TYPE 23
SHIP CONTROL CENTRE

BY

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Introduction

An article by Cdr. R. C. Pelly[1] in a recent issue of the *Journal* was based upon the ideas which were then being considered for inclusion into the design of the Type 23 Frigate Ship Control Centre (SCC). The design of the compartment, and the equipment contained therein, has now reached the stage where only the physical location of minor items of equipment within the compartment remains outstanding. This article will describe the design of the Type 23 SCC, and explain the 'philosophy' behind some of the decisions which have been taken.

Background

A Statement of Technical Requirements (STR) was drafted for the SCC by Type 23 project staff and the controls specialist section in 1982. The design of the compartment was developed by Yarrow Shipbuilders Ltd. (YSL) from this STR, with the initial design work being sub-contracted to YARD Ltd. The responsibility for ensuring that the design met the STR as it was being developed has always remained with YSL, in accordance with the procurement policy for the Type 23 frigate. Throughout the design period

the Type 23 Project Design Sponsor has sought to provide guidance and advice to the shipbuilder with the ultimate intention of achieving the best possible design compromise, utilizing all the available sources of expertise within MOD(PE), C-in-C Fleet, and C-in-C Naval Home Command. However, the contract was let strictly on the basis of the contents of the STR and therefore some good ideas which had not been foreseen during the drafting of the STR could only be included (at extra cost) if they could be shown to be operationally necessary. Most of these were lessons from Operation Corporate.

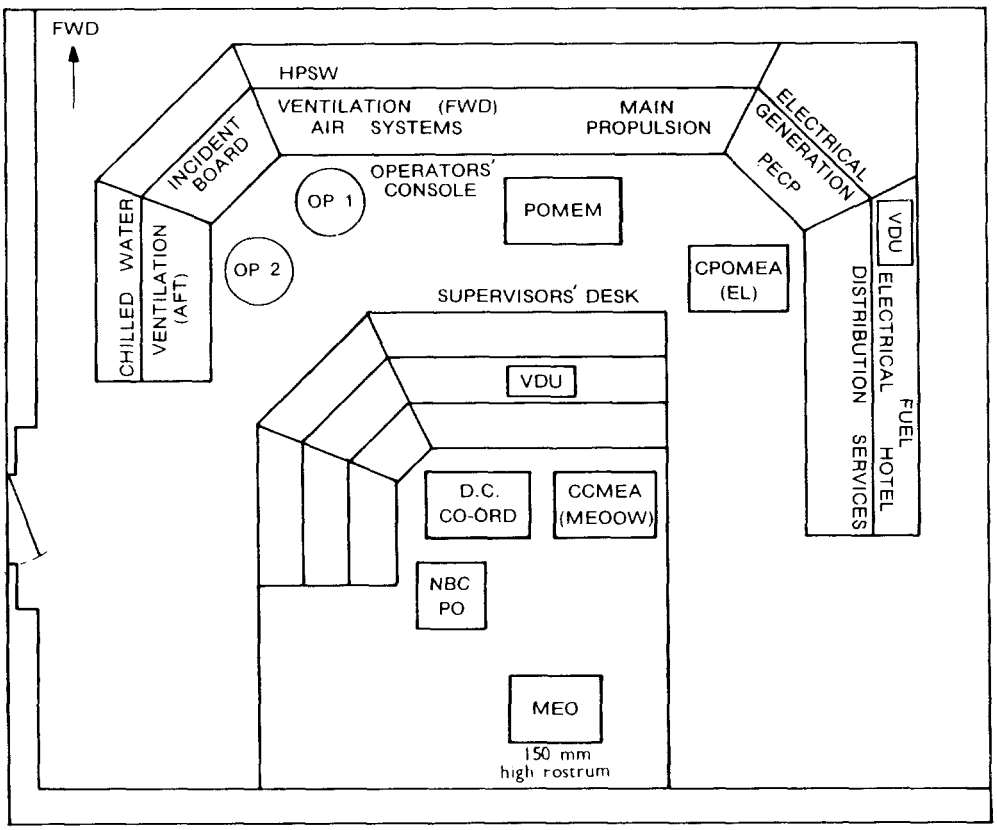

FIG. 1—TYPE 23 SHIP CONTROL CENTRE LAYOUT

Compartment Layout

The SCC has been designed as an integrated compartment so that the requirements of both the Machinery Control Room and HQ1 in NBCD States 1 and 3 have, as far as possible, been optimized. If the compartment had been designed exclusively for one or other NBCD state, the layout would undoubtedly have been different.

