moreby (22) mentions that relative time ashore is partly a function of the age of one's children, there being certain childhood years when close contact with the father is particularly vital. Despite misgivings about too much free time (to be discussed), there seems an irreversible trend toward the fifty/fifty split.

One compromise that has been proposed (23) would allow the ship's regular crew full time ashore whenever the ship is in certain ports. They would be temporarily replaced by other seafarers who are in the midst of their home-leave periods, and who would perhaps welcome a brief respite from the boredom of inactivity.

Where European ratings are employed, their rotation schedule may be as favorable as that granted the officers. In other cases, or where Asian ratings are employed, the rotation schemes are less structured; the individual having served a few months, and after being paid off, remains out of the work force until economic pressures dictate a return to work.

As may be inferred from the above, some companies look upon ratings as permanent employees while others simply draw their ratings from a hiring hall (pool) run perhaps by one of the seafarer unions. In keeping with the trend toward greater crew autonomy -- and the higher level of teamwork required -- a tendency away from casual pool employment seems probable.

Aside from relative times on and off, opinions and practices regarding rotation schemes vary widely. At one extreme, some argue for (a) keeping the

team (perhaps entire crew, perhaps just the officers) intact and (b) returning them always to the same ship. At the other extreme, no attempt is made to keep teams together or to return a person to the same ship.

If the previously discussed devolution schemes are to work, many managers believe the officer teams should be kept together, while the maintenance teams should not only be kept together, but be returned to the same ship (19,22,30, 31,37,56,60,69,77). Proponents of this view argue that keeping the team intact makes for a safer ship, a more efficient ship, and a ship with a favorable social climate. Obviously, a maintenance team will be more likely to take an interest in its work if it returns always to the same ship. Some seafarers, however, speak of the stimulus of working on different ships with different people, and perhaps visiting different ports (25,28,29).

There are disadvantages of permanent association with any one ship. Some senior officers come to think of themselves as owning the ship, and may prove difficult in their dealings with home office. Junior officers who keep coming back to the same ship are denied the benefit of learning about a variety of types of ships, or a variety of ship management methods (22).

In managing human affairs extreme positions are seldom right. Rogne and Moreby (56) are probably right in recommending a general policy of same team/same ship, but with occasional discrete relaxations. Another compromise is to return men not to the same ship, but to a sister ship (19). One fleet uses three crews on two sister ships. Two of the crews return always to their own ship, the third alternates between the two (30). This plan is tailored, of course, to ship/shore ratios of two-to-one.

A development worthy of note is the flexible manning levels now allowed under Norwegian law (37). In one instance (36) the entire crew is granted permanent year-round employment. Each is expected to work eight months out of twelve, but the captain is free to operate with only about half of the total

complement if conditions warrant. If, for example, the ship is about to enter a winter of operation in the north Atlantic (making maintenance difficult), he may elect to operate with a minimum number of ratings aboard.

Some fleets (5) allow overtime put in at sea to lengthen the time allowed on shore.

Crew rotation always raises the question of who among the captains and chief engineers is really in charge. That is, who is responsible for long-term planning and decision making. This question becomes particularly acute when decentralization is combined with a rotation scheme that puts two alternating crews on the ship, each half the year. In one British company (18) the two captains have equal responsibility, as do the two chief engineers. The teams meet with a representative from the office each time a change in command is about to take place and reach agreement on maintenance plans for the months ahead. In other companies one captain and chief may be given senior status and put in charge of overall planning.

In one Dutch company (24) the two captains and two chief engineers share seniority, and the one who is off the ship is expected to spend a certain amount of time in the office. There he works with the regular office staff developing budgets, writing repair specifications, and ordering spare parts. Moreby explains some of the advantages of this arrangement (70). The disadvantage is that added pay may be required and, perhaps, travel costs (3). To minimize such costs, owners may be able to include an understanding about office responsibility when negotiating about longer vacation periods.

In fleets where the on/off schedule is perhaps two/one, the so-called yoyo system may be employed. When the captain is on leave, the first mate takes over command. The other mates down the line are each stepped up to fill the gap above, and the lowermost position is given temporary replacement from a company pool. The same scheme applies to the engineering department (22,37).

The question of cycle times must also be addressed. One straightforward plan is to rotate after every long voyage (55). To save on travel costs the crew-change should occur at a time when the ship is in home port, assuming that happens with some frequency. But, what is the ideal cycle time, aside from such practical considerations? One mate (25) speaks of three or four months as being about right. This brings up social and psychological complications that are beyond the scope of this study. There is no question but that most men are ill-fitted for prolonged periods of inactivity, and few wives like to have them underfoot for more than two or three months at a time (5,58).

Regardless of the cycle time and rotation scheme, the schedule should be worked out well in advance. This allows families to plan their activities (8).

One conclusion seems clear. As fleet policies move toward equal times afloat and ashore, shipowners should give thought to the human problems that arise from underloading. As Lovrić (53) puts it, six months of relaxation "can leave dangerous consequences on a person's personality." Potential solutions include studying for advancement in license, taking over as instructors in training academies, working in the home office (as mentioned above), becoming active in professional societies, or learning new skills (perhaps at one of the bridge or engine control simulators). The irony in all this is that, as the owner spends more money to employ more men so he can grant longer leaves, he must also spend money to overcome the psychological problems arising from the same (3).

## Wives, Families, Etcetera

A clear trend in north European fleets is an increasing possibility for crew members to be accompanied by wives and perhaps children. Aside from the

obvious desirability of maintaining normal family relations, women on board have a civilizing influence and lead to improved social behavior (80). Moreover, bringing families along helps overcome the loneliness problem simply by placing more people on board (22).

There are also potential social complications that may arise. Some wives may become excessively bored -- a mirror image of the husband's problem when ashore (58). On occasion, too, some wives simply do not get along with one another. Social conditions may deteriorate under such circumstances (26).

The problem of boredom may be overcome in part if the wives are allowed to contribute their labor to the running of the ship (9). They may, for example, keep their own cabins clean and, perhaps, help in the galley. Not very exalted duties, it is true, but good occupational therapy.

Having families on board brings up numerous practical problems. There is, for example, the added cost of victuals. Some companies require a payment of $5 per day per guest (15). If the ship operates in regions far from home, there is the expense (usually to the seafarer) of flying his family to and from the ship (25).

The standard crew cabin today has its own toilet/shower, and that has made it convenient to bring wives (37).

Some single berths, which are most comfortable when in a seaway and singly occupied, can be extended into double berths when the occasion requires.

Some ships are fitted with one or more family suites: dayroom, bedroom, toilet/shower, and perhaps a kitchenette (14).

Wives are one thing, children another. Some companies allow them, some do not. Some allow only certain age categories. One company forbids children less than three years of age on the ground that such an infant, if sick, cannot explain where he hurts (6). Some argue that a deep sea voyage is no

place for any offspring under twenty years of age; but they would encourage children to visit the ship in port simply to see what sort of work their father does (8,25).

One company (27) discourages bringing children because of past experiences when they became sick and forced diversion of the ship to the nearest port with a hospital.

In today's spirit of sexual equality, the husbands of female crew members may be as welcome on board as any other spouse (30).

In view of the pros, cons, and complications mentioned above, it is not surprising that considerable differences of policy regarding families are found in the fleets of northern Europe. In many, policies differ between officers and ratings; in others they are the same. At the most restrictive end of the scale, officers can bring only wives and for only one voyage per year; ratings have no family privileges at all. At the most liberal end of the scale, any member of the crew can bring his entire family as often as he pleases -- subject only to overall limits on lifeboat capacity and other practical considerations.

Now what about the crew member's Etcetera in the headline for this section? The reference is to his unmarried sexual partner, for whom the English language has yet to produce a satisfactory term. ("Putative common law wife" is fairly accurate, but too unwieldy; so we shall use the more convenient, albeit ambiguous, term "girl friend.")

Policy regarding bringing girl friends along varies from strict prohibition to willing permission -- provided only that the girl friend be named and permission requested several months in advance. Within Europe, the degree of liberality seemingly increases with the geographic as well as philosophical latitude. In the more northern countries the only exceptions to a liberal attitude are with a few companies who turn thumbs down on the grounds that a

policy of allowing girl friends may eventually lead to demands by homosexual seamen for equal rights for their boy friends. The generally held belief is that such a practice would be extremely unpopular with the rest of the crew.

Segregation and Integration

The stress caused by a seafarer's inability to escape his surroundings has led many experts to recommend changes in the overall arrangements of living and working spaces (7,8,19,21,22,25,55). What this comes down to is a strict geographic separation of living and working spaces, and within the living spaces a strict separation of public and private accommodations. The details of this are spelled out in Chapter VII.

While the trend is toward physical segregation according to activity, an opposite trend is evident within the realm of social contact. This amounts to a leveling of ranks, when off duty, with the aim of overcoming loneliness. As the experts (7,8,22,37) point out, as crew numbers diminish, those that remain must be given a wider latitude in selecting friends. There are those who expect all social barriers to fall before the ultimate in crew reduction can be achieved (55). In any event, as officers begin to outnumber ratings, discrimination by rank becomes ever less acceptable (21,37).

This issue of social integration is in a state of change and is the source of a great deal of controversy in northern Europe. In general, most seafarers today expect to find officers and ratings mixing at parties and in the use of recreational spaces such as gyms and swimming pools (6,14,15,23). The degree of this is obviously influenced by each nation's tendency toward maintaining class distinctions and by the range of cultural differences throughout the crew. Some British ships, for example, have English officers and oriental ratings. In other ships, particularly those flying flags of convenience, the crew may comprise not just two cultural groups but an odd

assortment of many. With such divergence of education, culture, religion, and interests, one should not expect either officers or ratings to rush into integrated leisure activities. Nevertheless, the tendency is in that direction (21,79).

The biggest source of debate concerns integrated messing. The substitution of a common restaurant in place of separate officer and rating messes is being widely advocated. This not only increases social contacts, but also saves money in the steward's department (fewer waiters and a single menu). The concept has perhaps worked best in the Norwegian merchant marine. This may be explained by the leveling requirement that officer training schools accept applicants only from among seafarers with at least three years' sea duty (36,37).

The restaurant offers some secondary, psychological benefits. It encourages positive communication in that it breaks up the traditional ranked seating arrangement (70). It also helps suppress negative gossip of officers against ratings and vice versa (8).

