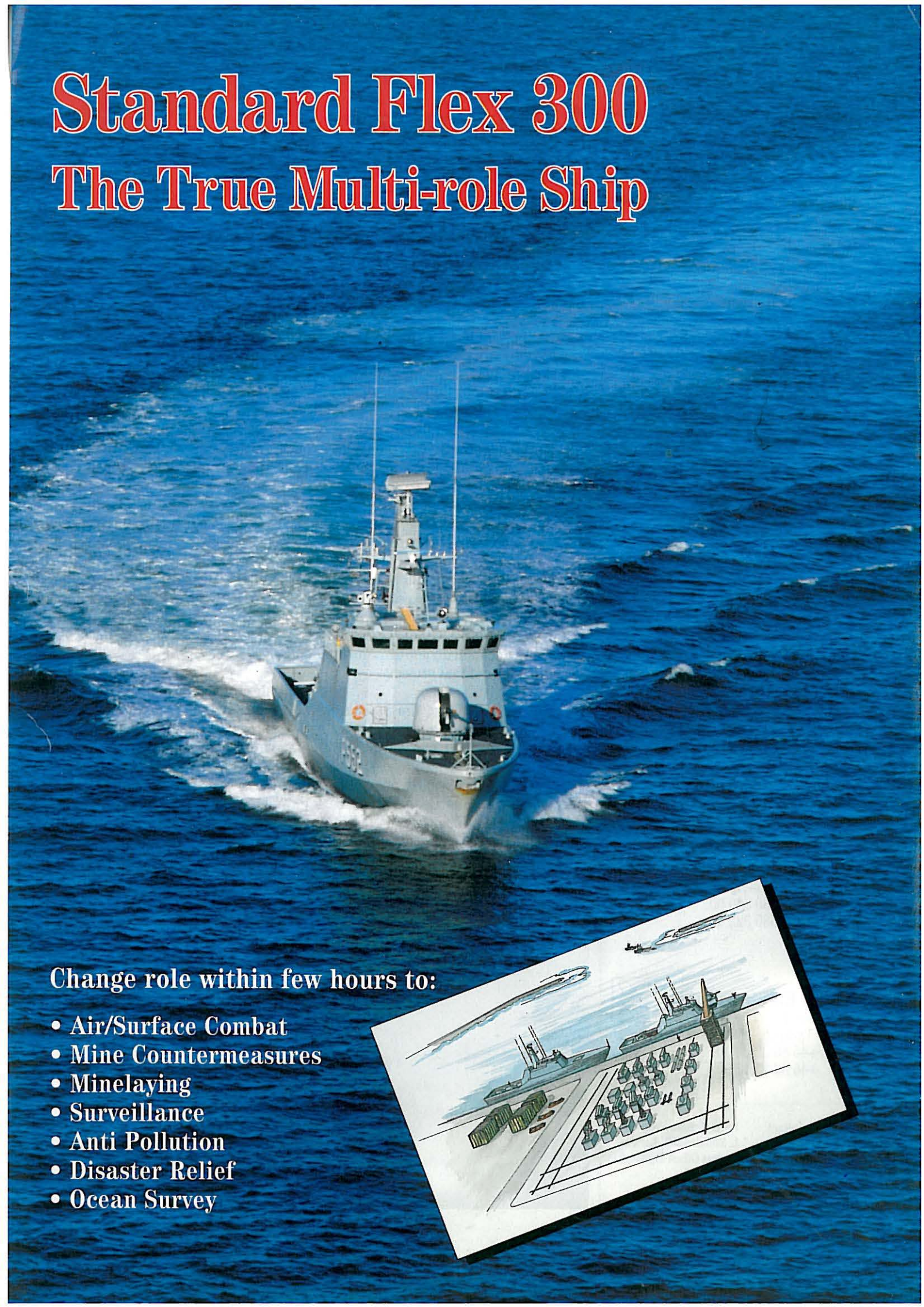
Standard Flex 300

The True Multi-role Ship



Change role within few hours to:

- Air/Surface Combat
- Mine Countermeasures
- Minelaying
- Surveillance
- Anti Pollution
- Disaster Relief
- Ocean Survey

Contents

Publishers

DANYARD
DK-9900 Frederikshavn – Denmark
Phone: +45 98 42 22 99
Fax: +45 98 43 29 30

NobelTech
Nobel Industries
NobelTech Systems AB
S-175 88 Järfälla – Sweden
Phone: +46 8 580 840 00
Fax: +46 8 580 322 44

TERMA Elektronik AS
Hovmarken 4
DK-8520 Lystrup – Denmark
Phone: +45 86 22 20 00
Fax: +45 86 22 27 99

Editorial consultant:	Hans Harboe-Hansen
Layout/coordination:	L. Stubdrup/C. Larsen
Printers:	Aarhus Offset Trykkeri, Denmark
Published:	March 1992
Circulation:	18,000

Danish Minister of Defence, Mr. Knud Enggaard ▸

A Programme Convenient for Political Planners

By Minister of Defence, Mr. Knud Enggaard.

In these times of changes in the European security situation almost all countries are seeking to trim their defence spending. It is important that changes are made in a well-considered way so as not to leave the armed forces without an essential capability. This puts a lot of pressure on politicians, administrations and military staffs to show flexibility and innovation.

At times procurement schemes requested by the Armed Forces have to be modified. At other times such schemes have to be postponed or jettisoned. One project, however, which in Denmark has enjoyed wide political support is the Standard Flex 300 programme, undoubtedly due to the many obvious benefits of that project.

By designing and fitting the Standard Flex 300 ships in such a way that role-dedicated equipment can be quickly changed, the Navy can meet operational requirements with a smaller number of ships than would be needed using single-role (traditional) ships.

The modularity of the concept also offers a convenient flexibility in the planning and execution of programme financing. Without seriously jeopardising a long-term procurement plan comprising a certain number of ships and sets of equipment and weapon systems, the gradual fulfilment of the goal can be adapted to a sequence and a time scale dictated by what is economically feasible under changing circumstances.

The foresight manifested by this pioneering concept has recently been proven by the fact that the Standard Flex 300s fit well into NATO's revised strategy, calling for flexible, mobile and powerful units suitable for rapid reaction to all conceivable future situations within the scope of the treaty.

In a state of détente, as enjoyed at present in Denmark's part of the world, it is furthermore a great advantage that the Standard Flex 300 ships can be easily converted to perform also a range of civilian tasks. The prospects of exploiting these possibilities are at present being thoroughly investigated. ■

The Standard Flex 300 lead ship "Flyvefisken" configured as a surveillance unit ▾

Chief of Danish Naval Materiel Command, Rear Admiral Søren Torp Petersen ▶

A New Concept

By Rear Admiral Søren Torp Petersen.

