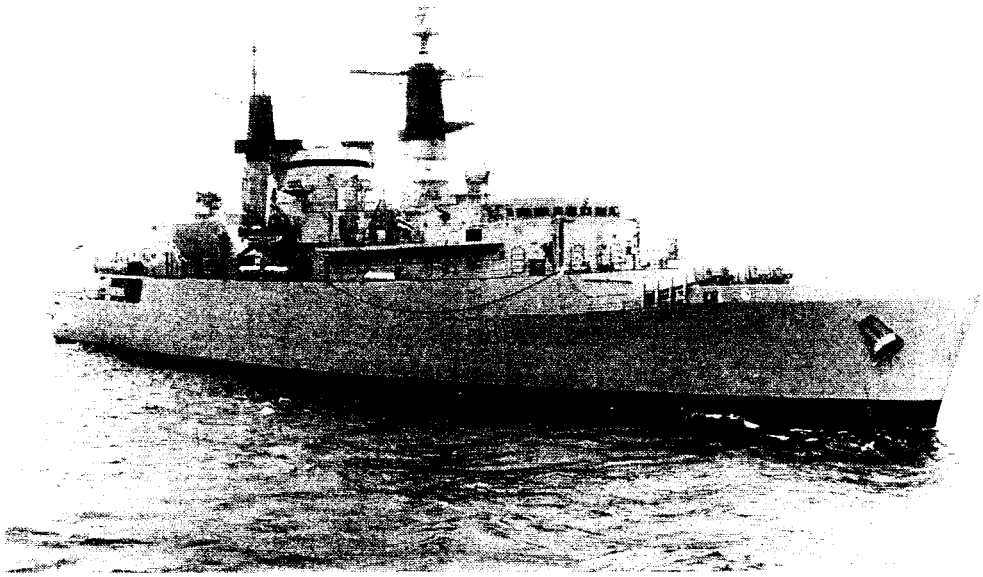

THE TYPE 22 FRIGATE

DESIGN AND RUNNING EXPERIENCE

BY

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Introduction

The first Type 22 frigate (H.M.S. *Broadsword*) has been in service for two years. The author spent four years as the Marine Engineer Officer of H.M.S. *Broadsword,* three at the shipbuilder's (Yarrow Shipbuilders Ltd.) yard and one in service. The Type 22, in the main, uses the same propulsion plant and ship's equipments as the Type 42, so it is not intended to waste the readers' time with technical description but to concentrate on the differences and some of the operating factors.

The Role

The ship is designed for anti-submarine purposes using a new sonar 2016 for detection and two Lynx helicopters plus STWS2 for attack. The comprehensive communication and control systems allow full use to be made of other ships and aircraft and the ship makes an ideal leader. The self-defence capability of the twin-headed Sea Wolf and the Exocet allows the ship to operate on its own away from the protection of other ships should it be necessary to do so. All these factors make the ship suitable as a Task Unit Leader and for this reason it was decided that all the Type 22s are to have captains in command. Consequently the technical officers are commanders but, as squadrons are now type cast, there is only one ship with squadron staff onboard.

Ship Dimensions and Layout

The need to carry two Lynx helicopters, the size of the 2016 sonar hull outfit 29, and the upkeep-by-exchange support policy has resulted in a large hull, making the Type 22 a little longer than the Type 42 and of about the same displacement. The ship has centreline passages on 1 and 2 decks which go the full length of the ship and make for easy access to all compartments. This layout is of great benefit as it eases damage-control tasks, movement of stores, and the positioning of removal routes. The lack of a gun forward has permitted the use of a bulwark around the forecastle (reminiscent of the Type 14) which assists in providing a dry ship. Great attention has successfully been paid to minimizing the clutter on the upper deck superstructure and screens and also on the sides of the passageways. The use of aluminium in the superstructure has been limited to the unimportant areas and so extra spray systems have not been necessary.

The accommodation standards are the highest in the Navy with the officers and FCPOs in single cabins, CPOs in four-berth cabins, POs in six-berth cabins, and junior ratings having recreational spaces partitioned off but within the sleeping area. The furniture is all of the same modular configuration and provides good storage space for everyone. Recreational spaces, cabins, and dining halls all have false deckheads and linings for noise suppression and to provide for easy cleaning. The CPOs and POs have separate dining-rooms-come-recreational spaces each fitted with a bar and having a common servery supported by the main galley. The wardroom is large and a very pleasant square shape and has its own galley adjacent. Its position below the bridge structure on 1 deck with all cabins at the same level makes an easily defined 'Officers' Territory' yet is convenient of access.

