INNOVATIVE SHIPBOARD MANNING

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Abstract

The paper discusses Innovative Shipboard Manning in the light of comparative ship manning costs and ship manning systems which have evolved as a result of new shipboard technology. The paper essentially attempts to answer whether Australia, if it wishes to maintain an efficient shipping industry and to further expand into international markets, needs to adopt the maritime industry policies of other developed nations.

INNOVATIVE SHIPBOARD MANNING

INTRODUCTION

The Hawke government is pledged to the 'revitalisation' of Australian shipping by increasing flag participation rates in the overseas trades. The government also accepts that lower-cost capital for sophisticated tonnage is not, in itself, sufficient to achieve economic fleet expansion unless it is tied-in to a cost-effective manpower policy.

The potential for shipboard automated systems is to reduce ship operating costs. One of its effects is that shipboard automation also reduces manpower demand for traditional seafaring skills. The conceptualised 'crewless ship' may still be somewhat distant. However, critics of Australian shipping consider that even with the existing levels of shipboard technology which are available, Australian vessels are overmanned and her crews are less productive than seamen from other nations fleets. Australian shipping's uncompetitiveness is seen as a major reason for not pursuing a 'revitalisation' policy.

This paper discusses some of the issues surrounding the present manning debate and considers future manpower policy options in the light of increasing shipboard automation systems, given that there is a firm commitment to extend Australia's flag into international shipping.

THE MANNING SYSTEM

Manning levels on board Australian vessels are usually set by agreement between the employer and the maritime union. The Minister for Transport can formally 'arbitrate' in the event of an agreement not being reached, and make a decision based upon professional advice received from the 'Manning Committee', a committee chaired by an officer of the Department of Transport.

The formal Manning system, while imperfect, does appear to have received broad support from within the shipping industry. The 1976 Commission of Inquiry into the Maritime Industry considered:

> "The manning committee system has worked well and should be retained". (1)

More recently, in 1982, shipowners and unions reconfirmed their commitment to the manning committee system. The overall system of manning agreements, however, is not without its critics and is seen by some contemporary commentators as a series of short term solutions creating what are essentially longer term problems:

> "... the present system appears to have solved industrial problems by creating economic problems. Overall manning costs, of which crew levels are an important component are the major cause of Australian shipping being so uncompetitive." (2)

In July 1982, the Commonwealth Minister for Transport announced a number of initiatives with which government could encourage the development of a more efficient, revitalised shipping industry. These policy initiatives had arisen from submissions presented to a joint committee of shipowner and maritime union representatives under the independent chairmanship of Sir John Crawford. (3)

The Committee's terms of reference were to:

> "assist in the evolution of practical proposals for the benefit of the shipping industry as a whole having regard to problems identified by the shipowner and union groups" (4)

with the express purpose of producing:

> "... an efficient Australian shipping industry which can compete commercially with both land-based transport and international shipowners" (5)

The Crawford committee examined, inter alia, two major areas of concern within Australian shipping. These were:

1) the high capital costs of Australian vessels compared with international competitors, whose governments often gave generous purchase and depreciation concessions, and;

2) the high manning levels and crewing costs on Australian vessels.

Crawford recommended, inter alia, that a greater level of flag participation should be encouraged in Australian overseas trade. He proposed a series of financial incentives, including taxation concessions resulting from a 20 per cent per annum depreciation allowance for new vessels, commencing in the year prior to their commissioning; abolition of the 2 per cent revenue duty on imported vessels, and the extension of the investment allowance to all Australian vessels, not just those engaged in coastal shipping. These recommendations were to apply to Australian registered and manned vessels which are subject to Australian taxation (flag vessels). Since Crawford reported, more general taxation and industry assistance provisions have been introduced by Federal government. Despite this, dedicated shipping industry incentives appear more favourable, some eligible ships being able to extend their depreciation to 58 per cent over only 13 months of operation.

The Fraser government accepted the Crawford proposals in 1982 and subsequently, in 1983, the new Labor Government confirmed their own commitment to the implementation of the 'revitalisation' package.

Crawford had emphasised in his Report that any financial incentives available to the industry should be 'tied-in' to a reduction in manning levels. More significantly, he further argued that any reduction in manning levels must not be merely in absolute terms, but should be accompanied by the introduction of training programmes specifically tailored to provide seafarers with the range of skills they would require to effectively handle automated shipboard systems. Implicit in this proviso was a commitment to establish a new manpower policy aimed at ensuring more flexible crew training and greater interchangeability between crews.

Crawford also noted some of the major problems associated with his recommendations. Foremost among these was the age distribution of the sea-going workforce, 29 per cent of whom are presently in excess of 50 years of age. (See Table 1.) It is considered that this high average age distribution will require a major recruitment and training programme over the next ten years, 'simply to maintain existing numbers'. (6) However, the industry will still fall below long term recruitment targets largely because of the effects of more immediate actions, such as Australian National Line's (ANL) current ship disposal programme. Additionally, projected fleet requirements based upon the successful outcome of the Crawford proposals envisage a further expansion of the 2000+ recruits the industry will need to take it into the mid 1990's.

