PLATFORM MANAGEMENT
EVERY DAY THROUGH TO A DAMAGE INCIDENT

BY

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There is a continuing requirement to reduce the complement of current and future warships. This article proposes one method of using existing, de-risked Platform Management System technology to not only increase the efficiency of day to day running, but provide a greatly enhanced action state capability within the constraints of greatly reduced manpower.

Introduction

The key to the realization of manning reductions is the effective implementation of technology. Historically the insertion of technology has enabled organizational changes within the Royal Navy. The evolution of steam from sail moved a large number of naval personnel below decks, then the introduction of Gas Turbines and their associated Control Systems allowed monitoring of the prime movers from a remote Ships Control Centre (SCC). The introduction of Integrated Full Electric Propulsion (IFEP) within the Royal Navy's latest ships, LPD(R) and the T45 Destroyer, will enable a further step change towards a whole ship approach to management of the platform and its crew.

This article discusses the affect of technology and its probable implementation, which will facilitate a change in operating philosophy within the next generations of Royal Navy warships, as a result of Electrical Propulsion and the use of Platform Management Systems (PMS). It then provides a 'snap shot' view of the operational concepts and describes how the platform will be managed from the day to day operation through to Electrical Damage management.

A PMS

The operation of a ships PMS system within peacetime has been de-risked by its implementation within the commercial sector. It is its use within an Action environment that has yet to be proven, and thus this is where the greatest risk to its implementation within the Royal Navy lies. A basic PMS will include:

- Machinery control
- Electrical Power management
- Platform Management support
- Damage control Management functions.

But there are a host of other functions that will be required such as:

- Condition Based Monitoring

- CCTV
- Data recording
- Training simulation
- General administrative capabilities.

Central to the PMS's successful integration into a naval environment is the operator and the philosophy behind the systems operation (FIG.1). Technology can deliver the functionality required to effectively manage a platform within all required Action States, however it is still the operator who is key to the applications success.