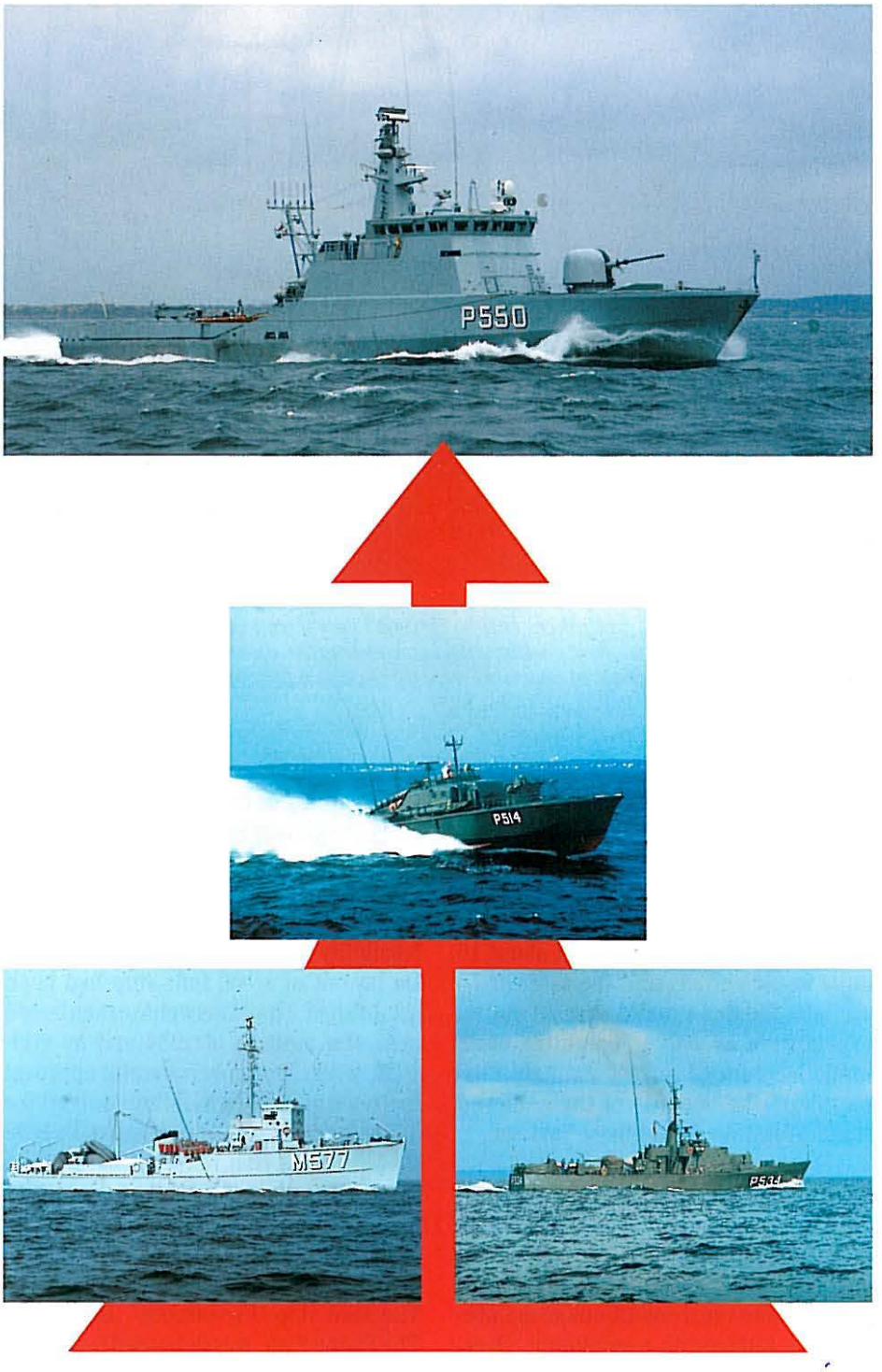
Necessity is the mother of invention, as the saying goes, and this proverb aptly describes how the concept of the Standard Flex 300 was born.

In the early 1980s the Royal Danish Navy was facing a major replacement problem. Long-term plans called attention to the fact that – during the 1990s – 32 units, about half the strength of the Navy, would have to be phased out due to obsolescence and age. Ten of these units were submarines and ships of frigate size, mentioned here only to stress the magnitude of the economic problem. The remaining 22 ships comprised six fast attack craft, eight patrol craft, and eight mine countermeasure vessels.

In operational planning the existing number of each above mentioned vessels was considered an absolute minimum. Realistic long-term budgeting clearly indicated, however, that an ordinary ship for ship replacement would not be feasible, particularly as development and experience dictated updating of the characteristics of all three categories of ships to be replaced.

As it was, the idea emerged to have a standard hull with a standard propulsion system designed in such a way that it could take a variety of containerised equipment and weapon loads to suit various roles. Standardised containers and interfaces should then allow the outfit for one role to be interchanged with that of another within a few hours. Sensors common to all roles, or not suited for containerisation such as a hull mounted sonar, should be permanently fitted. In addition, a modular and flexible Command, Control, Communications and Information System (C^3I-system), based on a data bus and standardised consoles and processors, would be essential for control and operation of weapons and systems carried. An open configuration should allow the C^3I-system itself to have hardware and software modules added (or removed) to meet the changing requirements or new technology. ▶

The Danish MCM-units of the SUND-class, the surveillance units of the DAPHNE-class, and the fast patrol boats of the SØLØVEN-class – all together 22 ships – are replaced by the Standard Flex 300 units, now named the FLYVEFISKEN-class after the lead ship ▼



▲ *Weapon and equipment containers can be changed easily and quickly. All containers have crane hook fix points. Lifting in and out, securing the containers in their positions and connecting the standardised interfaces are performed in less than an hour. The alignment procedure needed in the case of gun systems may require a few more hours*

It was evident that the operational requirements dictating a minimum of 22 vessels of the three specialised types could be met by a smaller number of ships built to the new concept. A pre-feasibility study indicated that about 16 units would suffice, and the number 16 was later fixed as a goal. As a result initial expenditure as well as operating costs would be reduced correspondingly. Furthermore, the benefits of the achieved standardisation meant more savings.

Again, in various ways the modularity of the concept also contributes favourably towards minimising the life cycle cost. Modules not embarked can be stored ashore under ideal conditions so maintenance is reduced to a minimum. Overhaul scheduled for each type of system and for the ships are not interdependent, and updating or complete change of systems are greatly facilitated.

From the pre-feasibility study the Standard Flex 300 project rapidly proceeded to feasibility study and by mid-1983 the basic lay-out of a 300 tons ship had been established. The project phase then lasted until the autumn of 1984 and by mid-1985, when final governmental approval had been granted, a building contract for a first batch of seven was signed. In 1990 that contract was followed by another comprising six units, and according to plans a third batch of three should be ordered in 1993.

The lead ship "Flyvefisken", Danish for The Flying Fish, was delivered by the end of 1987 and in 1988 series production started. The building schedule has since been laying down two a year at six months intervals, followed by a building time of about a year per ship and the Navy's additional fitting-out period of six months. By the end of 1991 five Standard Flex 300 vessels had been commissioned, and commissioning of the following units will continue at a rate of one ship every six months.

The administration of the programme has been facilitated by the financial flexibility which the concept also offers. For budgetary and other reasons it has been found expedient to plan acquisition of some weapons and systems in such a way that their delivery schedule will lag somewhat behind the building schedule. ■

Containers

A basic idea of the Standard Flex 300 concept is to mount weapons and non-permanent equipment in standardised containers to make possible a rapid exchange of weapons and equipment required in one specific role to that called for by another.

