AN MEO'S GUIDE TO DEVELOPMENTS IN PLATFORM SPARES PROCEDURES

BY

LIEUTENANT-COMMANDER K. WILLINGALE, C ENG., MIMECH E, MIMGT
(Surface Flotilla Engineering Data Centre, Portsmouth)

ABSTRACT

This article concentrates on the processes associated with Spare Gear provisioning. It discusses current practices and their shortcomings, and suggests improvements—in particular how the User can help himself. In a changing world, it welcomes the prospect of the bright new dawn of the Naval Support Command with Integrated Logistic Support.

Introduction

The Engineer's understanding of the processes and procedures associated with logistic suport, and with the provisioning of Spare Gear in particular, has been on the wane since the Pusser assumed responsiblity for the ship-borne aspects in the early 60s. Integrated Logistic Support is big business and is more the Engineer's business than the Pusser's, witness the change from 'CSO(E)' to 'CSO(S)' at Northwood. The wind of change is blowing across the Atlantic (initially via NFR90) and the MOD is struggling to accommodate a multi-disciplinary science within its hierarchical organization.

This guide to spare gear processes sets out in straightforward terms the objectives behind spare gear provisioning, and the means used to try to reach these objectives. It covers the whole spectrum of activities—from the time an equipment is selected, to the time the MEO or SO decide that the On Board allowance is not good enough—from the Engineer's perspective. It therefore deals with the derivation of allowances at the equipment level, their consolidation and rationalization, but touches only superficially on material handling—or 'grocery'—matters. No punches have been pulled with respect to the weaknesses of the present procedures, so that the User may make some judgement as to whether a perceived deficiency is endemic, or whether he can make a useful contribution to improving the situation. The perspective is primarily the engineer's, and specifically the Marine Engineer's where WE procedures are different; the term User has been used as the SO may also be involved. The many abbreviations used in this article are listed alphabetically in the Appendix (p. 389-390).

The author is an ME officer who has recently spent seven years co-ordinating the activities of the various authorities involved in spare gear provisioning, and he now runs the Surface Flotilla Engineering Data Centre (ERSUI, FLUBCON, SAR, *et al.*). Opinions expressed or implied are personal, and have been given as being of interest to the User.

This article is devoted to procedures used to provide Parts Identification and Allowances of Spares for Platform equipments sponsored by the sea Systems Controllerate (SSC) and which are required to be given Type A support in accordance with a Staff Requirement (Sea). Weapon and External Communication equipments sponsored by DGSW(N) and DGUW(N) or CNSWE, and items sponsored by other MOD Departments, such as DGA(N) and MDG(N), are not specifically covered, though the principles apply. Type B and Ad Hoc procedures are also not discussed.

Objectives of Spares Provisioning

Clearly the prime objective of spares provisioning is to provide sufficient spares in the right places to ensure that a vessel fulfils her Operational Requirement. The art lies in defining and providing sufficiency, and avoiding superabundance.

The period for which a vessel is stored is governed partly by a Naval Staff Requirement (NSR) and partly by the procedures for initial provisioning.

Initial provisioning of spare gear is based upon equipments rather than the class of vessel. Since the same eqipment can be fitted in several classes of vessel, it is normal practice for initial provisioning allowances to be based on the period to be stored for a 'standard' frigate, which is 90 days at peacetime levels of consumption[1] (but see Sparedex, p. 383–384, with respect to times of tension and war). However, where an equipment is clearly expected to have limited application (e.g. it is non-magnetic, for minesweepers, or is submarine equipment), then the calculation may be based on 30, 45 or 60 days duration as appropriate.

Definitions

An Equipment

The understanding of the System—Equipment—Assembly—Sub-Assembly—Component hierarchy is intuitive to an engineer and no problem until he thinks about it. After all, a vessel is a system (vessel = boat, ship, or submarine), as well as a collection of systems, and an element of a system may be an equipment, a component, a test equipment, or a built-in spare. However, as control electronics become more integral with the machinery being controlled, it can be more difficult defining the boundary—are the transducers part of the equipment being controlled or of the control system, for example?

The Staff Answer for support purposes defines an equipment as: 'A complete item of material capable of performing a specific function on its own. It normally incorporates replaceable Assemblies. Sub-Assemblies and Components[2].

There is a list[3] which defines which equipments may be the subject of Illustrated Parts Catalogues (IPCs) and Provisioning Schedules (PSs) and have spares allowances defined through the procedures described here. The final decision depends on the function to be performed as well as the type of equipment and the availability of alternative methods of support, Thus television cameras and monitors may earn IPC-PS support if they are for monitoring, but not if they are for recreational use (in which case a running contract with a civilian company suffices). Air conditioning plants may be 'Pool Items' if 'self-contained, hermetically-sealed' (because they have low maintainability), but otherwise would earn an IPC-PS. A decision has to be made concerning the Upkeep and Maintenance Policies for each equipment; the provision of spares has to go hand-in-hand with provision of the BR and the necessary training, special tools, facilities, and test equipment.

Upkeep and Maintenance Policy

Upkeep and Maintenance Policies are 'Staff Requirements'. They are developed as part of the design process for a vessel and are expressed in terms of Operating Cycle and maintenance philosophy, in terms such as 'maximum use of Condition Based Maintenance, Repair for Ship, or Upkeep by Exchange, etc.'. All those with design authority are responsible for ensuring that their designs take full account of the appropriate Upkeep Policies[4]. The specific requirement for any equipment will (eventually) be defined on form SSCF 114, 'Equipment Provisioning Requirement Sheet', and particularly in the form of an Upkeep Code.

An Upkeep Evaluation (UPEVAL) may be undertaken for major equipments.

Upkeep Code

The alphanumeric Upkeep Code defines, with a view to overhaul requirements, what is to be done, when, and by whom. It is a necessary precursor to the Provisioning Schedule.

