The importance of modern technology

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The importance of modern technology

At the conference of the German Institute of Naviga-
tion (Deutsche Gesellschaft für Ortsung und Na-
vigation, DGON) on Modern Technology in Naviga-
tion, Düsseldorf, FFG, Günther Zade, Professor and
Vice Rector of the World Maritime University, WMU,
Malmö, Sweden, read the following paper. By this
he interpreted technology as navigation technology
and seafaring personnel as navigation personal-
nel, i.e., nautical officers and master mariners of
bridge personnel.

Navigation training as a syllabus sub-
ject

Today navigation is only one of three ma-
ajor professional subjects in the training of
nautical officers and master mariners. The
other two are seamanship, a combination of
subjects dealing with the safe and effi-
cient handling of ships and their cargoes,
and maritime law. The latter does not al-
ways receive the same weight as is given
to navigation and to seamanship. Twenty
years ago navigation was the most impor-
ant subject in the training of nautical offi-
cers and master mariners and further back
to even been the subject for the training in
which navigation schools have been estab-
lished.

The development of navigation from the
subject for nautical officers and master ma-
ners to a subject has some reasons. Pro-
gress in technology has enabled manufac-
turers to produce advanced navigation equip-
ment which, if appropriately used, contributes
to safety at sea and of the ma-
rine environment and helps facilitate ship-
board navigation. Most shipowners have
introduced such modern technology on
their ships with the objective to gain in sa-
fety and efficiency of navigation, to redu-
ce expenditure for manpower and, if pos-
sible, to substitute members of crew by
hardware and software. Moreover, the in-
crease in carriage of dangerous and hazar-
dous cargoes by sea and the raising of pol-
lution prevention requirements have made
seamanship and maritime law more impor-
tant than before.

Adaptation of the environment to the
use of modern technology in shipping

International conventions of the Interna-
tional Maritime Organization, IMO, have
provided the basis on which maritime ad-
ministrations have developed national le-
gislation for the use of modern navigation
technology on ships, to a limited extent, for
the adaptation of Manning requirements.
Maritime training institutions have, someti-
mes reluctantly and with delay, adjusted
their training programmes to the increased
use of advanced navigation technology by
attaching, on the one hand, greater im-
portance to electronic navigation in the navi-
gation syllabus, that traditionally consists of
terrestrial, celestial and electronic naviga-
tion, and by giving, on the other hand, mo-
re attention to mathematics, physics, elec-
trons and the use of computers as the ba-
sis for electronic navigation (and technolo-
gy-influenced seamanship) in the
syllabus for nautical officers and master ma-
ners.

The use of modern technology in ship-
board navigation and Vessel Traffic Sys-
tems, VTS, is now taken for granted. The
introduction of advanced technology in
ports and shipping companies as well as the
traffic raising of transport from manufac-
turer to user have established a
maritime industry where modern technolo-
gy plays a key role in safety and economy
and where the rendering of services without
the employment of such technology is no
more imaginable.

The need for training in the use of mo-
dern navigation technology

There is sufficient proof that seafarers ha-
ve not always been able to use modern na-
vigation technology without endangering
safety at sea and the marine environment.
Lack of training and over-confidence in
technology have resulted in marine casual-
ities. The term "radar-assisted collision" and
"computer-assisted collision" have been
used in this context, implying that accidents
have partly happened because of the use of
radar and computer-supported radar or
automatic radar plotting aids (ARPA).

Nearly 20 years ago, research of the De-
partment of Maritime Studies of Liverpool
Polytechnic into the use of ARPA has al-
ready shown that the application of ad-
vanced navigation equipment by insufficien-
tly trained personnel creates a threat to sa-
fty. The recent collision of a passenger li-
ener and another ship in the Black Sea, that
resulted in the loss of many lives, has con-
firmed that present navigation technology
can provide the basis for human decision-
making but is not able to replace it. Thus,
a first lesson from marine casualties, is that
modern navigation equipment has to be
operated by navigators who have a good
understanding of the possibilities and limi-
tations of the equipment, are able to assess
its performance and to make appropriate
use of the data provided.

Seafaring personnel has to be trained
in the use of modern navigation tech-
nology

The navigation equipment in the use of
which seafarers have to be trained, should
be available in maritime training institutions.
This is normally the cause with radar, AR-
PA and other electronic navigation equip-
ment such as, e.g., Decca, Loran C, Omega
and satellite receivers. Radar, when situated
at the coast, allows to observe ship traffic.
Position-finding receivers are confined to
the reaffirmation of the position of the tra-
ining institution in which they are installed.
This limitation can be overcome if a tran-
smitter is added that offers a free choice of
position and perhaps even provides for the
introduction of failures.

Such simple simulation equipment, which
is also available for radar in the form of tar-
gel injectors, is now used in the majority
of maritime training institutions. It is suited
for the training in the operation of buttons,
switches and other steering elements. It is so-
metimes referred to as "knobology" and
enables the trainee to get acquainted with
the operation of the devices, their poten-
tial, limitations and possible failures.

Training in the use of modern naviga-
tion technology

It has been an on-going discussion
among teaching staff of maritime training
institutions what what is to do about the use
of electronic navigation equipement works. There are maritime
lecturers who advocate a thorough com-
prehension of the internal operation of the
equipment. On the other hand, those who
believe that — although principles of internal operation should still be dealt with in the navigation training of nautical officers and master mariners — modern navigation devices have to be looked at as black boxes seem to gain in following. Students should receive a good understanding of input-output-relationships and should know what the pressing of a button, the turning of a switch or the operation of another steering element will produce at the output but should not be taught in detail why this is so.