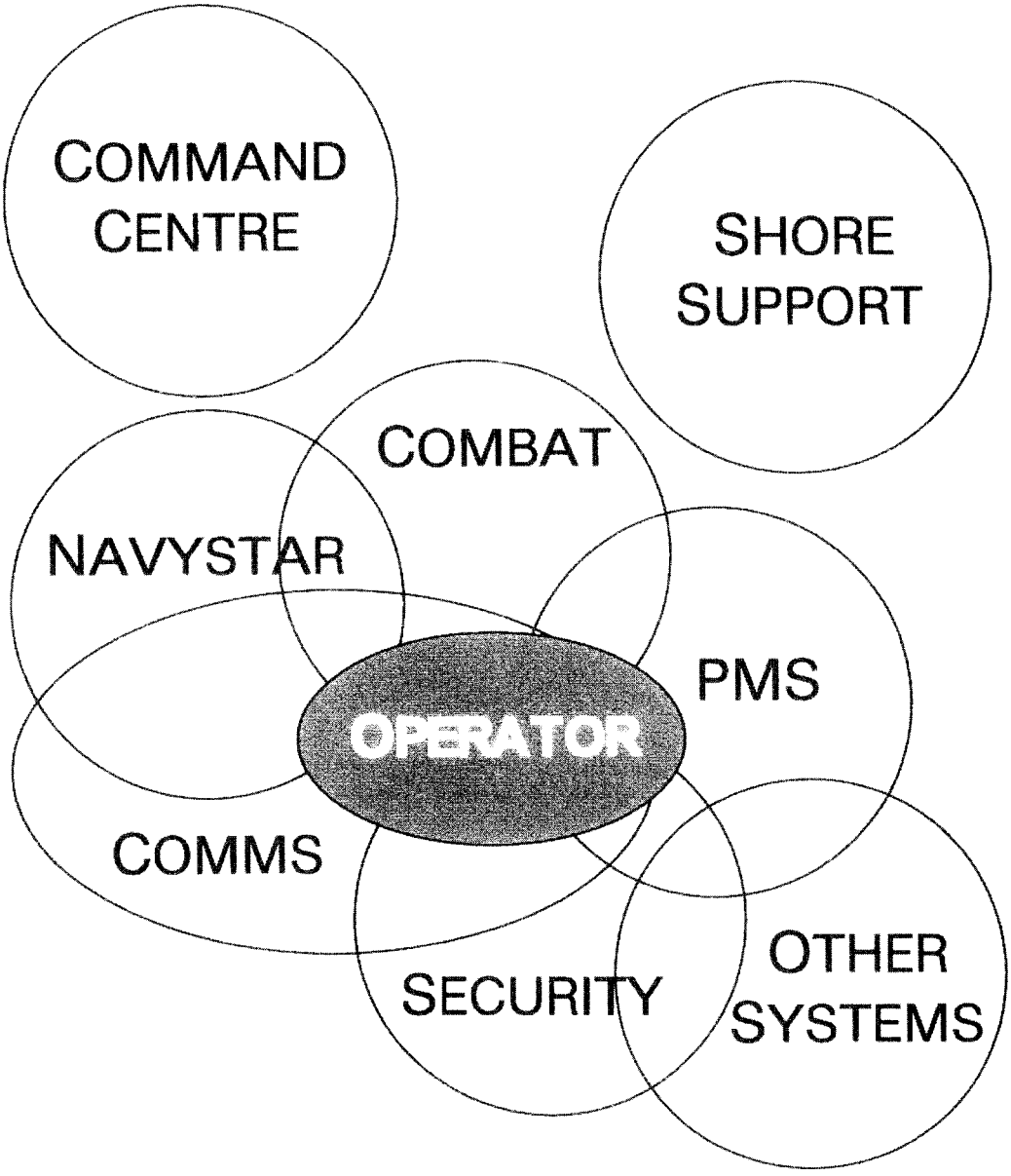

FIG.1 — PMS INTEGRATION [1]

Enabling Technology

Significant and effective manning reductions can only be achieved if they are accompanied by an investment in technology. Only then will the longer term cost savings be realised. The fast growth and increasing capabilities of commercial systems have been driven by market forces, such as the off shore industry where

the loss of oil production for even the shortest time period can have huge financial implications.

There are a host of PMS suppliers who claim to provide the complete requirement for a Warship. Generally speaking PMS systems are based on large numbers of distributed local controllers with centralized monitors with high level control. This is achieved normally by at least using a dual redundant data network, which connects all the local PLCs and provides the interface with the operators at a number of workstations, which are strategically located throughout the vessel.

The basic architecture can become vulnerable to failures, which in the extreme case may result in the complete loss of a function; a serious consideration when a ship's safety is potentially at risk. The current trend to overcome this potential risk is to further distribute the 'Intelligent Control System' to the local level. As a result equipments such as a Diesel Engine or a Gas Turbine can now be supplied with highly sophisticated local control panels capable of 'intelligently' controlling the plant from local. This eases the burden on the PMS supplier, as limited detailed control software is required only for the ability to integrate systems using open system standards.

The major man power driver in all warships is the manning required for Action to cope with the various demands of damage control and of course to fight the vessel. Any manning reductions could have severely detrimental effects on a vessel's ability to contain damage or fight the battle. The solution is extensive use of fixed fire fighting systems on a scale not previously experienced within the Royal Navy. This together with greater proposed use of autonomous zones will allow smaller numbers of personnel to manage damage received whilst retaining the ability to fight. In an emergency condition such as an Action State, effective communications are critical to the success of a teams ability to control the situation. It will be the PMS, which will allow effective management of any incident.

Future Manning

Technology could allow a warship to be manned by only a handful of personnel, effectively as seen by the US Arsenal ship concept. However the modern warship is required to perform a wide range of functions which are manpower intensive thus the minimum manning state is not desirable all the time. Table 1 details one possible Marine Engineering department solution for the T45 and compares this to the current manning levels for the T23.

TABLE 1. — *ME Department Comparison*

	Type 45	**Type 23**
Officers	MEO, DMEO	MEO, DMEO
Chiefs	1xCCMEA 4xCMEA	1xCCMEA 6xCMEA
POs	1xPOMEA 3xPOMEM	1xPOMEA 3xPOMEM
LH	5xLMEM	1xLMEA 6xLMEM
AB	9xMEM	21xMEM
Totals	**25**	**41**

As can be seen there is very little difference at the Officer/Senior Rate level, the most significant change is apparent at the Able Rate level. The DMEO can

usefully be employed as a Zone Control Officer but is primarily there to be 'grown' into a MEO. The high levels of senior technicians will provide the detailed system diagnostic capabilities for the future department. Many of the traditional tasks carried out by the junior levels will be automated or contracted out when the vessel is within harbour. This has the added advantage of fulfilling a Fleet requirement to reduce the mundane activities that lead to dissatisfaction and a loss of trained personnel from the service.