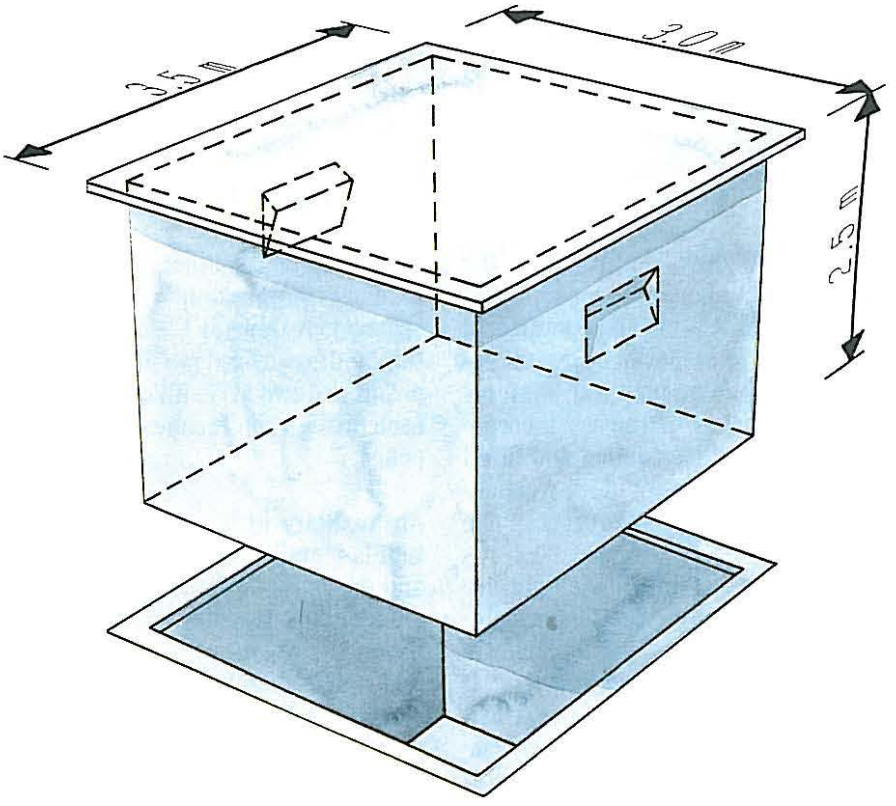
The containers are adapted for the various types of weapons or equipment they hold and/or carry on top. The standardisation applies to the outer dimensions, the deck fitting, and the interfaces.

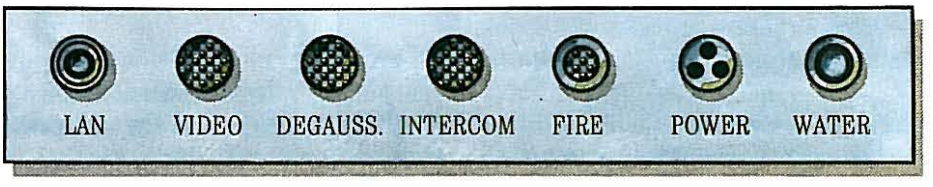
The outer dimensions are 3.0 m in length, 3.5 m in width, and 2.5 m in height. The interfaces comprise power supply, data bus connections, communications, ventilation, and water supply.

Depending upon purpose, the various containers are configured either as a closed box with a watertight door and hatches providing access to the interior, such as a storage container, or they have open sides and only the corner constructions to connect top and bottom. The weapon or equipment itself is mounted on the container top and all dedicated electronics or machinery – including any local controls – belonging to the system are installed inside the containers and connected to the standard interface panels.

The container carrying the multi-purpose gun on top and its loading system and local controls inside is an example of an open container which has only the corner constructions to connect the top and bottom. The open gun container allows the crew access from the outside to the revolving magazine.

If one or more container positions are left unoccupied, purpose-made hatch covers are fitted to seal the wells. ■





▲
The standard containers are made of stainless steel and have a precision machined flange to ensure accuracy when bolted to the corresponding deck flange. Each container has two connector-areas, one on either side, for connections to the dual bus-sustem, power supply etc.

Gun container
▼

Storage container
▼

A Flexible Platform

The Hull

The Standard Flex 300 (SF 300) – the result of the fundamental concept that logistic standardisation and operational flexibility can be achieved by use of rapidly exchangeable, modular systems matching a variety of roles – incorporates four wells dimensioned and fitted with all interfaces for any of the weapon/equipment containers of the programme.

The ships, built by Danyard, Aalborg, are of GRP sandwich construction, a material selected to save weight and maintenance and because it is non-magnetic. It also offers a high standard of fire resistance due to its low heat transmission factor and due to use of fire resistant intumescent coatings. Incorporation of Kevlar panels into certain areas of the hull and the superstructure provides protection against splinters and small arms fire.

Electromagnetic Compatibility (EMC) in the non-metallic ship has been achieved by sprayed layers of zinc and shielding of cable glands and penetrating, non-metallic pipes and ducts.

Propulsion and Auxiliary Installations

A CODAG propulsion plant has been chosen to meet requirements for speed and economy. A General Electric LM500 gas turbine drives a fixed-pitch centre-line propeller, and two MTU 16V396TB94 diesels each drives a controllable-pitch wing propeller.

An auxiliary hydraulic propulsion system is installed for silent minehunting and economic loitering. The system includes a bow thruster.

Roll stabilisation is obtained by a system acting on the wing rudders and by a complementary tank system. Trim flaps are also fitted.

Ship Control and Supervisory System

All propulsion units, auxiliary machinery, pumps, valves, ventilation etc. are controlled and supervised by a fully electronic system operated from a console at the bridge. Handling of the ship is performed from a panel positioned at the front of the bridge or from wing ▸

Principal Particulars

Length overall	54.0 m
Lengh waterline D.W.L.	50.0 m
Breadth	9.0 m
Draught at full load displacement	2.5 m
Light displacement	320 t
Full load displacement	450 t
Max. continuous speed, CODAG	+30 knots
Speed, on diesels only	approx. 20 knots
Speed, on hydraulic drive	approx. 6 knots
Endurance at cruise speed 18 knots	approx. 2400 nm
Complement	19-29

This demonstration section displays the GRP-sandwich layers with the cellular core between the outer and inner GRP laminates

Standard Flex 300 and Surface Auxiliary Vessel (for mine countermeasures) at the final stage of completion in the GRP construction facility prior to transfer to the outfitting plant

▲
The bridge console of the ship's control and supervisory system and the ship handling panel to the right

panels at either side. The bridge console is duplicated by an identical console placed in an equipment room below deck, primarily used for servicing. Under normal conditions of operation equipment and engine rooms are unmanned.

Vital controls of the system have hard-wire back-ups.

Accommodation

The advanced systems selected for the SF 300 have low manning requirements so the total complement numbers only 19 to 29, depending upon the role for which the ship is armed. Therefore, and because the SF 300 is extremely roomy, all ranks enjoy a high standard of accommodation. Further to the captain's cabin there are five double cabins for officers and senior ratings and nine double cabins for junior ratings, all with private shower and toilet facilities.