Some shipowners have tried compromise arrangements. Partial separation of officer and rating areas may be provided by a screen of plants, for example (6,31). Sliding panels or folding doors have been tried (7,18). In many instances such closures, when installed, have never been shut (37).

In another compromise, one British company provides two messes: one for a rather formal, dressed-up environment -- the other informal (22). Officers and ratings are free to use either facility. Experience shows a natural, hence desirable, sort of segregation. The older men tend to gather in the formal setting, the younger men in the other. This follows the sensible dictum that everyone should be allowed to choose his own friends regardless of rank (31). This is, indeed, one of the oldest laws of social science, having be propounded by the great Sir Joseph Porter, KCB, himself.

In some ships where a common restaurant has been tried the officers have registered enough complaints to force resegregation (11,30). In many other instances, however, the owners have yet to be convinced the experiment could work in their fleets (3,14,15,23,25,32).

Other Food Service Matters

Another source of debate is the virtue of saving money through the expedient of cafeteria service in place of served meals. Some owners use it for officers and ratings, apparently with success (6,12). Others use it for ratings only (19,22,30).

Other food service shortcuts are being tried. Pre-cut meats are in common use and frozen foods are also becoming more widely accepted (12). Airline-type meals have been tried, but abandoned as being monotonous (2,5,6).

In general, however, owners are reluctant to try shortcuts in food service. Being fussed over at meals, and being served well-prepared nutritious food is a key part of the social contract between owner and crew (8,22). One proposal, however, is to use extensive pre-preparation but to make up for any culinary shortcomings by granting the crew complete autonomy in specifying individual menus, and serving the food in silver-salvered, candlit splendor (55).

Crew Selection

Nearly everything that has been said up to this point underscores the importance of exercising the greatest of care in crew selection. As crew numbers diminish this becomes ever more important. Misfits must be screened out (8,30,51) and officers and ratings must be given a say in selecting working partners (61).

The desirability of holding teams together strengthens the tendency of

offering permanent employment to ratings, a trend that also encourages the development of company-run training schools. This can lead to a highly desirable level of company loyalty, but requires a departure from the dominion of the union-run hiring hall (25,69).

Moreby (70) is a good general reference on the topic of crew selection.

## Labor-Management Relations

Note: In my travels I had no opportunity to interview any spokesmen for organized labor. My impressions are therefore based exclusively on the opinions of shipowners and seafarers. Because the subject is a sensitive one, I shall not cite any specific sources of information in this section.

My general impression is that there is relatively little direct confrontation between the unions and the shipowners of northern Europe. The major issues of minimum allowable manning levels and working conditions are argued before the respective parliaments, with the shipowners being represented by their trade associations. The parliamentarians are ill-trained to make rational judgment on such matters, so decisions tend to be political compromises. Unions argue that small crews are dangerous. The owners argue that unless crew complements are reduced they will not be competitive in world trade. The only way an owner can prove his point is to go out of business, and many of them are doing exactly that. Alternatively, they may transfer their ships to flags of convenience registry.

The degree of conflict seems to vary widely from country to country, and within any one country from union to union. Some owners report reasonable levels of cooperation from enlightened labor leaders. Others complain that trying to reason with unions "is like pouring water on a duck."

Part of the problem arises because of union divisions that are out of keeping with modern manning concepts such as general purpose ratings or dual

purpose officers. Swedish officers' unions, for example, effectively forbid their members from developing dual capability. It seems apparent that unions must restructure themselves or go into decline.

Another part of the problem arises because of differences between the crews and the unions that are supposed to represent them. Some owners find that their crews really want to be more cooperative than union rules permit. A typical problem is that found in Sweden, where many seafarers chafe at union constraints against working more than six months per year; or in Germany, where crew members would like to work more overtime than their unions permit.

In summary, the shipowners and seafarers report mixed views on labor-management relations. In some nations relatively enlightened labor leaders are cooperating in developments aimed at improving labor productivity. In others they are not. The general tendency is to slow the process of crew reduction, but not to stop it. In the years ahead, as further progress calls for multi-skilled officers and ratings, the unions are going to have to solve their own organizational shortcomings or go into decline. The danger is that they will drag management and their own members down with them.

## Governing Institutions

Federal governments, classification societies, and international agencies such as IMO all have a role to play in effective manning. This can range from positive helpful leadership through neutrality to strong inhibition owing to an unwillingness to change outmoded regulations.

The Norwegian government offers a good example of positive leadership. It has sponsored research in ship manning and accommodations (7,8,9,10) and has been quick to change its training programs to suit the demand for multi-purpose talents.

At the other end of the scale IMO (International Maritime Organization,

formerly IMCO, a branch of the United Nations) is an inadvertent hindrance to progress (86).

Classification societies, although inherently cautious, have been willing to go along with new developments. Bureau Veritas, for example, may issue temporary certificates for new automation devices. Final approval follows several months of close observation, and perhaps adjustments, to the devices in question (37).

Gaffney (37) presents a good summary of how manning developments are being affected by various governing institutions around the world.

## Shipowners' Associations

The shipowners' associations of northern Europe have been much involved in crew productivity improvement. As already mentioned, the associations have taken the debate before their national parliaments. They have also financed research projects in Norway (7), Sweden (12), Germany (31), and the United Kingdom (2,3,18,20). In other instances, where research money has come from the government, the associations have helped in a coordinating role.

## Consultants

Several shipowners have obtained advice on new managerial methods by hiring consultants from more experienced companies (11,13). This has proven an effective expedient. Other owners report satisfactory use of consultants for advice on crew diet (13) and in selecting shipboard and office personnel (4). One company has obtained useful advice from a consulting industrial engineer (13).

A more controversial question is that of bringing in psychologists or social scientists for advice. Some owners (2,31) report good results from that sort of expert, but others express disappointment (13,18,24). If nothing

else, however, such outsiders bring in fresh ideas, and using them may be politically expedient (18).

A fundamental problem here is that of communication. Social scientists and psychologists are inclined to express themselves in terms that have little meaning to shipowners. There is also the problem that crew members, finding an interviewer aboard, are likely to modify their behavior, perhaps unintentionally, because of the foreign intrusion.

Outside advice can be useful, but only if properly planned and executed.

## In Summary

This has been a long chapter, perhaps a confusing one. It may be well at this point to summarize what has been said. To do so, let us borrow from Thorsrud's testimony (62). In it, he predicts the following changes:

(i) From mono-role system, where everyone fills one, and only one role, e.g. as a mate, a master etc.,
To multi-role system, where most members fill at least one secondary role besides the primary one. (Sometimes in a group system, sometimes in a matrix system.)

(ii) From a segmented departmental system, where, e.g., deck and engine are sharply divided,
To a partly integrated system where members can alternate to some degree when needed.

(iii) From unstable, high turnover employment,
To permanent employment with limited turnover.

(iv) From closed careers with linear promotion,
To relatively open careers at sea and between sea and land.

(v) From hierarchial information and control,
To shifting patterns according to needs.

(vi) From office based control system (budgeting, planning etc.),
To decentralized, partly ship-based control.

(vii) From segmented and status based living quarters,
To integrated 24-hour society with private areas.

(viii) From segmentation of work places, schools and research, To combined work, education and development activity.

(ix) From a uniform organization model, the same for all ships, To multi-form organization, alternative forms in different ships and different companies.

(x) From low degree of participation in decision making, To high degree of participation and control over one's own work situation.

* * *

The managerial changes outlined above call for supportive changes in crew training, in the way we go about designing ships, and of course in the designs themselves. These topics are taken up in the next three chapters.

## V. NEED FOR CHANGE IN TRAINING OF SEAFARERS

Throughout northern Europe the maritime training academies are in a period of critical self-evaluation. They realize that current trends in ship management demand changes, some of them far-reaching, in the education and training of their charges. Like all other human institutions, centers of education often find it difficult to effect the alterations they admit are needed.

The one change that is most apparent is to prepare the seafarer for multiple roles. Some training centers have moved in that direction, but others lag behind. As with the labor unions, their own organizational structures may need to be torn down and rebuilt before major improvements can be made in their ability to carry out their major function.

Another problem is coming into view in countries such as Norway and Sweden, where officer candidates must prepare themselves with several years of shipboard experience as ratings. As crew reduction schemes eliminate a disproportionate share of the ratings, a question arises as to the source of new officers.

As social integration becomes more widely accepted, the virtues of encouraging ratings to become officers grows ever more obvious. Yet, where ratings drift from company to company, or are of totally different cultural origins, such internal promotions are difficult to achieve.

These are some of the general problems that we can see in the realm of training for tomorrow's seafaring careers. More specific topics are dealt with below.

### Officers

The universal appeal that I have heard from shipowners is that ship

officers be given broader training. This has three dimensions. One is the need for better theoretical understanding and greater technical versatility (3,8,12,13,19,30,37,90). Another is the need for administrative training to meet the demands of greater managerial responsibility (8,12,60), and the third is the need to develop skills in human relations attuned to the trend toward democratic decision making and the removal of social distinctions aboard ship (8,12,27,43,61).

Erik Heirung (60) urges that officers be soundly trained in:

Accounting systems

Budgeting

Economic reporting

Manning routines

Manning policies

Purchasing routines

Planned maintenance systems

Spare parts systems

Control of technical conditions.

One of the recommendations of Britain's Sealife Programme (71) is that officers be taught blueprint reading so they can evaluate drawings for accommodations and working spaces.

Legal requirements for minimum time aboard ship is a matter subject to some debate. The question arises: what educational benefit does a mate derive from standing boring watches on long deepsea voyages? This question becomes increasingly acute as seafarers find their advancement slowed by long leaves from shipboard duties (17,22,25,32). Some observers propose that certificates of competence based on training with bridge or engine simulators may in the future be accepted in lieu of at least some small part of seatime requirements (22). Others (24) oppose this on the grounds it could open the

doors to all kinds of shortcuts. This is a topic for debate and possible action at IMO.

Another area of debate arises because ship's officers seldom close out their working years aboard ship. Most, indeed, leave the sea after a surprisingly short period. Moreby, for example, estimates that as of 1968 British deck officers averaged 6.7 years in seafaring, and engineering officers even less (56). Some observers conclude that officers should be more broadly educated so that they will be prepared for post-seafaring careers (53,56). Others reach the opposite conclusion, which is that the officers are already being so broadly educated that they have too many opportunities for shoreside employment (86).