One major benefit resulting from the centre passage layout is that the shaft lines are further apart than those of the Type 42 giving much more space between the gearboxes and also between the gas-turbine modules. Hence there is no 'snake pit' and rounds in the after engine room can be carried out effectively.

Major Marine Engineering Differences

The following constitute the major departures from the designs of the Type 21 frigate and the Type 42 destroyer:

Forced Lubrication System

In the Type 22, the port and starboard systems are totally independent with one motor-driven pump running and one motor-driven pump standby per shaft. In addition there is a third pump per shaft driven by air off the H.P. air systems. The H.P. system air bottles give the third pump thirty minutes of running which should be sufficient time to overcome the generator problem or reduce the bearing temperatures to a safe level. In practice the system gave no concern although diesel generator failures have not proved uncommon during the first year; fortunately a coincidental failure was not experienced. In a non-manned machinery space, unitized forced-lubrication systems make sense but a combination of CPP, gas-turbine, and forced-lubrication pump equipment failures could be less embarrassing if a cross-connecting facility was available.

Fuel Systems

A three-stage system has been fitted—storage tank to buffer tank via centrifuge, buffer tank to service tank via filters, and service tank to engine via coalescers. Thus the cleaning is comprehensive and coupled with a stripping system (it seems an oversight that this does not include the service tanks) ensures good fuel condition at the engines.

Machinery Controls

The control logic is almost identical to that of the Types 21 and 42 but the presentation (i.e. the control panel) is very different. Opinions vary as to which panel is the better; there are advantages with each but, in the opinion of the author, a person who returns to a Type 21 or 42 from a Type 22 would prefer the Type 22.

The experience gained in the various classes has manifested itself in the improvements to the fitted fault-indication and fault-finding devices with the result that there were very few problems during the first year and the usage rate of modules was low. An enthusiastic maintainer and an accurate FIDA helped considerably. The Type 22 MECCA incorporates a servo-manual control both of engine throttle and pitch. The system bypasses the auto-controls but uses the same actuator (a possible weakness). Its use, especially if both shafts are involved, does require experience and concentration but is far easier and more effective than reverting to local control. It is also very useful as an aid to identifying any area of fault and altogether is a definite asset. The MECCA includes the DECCA ISIS surveillance unit which continuously monitors up to 240 parameters throughout the ship (mast-head temperatures to cold-room temperatures) and insures that a watchbill of four is quite sufficient. The ISIS includes a printer which should help with the registers but this potential has not really been developed.

Full advantage was taken by the Command and the MEO of the facility to control the machinery from the bridge, and this became the normal mode of control. It was particularly effective during RAS serials. However, the first action on experiencing a propulsion fault is to take SCC control, and this must become an automatic action for operators (OOW, QM, MEOOW, MEPOOW, LMEM) and so merits frequent practice.

Special Services Air

In addition to the Agouti supply, air is also fed to the stabilizer fins and to a hull masker. The air is supplied from the running gas turbine and, as it emerges from the turbine compressors at relatively high temperatures and pressures, the system reminds one of a steam system with heavy-gauge lagged pipes, expansion bends, and adjustable pipe-hangers. The effectiveness of the system on hull noise is unknown but the hull masker emission causes ingestion of air into the sea-water systems and subsequent cooling problems and propeller wear problems. It is understood that a redesign of the inlets has resulted in a cure.

Environmental Control

The latest international intentions were accepted in the Type 22 design and so the ship was fitted with sewage plants (thankfully with fitted bypass overboard pipework), incinerator, and bilge sullage systems. The systems do impose a considerable extra support requirement and are space consuming but presumably will now be the norm.

Ventilation

A reduced number of ventilation inlets and outlets and a new design of quick-action HWTC were fitted. Both details considerably ease the closing-down operation and also the upper-deck maintenance. In addition, the AFUs are designed to be in continuous use, and this further simplifies the NBCD organization. The ventilation is cooled by a traditional chilled-water main and is heated by electrical heaters in the trunking within individual compartments. The system coped well with arctic and near-tropical conditions experienced during the first year.