The structure detailed above may raise concerns as to how sufficient quantities of senior rates can be drawn from the lower rate levels. Within the T45, although the complement may be as above, the actual numbers embarked at any one time may be much higher. The vessel is likely to be able to complement up to 235, which will cater for a substantial training margin.

Day to Day operation

It is within the day to day operation of the vessel that will no doubt cause the most controversy within the Naval environment. The use of Single Generator operation[2] will offer substantial savings to through life costs both in fuel terms and in maintenance of prime movers. This type of operation will lend itself to unmanned spaces, including the SCC. It is likely that the current SCC watchkeepers will be replaced by a single Leading Rate located on the bridge with the Officer of the Watch. These watchkeeping duties could even fall to the existing QuarterMaster, who is currently located on the bridge at sea. A suitably qualified senior rate will be on call at all times and will make use of a 'Duty Engineer' alarm system for call outs. The propulsion plant together with alarms and alerts can be monitored from the bridge and the Duty Engineer can be called as required. This is radically different to current practice but this practice is standard throughout the Merchant environment[3].

Within harbour

When in harbour the requirement for a watchkeeper within the SCC can again be dispensed with. A PMS console could be provided on the gangway, the Duty Engineer would be responsible for accepting alarms in a similar fashion as at sea. The gangway staff would be responsible for initiating any investigation to more important alerts such as fire/flood indication.

During periods of main leave such as Christmas or the main summer breaks it is common to find groups of vessels within their base ports (Portsmouth and Plymouth). Currently each vessel has its own duty watch who conducts limited maintenance and maintain a fire/flood watch. A duty watch can be as many as 25 persons in all to cope with all manner of incidents. To facilitate more flexible manning during these periods a PMS will enable the networking of several like vessels. This will remove the major risk to ships during these periods i.e. the watchkeepers themselves. The ships would be completely unmanned with one duty watch monitoring all the vessels from either a rear link office or one of the vessels.

Confined waters

When in confined waters or circumstances, which require the use of additional personnel closed up, to respond to potential dangers, additional manning would close up. However the flexibility and the increased redundancy of a PMS will negate the current requirement to have numerous personnel closed up in local control positions. Table 2 indicates where personnel would be closed up during these operations:

TABLE 2. — *ME Manning at Special Sea Dutyman*

	Type 23	Type 45
Bridge	MEO/DMEO	Not required
SCC	CCMEA CMEA 2xPOMEA	MEO/CCMEA CMEA
Machinery Spaces	3xPOMEA or LMEMs	Not required
Switchboards	2xSOC holders	Not required
Tiller Flat	1 xMEM 1xAB	1 xMEM 1xAB
Totals	**12**	**4**

Note the absence of watchkeepers within machinery and switchboards rooms, this is due to the capability of the power management function within the PMS. Reversion to local control and management of the electrical propulsion system is likely to be an extremely rare occurrence due to the built in high redundancy of the PMS. Furthermore, the complex power management calculations required to balance loads will not safety lend it-self to routine, manual, local control operations. It is further suggested that the MEO/DMEO is no longer required to man the bridge, under Lloyds rules a Charge Qualified Engineer is **only** required to man the SCC when in confined waters. The key to this type of operation is the concept of operating a warship along the lines of a merchantman when not in an Action State.

Damage Control State 2

This state is used when the ship is not in an Action State but is within a highly volatile environment, which may require a quick response to an immediate threat. In this state typically 50% of the Ships Company are available for duties at any particular time.

Within this state it is proposed that the supervision of the machinery plant be conducted from the SCC, although the routine control could still be achieved from the bridge. The 'On Call' senior rate would physically man a PMS workstation within the SCC. The senior rate would be responsible for ensuring that the machinery plant is capable of reacting to an immediate transition to the full Action State. To aid him he would have at least two Able Mechanics who would conduct physical rounds of the machinery spaces and act as the initial attack to any minor incident.