Stealth Features

Both hull and superstructure have been designed to offer the smallest possible average radar cross section, and in addition the properties of the GRP sandwich material greatly contribute to a low level of radar reflection.

Furthermore, the non-magnetic nature of the building material used reduces the degaussing problem considerably, and the insulating qualities of the material assist in reducing both acoustic and heat emissions. Besides, specific measures have been taken to minimise the IR signature of the exhaust.

A Design of Great Promise

Although designed for the Royal Danish Navy the SF 300 would serve well in any water all over the world. Its seaworthiness has been well proven and meets the requirement for full operability in wind force 6 in open waters.

It is noteworthy that the SF 300 is considerably larger than its displacement figures suggest. Ships constructed by the GRP sandwich method offer a more favourable ratio between the inboard volume, which can be turned to practical account, and the displacement than conventionally constructed ships. In fact, as for size the SF 300 has a larger displacement than contemporary coastal corvettes of traditional steel designs.

In this the fifth centenary of Columbus' epoch-making voyage across the Atlantic to the New World it is worth recalling that the Admiral's flagship, the "Santa Maria" measured only half the length of the above vessels and displaced a mere 120 tons. ■

▲
A view of the wardroom

One of the junior ratings' cabins
▼

1 Forward container position

2 Combined bridge/ops-room

3 Search light

4 Fire control radar & EO trackers

5 HF, VHF, UHF communications

6 Navigation radar

7 Surveillance X-band radar mounted back-to-back with Surveillance C-band radar

8 ESM system

9 Decoy launchers

10 Antennas

11 Torpedo tube deck-rigs

12 Mine rail deck-rigs

13 3 Rudders, outboard with roll damping

14 3 Propellers

15-17 3 Aft container positions

18 Main machinery:
2 diesels
1 turbine

19 Accommodation

20 Ammo magazine

21 Hull-mounted sonar

22 Bow thruster


7
8
6
10
9
19
11
12
17
16
15
18
14
13

The Command, Control, Communications and Information System

The modular and flexible Command, Control, Communications and Information System (C^3I-system) of the Standard Flex 300 (SF 300) is as vital to the implementation of the programme's concept as is the ship itself with its system of exchangeable weapons and other types of outfit.

Irrespective of the role for which the SF 300 is fitted, the C^3I-system is the electronic back-bone which connects the embarked, role-dedicated equipment with the standardised operator consoles and all permanently installed sensors, including trackers belonging to the fire control system, communications, navigational aids etc.

The system is based on an Ethernet (IEEE 802.3) data bus, duplicated as a redundancy measure, and a series of intelligent nodes which form the gate-way for subsystems to access the data bus.

Each node contains one or more processor cards on an industry-standard VME bus. This architecture allows functional system intelligence to be distributed to the nodes and provides an easy way of adding extra boards and software to the nodes. The open configuration of the architecture ensures growth potential by allowing new functions (new weapon systems etc.) to be added by hooking new nodes to the data bus, and any obsolescent function can be updated or extracted. A data base provides long term data storage and, like the data bus, this base is duplicated for reasons of redundancy.

▲
The standard console of the Standard Flex 300 C^3I-system. Varying with the role of the ship a minimum of three and a maximum of six such consoles are mounted in the combined bridge/ops-room

Unmanned standard console of the Standard Flex 300 C^3I-system

▼

Ada Software

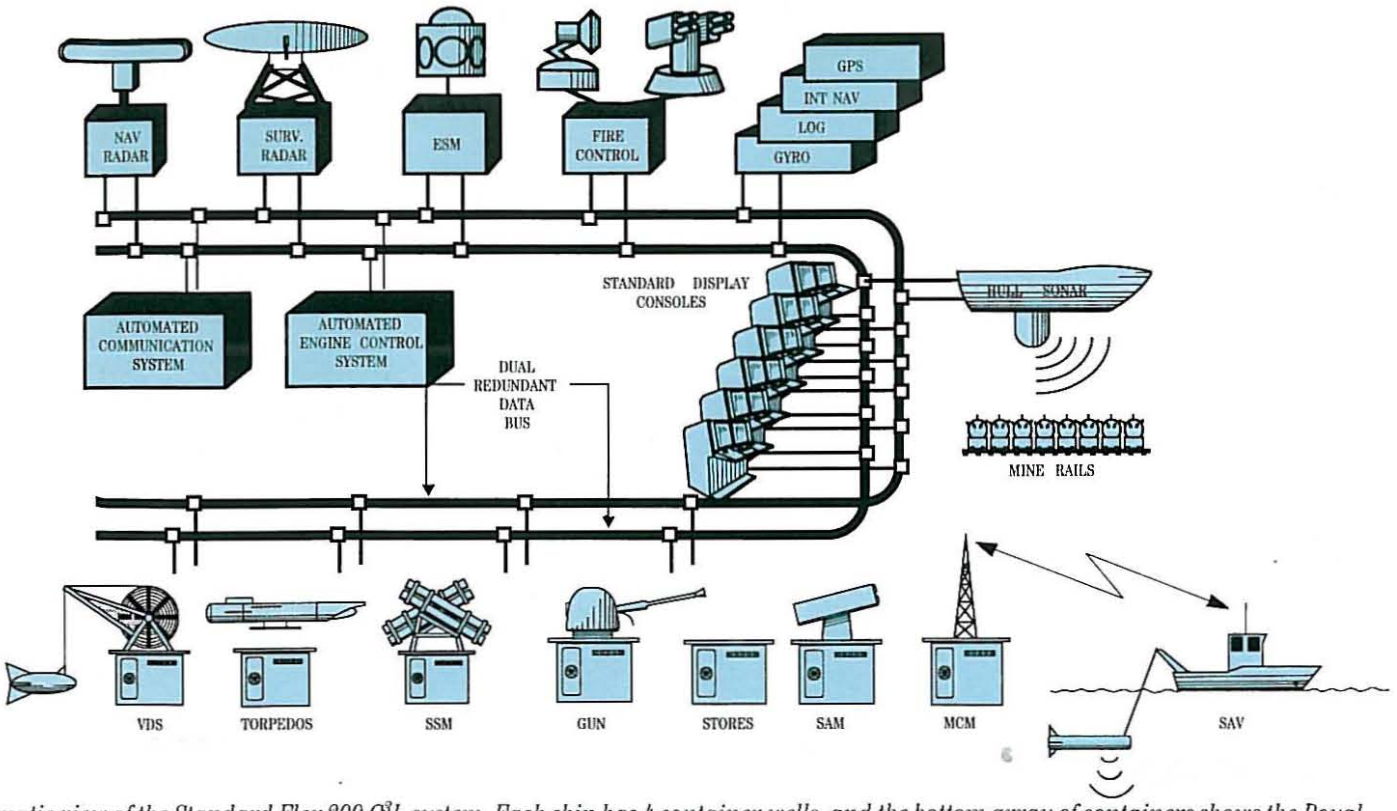
A significant benefit of the selected system architecture with its large number of distributed processors is that it lends itself easily to inclusion of spare capacity, in terms of processor load as well as memory size. Such spare capacity will allow the application software to reconfigure itself in case one or more nodes of the network is lost. The basis for this reconfiguration is the highly modular and distributed architecture of the Ada code employed, which implies that the applications are written with no assumptions as regards processor or node allocation.