The layout of the compartment was originally designed as a two-tier structure, the supervisors being seated behind a desk, with the operators seated at a console in front of the desk. The need for a third tier—to move the MEO in State 1 away from the detailed co-ordination of a post-damage situation—became apparent at a late stage of the design and has been accommodated by placing him in a higher chair behind the supervisors (FIG. 1) where he will have an uninterrupted view of the whole compartment.

He will be provided with a writing surface, 'hot line' communications to the WEO in the Operations Room, and the Operator 2 line for all the Damage Control (DC) Co-ordinator's VCS* communications. This layout will assist the current FOST policy of the MEO's taking account of the overall picture and being able to pinpoint the areas of developing importance before they become too acute. His communication with his three co-ordinators will be person to person, the space available behind the Supervisors' Desk being ample to allow him the necessary freedom of movement.

The use of an 'open line' form of communication between the co-ordinators and the MEO was investigated. Half headsets had already been proposed for use in State 1 to allow the freedom for writing, etc., and to include an open line within the compartment would have meant the use of full headsets with the consequent loss of aural awareness of the general proceedings. It was decided that the close physical proximity of the operators and supervisors would provide for satisfactory communication in the compartment without leading to a confusing and potentially dangerous 'babble'. Nevertheless, VCS lines between the DC Co-ordinator and the Electrical Co-ordinator and the Incident Board (IB) operators 1 and 2 have been included, to allow detailed briefings to be carried out without disturbing other occupants of the compartment.

It is intended that the NBC Protection Officer (NBCPO) will act as a 'receptionist' for the compartment during busy periods in State 1, to allow the supervisors to concentrate upon their responsibilities without unnecessary interruption. There is adequate space between the door of the compartment and the desk for the messengers and any visitors to be received. There is room for passage between the desk and the console in the fully manned compartment, but this will have to be discouraged because of the probability of obscuring the view of the supervisors.

As a direct result of Operation Corporate the compartment has been given some additional features. A completely independent fresh air supply fan has been included which will pressurize the compartment with unfiltered air from the upper deck in the event of the Zone Two 2 deck passageway becoming smoke logged, thereby allowing the SCC to remain habitable for the longest possible time. Partly as a result of this improved habitability, and the consequence that escape from the SCC via normal access routes could become impossible, an escape hatch giving direct access to the 1 deck starboard waist has been incorporated in the deckhead.

TABLE I—*Manning of the SCC in State 1*

Action NBCDO	MEO
Damage Control Co-ordinator	Off-watch EOOW
Machinery Co-ordinator	CCMEA
Electrical Co-ordinator	CPOMEA (EL)
NBC Protection Officer	CPOWEA (WD)
Propulsion Operator	POMEM (ex-MEOOW)
Incident Board Operator 1	LMEM (ex-Propulsion Operator)
Incident Board Operator 2	LWtr (Technical Office)

Manpower

The compartment accomodates 8 men in State 1, as listed in TABLE I. It is planned that two messengers will be based there also.

* VCS: Versatile Console System

In contrast, the State 3 manning level is likely to be a POMEM as the MEOOW, a LMEM as the Propulsion Operator, and a Watch CPOMEA within hearing of the machinery broadcast. One MEM will act as switchboard and running machinery roundsman, working from the SCC. When going to State 1 from State 3 FOST has highlighted the importance of ensuring that the up-to-the minute machinery and system knowledge of the on-watch personnel should not be removed from the SCC at such a potentially critical time. Consequently in the Type 23 the on-watch MEOOW will give a brief handover to the CCMEA at the Supervisors' position before relieving the Propulsion Operator at the console, from where his detailed machinery knowledge and experience and will be invaluable to the CCMEA. The LMEM who has been relieved as the Propulsion Operator by the MEOOW will move across as the IB Operator 1 from where his current knowledge of the state of the auxiliary systems will be available to the DC Co-ordinator. In this way the knowledge of the on-watch State 3 personnel remains available to the co-ordinators. The potential wastefulness of any of the four watchkeeping LMEMs being the IB Operator can be offset by their detailed system knowledge and operating experience, together with the possibility of carrying out on-watch training during 'steady steaming' watches because of the layout of the compartment.