Efforts for navigation calculations have drastically been reduced by electronic devices. Navigation procedures and interpretation of read-outs have gained in importance.

The division between the two schools seems partly to base on the difference in opinion on whether a nautical officer or master should be able to maintain and repair an electronic navigation device and whether a thorough knowledge of the internal functioning of the equipment is necessary for making optimum use of it. The maintenance and repair issue seems to disappear because of the reliability of modern navigation equipment and because of existing redundancy as a result of overlapping possibilities for position-finding and doubling of equipment. Thus the school of thought that used to consider a thorough comprehension of the internal working of electronic navigation equipment as essential comes closer to the originally different school that classified such understanding as nice to know.

This development is supported by the general increase in shipboard technology in addition to its use for navigation, the use of advanced communication technology aboard and ashore and of modern technology for other purposes in shipping companies, ports and transport. It has resulted in a growing awareness of the need for a better fundamental scholastic ability of future shipboard personnel in mathematics, physics, electronics and computer science without a sufficient ability in which the operation principles, potential and limitations of modern shipboard technology cannot be well enough appreciated. Moreover, adaptation of bridge personnel to new developments in technology and to the use of new equipment will be facilitated by a good education in science with its long-lasting validity.

There seems to be increased satisfaction with a black box approach to training nautical officers and master mariners in electronic navigation. Not much attention is given to maintenance and repair anymore. At the same time, it is also understood that an equivalency between shipboard equipment and training institution equipment has its limitations, even if the devices offer simulation possibilities. Such training equipment lacks the complexity of shipboard reality and can hardly be used to narrow the existing difference between training requirements and training achievements, the so-called training-job-gap.

**Navigation training by the use of modern technology**

It is of crucial importance for safety at sea and protection of marine environment to reduce the gap between training and job in subjects of the syllabus for nautical officers and master mariners which are directly related to such safety. Navigation is one of these subjects as are a.o. manoeuvring of ships, cargo operations, fire protection and fighting. It is especially risky to operate a ship in restricted visibility, in dense traffic and in coastal approaches and fairways.

Radar simulators were the first navigational training devices which made it possible to offer a considerable degree of complexity in the training situation for nautical officers and master mariners. They provided for training in the navigation of ships in restricted visibility and allowed to train the use of radar not only as a means for the avoidance of collisions but also as a tool for navigation.

First radar simulators in the 1960ies used analog computers and analog contours of coastlines (analog coastline generators). Modern Systems are driven by digital computers, comprise digital coastline generators and electronic navigation equipment as can be found on ship bridges. Such radar navigation simulators are now in use in maritime training institutions all over the world. In the early stages of development, technology has been the limiting factor in the use of the simulators. Today's radar navigation simulators however offer capabilities which are not always made full use of.

The International Radar Navigation Simulator Lecturers Conference (IRN SLC), a regular gathering of simulator instructors, was founded in 1980 and will hold its fifth meeting in 1988. Two main subjects for discussion will then be use of simulators for training in navigation procedures and the development of so-called effective exercises by which the potential of radar navigation simulators is better exploited for obtaining increased benefit for the trainee in a shorter time.

The advent of large ships and other ships with unusual manoeuvring characteristics has coincided with a growth in density of traffic as result of a reduction in laytimes in ports and with an increase in the amount of dangerous and hazardous cargoes carried by sea. Such "kinky" ships have supported the development of shiphandling simulators, i.e. simulators in which both navigation and manoeuvring of ships can be trained.

Present full mission simulators, in contrast to part task simulators as radar navigation simulators, do not only offer possibilities for better training in the navigation and manoeuvring of various classes of ships, for such training in certain areas and port approaches, for passage planning and training in bridge procedures but also for the training in other elements of a navigation and seamanship syllabus. They can be used for research into e.g. bridge design, operators performance and navigation procedures too.

**Modern technology and training research**

The use of modern technology for the training of seafaring personnel can be extended to purposes beyond training for technology and training by technology. Simulators offer themselves for the examining of seafaring personnel. Findings from training research in simulators can be applied to the improvement of training for seafarers.

Considerable reservations still exist about whether training on a simulator can be used as a substitute for shipboard service and experience.

It is however accepted that modern technology in form of nautical training simulators provides for better training than can be offered in a classroom or by the use of stand-alone electronic navigation devices. A simulator is closer to shipboard reality than blackboard and chalk and single navigation devices. The use of simulators allows to narrow the training-job-gap and facilitates transfer of training to shipboard. Despite these mostly qualitative advantages from simulator training, a quantification of the effect of simulator training is missing which would enable simulator instructors to design the most effective training possible.

Taken together, considerable progress has been made in the use of technology for the training of seafaring personnel. There is now a clearer understanding of what should be trained before technology, how we should train for technology and by technology. The potential of modern navigation technology enables us to give more attention than before to the training in procedures and decision-making and to reduce human efforts for navigation calculations. Modern technology has brought nautical and engineering officers closer together and has resulted in changes in the job requirements for seafarers.

Nautical officers and master mariners of today have to cope with a more engineering type of work than before.

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