Table 1: General Register of Seamen, Age Groups by Broad Occupational Category 1982-83

Rank or Rating	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64	65+	Totals	%
Masters	-	-	5	24	57	59	56	58	40	16	3	318	3.6
Deck Officers	-	-	167	159	146	100	75	71	58	29	4	809	9.2
Engineer Officers	-	6	60	74	217	166	146	120	111	30	2	932	10.6
Uncertificated Officers	-	105	135	194	91	52	39	36	22	9	2	685	7.8
Radio Officers	-	7	12	24	26	31	18	31	33	15	2	199	2.3
Cadets/Apprentices	120	68	-	1	-	-	-	-	-	-	-	189	2.2
Deck Ratings	129	224	187	265	295	308	324	345	218	79	6	2,380	27.2
Engine Room Ratings	10	77	82	92	108	86	71	137	134	59	13	869	10.0
Catering Ratings	10	103	137	157	178	185	222	278	196	85	12	1,563	17.9
Miscellaneous	11	52	99	113	61	79	60	94	149	78	9	805	9.2
TOTAL	280	642	884	1,103	1,179	1,066	1,011	1,170	961	400	53	8,749	
%	3.2	8.2	10.0	12.5	13.4	12.0	11.5	13.3	10.8	4.5	0.6		100.0

Source: Sea Transport Statistics
Department of Transport 1984

SUB-SYSTEM COSTS

A major criticism of Australia's merchant marine is that manning levels and crewing costs, as a proportion of total ship operating costs, are too high. It is argued that these cost differentials are even more apparent when comparisons with foreign vessels' operating costs are made. (Wood, 1981; Stubbs, 1983; Thompson Clarke, 1983). This section considers some sub-system costs.

Seafreight

The cost of transporting cargoes from and to Australia can be high. Sampson and Yeats (1977) calculated the costs of Australian exports to the United States. They found that the weighted average transport cost was 11.8 per cent of the 'free alongside ship' (F.A.S.) value of products at Australian ports.

Table 2: Estimated Nominal Transport Costs for Australian Exports to the United States in 1974

	Nominal Transport Cost (a) (%)
Primary Products	26.5
Intermediate Products:	
semi-processed	25.7
processed	21.6
Investment Goods and Machinery	8.0
Consumer Goods and Foods	14.4
Average (Australian trade weights)	11.8

(a) Measured as: [(c.i.f.* - f.a.s.)/f.a.s.] x 100

* CIF: Cost, insurance, freight.

Source: Sampson and Yeats (1977)

The Department of Transport (1981b) estimated that voyage charter rates can account for up to 40 per cent of the sea transport costs for iron ore to Japan (60/80 per cent to Europe); up to 30 per cent for coal to Japan, and almost 60 per cent for coal to Europe

Conlon (1979) considered ad valorem costs for imports. He found that sea transport costs added an average 14.5 per cent to the cost of imported goods. Research by Geraci and Prewo (1977) indicates that these costs are higher than those for similar trades in other developed countries. Sea freight costs:

> "...clearly provide a substantial wedge between prices in Australia and overseas. They provide a barrier which must be jumped before our exporters can compete on overseas markets" (7)

Manning

Within the total seafreight cost structure is the carriers operating contribution, of which crew costs are a major component.

Each year, Australian registered vessels lift only 4 per cent, in revenue tonnes, of total overseas trade. This is an extraordinarily low level of flag participation for a developed island economy. Australia is clearly not yet a 'maritime nation'. One of the reasons given by shipping sources for this low level of flag participation is that, in addition to vessel financing disincentives, Australian manning scales and crewing costs, as a proportion of achievable sea transport costs, are too high. Stubbs (1983) appears to support this view, and considers that Australian seamen's unions are:

> "Another group which has fared well in recent years...." (8)

and cites Wood (1981):

> "Australian ships have more than two full over-manned crews employed for each vessel enjoying the ultimate in victualling and amenities with one of the most generous sea-going employment packages in the world. Accommodation is extremely comfortable and the pay scales generous.
>
> Yet high rewards do not always produce the most enthusiastic work." (9)

This is not a universally accepted viewpoint as the maritime unions' submission to the Crawford Inquiry indicates:

> "Australian crewing costs are not excessive, and, in fact, are similar to those of European flag vessels" (10)

As an example, Lloyd's List earlier this year illustrated that Japan has the highest crewing costs in the world, more than twice the cost of a British flag and four times that of a flag of convenience.

Wood, however, argues that:

> "My own experience in recent years lends support to the claim that not only are for example, Greek, Hong Kong, Korean, Taiwanese or Singaporean crews considerably cheaper but they also perform better than many traditional flag crews. Good maintenance, proper cleaning of holds between cargoes, willingness to work hard and turn out at any time the pressure demands it to reduce port time or service equipment, together with a more flexible approach to manning and general purpose duties are the ingredients to give management and charterers confidence." (11)

This could be interpreted as a somewhat subjective view. Australian maritime unions recognise the essential differences between 'European standards' of manning and crewing and open registry standards. They agree, however, that Australian crewing costs are:

> "...still higher than open registry or Asian flag ships." (12)

The order of magnitude of these crewing cost differentials, is at the core of the Australian manning debate. Before we can consider manpower policy options, we need to establish how significant these manning costs are.

In 1983, Wickham and Phuc estimated that a ship manned by Chinese, Indian or Pakistani seamen could reduce daily vessel operating costs by up to 33 per cent when compared with European flag vessels manned by Norwegian or Swedish crews. The problem of high crewing costs is world wide. A United States working group recently observed that foreign crew costs for a container ship were estimated to be one half to one sixth of U.S. flag crewing costs. (Lloyd's List, June 22 1984).

Australian based research by Gallagher and Meyrick (1984) indicates that $9 per tonne may be added to liner cargo between South East Asia and Australia when an Australian, rather than Asian crew is employed. Other researchers have found that meeting all of the requirements of an Australian crew can add 15 per cent to the costs of operating a liner vessel in the South East Asia - Australia trade. (Stubbs, 1983)

There are further data available to support the allegedly high crewing costs of Australian ships. In 1983, Thompson Clarke presented a comparison of operating costs for a 'Panamax' Bulk carrier.

Table 3: Comparison of Variable Operating Costs for a Panamax Bulk Carrier

	Australian Flag		OECD Flag		Open Registry Flag	
	$	%	$	%	$	%
Manning	1,980	54	846	42	758	41
		57		45		44
Victualling	91	3	65	3	50	3
Stores	200	5	200	10	200	11
Insurance	285	8	230	12	225	12
Repair & Maintenance	650	18	450	23	450	25
Administration & Miscellaneous	300	8	200	10	140	8
Accommodation Upgrade	150	4	-		-	
TOTALS	3,656		1,991		1,823	

Source: Thompson Clarke (1983).