Continuing Education and Training

The increasing demands placed upon ship's officers, coupled with increased periods of time ashore, point to the obvious need and opportunity for advancing professional capabilities (2,37). This can take many forms: active membership in professional societies, in-house instruction in special topics such as firefighting or fuel economy, or intensive training with bridge or engine simulators (13,37). British law now requires that all junior and senior deck officers be trained and examined in voyage planning, and especially in navigation of the ship through restricted waterways (22).

Ratings

The central aim now in the training of ratings is to develop competence for work in both deck and engine departments. Most observers believe that such versatility can be obtained with but moderate increases in seatime requirements and little or no increase in shore training (8,22,31,56).

As crew reductions reach levels below twenty men, all members of the crew

should perhaps be trained and certified in rescue boat operation, fire fighting, and fire protection (50).

Self-training aids such as videotapes can be placed aboard ship, but ratings do not seem anxious to use them (3). More effective methods may involve asking one of the officers to take over the role of encouraging and instructing the ratings (3,9). This requires two conditions that are not always easily established: One is that an officer can take time off from other duties; the other is that the intellectual gap between instructor and pupil be not so great as to preclude effective two-way communication (24).

Training Institutions

There seems to be a general consensus that traditional square rigged training ships are a waste of money. They may be helpful in attracting young people to the sea, but their attraction is misleading and inevitably leads to disenchantment. They are bad, too, in that they teach an autocratic style of leadership that is more or less passé (9,22). A better approach is Denholm's cadet ship (83), which employs 24 cadets in place of ratings, under the tutelage of carefully selected officers.

Bridge and engine simulators, if properly used, can be valuable assets in officer training (22,37,53). Their limitations must be recognized, however, and no training can be complete without actual seatime involving non-routine operations (27). There are of course many important subjects for training, ranging from maintenance to human relations, that cannot be taught on the simulators.

As mentioned in the introductory paragraphs, the educational institutions are going through a period of difficult adjustment in order to meet the changing needs in the training of both officers and ratings. What has to be done is fairly well agreed upon; it is now but a matter of inducing the

instructional staffs to make the required adjustments. Anyone who knows the internal workings of educational institutions knows that this is easier said than done.

## VI. NEED FOR CHANGE IN THE DESIGN PROCESS

A completely successful ship design requires that the naval architect makes the best possible compromise in meeting often conflicting demands. This is particularly true when designing the living and working spaces. Here the designer must integrate factors relating to

* Technical requirements
* Economic requirements
* Work organization, and
* Social needs.

The typical naval architect, unfortunately, has a strong tendency to ignore the last two factors. The intent of this chapter is to suggest ways in which he can reform his thinking and so produce better designs. The emphasis here is on the accommodations, but the ideas can be extended to include all portions of the ship that impinge on shipboard work requirements. And that, after all, encompasses virtually the entire ship.

### Responsibility

The number one rule here is that accommodation design should not be left up to the shipyard (9,18,21,24). There are obvious economic benefits in accepting standard shipyard designs; but the typical yard's aim is to offer the cheapest, most austere accommodation allowed by law (33). Nor should accommodation design be left up to independent design firms. The shipowner who wants to retain good personnel, and to encourage efficient operations, must take a controlling hand here. In the interests of economy, of course, he must cooperate with the shipyard, recognizing the yard's construction techniques and necessity of integrating the accommodation into the rest of the ship.

When it comes to matching the accommodation to the rest of the ship, a factor to consider is the frame spacing and location of structural bulkheads. Even here, some persuasive shipowners have been known to induce the yard to modify the main hull structure so as to meet the needs of the accommodations. This sort of give-and-take is possible only when the owner's naval architect moves in with his proposals at the earliest stages, preferably before the contract is signed (38,39).

## Standardization

To overcome turmoil and conflict between the owner's desire for high-class accommodations and the yard's desire for a standard design, owners' associations may be able to induce agreement on a design that is both standard (i.e., acceptable to many owners) and high-class (38).

## What the User Has to Contribute

The naval architect who wants to provide the best possible design must understand the seafarer's needs both on duty and off. The only way to learn these needs is to elicit advice from the owners and the men who will man the ship (7,9,14,22,39,40,81). As one writer puts it, the seafarer has a right to be heard (71). Value judgments are required in accommodation design, and decisions can be be made only in full knowledge of the users' opinions (78).

Some words of caution are appropriate at this point. One is that every seafarer has his own opinions about matters, which means that judgment will be required in seeking overall compromises. (Some mechanics for soliciting and interpreting opinions are suggested in later paragraphs.) Another fact to keep in mind is that at some later time the owner may want to sell the ship to another owner who has altogether different manning requirements. In any event, crew turnover is a fact of life that must be recognized (14).

An important aim in interviewing seafarers is to learn in detail exactly what the work requirements are, and who does each task (98). The objective is to make the task as easy as possible or, better, eliminate it. A simple example is that of placing a well-equipped cleaning gear locker on every level of the accommodations (8). As Hatfield and Smith (61) put it, a failure to communicate leads to designed-in work requirements.

Finding out who does each task is important. If it requires one of the high-paid crew members, there may be economic benefit in automating the job - otherwise perhaps not (6,98). Needless to say, the people in charge of maintenance should be heard, as well as those in charge of navigation, machinery, and catering. Visualize the ship in all phases of service and try to provide a design that will make life easy and satisfying for the user (22,24,92,98). In this, do not forget the effects of rolling and pitching, or the trim that may be found in the ballast condition.

One final bit of advice to naval architects: You can pick up a lot of good tips just be spending time in waterfront bars (20). Moderation in all things, however.

## Organized Solicitation of Advice

Approaching seafarers for advice on an individual basis leaves much to be desired. It is far better to bring them in as a team and ask for their guidance in reaching a total solution (38,39,71). The owner's staff must be consulted, too, of course. Schjetlein and Klem are two of the successful pioneers in organizing conferences for the solicitation of advice. Their reports (38,39) may be consulted for details. Cain and Hatfield (78) have additional wisdom to add along these lines.

Incorporating Advice

Schjetlein and Klem have bigger fish to fry than how to organize a conference. Their principal theme is a dictum that should be carved in marble:

BEFORE YOU DRAW, THINK!

The purpose of the conference is to guide the designer's thoughts, particularly in the realm of crew accommodations and working spaces. Thoughts are developed by reaching mutually agreeable answers to questions posed in a sequence something like this:

* What are the owner's basic personnel policies: What is the composition of the crew? What about rotation schemes? Will devolution apply? (And so on.)
* What are the legal and labor agreement constraints?
* What shipboard activities must be considered?
* How does each activity relate to the others in location, ease of access, and potential for environmental conflict (e.g., a noisy bar next to a library)?

To help with this question, the participants prepare diagrams that show in principle how each activity relates to the others. A circle is drawn to represent each activity. The area of the circle is roughly proportional to the deck area required. The circles are joined by lines, the thickness of which is indicative if the desirability for ease of access. Overlapping circles indicate overlapping physical location.

* What is the ideal size, shape, and location of the space assigned to each activity? Can some of the activities be combined and carried out in a single space? If the ideal size or shape is not attainable, what size or shape might also be acceptable?

* What are the physical constraints imposed by the ship's contiguous structure (frame spacing, engine casings, available deck area, etc.)? Klem (39) is a good reference here.
* What are the owner's dictates as to allowable cost?

* * *

Having answered these questions, the participants in the conference are next asked to start sketching proposed accommodation plans. There will normally develop pressing needs for compromise and, often, (in this less than perfect world) some lowering of sights. The conference members may be divided into teams for this exercise, and one may expect considerable differences in their various proposals.

For any given ship design the naval architect may make use of an advisory group to answer the basic questions, but then he alone should take over the work of synthesizing their thoughts into a unified design.

## Interpreting Advice

What a person says he wants and what he really wants are not always the same. One has to develop some insight if correct interpretations are to be made from interviews with seafarers (59,70,71). Moreby (56) has good advice here.

## Teamwork

In addition to the advice to be solicited from ship personnel and office staff, much can be gained by cooperating with interior designers, house architects, color consultants, psychologists, and social scientists (6,24). There is great potential to be gained by developing a closely-knit team with such consultants, but decisions involving policy and value judgment must be retained by the owner and his naval architect (71).

Salesmanship

No matter how carefully a naval architect listens to those who must live with the ship, he must in the end convince them that what he proposes is the best solution to their needs. Seafarers are traditionalists and you can expect any innovative proposal to produce initial negative reaction frequently couched in the most colorful and unambiguous terms (5). Implementing changes must be done with caution (4). One of the best ways is to make it apparent that the need for change arose from the collective desires of the seafarers, perhaps expressed in a conference such as outlined in an earlier section. Gaffney (37) goes into this procedure in nice detail.

With regard to selling accommodation proposals, there is no substitute for building simple physical models (24). The benefits are not confined to those who cannot interpret drawings. The designer himself may discover flaws in what he had proposed.

After the ship is placed in service, the designer should go aboard and solicit the crew's reaction (7). He should listen carefully to their complaints. He may not be able to convince them they are mistaken in their views, but he can at least consider modification in his next design.

Designing for Work Satisfaction

Most of the foregoing sections have concentrated on the design of accommodations and how to satisfy the seaman's need for creature comforts. In designing a ship we must also consider his need for finding satisfaction in his work. Hatfield and Smith (61) have this to say:

> Labor turnover at sea is high, recruitment difficult and training expensive. The industry may have to automate to enable it to use few men, but it cannot afford to risk making those already there dissatisfied. The implications of automation in the human front are therefore vital.

This is another dimension for consideration in design. How, then, does one go about designing for job satisfaction? One answer is in the outline of fundamental needs given by Thorsrud (89):

(1) The need for the content of the job to be reasonably demanding of the worker in terms other than sheer endurance and yet to provide optimum variety;

(2) the need for being able to learn on the job and to go on learning;

(3) the need for some minimal area of decision-making that the individual can call his own;

(4) the need for some minimal degree of social support and recognition in the work-place;

(5) the need for the individual to be able to relate what he does and what he produces to his social life; and

(6) the need to feel that the job leads to some sort of desirable future.