One of the major areas of compromise has been in the positioning of the Primary Electrical Control Panel (PECP). The use of the CODLAG propulsion system means that electrical power generation and distribution has a direct effect upon the main propulsion availability and response, so the propulsion operator needs to be within reach of the diesel generator controls and the MEOOW needs to be within reach of the PECP. From a damage control viewpoint the Electrical Co-ordinator should be in close touch with the DC Co-ordinator, and preferably within his immediate compass of supervision. It was found impossible to satisfy both of these criteria fully, and the compromise decided upon was to position the PECP and the diesel generator panels next to the propulsion and auxiliary controls, and to provide the Electrical Co-ordinator with VCS communications to the MEO and DC Co-ordinator. The facilities provided for electrical DC in the Type 23 frigate are of a different nature to those used before, and this fact, together with the small number of personnel available, may require some reconsideration of the role of the Electrical Co-ordinator for this class.

The Machinery Control and Surveillance (MCAS) system has been designed upon the basis that a POMEM will act as the MEOOW for normal State 3 operations, and various interlock and trip functions have therefore been included to safeguard the main propulsion machinery. Overrides to these functions are provided for the MEOOW, to give the necessary operational flexibility.

A full-scale mock-up of the compartment has been produced at YSL to assist with the design and layout of the console and desk. In August 1984 this mock-up was used for a comprehensive 'passive operator's assessment' which showed that the general design should be capable of meeting the STR, but it highlighted many detail shortcomings which YSL have since corrected. Due to the shortage of experienced operators within YSL the opportunity was taken to invite some experts from FOST, MCTT, and Phoenix NBCD School, together with representative operators from H.M.S. *Sultan*, RAE (West Drayton), and H.M.S. *Brave*'s stand-by crew, to take part in the assessment, and a wide cross-section of views was therefore aired. Scenarios ranging from State 3 machinery breakdowns to a full FOST NBCDX were talked through, and were a particularly enlightening experience for the YSL (and YARD) staff.

Supervisors' Desk

The Supervisor' Desk contains the communications, surveillance, and control facilities which are necessary for the MEOOW, DC Co-ordinator and NBCPO to carry out their functions. FIG. 2 illustrates the proposed layout.

The MEOOW's position has a propulsion machinery panel for the interlock and trip overrides. The panel also includes the diesel generator load limiting