The software is written in Ada, and it operates in the system known as Base System 2000, developed by NobelTech.

When the system for the first SF 300 ship was delivered in 1989 it contained about 400,000 lines of Ada code in order to fulfil the requirements related to the basic patrol boat role. To meet the requirements associated with the other, more demanding roles the software of the system has since been gradually expanded and now it includes about 1.5 million source lines of codes.

Standard Consoles

The operator's standard consoles provide the Man-Machine Interface (MMI). A minimum of three consoles are mounted in the ops-room, sufficient for the patrol boat role. For more demanding roles the number of consoles is increased up to six. ▸



Schematic view of the Standard Flex 300 C³I- system. Each ship has 4 container wells, and the bottom array of containers shows the Royal Danish Navy's present inventory plan

The MMI for every sub-system is embedded in any standard console. In this way, with the possibility of carrying out all functions from any selected console, extreme flexibility is allowed in the organisation of ops-room activities and, besides redundancy is ensured.

Furthermore, the employment of only one type of console brings about advantages in connection with operator training as well as in the field of logistic rationalisation.

Readily Adaptable MMI

The MMI is created on the basis of a concept of "MMI-Objects" – an advanced mechanism which allows specification and implementation of applications without imposing any restrictions on how the MMI is configured. The tools used for producing MMI features allow changes without altering the basic Ada code. The result is a standard console which is readily adaptable to already existing practices and procedures and can easily be amended if, for instance after a period of experience with a new procedure, that should be considered expedient.

The standard console is developed and manufactured by Terma. It features a double set of screens for presentation of radar video, synthetic colour graphics, text-totes, RGB-sonar pictures, and IR/TV video from the cameras of the trackers. The screens can be used in a variety of ways and so the operator, at any time, can select the mode best suiting the demands of the situation. Two touch sensible, programmable keyboards provide the hierarchy of menus associated with the systems under control, rollerballs provide cursor operations, and a standard qwerty-keyboard allows text entries.

Functions only to be carried out by specifically authorised persons, and restricted information, are safeguarded by a password procedure. For training purposes simulation functions are integrated in the system.

Communications Sub-bus

Interfaced with the main C³I-bus is a communications sub-bus encompassing all internal and external communications, including data link. To a large extent this part of the C³I-system is based on fibre-optics, and like the main system its software is written in Ada.

The interface allows communication directly to and from the standard consoles. Therefore the screens of the consoles can be used for writing, receiving and retrieving messages, and paper circulation can thus be greatly reduced.

Integrated Fire Control System

The Flexfire weapon control system for the FLYVEFISKEN-class forms an integral part of the combat system. The Flexfire includes two separate channels of fire, one based on a fully coherent Ku-band TWT radar and one on optronic sensors. Both trackers may be fitted with laser, TV and/or IR sensors. Among the features can be mentioned extremely low side lobes, (multiple target) off-boresight tracking, extremely high range resolution, lock/track-on-jam and 1st/2nd order prediction. ■

The radar tracker of the Flexfire weapon control system which is integrated with the C³I-system. The Flexfire may control a variety of guns and missile systems

Roles

The significance of the SF 300 concept is the ability to change the role configuration rapidly to adapt to new situations. Keeping in mind that the C³I-system and the sensor and communications systems (save the towed sonars) are permanently installed, the figures on these pages illustrate the equipment inventory which will be on board in the various roles.

▲ *SF 300 equipped with SSM and torpedoes*

▲ *... and loaded with mines*

The Surveillance Unit's only weapon system is the multi-purpose gun. The remaining container positions are used for stores and a hydraulic crane, used for rapid launching of the large dinghy in search and rescue as well as boarding operations.

The Combat Unit is fitted for Anti Surface Action, carrying gun, surface-to-surface missiles (SSM), surface-to-air missiles (SAM), and wire-guided, homing torpedoes fitted on the quarter deck.

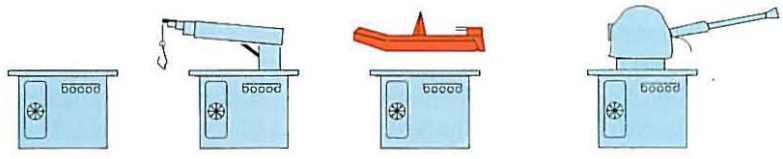
The Minelaying Unit carries gun and SAM systems for self-protection and has rails fitted to the deck to allow for a cargo of more than 60 mines.

The Anti Submarine Warfare Unit (ASW) carries weapons for self-protection and has – as a complement to the hull-mounted sonar – a variable depth sonar (VDS) system in the aft container. The type of ASW weapon has not been decided.

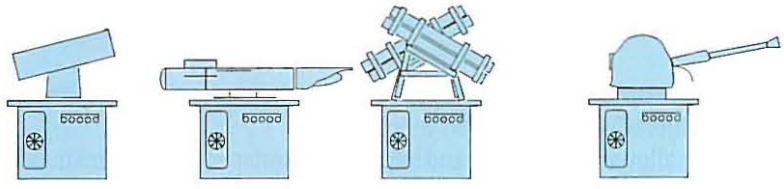
The Anti Pollution Unit may be stripped completely of weaponry to allow for embarkation of containers with equipment for fighting pollution at sea, such as oil booms, oil skimmers, tanks for storing polluted water, chemicals, etc.

The Mine Countermeasures Unit (MCM). A specific MCM concept has been developed within the SF 300 programme. This concept employs a minehunting system representing a further development of the route survey concept, based on the general principles detection, classification, identification and neutralisation. However, the SF 300 MCM concept is unique in a number of ways, and it offers the SF 300s an unprecedented degree of safety during the critical