Clearly, from the Table, it can be seen that 57 per cent of the Australian flag vessels' total operating costs are taken up with direct crew costs. This is 12 percentage points higher than OECD flag costs and means, on average, that the Australian flag vessels direct crewing costs are 140 per cent higher than comparable costs for OECD or open registry flag vessels.

It is a fact of industrial life that Australian labour does not 'come cheap'. There are various reasons for this, not all of which apply only to shipping. It is perhaps iniquitous to assign to one high profile sector of Australian industry all of the ills which are tolerated in Australian industry more generally. As Kasper (1980) states:

> "Australia has relatively expensive and scarce labour compared to neighbouring Asia. Compared to most other OECD countries, Australian wage rates are not high, but Australian labour productivity is relatively low so that unit labour costs (wage rates relative to productivity) in many industries are rather high". (13)

CMB, a major European shipowner, have commented that seafarers wages now account for a major portion of overall vessel costs.

> "Social charges for workers now represent 49 per cent of (this) wage bill." (14)

Accompanying high labour costs and of increasing concern to shipowners is what is happening to their labour on-costs, i.e. the associated costs of employment. These may include superannuation benefits, and other labour costs such as, ship and shore based training, payroll tax, shipboard safety, crew positioning costs and shore leave provision payments. As Richardson (1981) states:

> "It is one of the notable developments of the post-war period that many of the material benefits of employment come in forms other than cash in the pay packet. This trend is even more evident in Europe and North America than it is in Australia." (15)

This is particularly true in U.S. shipping where pension costs are considered to be a major element of U.S. crew costs. (16) The Australian Business Council's 1983 survey of labour costs (derived from a survey of large companies in manufacturing and mining) (Business Council Bulletin, 1984), although shore-based, does give some indication of Australia's on-cost relationships.

The survey found that direct hourly wage costs have declined from 77.5 per cent of total labour costs in 1974, to 66.5 per cent in 1983. On-costs clearly remain significant:

> "In 1983, during most of which the Accord was operating, while direct hourly wage costs increased by only 3.3 per cent hourly on-costs increased by 14.4 per cent." (17)

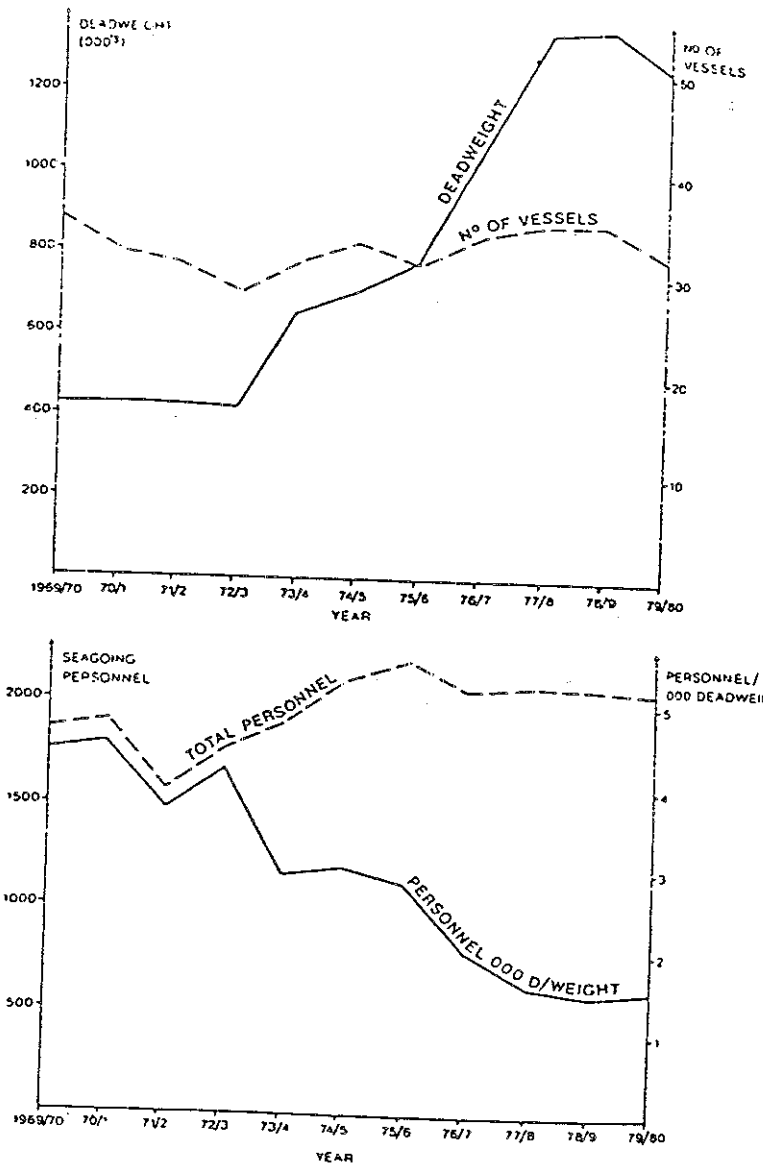
Kasper notes that labour intensive industries are not normally internationally competitive when located in Australia. He argues, however, that changes in technology which reduce unit-labour costs by raising labour productivity might be 'socially beneficial' in the Australian context. Applied to the shipping industry one can see that 'intermediate' technology introduced on board existing vessels might well have a high social rate of return, not only because it raises productivity, but also because:

> "it avoids the need to write-off buildings (ships), skills (seamen) and market knowhow..." (18)

The extent to which new vessel technology has 'raised' productivity over time has been measured by Amos (1981). He found that over the last ten years Australian National Line's (ANL) labour costs have halved as a proportion of total costs, from 25 per cent to 13 per cent.