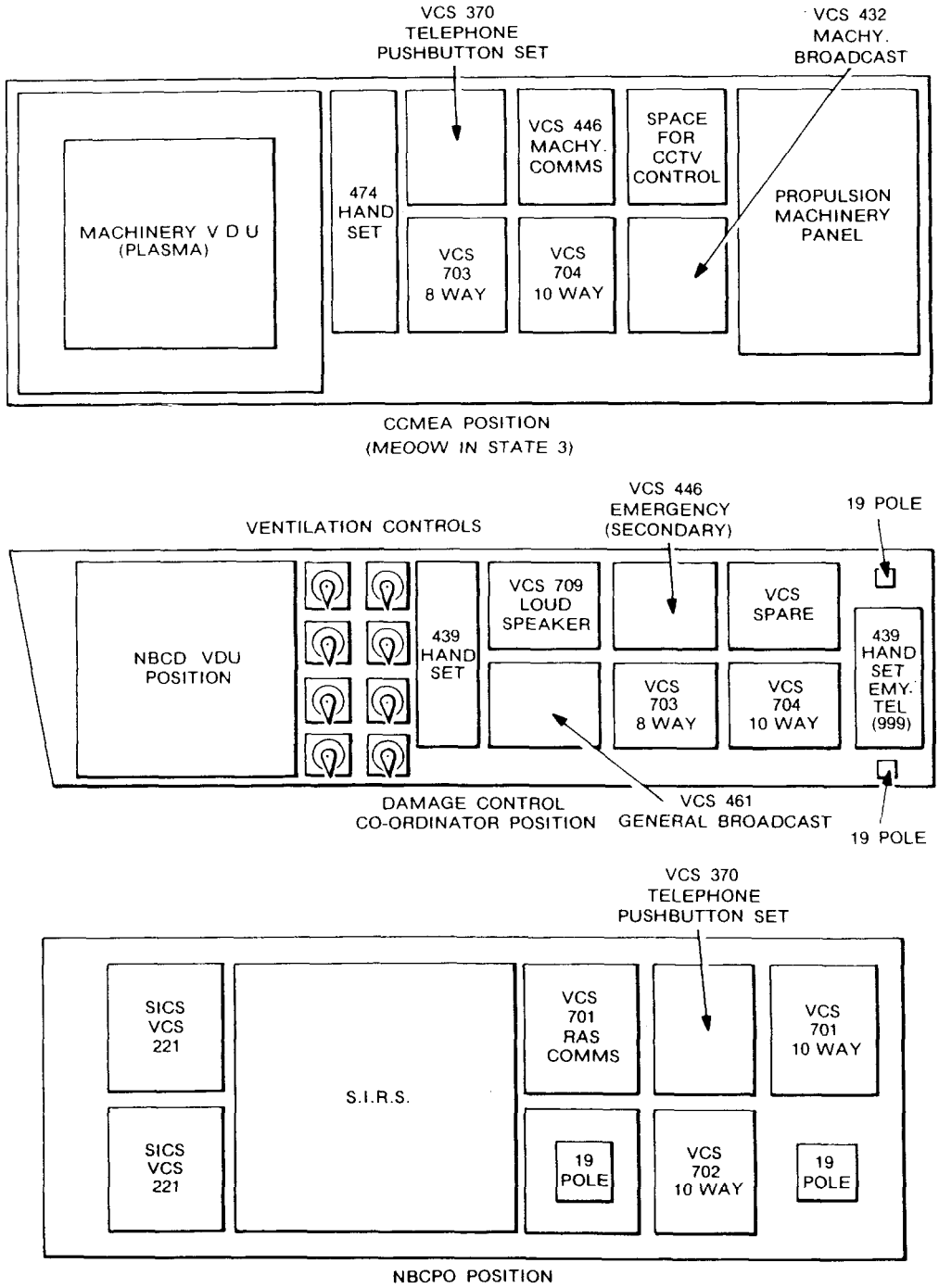

FIG. 2—SUPERVISORS' DESK LAYOUT IN SCC

switch and audio-alert mute.[1] A comprehensive primary and secondary communications fit is available to the MEOOW, together with space which has been allocated for closed circuit TV controls, should that equipment be fitted to the main machinery spaces. The secondary surveillance Plasma VDU is at the left-hand end of the MEOOW position and its associated functional keyboard is on the desk surface. The secondary surveillance system was described in some detail by Cdr. Pelly.[1] Its ability to continuously monitor 1,300 parameters, generating warning indications on the operators' panel where necessary, is the main reason why the machinery can be safely and efficiently operated by such a small steaming watch. Care has been taken to ensure that the volume of paper produced by the two printers has been reduced to a minimum by efficient formatting of the output.

The DC Co-ordinator's position has a comprehensive communications fit, which includes a '999' emergency telephone and a general broadcast control position. On his left-hand side he has a set of ventilation 'crash stop' controls which give him the facility to stop independently the ventilation in each smoke zone and the main machinery spaces. Space has been set aside in the desk for a NBCD VDU and keyboard, which would provide instant *aide-mémoire* facilities to the DC Co-ordinator, helping to prompt his actions and thought processes in the critical period after shock or damage; the unit is intended to be entirely independent of any surveillance systems, and may include ship stability calculation programs if memory space permits.

The remote control facilities provided for the auxiliary systems in the Type 23 SCC are considerably more extensive than in present ship designs. For example the HP sea water (HPSW) system mimic will contain remote controls for the ring main isolating valves at each smoke zone boundary, and at the forward and after extremities of the ring main. The discharge from the 3 pumps in the main machinery spaces can be diverted to either the port or starboard legs of the ring main, and each of the 5 pumps can be started, stopped and set to an auto cut-in mode from the SCC. (The auto cut-in of the standby pumps is activated from the magazines' Rapid Reaction Spray System). The pressure in both port and starboard legs of each zone can be read from gauges on the mimic, so that the remote control afforded by this design can be used to reconfigure the rig main after damage—if the necessary control and indication facilities have survived.

The NBCPO's position contains the SICS and SIRS VCS units, together with the necessary communications facilities for citadel entry positions, decontamination teams, and upper deck reporting positions. Communications with the upper deck and main machinery space fuelling positions have been included so that this part of the desk may be used as the RAS (L) desk when necessary.

