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Gunther Zade

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GUNTHER ZADE

SKILLED PERSONNEL

# Maritime Education and Training in the Nineties

## Istruzione e addestramento del personale marittimo per gli anni novanta



In questo numero della rivista dedicato alle tecnologie avanzate pubblichiamo un articolo del professor Günther Zade, vice rettore e professore di scienze nautiche all'Università marittima mondiale di Malmö in Svezia, una istituzione nata e operante sotto gli auspici dell'International Maritime Organization dei cui scopi abbiamo già scritto e che comunque riassumiamo in una breve scheda a parte.

L'articolo è estrapolato quasi integralmente da una memoria che il prof. Zade ha scritto per il simposio « Maritime Industry in the Nineties » - una visione europea, tenuto ad Amsterdam.

Il prof. Zade è una autentica autorità in materia e proviene dalla Scuola Superiore Nautica di Brema di cui è stato direttore e animatore per tanti anni portandola a livelli di professionalità altissimi.

Inoltre il prof. Zade è stato capitano marittimo prima di intraprendere gli studi universitari e poi la carica di insegnamento.

È uomo attento ai cambiamenti del mondo economico, sociale e tecnologico nel campo marittimo ed inoltre aggiunge quel « background » di esperienza a bordo che ne completa la personalità.

Il lungo articolo del prof. Zade è stato composto nella lingua originale, l'inglese, perché riteniamo che sia di buona comprensione per il livello dei

nostri lettori ed anche per allargare il consenso alla nostra rivista a quella fascia internazionale di lettori e abbonati che sta diventando sempre più diffusa.

In questo articolo Zade tocca tutti i punti principali dell'istruzione e dell'addestramento per l'industria marittima per gli anni novanta, una analisi che si articola su vari aspetti: economici, di sicurezza, sociali, di rapporto con l'ambiente.

La nave viene vista in chiave moderna, come « unità che si gestisce autonomamente » e non dipendente da terra.

La polivalenza del personale viene vista nel senso di coperta/macchina e nave/terra, cioè personale che è preparato per alternarsi nei ruoli di bordo e dal bordo agli uffici della società di navigazione.

Quali sono le necessità e la domanda di formazione e di addestramento in base al tipo di trasporto e al tipo di struttura aziendale prevista nei prossimi anni?

Quali devono essere i contributi che realizzano una funzione ottimale nell'istruzione e nell'addestramento da parte degli armatori e della amministrazione marittima? Sono queste alcune domande a cui Zade cerca di rispondere.

Zade vede l'uomo di mare come un professionista ben inserito nella società tecnologica e manageriale di oggi e perciò la sua specializzazione non è fine a se stessa; egli è un operatore marittimo non emarginato dal suo ruolo ma flessibile nei ruoli che, secondo la sua preparazione e specializzazione, può svolgere nello shipping.

L'istruzione e l'addestramento devono tenere conto di questa realtà, il professionista operatore marittimo non è un « soggetto » soltanto della amministrazione marittima o della compagnia armatoriale, ma qualcosa di utile e forse di indispensabile per il progresso della società moderna.

Questo discorso, detto e scritto dalla più alta « torre » della competenza nel campo della formazione marinara, dovrebbe far riflettere tutti coloro che per le varie sfere di competenza si insinuano nel settore della formazione marinara avendo una modesta opinione del professionista navigante, quasi un soggetto da « certificare » e non di un uomo da cui trasferire esperienza e competenza.

### WORLD MARITIME UNIVERSITY

The possibility of establishing an international centre for providing advanced training had been discussed in the 1970s and in 1981 the IMO Assembly — the Organization's governing body — adopted a resolution backing the proposal. Sweden offered building facilities in Malmö and financial assistance to meet a part of the annual running expenditure. The United Nations Development Programme (UNDP) offered additional financial support. IMO was asked to make preparations for the establishment of the University and completed the task so rapidly that it was officially inaugurated in July 1983.

The University concentrates on two-years courses leading to the award of the Master of Science degree. All instruction is in English, and the subjects taught are:

General Maritime Administration, Maritime Safety Administration (Nautical and Engineering), Maritime Education (Nautical and Engineering), Technical Management of Shipping Companies.

While the University has a full time academic staff, a feature of its work is the use of visiting professors. Mr. Srivastava said: 'The University has built up a roster of experts in a wide variety of subjects who are invited to Malmö to lecture on their speciality. In this way the students can learn from the world's leading authorities in each field'.