Within this state it is normal to configure the machinery plant to operate within autonomous zones. The 'On Watch Senior Rate' will be responsible with a small team of personnel (mobile party) of ensuring that the zoned system configurations are correct and that all fixed fire-fighting systems are both functioning correctly.

As is the current situation all other Damage Control related personnel would be 'On Call'. The initiation of Action Stations would require 100% attendance as discussed below.

Action State (FIG.2)

It is within this state that a warship is unique and the appropriate manning must be given to achieve the required capability to fight, move and float. Many of the traditional management tasks within the SCC team will remain, however the

difference within future vessels will be that the remaining personnel will become supervisors of the PMS rather than implementing system reconfigurations. The system will conduct many of the traditional functions that the watchkeepers performed during action i.e. system reconfigurations and starting stopping of prime movers etc. The supervision of the PMS to ensure this has been successfully carried out will become the responsibility of the watchkeepers at action.

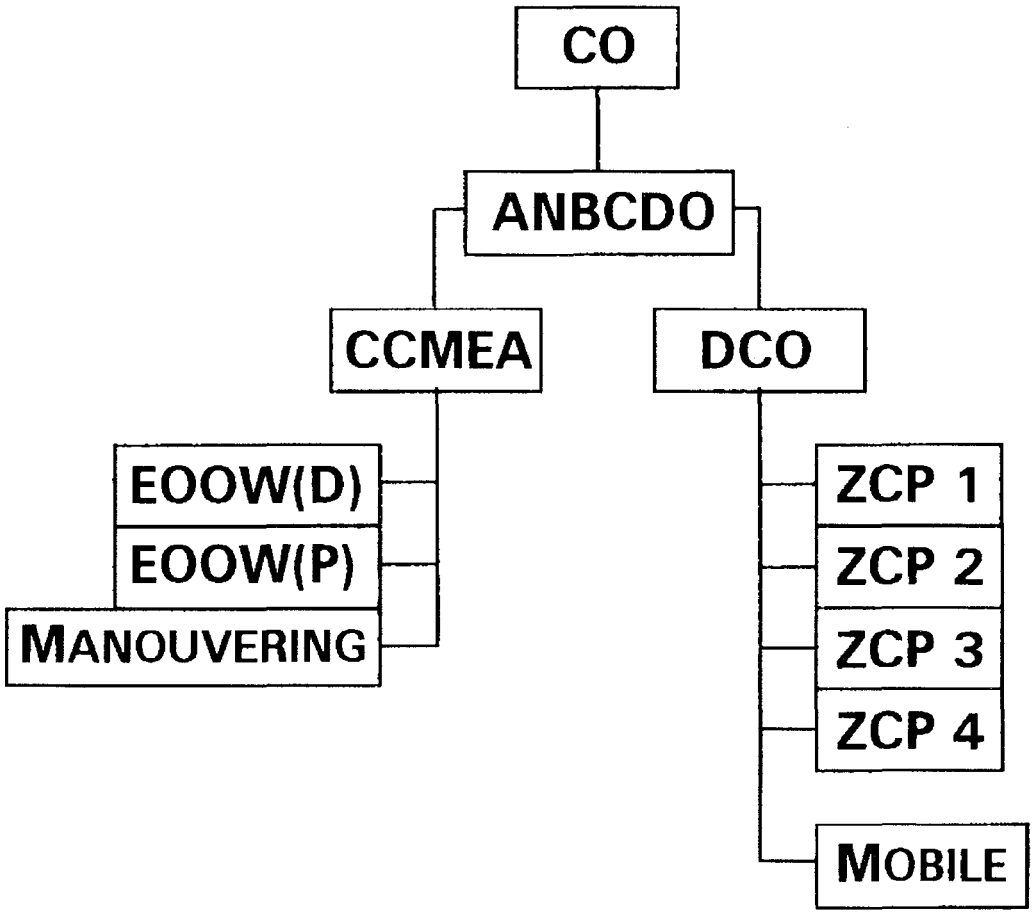

FIG. 2 — ACTION DC ORGANIZATION

The Action NBCD Officer (normally the MEO) will remain within the SCC and will remain responsible for fighting the internal damage and managing the machinery plant. To aid him he will still have a CCMEA who will supervise the entire machinery plant and the Damage Control Officer (DCO) who will co-ordinate all DC activities. The largest changes evolve at the lower levels.