He also found that although the seagoing labour force had increased slightly, productivity, measured by personnel/dwt had also increased from 4.5 men/'000 dwt in 1970/71 to 1.6 men/'000 dwt in 1979/80. The main reason for this appears to lie in the divisibility of seamen relative to vessel tonnage. In other words, the proportion of crew (and crew cost) per deadweight tonne falls steadily with size. Figure 1. reproduces Personnel/deadweight results obtained by Amos.

FIGURE 1: ANL MANNING LEVELS 1969/70 - 1979/80



SOURCE: AMOS (1981)

Amos also produced some interesting results when he calculated crew costs for a coastal bulk carrier.

Table 4: Representative Vessel Operating Costs

	Proportion of Costs (%)	
	Bulk Ore Carrier (106,000 dwt)	Crude Oil Tanker (66,000 dwt)
OPERATING COSTS:		
port charges/stevedoring	14	11
fuel	29	25
vessel manning	14	22
admin., op. maintenance, insurance and other	13	20
Total operating costs	70	78
CAPITAL: (annuity)	30	22
TOTAL COST	100	100

NOTES (assumed parameters)

Bulk Ore Carrier	Crude Oil Tanker
oil fired: round voyage based on Pt. Hedland - Pt. Kembla/Newcastle Pt. Hedland 28 day round trip incl. delays	oil fired: round voyage based on Westernport - Botany Westernport 8 day round trip incl. delays

Source: Amos (1981)

In the above Table, manning constitutes 14 per cent of total operating costs for a coastal bulk carrier. Amos, assuming a 32 per cent reduction in manning through the introduction of general purpose crewing (G.P.) calculated that a 5 per cent cost saving could be achieved. Against this, he argued that 50 per cent of this saving would be absorbed by higher earnings due to upgraded seamen's responsibilities and that of the remaining 2.5 per cent there must be offset the additional training costs involved.

He concludes:

> "I expect manning scales will continue gradually to be reduced over time. But this does not offer any immediate prospects of substantial cost savings" (19)

Notwithstanding the above, he also found during the course of his study that in general:

> "Discussions with both Australian and overseas shipping companies suggest that there is still considerable scope for reduced manning levels on Australian vessels". (20)

This is the crux of the issue. High capital investment in shipping implies a low labour content. Lower cost capital for new, technologically advanced ships as envisaged by Crawford will not, in itself, succeed in generating a cost effective overseas fleet unless Australia gives at least the same level of consideration to manpower policies as her potential competitors. Australian flag expansion will not necessarily diminish the number of vessels operated by lower cost cross-traders in Australian overseas trades.

Although maritime unions continue to press for the United Nations Conference on Trade and Development (UNCTAD) 40:40:20: cargo code* in all trades, this is impossible in practice. However, a 10 per cent Australian participation in bulk trades particularly would increase our share by over 100 per cent and have a minimal effect on the number of cross-traders. As an example, the iron ore trade with Japan employs over 160 vessels. To utilise 16 of these ships (10 per cent) with smaller crews would bring Australia more in line with OECD flags (see Table 3) simultaneously increasing, rather than decreasing job opportunities, thus taking most of the heat out of the manning debate, at least in that particular trade.

The discussion, so far, has centred upon the savings which can be achieved through reduced manning. The next section considers innovative shipboard manning systems, drawn from overseas experience, which may have applicability in Australian shipping.

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* The essence of the system is that a country has the right to ship 40 per cent of its trade in its own ships, its trade partners have the right to ship 40 per cent of the trade on their ships and the remaining 20 per cent is shipped on vessels owned by third parties

TECHNOLOGICAL CHANGE

There is little doubt that a fully automated ship is theoretically feasible. At present, the maritime industry has not achieved the overall reliability of the necessary automation system. Even assuming the final success of automated systems, it has not yet been fully established what is the optimum technical or economic trade-off between manpower and automated techniques in the sea-going environment. (Guiton, 1975; Istance and Ivergard, 1975; Jackson and Wilkie, 1975; Heirung, 1976).

Automation can increase shipboard safety; can promote occupational preferences on vessels equipped with automatic devices; can help to decrease maintenance costs, and there are many other benefits. What we do not know as yet is how to put a value on any of the factors. Among these are; man's true position as a back up for automation devices versus the use of redundancies; man's value for maintenance at sea measured against the performance of all such functions in port or drydock; the social problems of small crews on long voyages, and the training required of personnel for these ships.

All of these factors must be established, not just in monetary terms, but from a socio-economic viewpoint, for a comprehensive evaluation of the total impact automation will have on the future of the shipping industry. One of the areas which will require the greatest amount of consideration in the future of Australian shipping will be in reconciling shipowners economic advantages with the career aspirations and job security of the seafaring community.

The greatest change in the sphere of maritime automation has been in the pattern of shortening time lags between invention, innovation and diffusion. In the past, the maritime industry had a well founded reputation for accepting change slowly and only at a pace which allowed for the full examination and proving of equipment to establish confidence in new systems. This conservative approach has altered dramatically as technology has advanced. Specialised ships have evolved to take advantage of improved trading routes as a result of population increases, changing standards of living and the increased demand for energy per capita in developed and developing countries.

INNOVATIVE SHIPBOARD MANNING

Capital intensive units demand high utilisation with minimum downtime. They also require relatively sophisticated monitoring and control systems, plus personnel capable of handling, processing, making decisions and acting upon the information provided. The supply of qualified operators for complex machinery is limited and the recruitment, selection and training of personnel is obviously of great importance. Additionally, the human shipboard operator is required to work in a unique industrial environment.