## ASPECTS OF MARITIME EDUCATION AND TRAINING

There are a few main aspects from which maritime education and training is looked at, each of which is of primary importance for a certain group of persons in the maritime industry. The economic aspect ranks highly for shipowners and the national economy, the safety and marine environment protection aspect of maritime education and training is above all of concern for the maritime administration and the interest of seafarers and maritime academies may be closest to the social aspect.

### The economy aspect

The main objective of shipping is to make profit. There might be other important reasons for keeping a national fleet as a certain national independence in the carriage of goods by sea and the value of a national fleet in a crisis, but income from shipping for shipowners and for the country play a superior role in the operation of ships and a national merchant marine fleet.

It results from this economic priority that maritime education and training have to adapt to commercial necessities. Changes in shipping, which are



Snam's Marine Officers at the Credera training Center

dictated by economy, will — to a certain degree — have to be followed by maritime education and training by updating of contents and methods of training, by designing and specifying new syllabi and perhaps even by assisting in the development of new career structures for shipboard personnel.

### The safety and marine environment protection aspect

Certain minimum requirements in maritime education and training (International Convention on Training, Certification and Watchkeeping of Seafarers, 1978; STCW-Convention) have to be fulfilled by all member countries of the International Maritime Organization

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(IMO). European countries usually meet higher standards in the education and training of seafarers and in the fitting of ships with equipment than those required by the STCW-Convention, the International Convention on the Safety of Life at Sea, 1974, and Amendments thereto, 1981, and other relevant international Conventions.

There is a conflict potential between economy on one side and safety and marine environment protection on the other side. It is usually latent but may come to the surface on a level of education and training as well as shipboard outfit that is higher and more expensive than the required minimum.

It is difficult to specify what increase of investment would result in what increase of safety. For the time being, a cost-benefit-relationship cannot objectively be determined and discussions on economy vs safety are open to subjective considerations.

Maritime education and training has to live with such unsatisfactory state of affairs until the relationship between costs and safety can be more specifically described than now. Prior to this, a better understanding of the cause of marine casualties will have to be obtained.

#### The society aspect

It is sometimes neglected in economic considerations and in an attempted increase of safety by equipment that the social situation of the seafarer may have some bearing on both safety and economy as well as may have the value system of the society on seafarers and maritime education and training.

The qualification of shipboard personnel, working and leave conditions, the psychological atmosphere on board and the physical work requirements may influence the safe and economic operation of ships. It is too simplistic to calculate with shipboard crews only in numbers, salaries and as operators of a ship and her equipment. There is more to it. A ship, where job satisfaction can be found, is normally a safe ship. Whether a safe ship is an economic ship, may have to be decided case by case.

The state of society and the values which the majority of members of the society identify with have had a growing influence over the last few decades on what seafarers regard as important and are trying to accomplish. Particularly, the state and the objectives of the national education and training system have had an impact

on maritime education and training as can be seen in the introduction of academic degrees for maritime studies (UK) or the simultaneous issuance of certificates of competency and academic degrees to seafarers (FRG) or the equivalence of maritime education and training certificates to academic degrees (France). Such adaptation to and integration into the national education and training system does not only give the seafarer recognition but provides at the same time for some linkage to the national system. This may make difficult a lowering of study requirements in which those may be interested who are concerned with the cost of education and training and the cost of ship operation.

#### ISSUES IN MARITIME EDUCATION AND TRAINING

##### Autonomous ship vs dependent ship

Modern communication technology enables head offices of shipping companies to stay in close contact with their ships. A growing influence from ashore on the operation of ships can be exerted and ships can be kept under a considerable degree of control. The sole master after God-position has been scrapped during the last decades. A different role for the master has emerged slowly but steadily: Remote but close and constant supervision from ashore and a limitation in the range of independent decision making. The role of shipboard personnel may be reduced to the accompanying of overseas transports.

It coincides with such redistribution of work and responsibilities that the autonomy of bridge management is challenged by an increase of installations for the surveillance of ship traffic. Pilots and pilot organizations are partly dissatisfied with this development (See proceedings of International Symposia on Vessel Traffic Services, Rotterdam (1976), Liverpool (1978), Bremen (1981), Marseilles (1984)).

Part of the autonomy vs dependence issue is the discussion on where decisions on ship operations can and should be made, aboard or ashore. Shipboard personnel could usefully contribute to economic decisions provided they would be sufficiently qualified to think and act in economic categories. If no provision in maritime education and training for the obtaining of such qualifications would be made then sufficient cost concern cannot be expected and the potential of shipboard personnel would not be fully made use of.