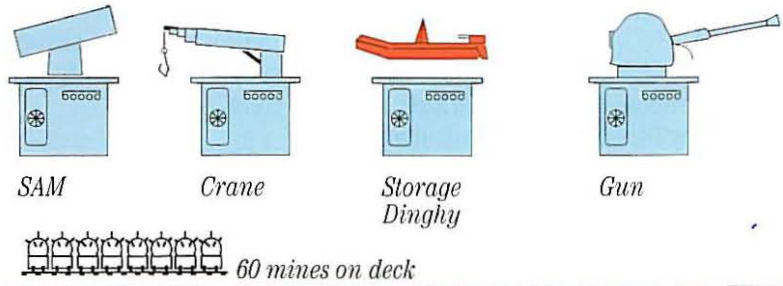
Surveillance Unit

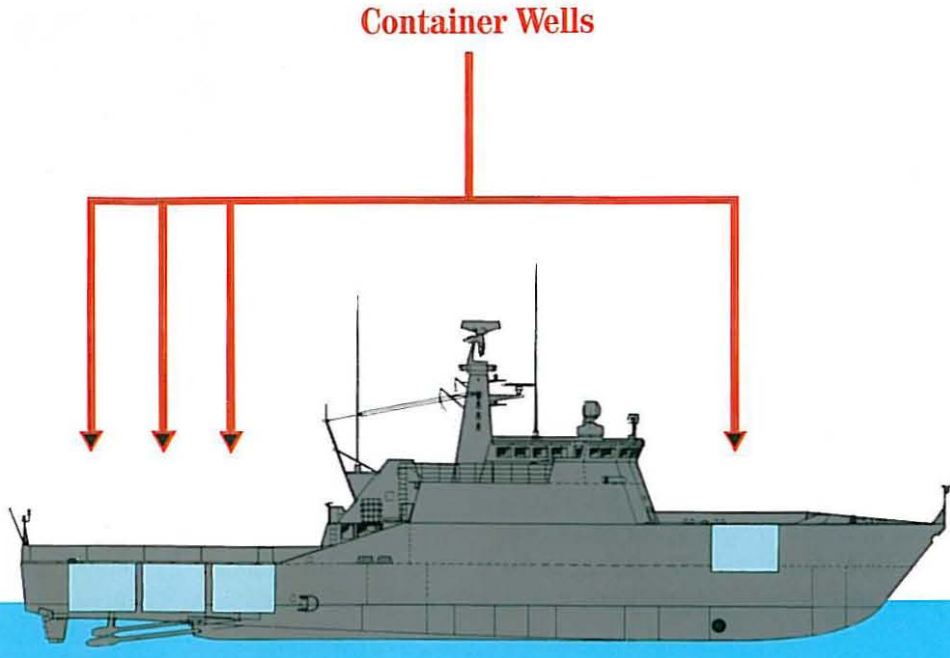


Combat Unit



Minelayer Unit





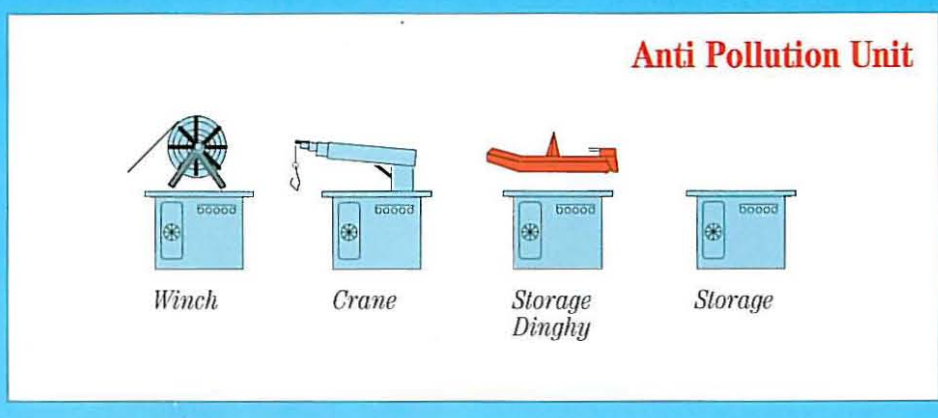
The SAV: 18.2 m o.a., beam width of 4.75 m, draught of 1.2 m, displacement of 32 tons

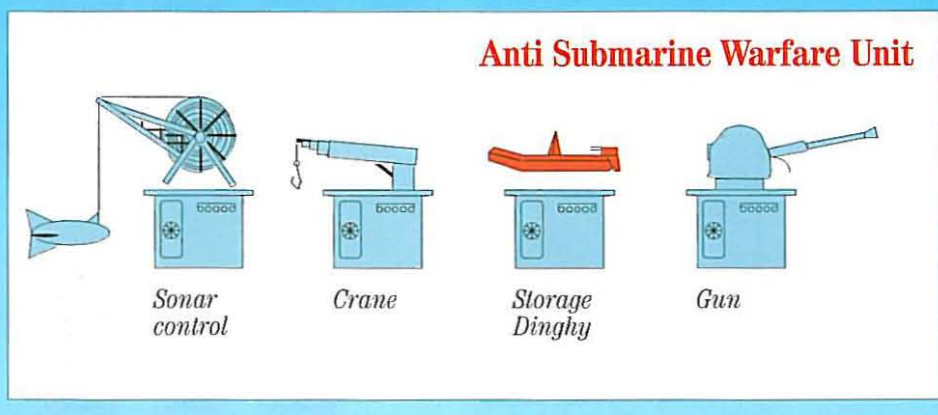
detection phase by making use of surface drones towing side scan sonars.

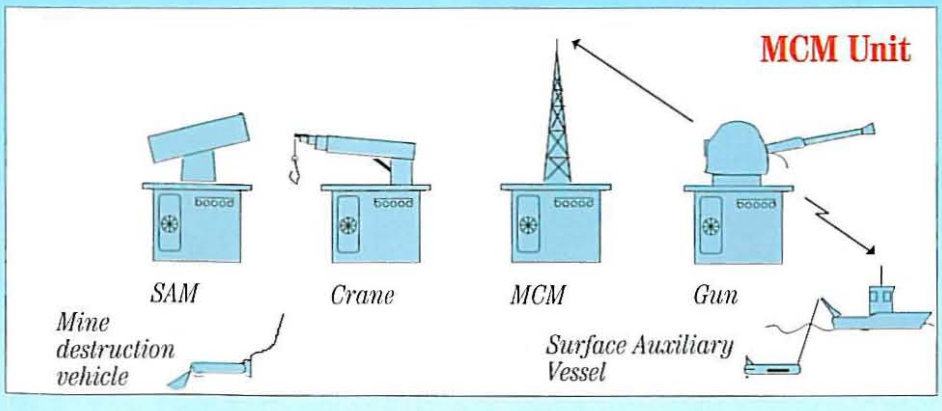
A standard container houses the on board MCM outfit, and each SF 300 will normally control two of the above surface drones, also designated Surface Auxiliary Vessels (SAVs). The container holds two electronics cabinets for the side scan sonars plus communication links, and at the deck are carried one or two remotely controlled mine identification and disposal underwater vehicles.

The SAVs are used in the detection and classification phases. Like the SF 300s they are of GRP sandwich construction. Their maximum speed of 12 knots is provided by a pump jet system which is installed in a well aft so that it flushes with the bottom. The sonar fish is lowered and hoisted from a stern mounted A-crane. In the MCM role the SF 300 will initially take up suitable positions in clean areas and from there manoeuvre the unmanned SAVs and operate their sonars so that the route suspected of having been mined is searched systematically. Afterwards, during the identification and – when necessary – neutralisation, the SAVs are withdrawn and an underwater drone is put to work and manoeuvred on the basis of position information from the hull mounted sonar.

The control systems of the side scan sonars and the underwater vehicles are interfaced with the C^3I-system of the SF 300, and so are the communication links and the data from the sonar sensors. In this way all operations can be conducted from the standard consoles of the system in the ops-room.







Flag Officer Denmark, Rear Admiral Knud Borck ▸

Operating a Fleet of Standard Flex Units

By Rear Admiral Knud Borck.

As Flag Officer Denmark, Rear Admiral Knud Borck is responsible for naval operations and for the operational education of personnel. In this article, Admiral Borck gives his evaluation of the new flex-fleet as seen from the Operational Command.

The basic peacetime tasks of any navy are to uphold control of national waters, to safeguard national maritime interests and to prepare for wartime tasks. In the Baltic Approaches and adjacent waters SF 300 units are now performing the round-the-clock surveillance necessary to control these waters and to safeguard Danish and NATO interests in the area.