The ship is basically a system within which certain functions are performed and its state, input, conversion and output have to be controlled. System effectiveness must be measured and this may be achieved in terms of output, reliability and maintenance criteria. The individual well-being of humans can also be measured in terms of attitude, motivation, absenteeism and sickness rates.

System effectiveness and individual well-being are not mutually exclusive since they influence overall costs and output values. Just as there are physical limitations on the systems hardware (the ship) so there are psychological and physiological limitations on man's capacity to interpret processes and make decisions under shipboard conditions of noise, heat, stress, fatigue and similar circumstances. (Hjelholt, 1974; Smith and Hatfield, 1975; Maritime Transportation Research Board, 1976) The shipboard environment plays a major role, not only in the selection and training of personnel of sufficient sea-going calibre, but in the retention and commitment of their services (Secord and Blackman, 1961; Perlberg and Shaal, 1968; U.K. Department of Trade, 1970; Moreby, 1971; Hill, 1972; Hopwood, 1974; Mannheim and Rosenstein, 1976).

At the present time there is sufficient technology available to execute ships' mission requirements by remote control. In the Australian context the robot ship concept may be somewhat distant. The task force formed to implement the Crawford proposals advocates:

> "...an orderly development towards an equitable share of overseas trades for Australian shipping being achieved against a background of harmonious industrial relations." (21)

This is undoubtedly the optimum approach for Australia. The major disadvantage with this type of approach, however, is that the prescribed rate of 'orderliness' may be difficult to control. Australian shipping developments may simply pursue international trends. As an example, manning scales for bulk carriers given in the Union submission to the Crawford Inquiry, when extrapolated, indicate that crews of 20 or even 15 men can be expected in the medium term. Some industry sources suggest a quantum leap from the current 25-30 man Australian crew to 'less than 20' as the most logical next step.

Traditional flag nations have been confronted with increasing operating costs in recent years. These costs have been particularly high in the areas of bunkers, shipboard maintenance and manning. Rising costs, coupled with the effects of world recession on these industrialised countries have been sufficient to render many of their fleets uncompetitive. This is even more apparent when their ship operating costs are compared with foreign flag vessels from developing countries, or with flags of convenience. In an effort to contain operating expenses, and check decline in their fleets, many nations' shipowners have been encouraged to examine the potential benefits of automated shipboard systems.

The effect has been to propel technological innovation to a point where it has almost surpassed the traditional industry's capacity for change. Shipboard technology is accelerating. Although some of the theoretical advantages of automated systems may continue to be commercially impracticable in the medium term, the trend is inexorably towards the utilisation of technology to improve shipping's economic performance. Not only has this prompted a desired reduction in crew numbers but a significant structural change in the reduced crew size. Cost-effective flexibility of available manpower is critical if automated navigation, cargo and engine systems are to realise their full technological potential.

The availability of technology is not, of course, only reserved for traditional flags. Some of the most modern tonnage in the world belongs to open registry fleets. However, if Australia wishes to successfully extend her role in international shipping, through an 'open seas' policy perspective, she will require a keenly competitive approach.

STRUCTURAL CHANGE

Automation may be considered as one aspect of mechanisation. In other words, it can be artificially isolated. Automation in relation to the techniques which are taking place on board ships may best be described as the extended use of control engineering. The modern ship is essentially an engineering plant within which three major functions may be automated. These are, the automation and remote control of main and auxiliary machinery, the automation of radio and navigational apparatus and the automation and remote control of mooring and cargo handling equipment. Recent trends in shipboard management techniques support this and are towards, 1) the centralisation of vessel operation at a single point, but with man still in control and 2) a steady increase in the application of electronic aids, particularly computers. This latter trend will move from supervision, through checking, to eventual operation - the crewless ship.

Traditional work organisation structures on board ships will become progressively inappropriate as automated systems develop This will particularly affect Australia's merchant marine whose crewing structure is one of the most traditional of the advanced countries.

Conventional crewing systems display a marked rigidity between deck, engineering and catering departments. Recent moves away from traditional 'demarcation' lines have been towards the better utilisation of crew members. This involves breaking down traditional departmental barriers. The basic work unit is the small team.

One of the inevitable features of automation is that it tends to displace personnel at the lower end of the wage scale. This, in itself, does not succeed in removing all of the less fulfilling shipboard tasks for those remaining operators. The Hoegh Multina Project was an interesting example of an integrated training programme devised with the objective of redistributing more equitably the less fulfilling, and the more challenging, technical tasks on board automated ships (22)

Here, bridge watchkeeping duties and maintenance tasks were shared by deck and engineering officers. All of the officers on the ship formed a cohesive team both concerning the planning and execution of the work. It was found that when training was designed with the experience of the seafarer incorporated into the ship's objectives, the results were experienced as beneficial and were welcomed on board ship. In addition, the occupational career and image of the ship's officer was enhanced.

Hapag Lloyd made similar advances in breaking down inhibiting traditional distinctions. They recognised that the Inspection Department was the main source of contact between ship and shore, with the crew management and nautical/technical departments providing a more supportive role. The Master's function they see as one of overall ship management with particular emphasis upon commercial and personnel matters as well as the administration of the ship. His shore contacts are therefore essentially with the relevant trade manager in the freight department and with the crew department. For day-to-day operation of the ship, contact is between the chief engineer and chief officer on board ship and the ship's group team ashore. The overall operating budget for each ship is prepared by the relevant ship group team and is discussed with the ship team to engage them in the responsibility of running the ship at least cost. By referring to anticipated work plans for the year the ship team is able to select materials and stores from a catalogue produced by the Company's materials' department and determine when they should be delivered. By these means the ship team controls their own budget.