The conscientious naval architect who wants to integrate human needs into his design -- along with technical and economic needs -- would be well advised to take Thorsrud's advice to heart.

## Conclusions

We have been talking here about new approaches to design. A major element in this is achieving human satisfaction. There are no neat equations for how to go about this. What is important is to establish good communications with those who must operate, maintain, and manage the ship. Listen to their advice and keep their day-to-day needs ever in your mind.

## VII. NEED FOR CHANGE IN DESIGN ITSELF

This chapter is in effect a catalog of design ideas, suggestions, and gentle admonitions. Taken together with the shipowner's standards and operating crew's advice, the material presented here may enable the naval architect to generate designs suited to current manning practices and social conditions in the maritime fleets of northern Europe.

### Principles

Success in all this is contingent upon making decisions within a framework of overriding principles, enumerated below.

* The design must be an artful amalgam of technical, economic, and human factors. Cain and Hatfield (78) put it this way:

  > To maximize operational efficiency, the living and working spaces of ships should be designed as an integrated socio-technical system, reflecting the needs of the seafarer, the operational requirements of the shipowner and ease of construction for the shipbuilder.

* In considering economics, a proper balance must be struck between initial costs and operating costs. The builder's problems must be recognized as well as the user's.
* The designer must know the demands of the trade in which the ship is to be engaged, including cargo terminal procedures and conditions.
* The designer must be aware of the composition of the crew (various ethnic and social groups) and keep their special preferences and tabooes in mind. Example: Moslems will not clean toilet spaces (19).
* The designer must adhere to the owner's policies as regards manning practices and standards for accommodations (as discussed in Chapter VI).

* The designer must continually visualize the ship in service -- at sea, in port, under repair -- and place himself in the seafarer's boots.
* Thought must be given to living and working conditions under a wide range of sea and weather states, and under ballast or loaded trim. Example: under ballast trim the galley range may need rails to keep pots and pans off the deck.
* The possibility of eventual resale must be kept in mind. The future owner may have altogether different needs as regards accommodations and capital intensiveness. Built-in versatility is the answer here. It not only enhances resale value, but may prove beneficial to the original owner if his operating environment should change.
* The mental health of the seafarer requires that during off hours he distance himself from his work. Although he cannot do this in the literal sense, he can do it psychologically if the designer uses care in establishing clear separation between living and working areas on the ship.
* The design should encourage internal communication. At least one public space should be of a nature that will allow relaxed conversation between all ranks.

Safety

Safety at sea goes hand-in-hand with reliability of hull, machinery and crew. Although absolute safety can never be achieved, it can be most closely approached through cost/benefit evaluation of alternative design and operating features.

This is not the place to go into the economics of ship safety in any kind of detail. I should nevertheless express the view that the prudent shipowner

will recognize his primary responsibility for safe operation. He will not unthinkingly accept minimum government requirements as maximum design specifications. Those who do are, in effect, letting lawyers design their ships.

One practical item of advice is appropriate here. In selecting lifeboats, the naval architect should remember that traveling work crews and families of crew members may be on board at the time of an accident. Lifeboat capacity and accessibility must recognize this.

* * *

So much for general introductory remarks and principles. The rest of this chapter will be divided into two major parts. The first will deal with design for working, the second with design for living. The two topics are of course closely related and neither should be thought about apart from the other. For example, an analysis of work requirements is requisite to selecting crew size, and crew size is the major factor in the design of living spaces.

## VII. SUBCHAPTER A: DESIGN FOR WORKING

### Economics

In designing for work, the central aim is to find the best economic balance between investments and operating costs, e.g., the proper degree of capital intensiveness. If the owner is free to base crew size on rational work analyses, then the proper degree of capital intensiveness can be found by evaluating the economics of various combinations of labor-saving investments (98). If, on the other hand, legal or union constraints arbitrarily set minimum manning levels, then the prudent degree of capital intensiveness will be at a level that will keep the crew gainfully occupied.

## Degrading Tasks

As the trend toward smaller crews continues, the general level of talent tends to rise and it becomes increasingly difficult to find people who are willing to do disagreeable or merely boring tasks. These cannot always be automated away. If they cannot be eliminated through careful design, such tasks can be made less onerous if shared on a rotating basis by several members of the crew.

## Integrated Design

Of greatest importance here is a realization that work-saving investments must be decided upon during the early stages of the ship design. They are not a collection of gadgets to be appended to a standard design or retrofitted to an existing ship. ("Clagged-on" is the expression that comes to mind.) This harks back to what was said at the start of this chapter about the need for an artful amalgam of techical, economic, and human factors. Amalgams are not achieved after some of the ingredients have already set.

## Published Advice

The literature contains much good advice on matching man-machine systems (8,9,18,32,61,71,75,78,80,81), and on available items of labor-saving hardware (37,40,48,50,51,55,65,75).

## Simplicity and Reliability

Among the shipowners whom I interviewed several (3,15,19,30) registered a plea for simplicity. They said, in effect, "If you must add a gadget, find one to take away." An even stronger plea was registered for more reliable components (1,9,21,23,28,32,53,55). One shipowner, for example, complained that his radar systems were good for only about 25 days of operation.

Although we tend to equate advanced technology with a plethora of elaborate devices, that is not necessarily a requirement. Careful and sophisticated design can lead to integrated, hence simplified, hardware. Standardized components and multi-purpose devices can help in this, too (96).

One owner (98) has concluded that most automation devices are self-defeating in that the simple labor they replace is balanced by demands for more maintenance. This same owner operates ships with 16-man crews, incidentally.

## Maintenance of Equipment

A large share of shipboard labor tends to go into maintaining the equipment in proper working order. This requirement can be reduced, or transferred, in several ways:

* By installing components of greater reliability.
* By sending the components ashore to be maintained.
* By improving access to the components so as to ease maintenance work.
* By sending maintenance specialists to ride the ship periodically.
* By protecting the component from harmful environmental influences: salt water, vibrations, physical impact, extremes of temperature, etc.
* By engaging in methodical procedures for periodic inspection and replacement (preventive maintenance).

## Cleaning and Painting

Another category of maintenance is that of cleaning and painting. The most frequent plea (2,7,9,12,18,19,21,32) here is for corrosion-free materials

or better protective coatings, and the elimination (through care in design) of:

*Dust traps

*Inaccessible corners

*Traps for water and other liquids.

One way to minimize interferences and inaccessible corners is to provide trunks for piping and wiring (18). Physical models can help here as well.

Some sources (18,19) spoke of the need for thought being given in design to keeping dirt from being tracked into accommodations or dust from being drawn into the ventilation system. Others (7,18) suggested that mechanical cleaning equipment be installed and that design details (e.g., rounded bulkhead corners) be incorporated so as to ease the use of such equipment. Built-in vacuum systems, foam carpet cleaning devices, and special equipment for cleaning PVC floors are other suggested aids (49). Every accommodation deck should be fitted with a small wagon or dolly for moving cleaning equipment, while galley decks should be covered with a material that permits hosing down (19). Instances were mentioned of engine rooms in which all electrical equipment was water-proofed so as to allow the entire space to be hosed down with water and cleaning compound (18,49).

Cargo hold cleaning is another family of tasks in which more developments are needed (23,48,49). This may be a particularly difficult function to automate if the ship carries a variety of cargos.

Traffic

When blocking out the arrangements of the ship, careful thought should be given to internal traffic. Try to minimize walking distances and congested intersections (18). Putting a cleaning gear locker on every deck is an example of how one may avoid built-in work requirements.

When the ship is rolling heavily, sloping ladders (stairways) that are oriented athwartships can be dangerous. If other factors force the designer to run ladders athwartships, they should be of relative moderate slope. Elevators should be safer, although one must pay attention to the likelihood of jamming when the ship is in heavy seas (97).

This matter of traffic flow arises again in our discussion of accommodation design.

To this point we have been dealing largely with questions of maintenance. Of equal importance is the necessity of actually driving the ship. What design features should be incorporated if we are to operate ships with minimum watch (as opposed to maintenance) personnel? This is a big question, indeed, and we shall organize the answer by looking at several individual functional divisions such as propulsion, navigation, food service, etc.

## Propulsion

Diesel engines drive the ships of northern Europe. Bridge control and unattended engine rooms are now fully accepted and little more need be said here along those lines. A few comments gleaned in my interviews may, however, be of value. One reference (71), for example, recommends that more care be given to locating valves so as to ease access for operation. Another (24) urges that more thought be given to the need for moving heavy items into, out of, or within the engine room. Trams, trolleys, monorails, and convenient access through hull closures are all part of this.

Standardization of components (strainers, pumps, motors, etc.) within the machinery space can be beneficial. Fewer spare parts are required and familiarity leads to faster repairs (21,55).

Another observer (23) recommends the use of twin engines geared to a single shaft. This allows under-way repairs without complete shut-down of the main propulsion system.

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Navigation, Control, Communication

The advent of the unattended engine room makes it logical to locate the machinery monitoring (as well as control) equipment on the bridge. This is now accepted practice. A less settled issue is that of where to locate cargo system controls, a debate the outcome of which will hinge on the type of cargo and handling method involved. In any event, the logical choices are either on the bridge or down on the main deck. A BSRA study (65), however, considers the use of two control rooms, one immediately above the other. The upper room, with a clear view of the deck, would be for navigation and cargo handling. The lower room would be for machinery surveillance, machinery control, bunkering, and ballast handling. A somewhat similar arrangement is advocated in a Japanese study (55).

Sufficient space must be allocated to navigation, control, and communication equipment -- and cable runs -- in these spaces. An elevated platform for computers may be a desirable feature (55).

Internal observation and communication via optical cable is a promising development that may in the near future have its impact on design (6).

Exactly what electronic equipment should be incorporated is a topic that we shall not go into here. The entire area is in a state of rapid development, suggesting the wisdom of building versatility into the arrangement of the control spaces. Ease of access to equipment and cables, ease of replacement, and generous provision of unassigned space (to allow future additions) seem wise moves in this direction.

Several of the references (37,40,48,49,55,61,65,72,75) may be consulted for the sorts of advanced equipment used for navigation, control, and communication in modern ships. Another reference (65) tells of the development of voice-controlled equipment, while yet another reference (53) advocates a perhaps conflicting feature: background music to keep the watch officer alert and to sooth his nerves.