In accordance with the SF 300 concept – that the outfit of exchangeable weapons and other systems at any time shall be adapted to the requirements of the current type of task – the SF 300s, while operating in the surveillance role, are fitted with only their multi-purpose gun, a hydraulic crane and a dinghy. In the ops-room only three of the possible six standard consoles are mounted, and in this way a crew of no more than 19 suffices for patrols lasting up to six or seven days.

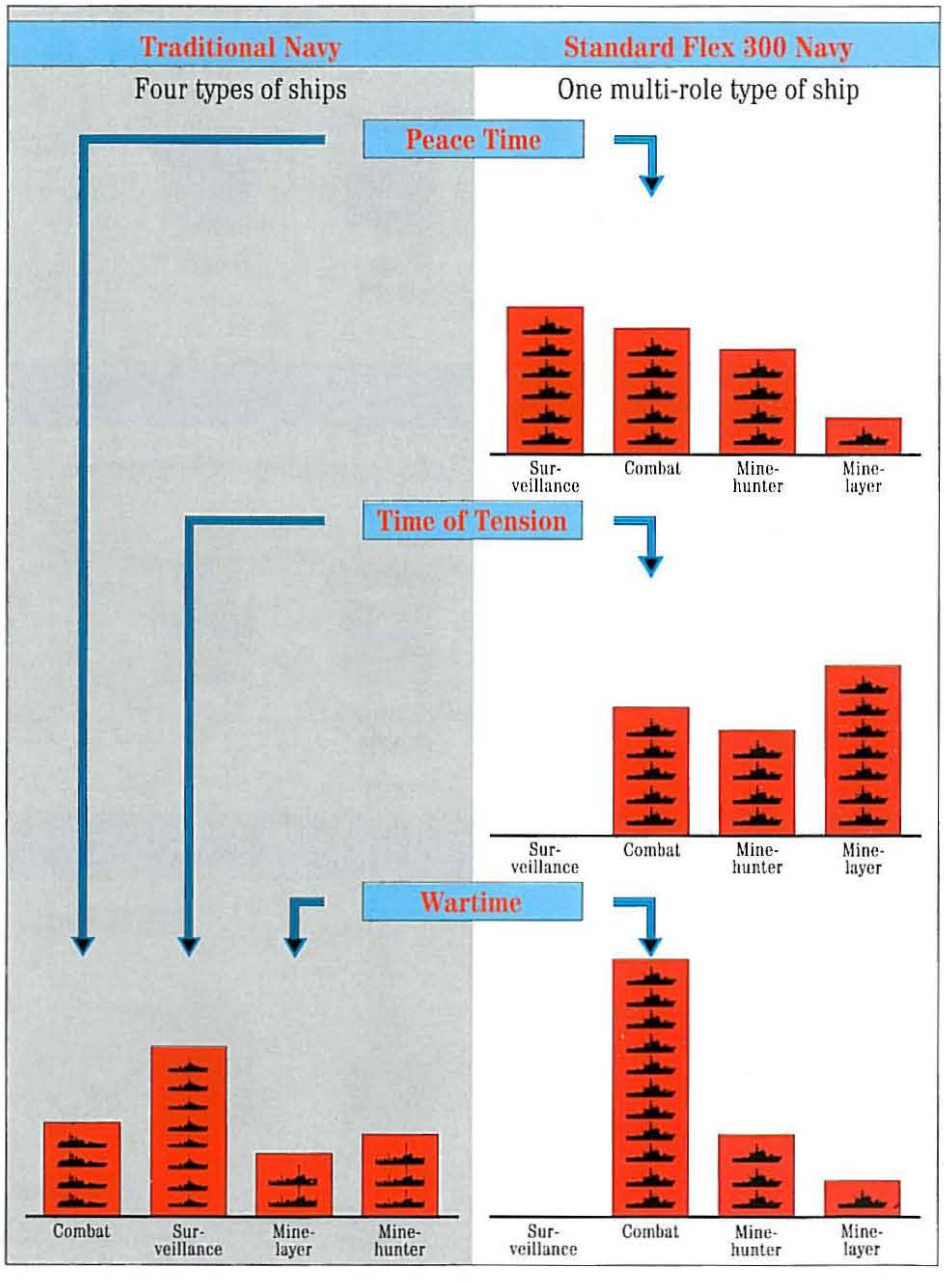
Elsewhere in this magazine is described how the SF 300s, in a matter of hours, alternatively can be fitted out as FACs, minelayers, MCM vessels or ASW units, and how these outfits meet the performance requirements of each role. This portion of the programme is in the process of being effected and, when gradually implemented, the operational concept for the employment of this part of the RDN can be outlined as follows.

In peace, parallel with the SF 300s on surveillance duty, the other commissioned SF 300s will be fitted out for the other roles in order to train for them. The number of units outfitted for each role will depend on training requirements and the exercise schedules.

In a period of tension or in case of war, the SF 300s on surveillance duty may be upgraded with added equipment. However, as Danish waters are ideally suited for minewarfare, initially weight is likely to be attached to capacity for minelaying and MCM operations. Depending on the situation subsequent operations may call for an increased capacity in other roles, while the proportions of MCM and minelaying capability will be adjusted to circumstances.

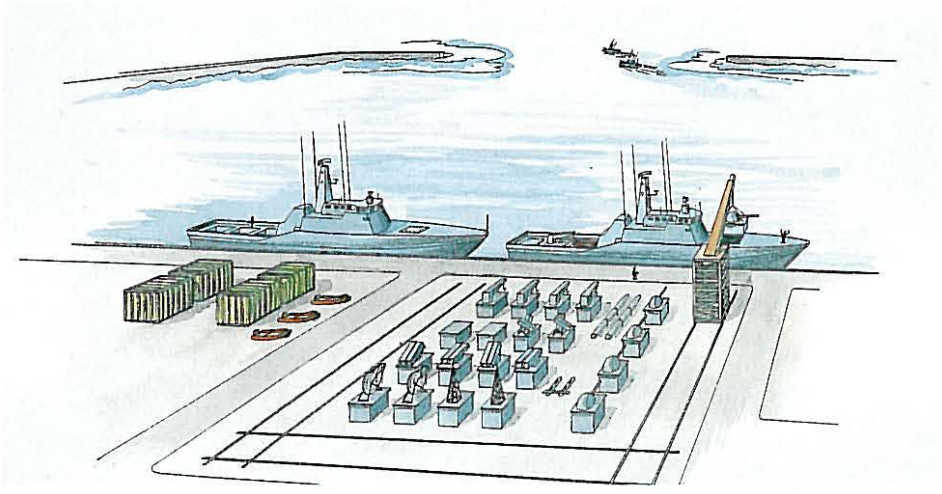
Naval warfare is characterised by situations that may change frequently and quickly, and the demand for various ▸

This table indicates the situations in peace-time, in times of tension, and in times of war. With a traditional navy one must make do with the inventory at hand. The Flex-fleet provides potential for a flexible response to a variety of contingencies and changing requirements ▾



kinds of combat capability will change accordingly. In all circumstances the capabilities of a fleet consisting of multipurpose vessels like the SF 300s can be optimised to match the operational requirements. In consequence such a fleet is believed to represent an operational potential which is far greater than a traditional fleet of similar size comprising a variety of specialised ships. ■

An artist's impression of the naval base container depot. Role configuration may, however, take place at any port by means of a crane



Visions and Prospects

The Standard Flex 300 (SF 300) programme heralds a new era in construction, operation and management of naval forces. The fundamental concept of the programme expands on existing concepts for containerisation and standardisation of naval systems.