Pan Ocean Anco Ltd. have also developed the theme of a closer ship/shore relationship and adopted small shore groups which support a certain group of ships. Officers are attached to ships for a minimum period of two years as are the ship's shore team; thus continuity and a greater level of responsibility and job enrichment may be developed. The emphasis for officers within Pan Ocean is on their ability to 'manage' within the ship's environment and officer training is based on simulated voyage circumstances, the development of training being the manner in which the team handle and respond to certain events.

INNOVATIVE SHIPBOARD MANNING

The closer ship/shore relationship is supported in Hapag Lloyd by the increased role the Personnel department plays in ensuring that replacement crew members are adequately trained to join multi-purpose (M.P.) crews. A study undertaken by them showed that by developing MP crews co-ordination was improved, with management teams identifying proper priorities and allocating crew accordingly. With this flexible and more efficient use of manpower came a widening of ratings knowledge and skills, and the maintenance of morale standards which had shown signs of weakening due to the increasing social pressures of smaller crewing. To introduce this system took time and careful negotiation with trade unions in West Germany, but agreement was reached in return for the Company providing improved training facilities and adequate payments.

Hapag Lloyd began training deck seamen in engine room and similar mechanical skills and engine room ratings in practical seamanship. It was found, however, that it was easier and more successful to train mechanics in seamanship. Now, for MP crewmen, the Company concentrates on recruiting 'mechanically oriented' workers from shore industry and teaches them seamanship skills in a working environment on board ship. The men are answerable to the Chief Petty Officer who is responsible for all deck and engine room work performed by ratings and they must complete a rigid training programme before they are classified as M.P. crewmen.

Since the basic objective of the MP System is to have as wide a range of skills amongst the least number of people it follows that provision should be made for allowing those skills to be applied. Thus, integrated work cycles have been introduced. By means of an agreed work plan, formulated in conjunction with the voyage plan, a system of work rotation is promulgated throughout the whole ship It is worth noting that nowadays work planning forms a major part of each voyage plan.

In 1984, Hapag Lloyd had approximately 25 ships working the MP System and the sort of reduction in crew size was in the order of 36 men down to 25. This reduction had been achieved by combining an increase in shipboard technology with an MP system and the cutting of crew to the lowest possible number (with the risk of less good looking ships). Daily running costs of an MP crewed vessel are estimated to be approximately 17.6 per cent lower than a conventionally manned vessel.

A further development often equated with reduced crewing objectives is 'minimum manning'. The concept, however, is quite distinct. Brostrom's Rederi AB introduced minimum manned ships on Swedish Orient Line's RoRo Service to the Mediterranean. With voyage-on, voyage-off arrangements a total of 12 crew were required, plus maintenance staff ashore. Thus, the theoretical traditional crew of 23 men was reduced to 16. This included a master, three mates, a chief and two assistant engineers, one radio officer, a cook/steward, a messman and six 'ship operators'. The emphasis on minimum manning is that crews perform only those duties considered necessary to safely 'drive the ship' between ports. This places a greater dependency on shore based facilities for such things as shipboard maintenance and victualling. Additionally, it can also require teams of seamen capable of being transferred to vessels at port approaches to assist with the more traditional labour intensive tasks, such as line handling.

The role of ship operator is becoming increasingly familiar throughout developed countries fleets. The ship operators initially recruited by Brostrom's were all experienced former AB's, boatswain's and engine room ratings. As more automated ships come on stream a regular supply of experienced, well-trained personnel will be required.

A recent example of successful minimum manning, yet still retaining traditional 'deck officers only' for bridge watchkeeping duties, is the 15 man, Norwegian crewed, bulk carrier M.V. "Lindness". This vessel, owned by Jebsen's, operates world wide. The success of the enterprise, which has lower operating costs than her '25 man' Filipino crewed sister ship, is attributed primarily to the provision of automated shipboard systems, shore based maintenance and well trained, integrated crew members. The potential for expansion of the Jebsen fleet with this type of low crewed vessel will increase job opportunities for Norwegian seafarers. Norway currently has 65 vessels operated by crew sizes of between 16 and 21 men.

Minimum manning does have certain weaknesses, not least is crew strength. A '15 Man' crew could be the theoretical limit. For example, lack of confidence in new shipboard systems still requires that crews should be large enough to operate or safely control a vessel when automatic devices fail. Another potential failing is that small crews might be unable to effectively render assistance to another vessel in distress. It is doubtful, however, whether a conventionally crewed VLCC/ULCC in ballast would be able to assist in similar circumstances due to the physical distance between deck and sea level, although use as a helicopter landing base is a possibility.

In addition to training ratings in wider skills, programmes whereby engineer officers may be trained to undertake bridge duties and deck officers instructed in engine room functions may be introduced. The latter training entails emphasis on the best method of operating equipment and machinery rather than maintenance instruction. Further flexibility has been suggested; by the master performing a full bridgewatch, and through the removal of traditional roles such as radio operator. It has been argued that the reduced requirement for continuous operating has led to a 'purser' type role for many existing radio operators. (23)

With the widespread adoption of systems such as SATCOM, coupled with the implementation of the International Maritime Organisation's (IMO) Future Global Maritime Distress and Safety System (FGMDSS) by 1990, the traditional eight hour watch of the radio operator will be unnecessary. Additionally, the working schedule of the conventional radio operator does not always coincide with the times of existing systems optimum propagation conditions. Future electronic circuitry systems could also be subject to shore maintenance criteria which encourages the replacement of parts at sea, rather than repair. Thus, a highly skilled electronics officer, often seen as the radio operator of the future, would not be required on board. Many companies feel this work can be undertaken by the second or third officer on board ship with the engineer officer providing technical maintenance cover. This is, however, an area where resistance from traditional seafarers world wide is being encountered.

The benefits of MP crewing can apply not only to cargo but also to passenger vessels. Faster, more automated ships on short sea routes have resulted in companies being able to offer lower service standards, a switch from restaurant to self service facilities, improved passenger handling, and more efficient maintenance through the provision of programmes controlled from ashore.