In the modern ship internal communication is encouraged by the provision of a conference room, usually associated with file space for technical records (9,24,25,78). It is here that the ship's managing committee meets to agree upon maintenance plans, and so forth, as discussed in Chapter IV. This conference room may also serve as a common office space for most or all of the officers, or be immediately adjacent to such a general office (55). This sort of arrangement is clearly beneficial in promoting teamwork and encouraging human contacts (25,78).

The question of where best to locate the captain's office is controversial. Some observers (7,19,25,55,97) maintain that all offices should be on the main deck. They argue that when the ship is in port many business contacts come aboard to see the captain or other officers. If the offices are located on the main deck, such strangers need not invade the privacy of the crew's living quarters. One suggested arrangement calls for a small, easily identified lobby on the main deck to serve as a reception center. The general office, or offices, could open off the lobby and also be adjacent to the conference room (97).

On the other hand, others (5,19,21,28,29) argue that when the ship is at sea the captain may be called upon many times a day for decisions on the day-to-day operation of the ship. One might conclude that ships intended for frequent port calls should place the captain's office on the main deck; ships intended for long voyages and infrequent port calls should place the captain's office adjacent to his day room (22,24). In any event, the desirability of allowing crew members to separate their working and off-duty lives dictates that the captain's office <u>not</u> be incorporated into his day room (10). In traveling around European campuses one often sees colored lights outside each professor's office. The one that is lighted at the moment indicates the occupant's degree of availability. Green means students or colleagues are

welcome, amber means only colleagues are welcome, and red means nobody is welcome. Perhaps a similar scheme would be appropriate where the captain's office is integral with his cabin.

In some instances the captain is provided with dual offices, allowing him to use the lower one in port, and the upper one at sea (30,31).

## Mooring

The mooring operation, whether anchoring or alongside the quay, places peak loads on the deck crew. This has long been met through union agreements allowing the engine maintenance crew, or other maintenance workers, to help in the mooring operation. Going beyond that, new devices have been incorporated to improve observation and control (54,55), although the fundamental mooring systems have seen but marginal improvements since the introduction of the constant-tension mooring winch several decades ago.

Quite aside from radical reforms in mooring systems, there is often room for improvement in the layout of conventional mooring gear and the associated working areas (21,54). Mock-ups and models may be used in this service (71). A Japanese study (55) suggests specific devices for automatically holding the ship's quayside position.

One proposal (18) of interest is to place the mooring crew on board only at each end of the voyage, a proposal confined to ships on a fixed run.

## Cargo Systems

In recent years we have witnessed impressive, often revolutionary, developments in cargo handling systems and cargo access gear (94). The next logical stage of development should be to simplify and improve the operability, reliability, and maintainability of these newly developed systems (30).

The problem of cargo distribution for minimum bending moment is being met through the use of shipboard computers, some of which are already commercially available (13,75).

## Life Saving

Current trends in manning reduce the need for large life boats. The same trends call for boats that are more easily maintained, more easily launched, and more easily retrieved. Capsules may replace conventional boats (48). Indeed, some experts (23) aver that conventional boats are so inferior to capsules that SOLAS needs to take a completely new look at its archaic rules. One matter that merits further study is the problem of retrieving a capsule after test launchings. One likely answer is to install a special crane, admittedly at some considerable expense (97).

## Food Service

The well-designed ship has a carefully thought-out arrangement for food service. Supplies may be brought on board, and stored, in special containers -- some refrigerated -- that are integrated into the structural design (24,55). Wherever possible, food stores, food preparation, food service, and scullery facilities should all be on one deck and in close proximity (24). Nearly everyone recognizes that good food, well served, is an important factor in successful ship operation. Yet, many observers (18,19,21,71) comment that naval architects seldom pay proper attention to this facet of design.

## Miscellaneous Operating Features

In addition to a central laundry for ship's linen and bedding, a self-service laundry room for the use of individual crew members is a desirable feature (29).

Exterior decks and ladders provide continuing demands for cleaning and maintenance. The current trend is to keep such fittings to a minimum. they are today often confined to the after side of the accommodation house. The attendant problem of cleaning windows must not be overlooked in the design.

Elevators are now widely used, some extending from engine room to bridge. Some experts (55) advocate twin elevators to minimize inconvenience when one is under repair. Elevators bring the threat of widespread tracking of engine-room dirt throughout the ship. Some care in the provision of foot mats and location of shoe-changing rooms can minimize this problem.

## VII. SUBCHAPTER B: DESIGN FOR LIVING

As Rogne (41), Thorsrud (43) and others point out, the new forms of social organizations that we find on ships today demand new forms of living accommodations. The ship must be looked upon as a floating community in which the stresses of an unnatural existence can be attenuated by proper attention to living conditions (53). Quality of life at sea is made up of many factors, most of which are beyond the naval architect's control. What is under his control is the physical accommodation, although this is not to say that any designer ever finds himself with a free hand to draw up plans for a floating Xanadu. Financial realities and physical constraints are always present to one degree or another.

A physical constraint that is particularly onerous in container ships is simply that of deck area. Pressures exist to maximize the area of deck available for cargo boxes. This squeezes the accommodations into something of a highrise structure in the stern. This tendency is exaggerated by a concurrent drive to keep the main deck clear over much of the machinery spaces (so as to allow ease of access for handling large units in or out, and to

isolate the accommodations from the noise and heat). Owing to the deck house's location and tall, thin shape, it is highly susceptible to problems with vibration (18). Indeed, some German labor leaders want a law that requires placing accommodations entirely out of vertical line with the machinery spaces (97). Naval architects argue that the major problem is not the noise and vibration from the machinery, but the hull vibrations induced by the propeller. Mounting the deckhouse on shock absorbers can solve the noise problem, but is less effective in eliminating vibrations -- particularly those of lower frequency. The trend toward adding propeller blades helps solve this problem (97). The German Ship of the Future study considers, among other arrangements, an aircraft carrier-like deckhouse, and another in which the deckhouse is carried on legs port and starboard, which straddled cargo containers piled four-deep on deck (97).

Other physical constraints (e.g., frame spacing) are more or less inherent in the structure of the ship, which points to the wisdom of developing accommodation plans early in the design.

The central aim in designing living quarters goes beyond providing creature comforts for the crew. It involves questions of psychological satisfaction and, basic thereto, social satisfaction as well. How best to achieve these satisfactions is a matter of great debate (7,8,10,38,39,41,43, 59,62). The practical approach is to follow the recommendations of Chapter VI and elicit the views of those most directly involved. You want the crew to feel at home, and who else can define "at home"?

In 1977 a group of students at the Plymouth Polytechnic School of Architecture, with cooperation from cadets and instructors in the nautical department, prepared two sets of idealized accommodation plans (84), one for a tanker, one for a container ship. In this they used realistic physical constraints but assumed no limits on financial resources. A great deal of

imagination went into their work, and the outcome is what I describe as the Santa Claus list. It may not be altogether acceptable in real life, but it gives the designer a stimulating menu of appealing ideas. (Some of these are listed later in this report in the section on recreational facilities.) There is much more to the report, and any naval architect would gain from studying it. For example, the central aims cited by the authors can serve as a useful guide in any accommodation design:

a) To break down the symbolic barrier to the feeling that "society is out there," and to generally create a community.

b) To encourage the social intermixing of officers and crew.

c) To provide a wide range of communal recreation facilities, allowing freedom of choice. This social area to become the "hub" of the ship.

d) To provide adequate, rather than spacious, cabins, in order to allow the seafarer the facility for individual privacy but encouraging him to make full use of the recreational spaces, and to draw him out into areas where social interaction can occur.

e) To make all necessary provision for the carriage of wives, and to consider the possibility of children being allowed on a voyage.

f) To allow for the interchangeability of materials within cabins, in order to provide a varying visual stimulus.

g) To alleviate the problems of long, narrow, dimly lit alleyways, and to form node points around lift shafts and stairs to encourage contact and interaction.

h) To consider the re-sale value of the ship to, possibly, a traditionally minded company, and to allow for this with a flexible design.

To round out this introduction, let me state that the shipowner who really cares about the crew, and wants to establish a feeling of mutual respect, can find few better ways than to provide the best possible accommodations. As one

conference (71) concluded, "Ship design is a manifest demonstration of company policy."

## Segregation and Integration

Two important elements in accommodation design are segregation and integration.

The segregation comes in separating the individual's working life from his leisure life -- an important factor in advancing his mental health in the face of the imprisoning constraints of shipboard existence. This segregation is enhanced by careful physical separation of those areas of the ship intended for on-duty and off-duty activities.

Further segregation occurs between those areas intended for social contact and those intended for privacy -- principally individual cabins.

Segregation is desirable, too, in that outsiders should encroach as infrequently as possible within the privacy of the crew accommodations. This matter has been touched on in our earlier discussion about the location of offices.

The practical way to achieve segregation is to put the ship's office(s), archives and conference room on the main deck. Next above should be the food service and recreation spaces (possibly on more than one deck); and then, yet higher, the private cabins.

There are other obvious settings where segregation is desirable: a noisy TV room and a library, for example. Common sense is the rule here.

The move toward integration is largely motivated by the desire to overcome the loneliness problem (7,8,18,37). As explained in earlier chapters, there is a strong trend toward the removal of social distinctions based on rank when off-duty. Indeed, in blocking out the accommodations a primary goal should be encourage human contacts (7,8,38). This can be done in

several ways, some less obvious than others. Among the less obvious methods, Schjetlein (10,38) suggests:

*Minimizing numbers of corridors and ladders.

*Placing large windows so as to make highly visible (hence inviting) any activities occurring in leisure facilities such as the swimming pool.

*Being careful to make public spaces especially attractive, but cabins only marginally so.

Those who have tried to promote social contact in accommodation design inevitably find problems with the SOLAS fire confinement rules. These strongly discourage open stairwells and thus inhibit, both physically and psychologically, traffic between social spaces on different decks. Thought should be given to some modification of those requirements (10,97).

A clever, albeit non-maritime, approach to social mixing (42) is employed in a 44-story bank building newly erected in Hong Kong. In this building the elevators stop only at every eighth floor. Those special floors are of double ceiling height and contain shops, restaurants, and other public amenities. Office workers ride the elevators to the appropriate level, walk past the various shops, and then ride open escalators to the level of their place of work. The intent of this arrangement is to promote human contact and its success seems assured. The level of imaginative thinking that went into this arrangement should be appropriate to ships' accommodations.