Operators' Console

The distribution of information around the Operators' Console may be seen in FIG. 1, and much of the reasoning behind the structure of the information presentation has already been described by Cdr. Pelly.[1] A mimic style of presentation has been used for the following systems:

- fuel supply
- electrical generation and distribution
- HPSW
- HP and LP air
- ventilation
- chilled water

In each of these cases the remote controls associated with the system have been incorporated as part of the mimic, and the status, warning, and alarm indications have been positioned above the relevant item within the mimic. Other systems, such as main lubricating oil and LP sea water, have schematic diagrams on the secondary surveillance system which can be inspected by the MEOOW and the Propulsion Operator on their VDUs.

The integrated nature of the compartment has had the most marked effect upon the design of the NBCD Console. The Incident Board is flanked by the mimic diagrams of the important HPSW and ventilation systems, as shown in FIG. 3. The complex ventilation mimic has been split between the two IB operators such that they mark up and control the ventilation for their own halves of the ship. The forward operator (LMEM) also has the HPSW and air systems, whilst the aft operator (LWTR) has the chilled water system which, although not strictly speaking a NBC system, is positioned close to the NBCPO (CPOWEA(WD)) whose professional weapon knowedge will be very useful if the system needs to be reconfigured. The IB, apart from having all the standard information, will also contain individual lamp indications for each fire group and flood detector, and door and hatch indication for citadel exits and smoke zone boundaries. An isometric style of ship drawing was considered for the IB diagram, but it was decided that the current plan form presentation gave a clearer picture and was easier to mark up.

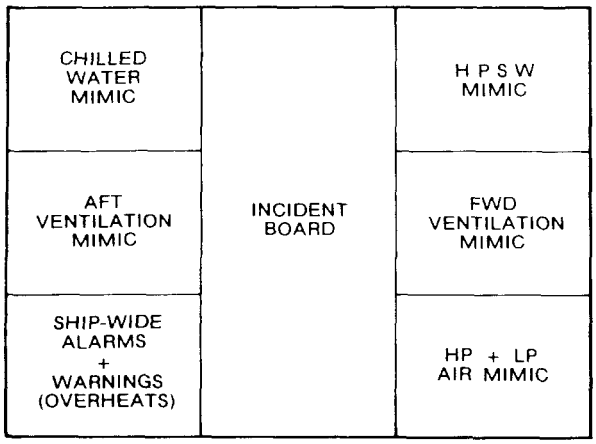

FIG. 3—NBCD CONSOLE LAYOUT IN SCC

The ship-wide alarms and warnings have been positioned on the console according to their type; the overheat indications are all adjacent to the IB, beneath the aft ventilation mimic, while the electrical supplies and gyro compass indications are on the PECP. It was cheaper to incorporate the control of the annunciation of these alarms and warnings within the MCAS electronics rather than to use the standard VCS units, and therefore the ship-wide alarms and warnings have been fully integrated into the SCC console.

Maintenance

Ease of maintenance of machinery control consoles is an important factor which has been taken into account in the design of the compartment. The electronic racks for MCAS and Damage Surveillance systems are housed in those parts of the console which have back access, the racks being hinged to ease the accessibility to ribbon cable connectors and power supplies. Front

panel hardware is also reached from the back wherever possible. Front access has been provided to all the terminal connectors, which run around the lower part of the console, and to front panel hardware where back access is not possible. The Propulsion Operator's panel will therefore be hinged to allow maintainer access to the wiring for the meters, switches and indicators but access to the lamps for the indicators and illuminated switches will still be from the front of the panel.

Conclusion

The integrated design philosophy of the Batch I Type 23 SCC has been implemented utilizing similar technology to that at sea at present because of the tight budgetary constraints upon the design. Studies are in progress to assess the potential for improving the efficiency of the man machine interface by the use of more modern technology for the Batch II design.

The Type 23 SCC design should greatly assist the MEO in his role as Action NBCDO, and enable the three DC co-ordinators to carry out their responsibilities more effectively. Consideration needs to be given to the provision of a complete training facility at either H.M.S. *Sultan* or Phoenix NBCD School, where State 1 team training can be undertaken.

Reference

1. Pelly, R. C.: Machinery surveillance in the future; *Journal of Naval Engineering*, vol. 28, no. 2, June 1984, pp. 263–268.