The underlying theme in all systems designed to adapt existing and future personnel to automated ships is the recognition and increasing importance of ship/shore contact. The developments in shipboard automation are no longer just shipboard experiments but involve changes in operation on a company-wide basis.

Although the precise arrangements may vary, current manning policies would appear to lie between 1) full crew integration, whereby all departments disappear, and 2) limited integration, maintaining modified deck and engine departments but with peripheral functions such as catering absorbed into general duties. For the future, the second alternative will probably be the more realistic option. Under such a system ratings are engaged under new general purpose 'G.P.' titles. As we have seen, the main advantages of such a system are that shipboard management teams can ensure better co-ordination and allocation of proper priorities, there is a widening of knowledge and skill for ratings and there is also a more flexible and efficient use of manpower.

To date, there has been a general reluctance to introduce fully integrated crews, not the least from officers whose future role is increasingly seen as a dual purpose one. This concept has been proposed because much deck and engine work is basically of an engineering nature. Technological and managerial developments on board ship have led to a decline in the share of maintenance for engineer officers and a reduction in cargo responsibility and handling for deck officers which is being increasingly transferred ashore. In the future, a more meaningful division of responsibilities could be operational officers responsible primarily for navigation, engine control and cargo care and maintenance and repair officers in charge of engines, electronics and all stores and spares.

Opponents of this system argue that existing deck and engineer officers already have sufficiently wide responsibilities in increasingly sophisticated spheres; only a relatively few high calibre men are available and that, coupled with longer and wider training requirements, it might lead to a system which produced neither expert navigators or engineers. In addition, it is argued that ships of the future may require only one highly qualified 'all round' engineer and it could be considered wasteful to give many officers a thorough grounding in engineering.

It is, of course, easy to see faults in any new proposal but the matrix organisation of small teams of officers each with a professional/technical role does have advantages, especially in the provision of competency overlap. It can also help to reduce boredom amongst task groups and lead to a safer and more efficient ship operation. There are other benefits of dual role systems. An engineer officer may find a break from the engine room to bridge a welcome relief. In addition, a greater breadth of experience does have the spin-off effect of improving career opportunities ashore.

The future organisation of an automated ship could be one in which the Master's role is viewed as the effective overall operation and commercial management of the vessel. For him, continuity would be more with the particular route than the ship. In this he would be supported by 'Operational', and 'Maintenance and Repair' officers whose continuity of role would be with that particular ship.

As Lewarn (1977) has stated, the final determinant will rest with shipowners and operators who must decide whether:

> "...personnel are being recruited for increasingly automated vessels which may be operated in a manner similar to international aircraft or in a manner designed to give increased managerial autonomy to the personnel aboard the vessel". (24)

THE AUSTRALIAN SCENARIO

European maritime nations are committed to the development of the conceptualised 'efficient ship'. (25) Similar developments are taking place in Japan. While there are many examples throughout the world of technologically advanced vessels, the majority are hybrids of one form or another. The technologically integrated ship is not as common.

It is generally accepted that as crew costs decrease the costs of other sub-systems tend to rise. The objective in shipping, therefore, must be to reduce not only crewing costs but total system costs. To achieve this requires full system integration, i.e. automated shipboard systems, appropriately crewed.

The preceding examples of lower shipboard manning levels are, in their various forms, some attempts by maritime nations to reduce these sub-system costs. The problem of high manning costs in Australian shipping, although widely recognised, has not until recently been approached in a similar manner. An industrial agreement (June, 1984) which ended a demarcation dispute between two Australian maritime unions has prompted the reorganisation of crewing on board Australian flag vessels. As a result, the upper limit on the average Australian vessel is now 26 men instead of 32, a reduction in crew size of 18.75 per cent. This is significant. The implications of lower manning will filter through existing crewing structures and ultimately influence new entrant intake and training policies.

A recent study arising from the Crawford Report examined the employment and mobility characteristics of Australia's merchant marine personnel (Bureau of Transport Economics, 1984). The study produced some interesting results which will have implications for maritime training. As an example, it was found that approximately 40 per cent of Australian sea-going officers had previously served on foreign flag vessels while the number of ratings with previous foreign flag experience was only in the order of 20 per cent. The study's major drawback, which was clearly stated, was that it was only concerned with estimating the number of recruits who would be required to sustain balanced industry growth, thus:

> "No attempt was made in this study to predict future growth patterns in the industry." (26)

The limitation of not predicting future growth patterns was imposed by the Secretary of the Department of Transport, with industry agreement. This is seen as the industry's task - using the Report as a data base.

Australia's manning debate hinges upon evidence which reflects the actual or perceived levels of cost savings which may be achieved through reduced manning. While there are limited data on the monetary costs of high crewing, what data are available clearly show some cost savings can be achieved. However, there are few reliable studies which directly relate reduced manning to shipboard safety and efficient automated shipboard operations. As a result, true cost savings of reduced manning:

> "...cannot be precisely quantified at present." (27)

In their submission to the Crawford Inquiry, Australian maritime unions stated they were:

> "...not prepared to start assigning hypothetical manning levels to hypothetical ships of the future - as there are too many unknown variables." (28)

But, more importantly, they also stated:

> "...maritime unions are prepared to discuss manning levels on Australian ships of the future and reach agreement with the shipowners - in the light of all known facts and within mechanisms constructed for the determination of manning levels." (29)

This is an extremely useful approach. The Broken Hill Proprietary Company Limited (B.H.P.) recently ordered three new bulk carriers for its overseas fleet. These vessels were only ordered on the prior understanding that they would be manned with smaller crews. Crawford recommended 'less than 30' as an acceptable number for qualifying benefits. B.H.P. achieved 26 man crews only two years later - a marked improvement. Clearly, future orders for all Australian shipping must include trade union consultation 'from the keel up'.