##### Deck-engine bivalence vs ship-shore bivalence

Maritime education and training in most countries prepares primarily for shipboard qualifications. Taking into account and accepting the fluctuation of seafarers from ship to shore, the question has to be raised whether there should not be a part in the syllabus for the training of ship officers that provides for a utilization of sea-leavers in the maritime industry ashore. Also considering the size of investment into the education and training of a master mariner, two extreme positions could be taken: Maritime training could be restricted to shipboard duties and kept to the absolute minimum in the deck and engine branch and would then be rather short and cheap or, alternatively, the scope of maritime education and training could be expanded so that it would result in an advanced shipboard qualification and would at the same time qualify for the maritime industry ashore. The latter concept would give graduates professional mobility but would be rather long and expensive.

As a possibility between the two extremes, shipboard qualifications could be extended and an on-board mobility be created by combining a deck officer with an engineer officer qualification.

Present thinking, above all in western European shipping companies, seems to favour such a deck-engine bivalence to a ship-shore bivalence. Costs for dual-purpose education and training would be high, if both qualifications would be provided for at the highest class of certificates of competency. It is therefore likely that the scarcity of financial resources for such education and training would produce a dual-purpose officer with a somewhat restricted degree of qualification, this the more so since also shipboard experience would have to be obtained in both capacities.

Whilst the economic situation of a shipping company may require deck-engine bivalence, society and national economy may gain greater benefit from a ship-shore bivalence of shipboard officers.

A narrow limitation of education and training to shipboard operation on either the bridge or in the engine is hardly favoured by anybody directly or indirectly involved in maritime education and training. It would result in a lower level of qualification but would not help reduce the number of crew.

### Training required vs training given

Training in maritime academies will always lag behind what is required on board. There are a few reasons for such training job-gap:

— Training in a classroom, even when sophisticated equipment is used, cannot match shipboard reality and experience. Without training vessels and simulators training can fall considerably short of meeting job requirements.

— Shipping develops rather quickly. Developments in maritime education and training take place at a slower rate. The close affiliation of maritime education and training to the ministerial bureaucracy may be a reason for such slowness. The latter may also be partly a result of a certain resistance to change by the teaching staff of a maritime academy. Often, a lack of direct contact with the shipping industry has to be identified for such deficiency.

— Maritime education and training has to provide for a wide range of possibilities and not necessarily for a specific type of ship.

It adds to the sometimes exaggerated perception of a training-job gap that older generations of seafarers may not be at ease with younger seafarers and their not always justified self-confidence.

### POSSIBILITIES FOR THE ADAPTATION OF MARITIME EDUCATION AND TRAINING TO CHANGING NEEDS

There is some adaptation potential in maritime education and training by which new requirements can be followed and can be met to a certain degree. However, the use of such possibilities sometimes results in gains in one and losses in another sector. It is regular practice of those trying to use these possibilities to exaggerate the gains and to belittle the losses.

#### Technological possibilities:

##### Shipboard and training equipment

Modern electronic equipment reduces the workload and increases the potential of cargo operations and related paper work as well as of the navigation of a ship. Devices as Automated Radar Plotting Aids (ARPA) facilitate navigation and make it safer provided they are used by well-trained and experienced ship officers. Satellite navigation reduces efforts for navigation considerably. Its use may even raise doubt whether a thorough understanding of navigation calculations is



Left: Mr. Srivastava Chancellor of the World Maritime University

still necessary when a few keystrokes are sufficient to obtain the necessary result. Modern electronic navigation equipment with its accuracy and reliability may further a black box-approach to navigation and a limitation of training to input-output relationships of instruments and devices as alternative to the still prevailing thorough training in navigation instruments and calculations. Older navigators will not like such decline in the value of navigation although they may have to admit that celestial navigation does not matter as much as training subject as before and that the importance of electronic navigation for a master mariner has grown although the overall importance of navigation in the syllabus has at the same time been reduced.

Assumed international regulations could be disregarded then the radio officer could be made redundant today by the introduction of automated coding, decoding and monitoring devices. The transition of radio officers into officers for bridge electronics has little chance of realization. Although bridge electronics have grown in amount and sophistication, this has not resulted in a demand for higher qualifications in maintenance and repair. The reliability of the systems has considerably been improved and maintenance and repair have been facilitated.