- The DCO will control DC activities directly with the four Zone Control Officers and the Mobile teams, gone are all Incident Board Operators.
- The propulsion plant will be controlled by:

  Engineering Officer of the Watch (Propulsion) (EOOW (P))

  Will have control of Electrical Generation and Propulsion.

  Engineering Officer of the Watch (Distribution) (EOOW (D))

  Will control all Electrical Distribution. Gone are the L DCO and the 'L' teams within the switchboards.

Electrical Action Damage

The methods of reporting, recording and repairing electrical action damage have changed little in the last 40 years. There have been minor improvements to communications and to the Damage Control (DC) cables and their method of connection. Indeed in the Type 23 Frigate these cables are only made up locally, as they are required, doing away with the need to have DC cables stowed throughout the ship. This enables savings in space and a weight reduction of about 2750 Kg. Within an All Electric Ship the management, control and the implementation of DC activities to the electrical power and distribution system will have considerably more priority than on any previous warship.

The manual reporting and recording of electrical action damage, which relies solely on verbal or written messages is at best unreliable and at worst totally misleading. All too often the report of damage is garbled, inaccurate and insufficiently detailed; this leads to duplication of effort and inaccurate reports to the command, which may lead to wrong tactical decisions being taken. The use of PMS will negate such recording methods as data will be collected automatically and displayed to the EOOW (D).

The accurate reporting of action damage remains the single most important aspect of damage management and this cannot be over emphasised. Clearly the importance of a particular piece of equipment will depend on the tactical situation at the time. It is likely that weapons will have the highest priority and will require the most urgent attentions of repair teams at the Zone Control Positions (ZCPs). If this involves the rigging of DC cables then the initiation of this will be by issuing of an 'Underground Map', this will indicate:

- The route to be taken
- The cables to be used
- The priority of the cable run
- Estimated Time Back Online (ETBOL).

The return of the 'Underground Map' indicates to the EOOW (D) that the cable run is complete and power is available. The safe connection of these cables is a well-established procedure, which will not be discussed here.

In certain circumstances repairs may involve more than just power restoration and this is where expertise and lateral thinking will come into their own, innovative repairs may be the only solution. ZCP team members must have a thorough knowledge of the supplies and systems in the ship, and be totally familiar with cable running techniques and safety procedures. Within a vessel with HV voltage, electrical awareness throughout the Ships Company will be much heightened. Rigorous and continuous training and practise, using realistic exercise scenarios will accomplish this.

At present the majority of verbal communications available rely on fixed, hard wired and sometimes-shared circuits, these are clearly very vulnerable to damage, message distortion and mis-routing. The advent of sophisticated PMS will allow some or all of the tasks involved in damage control to be performed automatically, particularly the time consuming, and often inaccurately reported, blanket searches. The display of electrical supplies status will enable repair actions to be prioritized correctly, and these actions directed towards essential repairs with the minimum of delay. It would also release manpower from blanket searches to action damage repair.

Conclusion

The manpower used in future platforms is likely to be significantly less than in present warships and the need for careful resource management in an action scenario to ensure an optimum performance of the 'system' (man and machine) must not be underestimated. This may be significantly facilitated by present and future PMS, which will allow all personnel to avoid nugatory and time wasting tasks.

At present, poor information and verbal communications difficulties often hamper them. To ensure that the repair teams are only deployed where they are of the greatest benefit the lack of credible data must be overcome. This will ensure the Command Aims are achieved in the shortest possible time and with the minimum disruption to the ships weapon systems availability.

A combination of technological innovation and integration will remove the traditional divide between Marine and Weapon engineering branches and the Command structure, so allowing a more flexible approach to manning issues.

The major challenge to future warship design is the management of the new levels of integration required for a Whole Ship concept, whilst working within any new procurement environment. This is further complicated by the expectations of many traditional Naval Branch structures. If the challenge is not recognized and successfully managed a Navy will suffer the consequences of a sub-optimal solution to warship requirements for many years to come.

Technology in the shape of a PMS will provide not only the means to face these issues, more importantly it will offer a solution acceptable to all the circumstances.

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