## Cabins

Some two dozen years ago Muller (95) published a paper on crew accommodations. His paper includes a list of 36 rules to keep in mind when arranging a cabin. This list, paraphrased below, is still worth consideration:

1. Use standard furniture

2. Provide a settee
3. Try to make rooms rectangular
4. Try to locate berths away from outboard bulkheads
5. Orient berths fore and aft
6. Locate head of berth forward
7. Hinge entrance door to shield vision from passageway
8. Arrange berth drawers and lockers so they will not foul adjacent furniture
9. Locate ports away from furniture
10. Center radiator with port or locate completely toward entrance door
11. Locate desk so man's back is not completely toward entrance door
12. Locate room away from heated fuel tank
13. Locate room away from noisy machinery spaces
14. Provide enough drawers for clothes
15. Provide mirror over chest of drawers
16. Provide adequate wardrobe space
17. Provide vent in wardrobe drawer
18. Integrate location of furniture and pilasters
19. Provide for swing of doors so they do not foul each other
20. Arrange furniture to allow clear access to room
21. Keep deck area outboard of air port clear to allow vision from room
22. Size room to allow tolerance in furniture size
23. Install ceiling at one level
24. Locate vent louvers in lower part of entrance door
25. Hinge air ports down or to side
26. Fasten chain to air port rather than ceiling

27. Provide a minimum of 130 sq ft.

28. Fit air ports in one common box with one set of curtains

29. Give consideration to color

30. Use concealed wiring

31. Provide adequate lighting

32. Integrate wardrobe door location with general illumination

33. Provide electrical and radio outlets

34. Locate berth light properly

35. Integrate ceiling lights and diffusers

36. Locate light switches in door frame to conceal wiring.

The standard cabin in north European ships is intended for single occupancy but is often made suitable for accommodating a spouse as well. A private toilet/shower space is provided and, on occasion, a separation between sleeping and waking functions. The German Ship-of-the-Future proposals incorporate a partial partition between the berth and those areas of the cabin intended for use during waking hours (97). This follows the precept of isolating the various functions the cabin is intended to serve, and presumably leads to sounder sleep.

As social distinctions are blurred, the trend is toward more or less uniformity in cabins. The most senior officers may have superior cabins, but all the rest may be identical -- with token recognition given to rank in the form of more desirable location (9,27).

Among the more imaginative concepts here are those proposed in a Japanese study (55), the previously mentioned Plymouth study (84), two Norwegian studies (46,47), and the work of Ferreiro (52). The last reference stresses the different needs of cabins intended for long-term or short-term occupancy.

The cabin's main purpose is to provide for the user's private needs such as resting, studying, and attending to bodily functions. It should be made

large enough for those purposes and not much more. Indeed, some owners have, in their desire to please the crew, provided cabins that have drawn complaints about being too big (6).

How big should a cabin be? The logical answer is to provide enough space for the furniture and fittings (to be enumerated next) and enough clear space to make it easy to clean (13). One Swedish company (6) considers 15 or 16 square meters about right, 22 square meters too big. Schjetlein (11) recommends 16-20 square meters. These figures offer marked contrast to the West German government's minimum requirement of 8 square meters plus some additional open deck area (33).

As for cabin furnishings, the biggest single item is of course the berth. If the cabin is to be suitable for spouse accommodation a double bed is implied. During single occupancy, however, a bed of such width may be uncomfortable when the ship is in heavy seas. The answer, now popular in many fleets, is a cleverly arranged bed and mattress that can be changed in width as the occasion demands (8).

As alternative to the expanding bed concept, some ships are fitted with one or more special family suites. This is especially appropriate if children, as well as spouses, are to be carried on occasion.

Most mariners insist that berths be oriented fore-and-aft, although there are always exceptions (25). A good bed reading light (better than found in most hotels) should be provided, and it should not be placed on the berth's centerline unless the putative occupant is certified as having a transparent head.

In addition to a berth, each cabin should have some sort of sofa or settee. This should be oriented at right angles to the direction of the berth; then no matter how the ship rolls or pitches the user may hope to find a comfortable orientation for sleeping (8).

One or two comfortable easy chairs should be provided, and these should be heavy enough to prevent sliding when the ship is in heavy weather. A study desk and chair, book shelf, reading lights, and a variety of storage spaces should also be provided. The cabin, however, should not be designed as a place for entertainment lest it lead to the development of cliques and so exacerbate the loneliness problem (28,97).

Hold-down fittings should allow the seafarer to choose between at least two alternative arrangements of furniture within any given cabin (97).

Attention must be paid to soundproofing cabin bulkheads as protection against one's neighbor's audio equipment and to enhance privacy when spouses are aboard.

Windows for cabins should be of generous proportions and should be located clear of major visual obstructions such as lifeboats. This of course is really a requirement for care in locating the cabin, not just the window.

Cabin air conditioning merits careful design. Ventilation and temperature should be easily controlled. The system should err on the side of extra capacity, and should, yet, be quiet (19). Ventilation outlets should have directional control (29).

In allocating space for cabins, you may want to provide perhaps ten extra units. These can be used for traveling maintenance crews, supplier's engineers, pilots, cadets, or crew members' children. They may also make it easier to sell the ship at a later time (13).

In the cabins, as well as throughout the accommodations, pay attention to detail. A typical complaint is directed at the ventilation outlet that blows dirt onto the ceiling (24). The hospital (a normal requirement) should be so located that a stretcher patient may be carried in without having to be tipped up to go through doors or around corners.

Messing and Social Spaces

Food and the eating environment are important highlights of the seafarer's day. This is why so much emotion attends the move toward asking the officers and ratings to share a common restaurant -- as expanded upon in Chapter IV. The decision is really not the naval architect's, so I shall say no more about it here except to suggest the wisdom of designing versatility into whatever sort of spaces are selected.

Aside from the eating space, one or more additional spaces should be provided for the encouragement of social contact. This usually takes the form of a bar, or pub, although some observers decry this because it tends to worsen the problem of excessive drinking (7,8,65,71).

It is not up to the naval architect to solve the liquor problem, but he must be aware of its existence and discuss it frankly with the owner. Some experts (69) go so far as to advocate a policy of giving liquor away free so as to maintain firm control. Those who argue against having bars on board are countered by the argument that open drinking at a bar is more easily controlled than private drinking in the cabin (7,80). Some shipowners try to prevent any drinking on board (30), others simply accept a bar as being almost necessary, but try to arrange it as being merely incidental to a larger space so as to avoid its becoming the very center of social life (7,69,71).

Possibly the best solution to the liquor problem is to offer other, less damaging social or recreational activities (69). Several suggestions are given in subsequent paragraphs.

Ideally, there should be at least two social gathering rooms, one for noisy activities, and one for quiet conversations.

Special attention should be given to making the social spaces both attractive and convenient. In one case the ceiling of the lounge was raised an extra meter so as to make it a more appealing room in which to enter

(22,55). In one case I observed (34) the lounge was simply an open space joining twin longitudinal corridors, making it impossible to avoid and, abetted by some rather luscious looking pastries, hard to resist as well.

Large windows, properly engineered, are always an attractive feature. In vertical dimension, windows should allow a view of the horizon when one is either sitting or standing. Some observers (97) go so far as to advocate floor-to-ceiling designs.

Social contact can also be encouraged by the provision of open-deck barbecues, game rooms (table games), and sun decks or verandahs.

Social contacts usually occur in any of a wide variety of recreational facilities that may be found on modern ships, although their primary functions may be for quite different purposes. Such spaces are dealt with next.

## Recreational Facilities

There is a surprising variety of recreational facilities found on the ships of northern Europe. A good word of advice here is to be careful in their selection. They are expensive and perhaps heavy. Moreover, if provided in too great abundance will decrease the frequency of social contact (6,9).

Another factor to consider is that as crews get smaller overtime tends to go up and so less use is likely to be made of recreational facilities (9). Under that kind of setting the most popular passtime is likely to involve the passive, supine absorption of TV video tapes or movie fare (7). Sad but true.

There follows a list of recreational facilities shown roughly in the order of current popularity.

Swimming pool (outdoor, indoor, or convertible)

TV video tapes or movies

Gymnasium, including principally ping pong but also exercise machines

Sauna

Table games

Library

Disco

Video games (still new)

Stereo room

Hobby shop

Chess room

Photo lab.

Some other imaginative proposals include a golf yard and bowling lane (55), as well as a greenhouse and a playroom for children (84). (To this point I had always thought that bowling and billiards would be pleasures forever denied to shipboard life. Where did I go wrong?)

Where space is available on deck or below, soccer and running races often prove popular (24,28) and water polo games have been played in deep tanks (28). When in port, bus tours prove another popular form of recreation (24) -- but that is getting off the topic of ship design.

## Interior Decoration

The typical naval architect is well advised to seek outside advice in matters of interior decor (8,10). That is rule number one. Rule number two is that, as regards individual cabins, the user should be allowed maximum freedom in choice of furniture and decorations (22,29,55). This suggests the establishment of a ship's depot (or trading post) for furniture. A library of pictures may also be set up, although most seafarers show a unique ability to acquire a goodly collection of realistic art generally emphasizing tender flesh tones. Cabin bulkhead coverings may be of cork board or other materials that will facilitate the hanging of unframed art.

For public spaces avoid nautical scenes; stress landscapes and bucolic

views (10). For variety, sliding panels may be employed to allow a change of scenery (29). Use imaginative color schemes, vary the ceiling height, use different sorts of light fixtures, paint patterns, planter boxes, and drapes -- all this in an effort to please the eye, tickle the imagination, and avoid boredom (9,10,38).

Many attractive wood veneers are available. Take advantage of them, and avoid large white surfaces (except for ceilings). As one officer (29) expresses it, put some pizzaz into deck coverings and bulkheads. But, don't overdo it. A thoroughly eye-arresting pattern is likely eventually to lead to distaste.

Another suggestion is to use a different color scheme for each deck (51).

Long straight corridors are inherently boring. Their monotony can be relieved in various ways. One is to place a window at the end (10,38). This violates the old precept that a corridor leading to a dead end is a waste of space; but if it serves a purpose it is no longer a waste. Another scheme is to arrange the corridor bulkheads in a shallow zig zag pattern (97).