As regards engine personnel, their need of existence on board is debatable too. Engines can run watchfree. However, a fault detection system has to be introduced and shipboard repair services have to be provided for. Then

the qualified engineer could sit in the head office ashore and could advise the ship on appropriate remedies after having learnt from the shipboard personnel about the exact diagnosis of the engine's malfunction.

Training equipment has been even more advanced than shipboard equipment. Modern training simulators (See J.D. van Manen: Maritime Research in the Nineties, this symposium) bring classroom teaching close to shipboard reality and help to partly bridge the training-job gap. The development of such simulators that has begun in the Netherlands about twenty years ago. It has divided maritime education and training institutions in two classes: One uses simulators, one does not. Simulators and other expensive training equipment as training vessels support the concentration of advanced training facilities in a smaller number of places than usually offer maritime education and training. This coincides with the reduction of maritime education and training institutions in western Europe that results from a decline in number of ships, crews and sometimes from a loss of interest in a seafaring career.

However, it is not yet specifically enough clear to what extent training in a simulator increases professional capabilities. The transfer of training from simulators to shipboard still needs to be precisely identified as well as the elements of a simulator from the use of which such transfer results. Such increased knowledge — in addition to the plausible conclusion that training in a simulator as a tra-

ining closer to reality is a better training — may also provide for opportunities to reduce costs of simulators by the design and construction of tailor-made systems.

#### **Organizational possibilities:**

##### **Work allocation and crew structures**

Modern technology and the autonomy vs dependence issue seem to invite a re-allocation of tasks for the operation of a ship. Stowage plans for the decreasing number of general cargo ships can be rather easily prepared ashore, even easier so the stowage plans of container and other special vessels. Paper work can be facilitated and sped up by the use of modern computers and computer-controlled printing devices. A higher degree of reliability and improved organizational arrangements is connected with the use of such equipment. Wage calculations are better done ashore. Preventive maintenance and repair may be left to shore-based labour force.

Taken together a transfer of activities from ship to shore has taken place that has provided possibilities for the reduction of crews. It is partly a result of this development that the

officer rating-ratio has changed from 1:4 and 1:3 to about 1:1.

A re-allocation of work may also be used to combine shipboard activities. Such approach usually aims at a combination of deck and engine room tasks. Consequently applied it will result in new crew structures; the main outcome of which will be the reduction of shipboard personnel. It has to be noted that such combination of work allocations will lead to a loss in specialization although the opinion may be held that modern technology reduces both workloads and job contents and brings deck and engine job contents more closely together than before. Contrasting to this, society developments point towards further specialization in spite of an increased use of advanced technology.

There is at least one researcher (D. Moreby, Dean, Maritime Faculty, Plymouth Polytechnic, UK) who has arrived at the conclusion that present nautical officers and engineer officers are better not combined in a dual-purpose officer because of distinct differences in their personalities. Many members of the two categories

themselves seem to feel such difference.

Maritime education and training could produce a dual-purpose officer who does either sail for a voyage in the engine or on deck (France) or attends to deck as well as engine duties during a trip and a day (FRG and Dutch plans). There could be differences in the grade of qualification in the two branches as e.g. the combination of a highest certificate of competency in one branch with the watchkeeping certificate in the other branch (FRG and Dutch plans). There could also be the same grade of certificate of competency in both the deck and engine branch (France). All students may have to qualify in the same dual-purpose system (France) or only those are allowed to do so who show the best performance during the initial stage of their studies (USA). Education and training can be combined from the very beginning (France) or the second certificate may be obtained after the first (project Lange Adem, Netherlands).

All such combinations could be used to reduce the number of crew. Those interested in combined certificates often try to sell the dual qualification



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as advantage for a transfer into the maritime industry ashore although a too close binding to shipboard qualifications and a lack of qualifications for transition from ship to shore may be the result.

It has to be noted that dual-purpose training may require extended shipboard training periods for which shipping companies normally will have to provide for - perhaps at higher costs than before. It is not without danger to consider a substitution of shipboard exposure by extended use of training simulators.

Staff of maritime education and training institutions does not gain satisfaction by being forced to implement decisions which have been made under economic pressure. It adds to the troubles that the number of institutions in western European countries has already been (FRG, Sweden, UK) or will be reduced (Netherlands) and that dependence on governments has developed, dependence on Transport and/or Education Ministries.

An important element is often overlooked in such changes. It is not always noticed that maritime education and training institutions do not immediately produce qualified nautical officers or marine engineers but that shipboard experience provides for about half of the value of such personnel.