Subjects Worthy of Particular Mention

Gas Turbine Propulsion

The machinery package is well suited to remote and automated control. The number of gas-turbine starts worked out to about six per day at sea during the first year, and a total of only five failed starts for all four engines during that period gives one tremendous confidence. The CPP system suffered from burst flexible hoses initially but, once the installation had been corrected, the system gave no more major problems; however, trouble was always half expected and frequent attention to tuning is necessary.

Auxiliary Steam System

The auxiliary boilers provide steam for the evaporators, calorifiers, oil purifiers, winterization, and last but not least the laundry press. The whole system is an anachronism and, although the boilers are good and the evaporators are excellent, the package provides an operating, maintenance, and support task way above its value. If one also considers the weight, space, training, and line overhaul requirements that go with it, one wonders why saturated steam has been allowed to continue in the DD/FF ships.

Air Systems

The HP and LP air systems are very important in this class of ship and both are adequate. It is essential that the systems achieve satisfactory pressure tests on commissioning and recommissioning. *Broadsword*'s were completed late and hastily by the shipbuilder but strenuous efforts were made by the PNO, Y(S)L, and ship's staff to achieve satisfactory test standards much to the relief of the ship's staff maintainers. At present the dockside air is not dry enough for the LP air system and HP air is not available (at Devonport) so the compressors have to be running or available at all times. GWS25 takes an enormous volume of air for wave-guide purposes so that the running LP compressor spends most of its time on load.

Support

The great range of equipments and ancillaries means a big support load, i.e. documentation, spare-gear provision, training, maintenance records. The management of support has to be comprehensive and thorough throughout the ship's life, e.g. the ability to change a major equipment within the forty-eight hour period is jeopardized if the one vital piece of removal gear has been lost or has not been modified in line with equipment modifications. Upkeep-by-exchange has led to a host of lifting points, beams, strops, etc. which need to be kept serviceable and in date for test. Configuration management has been used by DG Ships and the shipbuilders to control the build phase, and the Master Record (DB) computer printouts are fed to the ship for ship's staff managment functions. The layout of this documentation differs from that of the Type 21 and the Type 42 and is far more comprehensive than the ship's staff need. The total support documentation in a Type 22 weighs 1½ tonnes. A further problem is the lack of firm direction on the policy of equipment modification states; an essential discipline if the U-by-E policy is to continue successfully. There is a great need for documentation to be streamlined into a common-to-all-classes simplified format and for Heads of ship's staff sections to be completely familiar with it. The current career and PJT courses do not adequately teach the support management aspect of the duties of senior ratings.

Marine Engineering Personnel

With a departmental complement of only thirty-six, there is a great deal for everyone to do. The small cruising watchbill of four gives plenty of daywork

hands but, because of the constant need to have trainees on the watchbill, the number actually available for part-of-ship daywork is small. On the credit side, the flexibility of the machinery fit permits much more maintenance to be carried out at sea. Ship husbandry is a problem and the ship's staff need to be augmented by fleet maintenance group and contract painters at every opportunity. The SCC concept means that the junior watchkeepers are gaining familiarity with all aspects of all watchkeeping duties from first entering the watchbill. This simplifies training, and individuals gain experience quickly. A POMEM who has been brought up in SCC watchkeeping and also has the necessary power of command could be capable of passing a unit ticket examination and becoming the MEOOW. At present, the UWC is not open to POMEMs, and this is a pity. If it were possible and the achievement was rewarded by accelerated advancement to CMEM, it would not only be popular with POMEMs but also would allow 1st class artificers/mechanicians to spend more time as system engineers. When EBD has fully worked through, these ships will have seven MEA1/Mech 1 capable of MEOOW duties and six POMEMs capable of POOW duties plus the MEAs/Mechs under training. If two of the POMEMs had UWC, it might even be possible to reduce the MEA1 complement.

Summary

The Type 22 frigate is a very seaworthy weapon carrier with a straightforward and functional layout. It is comfortable to live in and easy to manage. The propulsion package and ship systems are logical developments of those in the Type 21 and 42 ships, taking advantage of the experience gained but minimizing the changes in order to ease the training and support problems. Nevertheless, there are further lessons to be learned and applied to the next generation of ships: the suggested primary one would be to apply a policy of simplification throughout in order to reduce the through-life support tasks and costs. The Type 22s are superb ships in which to serve and the author feels very privileged to have been appointed to the first one.