Good interior decoration need not cost a lot, but it can make it evident that the owner is interested in his crew. An attractive interior, moreover, usually results in better maintenance; and a clean ship is likely to be a safe and happy ship (18). Elementary psychology.

Let me conclude this chapter on design by stressing once again the importance of picturing the ship, and the men aboard, in service. Try to maintain two perspectives: one looking at the big, overall picture, the other looking at details. Try to convince the users that you understand their problems on the job and off -- and that you and the owner <u>care</u>.

## VIII. NEED FOR CHANGE IN TRAINING OF NAVAL ARCHITECTS AND MARINE ENGINEERS

Even the most superficial survey of what has been said so far should make evident the need for changes in educational programs for naval architects and marine engineers. Shipowners and seafarers are quick to point out the educational gaps that are altogether too apparent to those who must live with our mistakes. Their advice is summarized below.

### Shipboard Experience

By far the most urgent, and frequently expressed, plea is for the novice naval architect to work on board a variety of ships (3,9,14,18,20,24,29,30, 71,81). The recommended period of total service varies from six months to a year.

What is to be learned by sea experience? The answers are many. One family of answers in implicit in Chapter VI, dealing with the need for change in the design process -- and the desirability of communicating intelligently with seafarers. A naval architect must understand shipboard social conditions, he must observe how technology performs under sea conditions, he must observe ship motions and effects on operations, he must observe human reactions to ship motions, vibrations, extremes of temperature, cramped working spaces, and the unnatural life at sea. A winter crossing of the north Atlantic is held to be a particularly valuable element in the curriculum (14).

### Technical Subjects

Hatfield and Smith (61) summarize their view of educational needs in an era of automation:

> The experience of shore industry would suggest that training will be needed in the area of system design, of

> the integration of all factors, including operating requirements into a comprehensive procedure for design and construction.

One of the Sealife Programme reports (71) advises the naval architect to learn feedback gathering techniques. This reflects earlier commentary on the desirability of visiting ships to learn the users' reaction to various design features, and to interpret accurately the views expressed.

The same reference goes on to recommend studies of ship operations and ergonomics (man-machine systems), a view endorsed by Guy (81).

A grounding in engineering economics and cost estimating is another obvious necessity (3,6,18,33).

## Human Studies

As may be inferred from the foregoing, breadth of education is more important than depth to the ship designer (6). In addition to his traditional technical subjects, the naval architect should also acquire a good understanding of occupational psychology and sociology of seafarers (7,71).

## Summary

No educational institution can in a four or five year period teach a student all he needs to know in order to be a competent ship designer. Each individual must recognize his responsibility, to himself and to his profession, to continue to learn throughout his career. His first duty here is to work aboard a ship for some months. That experience will add another dimension to his education, and is an all-but-necessary prerequisite to an understanding of the human element in ship design.

## IX. SOME TOPICS FOR FURTHER RESEARCH

One definition of research is an organized searching after truth. One truth that every researcher soon discovers is that he has every reason to be humble about the state of his knowledge. Seemingly, for every fact discovered or conclusion reached at least two new unanswered questions arise. And so it has been with this study. Some of the questions still unsettled in my own mind are posed below.

### Watch-and-Watch?

Boredom is often cited as the biggest problem in seafaring life -- at least on deepsea voyages. Would reversion to the watch-and-watch system be desirable, assuming that it led either to higher pay or to longer periods at home? The practice works well on small coasters (16,44) and on the rivers of North America. Secondary advantages of the system include smaller investments in accommodations and lifeboats, and less need for leisure time facilities.

Views on this are mixed. Some observers note that many seamen work a good deal of overtime already. Norwegian seamen average 300 hours of work per month, nearly double the level of their shoreside compatriots (87). In one British fleet most ratings try to put in at least three hours of overtime each day (80); one more hour and they would be on watch-and-watch. Many Norwegian ship manning contracts promise the seaman some amount of overtime at his own option (44). These facts lead to the conclusion that most seafarers prefer to work more than the standard eight-hour day. There are, then, those who believe that watch-and-watch deserves consideration (1,3,5,24). Others are not so sure. Where used on the Baltic, for example, it proves rather tiring -- hence potentially dangerous -- in prolonged periods of heavy weather (8). Some seafarers express opposition to the proposal, and some owners are

pessimistic that the idea would prove acceptable (6,25).

More Pay or Better Quarters?

The high standard of accommodation expected on north European ships is achieved only at great expense. There is reason to wonder if the degree of comfort and decoration is not higher than the typical seafarer might be willing to pay for in his own home. The question then arises, might he not prefer higher pay to any further improvement in his shipboard environment? One ship's officer said no, on the basis that income taxes would swallow too large a share of the added income (25). The only positive responses to this proposal came from Spanish and Italian fleets (13,29), where pay scales are presumably lower than those of northern Europe. Nevertheless, it is a question worth further study.

Best Way to Rotate?

As explained in Chapter IV, crew rotation is in a state of rapid change. Ship/shore times are expected to settle down to a fifty/fifty split before the end of the decade. This raises many questions. These have already been posed in Chapter IV, however, and in the interest of brevity will not be repeated here.

How Best Exploit Satellites?

Satellite communication opens up the possibility of monitoring and even controlling a ship from on shore. Is it not feasible for a chief engineer to do his work at a shore station and to return home in the evening? Might one chief engineer keep his eye on several ships? Or, do satellites simply furnish further justification for placing more managerial responsibility on those aboard the ship? These and similar questions will merit thought in the years ahead.

What Role for Radio Officers?

Most observers have concluded that modern communication systems make radio officers a needless luxury (6,9,12,14,18,19,22,23,24,28). The position has already been eliminated in Scandinavian coastal service (12,18). IMO, however, still calls for a radio officer on ships of 1600 GRT or above (12). The only real questions here are how best to convince IMO that the time has come to delete the requirement, and how best to overcome the understandable opposition of the radiomen themselves, and their unions.

There is more to the problem than the wasted pay, accommodations, and victuals required to keep an unneeded radio officer aboard. There is also the degrading effect on the man himself, and the resentment that arises among his shipmates (22,23).

A compromise solution is finding some acceptance as radio officers are gradually being given broadened responsibilities. These may involve secretarial duties (6), or preferably, an expansion of training and responsibility to encompass electronic engineering (2,18,19,22,28).

Why a Helmsman?

There are those who question whether there is any continuing need for a helmsman (6,24,26,37). When on the open sea, mechanical steering devices are far superior to human control. When maneuvering in confined waters, the watch officer can steer the ship far better by himself than by calling orders to another person. Ask any airplane pilot. Yes, the watch officer may have to switch his standing place now and again, but multiple steering wheels (or levers) can be situated at strategic locations, just as has long been the case with engine telegraphs (99).

The practice of watch officer control has been proven effective on the rivers of North America. Operating conditions there are in many ways more

demanding than on most deepsea ships. To try to steer one of those flotillas by calling directions would be little short of suicide. Why do we cling to the outmoded practice on saltwater?

## Can We Ask the Captain and Chief Engineer to Stand Watch?

In smaller ships the captain and chief engineer are expected to stand watch -- perhaps four hours per day, perhaps eight (3,9,12,18). In some small coasters, with five-man crews, the captain even helps prepare meals (87). In some instances captains stand watch voluntarily, just for variety, or to free the mate for more pressing duties (24).

The German Ship of the Future study suggests that the captain and chief engineer's functions may be combined into a watch-stander on the bridge who is capable of maintaining the control equipment (48).

Another suggestion (21) calls for the replacement of the third mate through an arrangement whereby the captain takes over one four-hour watch on the bridge, and an assistant engineer (with some extra training) takes over another (21). A variation on this calls for the captain to stand one four-hour watch and two mates to take two five-hour watches apiece (16).

A related question has to do with the tradition that the captain must be on duty whenever the ship is in confined waters or other conditions of imminent potential danger. Asking him to stand a regular watch and be on duty at other times is asking too much. If there are laws that prevent a captain from being relieved of responsibility when off duty, such laws merit reconsideration (99).

## How Can Unions Save Themselves?

The major revisions we see in shipboard organization are in serious discord with the way traditional maritime unions divide their membership.

Unless the various unions can effect a merger, or otherwise adapt to new conditions, they are bound to hinder further progress in crew productivity. Any such major change in organization is sure to produce personal problems for union leaders, and thus arouse their opposition. Finding a practical solution will not be easy; but, it is a question that shipowners and seafarers need to see answered.

How to Get Naval Architects on Shipboard?

The main thrust of Chapter VI is that every naval architect and marine engineer should give himself the benefit of sea experience. Are shipowners prepared to make berths available? Are unions prepared to put aside current discouragements to such practice?

Is There a Role for an Occasional Teacher on Board?

One definition of a gentleman is a person who knows how gainfully to spend his leisure time (69). Without wishing to reflect too directly on the typical seafarer, it must be admitted that many of them are somewhat inclined to spend their off-duty hours at the temple of Bacchus. Might not some inspiration, in the form of an occasional on-board teacher, turn the seafarer to more gainful use of his leisure (71,78)? Could not those young naval architects who are on board to round out their education spend their leisure hours in teaching aspiring ratings the elements of trigonometry, ship stability, ship strength, or thermodynamics?

Do Looks Count?

No one argues that within the accommodations good interior decoration is an asset. But, what about how the ship looks to an outside observer? How does this affect the men aboard the ship, the owners, the customers, and the public?

Opinion here is evenly divided. Among those interviewed, eight agreed that external appearance is important (3,12,13,22,28,29,32,71); seven said no (6,7,8,20,23,24,25); and two took a middle position (5,30).

Those who favor an attractive appearance argue that:

* The crew will take pride in their calling.
* The crew will take better care of the ship.
* Looks are important in reefer ships because the customers are likely to visit it.
* A good looking ship will be easier to sell at some later date, especially to a liner operator from one of the developing countries.

The arguments against good looks are of course primarily a matter of reducing building cost. One expressed belief is that the ship should be designed to meet its function, and any modification for the sake of aesthetics would only subtract from its functional capability.