#### **CONTRIBUTIONS TO THE ADAPTATION OF MARITIME EDUCATION AND TRAINING TO CHANGING NEEDS**

Contributions to maritime education and training can be made from all

parties involved, provided they would develop and keep an interest in maritime education and training on the basis of a long-term planning.

#### **Shipowners contributions: Shipboard experience and job satisfaction**

Shipowners resp. shipping companies take a great interest in the reduction of the number of shipboard personnel. A substantial part of them also seems to favour the combination of tasks on shipboard and the training of dual-purpose crews and officers.

Shipping companies take great interest in the safe manning of their ships although they may use a different interpretation for safe manning than maritime administrations. Those remaining on board must be sufficient in number and appropriately qualified to cope with the normal operation of the ship and with shipboard emergency situations. For the latter the largest number of personnel is normally needed.

The individual's capabilities in the performance of shipboard tasks grow with shipboard experience. This may be costly to provide for. It can only partly be given on government-financed training vessels if such vessels are available at all. Shipowners would - as before - have to accept responsibilities and to take over costs for shipboard training. This should be increased in duration if a combination of shipboard qualifications is aimed at.

It is mainly a result of provisions made by shipping companies whether job satisfaction is created or not. Working conditions on board, planned lea-

ve periods and punctual replacements in foreign ports contribute to job satisfaction as do other measures which develop an identification with the employer. Such identification can be supported by job rotation schemes for shipboard officers who have been educated and trained for ship shore-employment. The work in the company office ashore in planned intervals produces a shipboard officer who can be of benefit for a company by increased qualification and loyalty. The regular attendance in specialized advanced training courses adds to the recognition of the seafarer that his company is interested in the qualification and well-being of personnel.

#### **Contributions from the maritime administration: Safety and pollution prevention standards**

The maritime administration (Ministry of Transport, Maritime Division) has to ensure that safety and marine pollution prevention standards are met as specified by national law that takes into account international (IMO) Conventions. This task includes the specifying and prescribing of the parts of maritime education and training syllabi, which are related to maritime safety and marine pollution prevention, and requires a direct or indirect involvement into examinations for certificates of competency and a monitoring of examination standards.

The work of a maritime administration also has a bearing on maritime education and training by the standards enforced and the number and type of dispensations granted in the manning of ships.

In a poor state of shipping economy, maritime administrations seem to be inclined to a certain flexibility in their enforcement of those safety and pollution prevention standards which would require financial investments.

#### **Contributions from maritime education and training institutions: Shipboard qualification and professional mobility**

Maritime education and training institutions have to implement new training requirements which become necessary from international or national regulations as e.g. for the training of tanker personnel and for ARPA-training. They have to observe and have to respond carefully to economic possibilities and necessities, not by following the ups and downs in shipping too closely but on a more balan-

ced and smoothed course. It helps to provide this kind of course that all education and training systems have a certain resistance to change. However, maritime education and training systems normally respond a bit quicker to new environmental conditions when they are solely under the authority of a maritime administration. Such administration is more willing and better prepared than a national education and training administration to respond to developments in shipping and to requests and demands from shipping companies.

It is the primary task of maritime academies to educate and train students for shipboard purposes. However, there are two developments from which the need for a broader approach to maritime education and training can be deduced.

Firstly, it can be expected that new requirements for shipboard training will emerge from future ship and cargo operations. This will result in a continued need for theoretical studies and shipboard experience. Maritime academies will have to provide for the theoretical part but they may — at the same time — have to educate and train their students more than up to now for an adaptation to future change. The academies will have to give more attention to methodological subjects and the use of e.g. system analysis and cybernetics in the presentation and teaching of subjects. How to study, how to manage and how to cope with new requirements and other «how to»-subjects will have to be enlarged. Understanding the purpose and the concept of an activity as well as its interrelationship with its environment will much more help develop capabilities for transfer of training than an abundance of unstructured details would cater for.

Secondly, the need for professional mobility in the maritime labour market will have to be responded to by most western European maritime education and training systems. Subjects will have to be introduced or enlarged in the syllabi for ship officers which are of use aboard and ashore as e.g. personnel management and computer science. The unsatisfactory employment situation may also result in the appreciation of the need for a ship-shore bivalence. The determination of the objectives of seafarer training should not only be left to shipping companies and maritime administrations. The society has to participate

in such task by lecturers of maritime academies and by education and training experts from outside the maritime industry.