Policy Options

There is not a prescriptive manpower policy available which will successfully match Australia's future manning standards and requirements. What knowledge we have is usually drawn from overseas experience.

Historically, Australia's merchant marine has relied heavily on qualified personnel from 'Commonwealth Validity' countries, particularly Britain. In April 1984, Australia ratified the International Maritime Organisations (I.M.O.) "Convention on Standards of Training, Certification and Watchkeeping for Seafarers" (STCW, 1978). The outcome of this ratification, coupled with other factors such as restrictions on migrant entry, will place a greater reliance on 'home-grown' officers and ratings. This will further reduce Australian dependency on imported expertise. (30) It is still not fully recognised throughout the industry that Australia cannot, and need not, continue to rely on overseas personnel.

In 1984, the National Maritime Industry Training Committee (NMITC) stated that:

> "In the inevitable move towards smaller crews on board increasingly sophisticated ships increasing emphasis must be placed on the professionalism of both officers and seamen." (31)

This is a clear indication of future training policy. Australia will undoubtedly need to move towards professionally integrated crews in the longer term. The manner in which this is achieved must be based on Australian standards.

Comparing Australian shipboard standards of accommodation and manning with other traditional flag comparisons may not provide a complete answer. Australians generally enjoy a materially higher standard of living than most open registry nations. This example can also apply to some traditional flag countries living standards. Shore based living standards should be reflected in the sea-going environment.

Although ostensibly displaying many of the norms applicable to British and European society, Australian social values are quite distinct. Australian society is fortunate in that it does not appear to suffer, to the same degree, Britain's socio-economic class structure. This is seen by one authoritative British shipping commentator as probably the most important aspect currently impinging upon the introduction of innovative manning systems on board British vessels (Moreby, 1984). Hierarchical structures transferred to the sea-going environment are by no means exclusive to British ships. As one leading European observer states:

> "Norway has similar hierarchical crewing divisions."
> (32)

Poor experience overseas need not necessarily deflect Australia from adopting her own approach to crewing arrangements. The impulse to do this will undoubtedly come from the 'hardware' side of the system, that is, from new ship technology.

The design of accommodation and recreational facilities on board many vessels is normally a 'two-class' structure. Smaller crews, per se, on board ships make it almost inevitable that status levels will be transgressed in interpersonal relationships. Increased exposure to the problems of smaller crewing has led many individuals to reinforce their traditional group boundaries. This reduces the crew's capacity to cope with interpersonal conflict at sea. While many seafaring peer groups support the two-tier system of separate mess-rooms, recreation rooms and physically separate accommodation levels, the system is not complementary to the effective operation of a ship manned by an integrated team.

Traditional crewing structures on board deep-sea vessels are absolutely based upon large numbers of personnel and the existence of a relatively undifferentiated aggregate at the bottom of the 'pyramid'. With smaller crews on high technology vessels the opposite is the case. Automated shipboard systems require greater internal flexibility among crew members. Collective responsibility becomes essential.

Australian crewing systems are governed by imported hierarchical structures, yet her overseas shipping could be classed as an 'infant industry'. This should be seen as a comparative advantage. Australia is ideally placed to transfer to the sea-going environment aspects of her egalitarian society which will allow innovative crewing systems to be introduced on board her ships.

For the foreseeable future, the matrix organisation of crewing will probably still require a reservoir of on board skills to safely handle vessels. The long term trend must be towards the implementation of multi-skilled integrated crews.

Conclusions

This paper has considered some of the manpower policy options which are available, given that there is a firm commitment by the Labor government to extend Australia's flag into overseas trades. No attempt has been made to 'fine-tune' training requirements. Rather, the emphasis has been upon the consideration of manning options drawn from overseas nations experience in the light of increasingly automated shipboard systems.

There is evidence which indicates that Australian manning costs, as a proportion of achievable sea transport costs, are too high. The problem is not confined to Australian shipping but is worldwide.

Australian labour productivity is lower than in other comparable countries. This has the effect of making Australian shipping expensive compared with other nations fleets even allowing for lower cost manning projections.

Notwithstanding manning disincentives, government policy is clear. As the President of the General Council of British Shipping in his 1984 annual address remarked:

> I was interested to hear a very bright Minister for Transport of one of our major Commonwealth partners explaining the other day that he had talked with our Government and found them, "in a great state of confusion over their objectives for the British merchant marine". "We", he said, "are very clear what we are going to do. We are going to support and build up our merchant marine."

Maritime industry policy advocates Australian crews in Australian ships. Recently, a British commentator (Moreby, 1984) has asked:

> "...which country... will still be in the business of manning its ships with national seafarers in 1990?" (33)

Australia's merchant marine policy may be imperfect. Despite these imperfections there is, in train, a commitment to extend Australia's overseas shipping influence. The success of this commitment will depend upon the appropriateness of her crewing arrangements.

The particular danger in Australia's case is that an expansionist policy, transferred to the international level by way of a protected shipowner group, could lead to a situation whereby the declared objective of 'harmonious industrial relations' (see p.15) will command a disproportionately high price. The nettle of high manning costs, a major cause of international uncompetitiveness, may simply not be grasped.

Although manning constitutes a smaller proportion of total system costs than vessel capital costs, subsidies, passed on in the form of employee benefits, should not be the price of industrial accord.

Given the arguments for, and against, a fleet manned by Australian nationals, it may be concluded that flag expansion is but part of a wider policy aimed at broadening Australia's structural base.

Deregulation is clearly not a policy option. The alternative to deregulation, however, must not be to prop-up ailing industries. Commitment to a policy does not mean accommodation at any price. If subsidised Australian flag expansion is to be successful, it can only be achieved through full system integration, i e., automated shipboard systems, appropriately crewed.

Public funds cannot be used to artificially immunise Australian Shipping from international competition