To close this debate, I shall come down on the side of the angels, by quoting Peter Wordie (3), who has this advice for naval architects:

> Try to make your ship good looking inside and out. That will give the crew pride and make it evident the owner cares. Remember, it's a ship to be lived in. Give it personality, good looks, and <u>atmosphere</u>.

## X. CONCLUSIONS

I am not going to repeat here all, or even any, of the dozens of conclusions reported in the body of this report. I do, however, want to submit one overriding conclusion. It is, I suppose, more accurately described as a hypothesis, since it is unproven. Perhaps we can call it an article of faith; and here it is: North European shipowners can successfully meet low-wage foreign competition, and this can be done primarily by continuing to move away from labor-intensiveness and toward capital-intensiveness in their fleets.

No attempt should be made to meet the competition head-on, but by adopting a strategy tailored to the north European economic and cultural environment. Ship's crews must be made more productive, the ships themselves must be made more productive, the fleets must be well managed both on shore and on board, and aggressive salesmanship must be employed.

The probability of success is likely to be proportional to the degree of sophistication inherent in the type of ship. That is, European shipowners should place their bets on those types of ships that demand high technology equipment and well-trained and educated crew.

A necessary groundwork in education, training, research, and development must be given generous financial support and enlightened guidance. Ways must be found more readily to absorb the findings of research into the industry.

Finally, if there is to be any hope for success, all elements of the maritime industry must learn to cooperate for the benefit of all.

* * *

If the above seems but a collection of platitudes please keep in mind that specific suggestions for meeting most of these goals are embedded throughout the report.

## APPENDIX: PERSONAL INTERVIEWS AND PUBLICATIONS

Our list starts with the personal interviews that were granted in connection with this research; and, for want of any better ordering, they are given in the sequence in which the interviews were held. In most instances two or more people from the same organization took part in the exchanges. My unsophisticated note-taking generally leaves the exact source of comments undifferentiated. More simply put, for any given gathering, I cannot tell who said what. Where more than one person was involved I have therefore organized the list in terms of the organization. Please be careful to remember, however, that the opinions reflected in the text are unofficial, personal opinions. They do NOT necessarily reflect company policy.

### Personal Interviews

1. Foo M. Lo, Project Director (New Construction),
   Scottish Ship Management Ltd., Glasgow, Feb. 21, 1983.
2. J.F.S. Parker, Marketing Director, Denholm Shipping Services Ltd.,
   Glasgow, Feb. 24, 1983.
3. Harrisons (Clyde) Ltd., Glasgow, Feb. 24, 1983
   Ian E. Burrows, Technical Director
   Peter J. Wordie, Chairman, Stirling Shipping Co. Ltd. (a subsidiary of Harrisons).
4. A. P. Møller, Copenhagen, March 4, 1983
   J.H. Frederiksen, Department Head, Fleet Deployment
   Bent E. Hansen, Managing Director
   J.J. Kappel, Manager, Newbuilding Department
   Svend Vilborg, General Manager, Marine Personnel Department.

5. Sten Ekholm, Manager, Design and Newbuilding, Technical Department, Brostrøm Shipping Company Ltd., Gothenburg, March 7, 1983.
6. Transatlantic Ship Management AB, Gothenburg, March 8, 1983
   Per Fagerlund, Technical Director
   Nils-Göran Nordh, Managing Director.
7. Einar Thorsrud, Program Director, Work Research Institute, Oslo, March 9, 1983.
8. Aslaug Hetle, Research Associate, Work Research Institute, Oslo, March 9 and 10, 1983.
9. Norwegian Shipowners' Association, Oslo, March 10, 1983
   Inge M. Johnsen, Director of Training, Manning and Organization
   Nils Telle, Research Manager.
10. Siri Schjetlein, architect, Oslo, March 10, 1983.
11. Svante Berg, Vice President, Finance, Wallenius Lines, Stockholm, March 17, 1983.
12. Johnson Line AB, Stockholm, March 18, 1983
    Arnold Idestrand, Senior Naval Architect
    Johan Lundblad, Commercial and Technical Development
    Lars Sjögren, Vice President and Fleet Manager.
13. Salén (various divisions), Stockholm, March 18, 1983
    Hans Alsén, Managing Director, Saltech
    Malte Edholm, Naval Architect, Saltech
    Alf Eriksson, Technical Manager, Salén Dry Cargo AB
    Göran Hammarberg, Technical Manager, Salén Tanker AB.
14. Oy Finnlines Ltd., Helsinki, March 23, 1983
    Jaakko Mattila, Vice President, Cargo Traffic and Commercial Projects
    Olavi Pylkkänen, Vice President, Technical
    Rolf Sundström, President

Tom Waselius, Naval Architect, Research and Development.

15. EFFOA (Finland Steamship Company Ltd.), Helsinki, March 23, 1983
    Rolf W. Karlemo, Naval Architect
    Jukka Suominen, Director, Fleet Management.
16. Per Forsskåhl, Managing Director, Finnish Shipowners' Association, Helsinki, March 23, 1983.
17. Stjernwall, Captain, M.V. Finlandia, EFFOA, Helsinki to Stockholm, March 23, 1983.
18. Shell International Marine Ltd., London, April 6, 1983
    D.G.M. Carpenter, Project Engineer, Engineering and Development
    Peter M. Swift, Manager.
19. J.C. Evans, General Manager, Technical, P & O Deep Sea Cargo Division, London, April 6, 1983.
20. John Weight, Director (Education & Training), General Council of British Shipping, London, April 6, 1983.
21. Furness Withy Group, London, April 7, 1983
    W.T. Cairns, Manager
    John Glover, Marine Superintendent.
22. David Moreby, Head, School of Maritime Studies, Plymouth Polytechnic Institute, Plymouth, April 8, 1983.
23. Roundtable Discussion, Madrid, April 22, 1983
    Gerardo Bonnin, Director of Engineering, Transport Division, CEPSA
    Rosendo Chorro Oncina, Manager, Department of Research & Development, ELCANO
    Luiz de Mazerredo, Professor, City University of Madrid
    José Enrique Moro, Naval Engineer, Compania Tranatlantica Espanola, S.A.
    Julio Trennas Fernandez, Director, CAMPSA
    Fernando Unceta Arenal, Fleet Captain, CEPSA.

24. Nedlloyd Fleet Services, Rotterdam, May 11, 1983

    E.F. Aalberts, Senior Marine Superintendent

    Th. D.H. van Halderen, Manager, Fleet Services

    M. van de Ree, Chief Marine Superintendent.

25. M.V. Nedlloyd Barcelona, Rotterdam, May 11, 1983

    Johan D. Smit, Captain

    Corstiaan D. Sonneveldt, Chief Officer

    Gerrit Tuinstra, visiting Chief Officer.

26. BSRA (British Ship Research Association, of British Shipbuilders),

    Wallsend, England, May 12, 1983

    David Goodrich, Director and General Manager

    E.J. Harding, Manager, Microprocessor Application

    Christopher B. Lamb, Manager, Automation and Micro-electronics Department

    Michael N. Parker, Senior Manager, Project Coordination

    A.W. Reed, Automation and Microprocessors

    Also

    Marshall Meek, Head of Ship Technology, British Shipbuilders

27. Discussions from Lecture Floor, Rijeka, Yugoslavia, May 20, 1983

    Krešimir Dulčić, Sales and Design Department, Shipyard "Split"

    Ivan Jedrlinić, Chief of Planning and Development, Yugolines

    Boris Glavan, Counsellor, Yugolines

    Jozo Lovrić, Director, Technical Department, Atlantska Plovidba

    Pero Poković, Manager of Planning and Research Services, Atlantska
    Plovidba

    Vladimir Vlašić, Chief, Investment Department, Yugolines

    Margan Vuk, Director, Economics and Technical Department, Yugolines.

28. Atlantska Plovidba, Dubrovnik, May 23, 1983

    Jozo Lovrić, Director, Technical Department

    Želimir Uskoković, Marine Superintendent.

29. Giovanni Letich, Chief Officer, M.V. Costa Arabia, Genoa, May 27, 1983.

30. Hapag-Lloyd AG, Hamburg, June 2 and 3, 1983
Helmut Stetler, Manager, Fleet Deployment
Burkhard Telschow, Director
Dieter Ulken, General Manager.

31. Werner Schöttelndreyer, Technical Director, German Shipowners' Association, Hamburg, June 3, 1983.

32. Detlef Zeizz, Second Officer, M.V. Monte Cervantes (Hamburg Sud Line), Hamburg, June 4, 1983.

33. Flensburger Schiffbau Gesellschaft, Flensburg, W. Germany, July 1, 1983
Heinrich Kerlen, General Manager
Hermann Loeffler, Chief Engineer.

34. Various Crew Members, M.V. Nopal Barbro (Ovind Lorenzen Line), Emden, July 24, 1983.

35. Ernst Metz, Purser, M.V. Helvetia (Köln-Düsseldorfer Line), Rhine River, Amsterdam to Basel, July 29, 1983.

36. Ugland Management Company, Grimstad, Norway, and aboard M.V. Akarita, series of interviews and correspondence, 1974 - present
Lars Engvahl, Captain
Andreas Ugland, President.

Publications

37. Michael Gaffney, "Reduced Manning in the Liner Trades," unpublished manuscript, Cornell University School of Industrial & Labor Relations, 1981.

38. Siri Schjetlein, "Main Principles of Modern Superstructure Design," (Originally published in 1980 in Norwegian by the Royal Norwegian Council for Scientific and Industrial Research.) English translation published

by the University of Michigan, Department of Naval Architecture and Marine Engineering, Report No. 275, November 1983.

39. Per Klem, "Accommodation Design," (Originally published in 1974 in Norwegian by the Norwegian Institute of Technology.) English translation published by the University of Michigan, Department of Naval Architecture and Marine Engineering, Report No. 276, November 1983.

40. Finnish Shipowners' Association, "The Influence of New Technology on the Onboard Operations of Merchant Ships," (Originally published in Finnish and Swedish.) English translation published by the University of Michigan, Department of Naval Architecture and Marine Engineering, Report No. 277, November 1983.

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42. Douglas Davis, "Elegant New Geometry," Newsweek (International edition), June 27, 1983.

43. Einar Thorsrud, "New Perspectives on the World of Work," Human Relations, November 12, 1982.

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45. Anon., "Varied Manning in Nordic Countries," Norwegian Shipping News, April 1983.

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