#### **THE FUTURE OF MARITIME EDUCATION AND TRAINING IN AND AFTER THE NINETIES**

A real threat to the future of maritime education and training could develop if present contents and structures would be sacrificed for short-term economic benefits to too large an extent. Education and training is a sensitive system. The determination of its objectives and of adaptation measures, which will become necessary as a result of changes in the environment, cannot be solely left to shipping companies and maritime administrations. The teaching staff in maritime academies should take a more active role in the specification and implementation of changes. Such teaching staff would need the recognition of and the co-operation with other parties in the maritime education and training system. The recognition cannot be obtained by maritime lecturers who have lost contact to shipboard and shipping reality. Maritime academies through their teaching staff need to have close contacts to the maritime industry. The maritime lecturers should make efforts to leave the ivory tower where some of them seem to stay in and where a considerable part of shipowners and maritime administrators believe most lecturers of maritime academies to normally be in. Such efforts would also require the participation of lecturers in maritime research, as experts in Court of inquiry-hearings, their work as consultants to shipping companies, maritime administrations and manufacturers, of shipboard equipment.

At the same time, contacts to learned societies as institutes of navigation have to be held and to professional societies as ship masters or marine engineers' associations. Applied research has to be taken up and, in general, the often prevailing attitude of satisfaction with an acceptable salary, regular working hours and generous holidays has to be changed towards an active involvement in specifying and bringing about the necessary change. Academies will have to abandon their too often defensive or fatalistic attitude to change for a constructive participation in the implementation of reasonable amendments to the present system.

Lecturers in maritime academies are closest to seafaring personnel and are in a good position to observe changes in society, in the national value as well as education and training system. They, the lecturers, will have to act as advocates of shipboard personnel in maritime education and training matters.

On the basis of such upgrading and active involvement of staff of maritime academies, some trends of development could be carefully observed and, if necessary, followed and supported by maritime education and training. Required changes may even be initiated by maritime academies.

Ships will sail with smaller but normally better qualified crews. The growing necessity to provide employment will help establish a limit to crew reduction. National interests in shipping will support the determination of the minimum size of a national fleet.

Dual-purpose ratings may replace deck and engine room ratings. The number of ratings will be about equal to the number of officers. It may even fall below the number of officers.

In most countries, officer training will be kept separate from ratings training. In general, the highest level of general education will (continue to) be required as entrance qualification for a maritime academy.

The radio officer is going to phase out. Ship-ship and ship-shore communication will be facilitated by advanced technology and will be taken over by a bridge officer.

The number of engineers may be reduced to two or one as a result of the availability of reliable automated engine operation and control systems.

Shipping companies' demands for the education and training of dual-purpose officers will continue. Advanced technology as in integrated bridge and ship operation systems will support such developments.

This may result

in a deck-engine bivalence of shipboard officers at a lower level of qualification compared to present levels of qualification in the deck or engine branch

or, preferably, in

a combination of the highest certificate of competency in one branch (deck or engine) with a watchkeeping certificate in the other branch.

Such developments, in particular the first one, may raise dissatisfaction among seafarers and may lead to an increase in ship-shore fluctuation and,

even more so, to a reduction in the attraction of a seafaring career.

Ship-shore bivalence will receive more attention in future than now, disregarding an increase in deck-engine bivalence. Maritime education and training will provide for qualifications on board and in the maritime industry ashore. A combination of the highest certificate of competency in one branch (deck or engine) with a watch-keeping certificate in the other branch would be least counter-productive for the development of ship-shore bivalence. It may even support it.

Certificates of competency will be connected to academic degrees normally equivalent to a Bachelor of Science-degree. In the majority of countries, this degree will qualify for further studies leading to higher degrees.

Maritime academies will scrutinize their syllabi, will abandon outdated contents and introduce new ones. Navigation will lose in importance whereas seamanship will have and maritime law may have a greater effect on the training of master mariners. Electronics and automation will receive increased attention in the syllabi for shipboard engineers. Methodological subjects including the use of computers and economic subjects will grow in importance.

Maritime academies will (continue to) offer specialized refreshing and updating courses.

An increase in research will lead to a clearer understanding of human failure in the operation of ships. Research into man-machine systems will lead to improved equipment design. Research findings will be used to update training syllabi.

The number of maritime academies will be further reduced. The remaining ones will be better equipped with sophisticated training equipment. They will co-operate more than now with other technical education and training institutions.

Changes can only result in full benefits for seafarers if maritime academies will actively participate in the determination of their need, their specification and implementation.

These trends will prevail in nearly all western European countries. There can be retarded or less distinct development in only a few countries.

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