The advantages of a programme of multirole SF 300 units are obvious and recognizable, be it in the ability to reduce a total number of units whilst maintaining a specific operational output – as in the RDN case – or be it the ability to increase the operational output whilst maintaining a specific number of units. Having introduced the SF 300 fleet, the concept can readily be utilized in design of other, larger ships, which would lend themselves to incorporation of a larger number of containers and, perhaps, a complementary, larger type of container. Elaborations over the possibilities of introducing the SF 300 container with its interface standards as a NATO standard are ongoing, but the potential advantages to any navy derived from a wide international acceptance of these standards are obvious.

The SF 300 is here today – and in operational use. Already within the existing project there are investigations into the possibilities of using the vessels for quite other purposes than originally planned based on the ability of the SF 300 to accept four standard containers with a wide variety of "cargoes". Ideas are being investigated thoroughly in order that perhaps other, special purpose navy or government maritime activities may become encompassed by the concept and further rationalisations spring from such ideas. It is really only left up to one's imagination what could be the future tasks of an SF 300 fleet. Anyone may elaborate further on the Danish list of possibilities being considered.

- *Anti pollution containers with booms, oil skimmers, tanks, etc.*
- *Accommodation containers for a surplus crew of trainees*
- *Hydrographic laboratory containers*
- *Disaster relief containers with emergency equipment*
- *Hospital containers*
-
-

Sponsors

BARRACUDA Technologies
Supplier of DIVINYCELL core material for the GRP sandwich

Brown Brothers & CO Ltd.
Supplier of steering and rudder roll stabilisation system

GTECH
Supplier of model CTS-36 light hull mounted OMNI sonar

INFOCOM
Supplier of message handling and communications system

LOHMANN + STOLTERFOHT
Supplier of single reduction gears NAVILUS GCK 470 P for propeller drive

Lyngsø-VALMET Marine
Supplier of the ship control and surveillance system

MT MONBERG & THORSEN A/S STEEL DIVISION
Supplier of stainless steel container system

mtu Deutsche Aerospace
Supplier of main diesel engines

OTO MELARA FINANZIARIA E. BREDA
Supplier of 76 mm Super Rapid Gun Mount

RACAL SABRE ESM SYSTEM Racal Radar Defence Systems
Supplier of ESM system

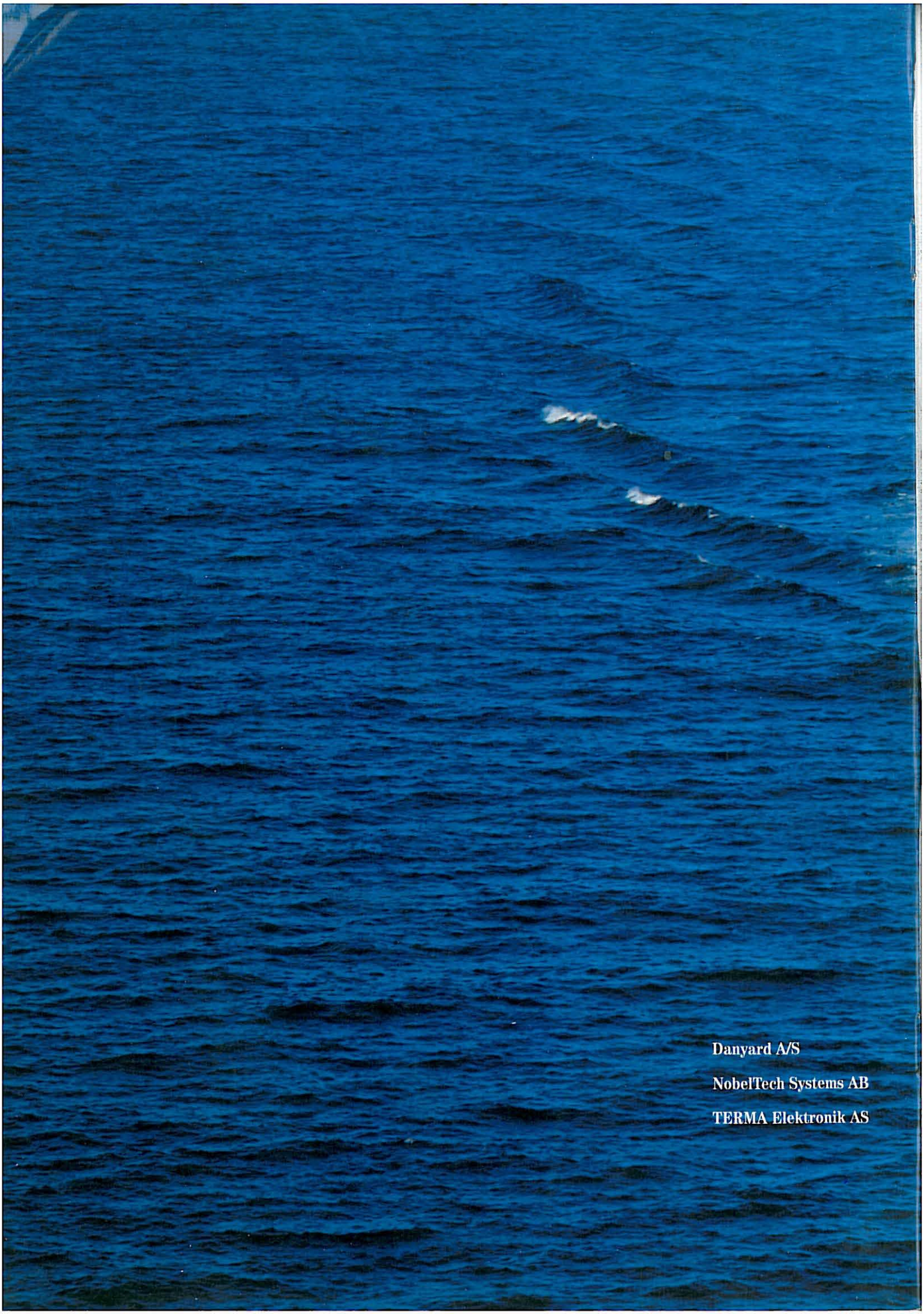
ROBLON
Supplier of non-metallic ballistic protection equipment

SIEMENS
Supplier of ASW-6 multi-role surveillance radar

Stone Vickers
Supplier of controlled and fixed pitch propellers

TELEFUNKEN SYSTEMTECHNIK Deutsche Aerospace
Supplier of 3D multimode ship radar for acquisition and battle control

THOMSON SINTRA ACTIVITÉS SOUS-MARINES
Supplier of IBIS 43 mine surveillance systems, degaussing systems, and the salmon ASW sonar system



Danyard A/S

NobelTech Systems AB

TERMA Elektronik AS