Provisioning Schedule

A Provisioning Schedule is the companion to the IPC that the user does not see (the WE equivalent is the E List). As far as the support process is concerned, the PS is the prime document, since it contains a consolidated list of all those sub-items associated with the equipment which are (DGST(N)) Items of Supply, along with the allowances of each, and much store-keeping information. The PS is used by DGST(N) to set up the equipment Scale, and part of this Scale defines the On Board Allowance (OBA). Not all items in the IPC are in the PS—because they are not all Items of Supply, and not all items in the PS are in the IPC—because they are not relevant to the user (they may be needed only by the 'refitter'), though the latter situation is comparatively unusual.

The Life Cycle of a Spares Allowance

What follows is a User's-eye view of decisions and practices that are of relevance to allowances i.e. those that affect their accuracy, timeliness, visibility, and effectiveness. An understanding of the subject not only enables the user to put his particular problem into perspective, but will also enable him to be more effective when suggesting improvements. However, the reader with limited need for detail may care to proceed directly to 'Changing an Allowance' (p. 386).

Conception of a Spares Allowance

The Start

The start of the cycle occurs:

(*a*) (for an Off-The Shelf equipment) when the contract is placed to purchase it;

(*b*) (for an equipment under development) when the design is frozen and Mod State Zero (MSZ) is declared.

It is for the equipment purchaser, or Sponsor, to ensure that he:

(*a*) requires the contractor to complete the RN Equipment Identification Certificate (RNEIC);

(*b*) requires the contractor to be prepared to answer any questions that may be asked of him to enable items to be introduced into the DGST(N) inventory[5] at fair and reasonable prices;

(*c*) declares MSZ (where applicable) in time for the support processes that follow to be completed before the equipment is in service.

Difficulty. The design Sponsor will delay declaration of MSZ for as long as possible to keep responsibility for shortcomings with the contractor. In practice this can mean organizing support for equipment which is susceptible to design changes, under conditions where there is no procedure for recognizing the effect of such changes on that support.

The Effects of this are:

(*a*) to cause delay to the provision of support and possibly even to modify the depth of support provided;

(*b*) to cause delay and/or the provision of inaccurate documentation, and purchase of unnecessary hardware.

RN Equipment Identification Certificate

The Information on the RNEIC is used by DGME 412d in the Sea Systems Controllerate (SSC) to assess whether the equipment is already in service. This is known as screening.

Difficulties. The screening is done on the basis of a Manufacturer's Part No. or Drawing No. (but not Issue No.). There is no standard labelling system used, and a misplaced symbol will defeat the computer (which is not capable of 'fuzzy' searches). Some manufacturers are very good at inventing numbering systems which suit their own purposes but bear little resembalance to the logic of design definition, e.g. the number that changes with each application; whilst others forget to change the number when the design has been modified.

After all, how big does the design change have to be before a new drawing number, rather than an up-issue is necessary? There is also a problem caused by the fact that a General Arrangement is not definitive with respect to the components (since the component drawing issue numbers are not shown). If the item has been given a Service Drawing Number (SDN) then identification should be more reliable, but quoted NATO Stock Numbers (NSNs) have to be treated with much suspicion.

Effects. If the screening fails to find an equipment that is on the SSC database then the procedures to set up support (as follows) are initiated. The least effect of screening failing to find an equipment is a waste of time and money is seeking information; the greatest effect is an eventual duplication of support. Duplication tends to confuse other databases, e.g. the Master Record Centres, which are programmed to believe that one equipment is entitled to only one IPC. On the other hand, if the equipment is falsely identified then no further support action will be taken, and the customer will be supplied with the inadequate support in due course.

Recent developments. A computer database of RNEICs is now maintained which enables searches to be conducted on all information in an RNEIC rather than just the equipment information, e.g. manufacturer's name, ship applicability, system in which fitted, claimed NSN and SDN. The thorny problem of Drawing Issue number, however, remains to be tackled.

Output. If the screening identifies the equipment as already in the inventory, then DGST(N) is informed. This is done either directly, or via the Master Record Centre (Ships) (MRC(Ships)) if the vessels concerned are catered for by this database. DGST(N) then reviews his stock holdings in view of the impending increased equipment population. If hardware has to be ordered, then DGST(N) would not expect to be able to meet the additional requirement for another 12 months. It has to be recognized that it would not necessarily be the additional application, or even the equipment concerned, that would not be properly supported during the interim 12 months, but rather the line items that would be affected (and these may have multiple applications throughout the fleet).

If the screening does not produce a complete match then a contract is placed to compile an Equipment Information Package (EIP) additional information with a view to either producing a new IPC or amending an existing one. Either course of action will involve extracting information from equipment supplier(s) to enable component items to be allocated NATO Stock numbers (NSNs) as appropriate. This is known as codification. The supplier may be concerned about Intellectual Property Rights and/or expect to charge high prices for drawings, perhaps because he wants to make the information less sensitive. If the supplier himself is not a problem, then his sub-contractors may be.

Equipment Information Package

An order for an EIP is placed on a contractor, who may be either one of the number of commercial companies producing technical publications, or may be a 'Ship Support Contractor' whose company ordered the equipment.

Difficulties. The EIP contractor is a third party. The MOD is usually his major, but not his only, client. The demands of codification are exacting. There is therefore plenty of scope for misunderstandings and confusion of priorities between the three parties. Regular meetings between MOD and contractors, which are of marginal productivity, are required to keep the show on the road.

Effects. Delays and acrimony.

Recent Developments. A commercial cataloguer carries no weight with equipment suppliers to the MOD, and is therefore in an unenviable position when it comes to inviting the supplier to participate in activities which he may well regard as contributing only to overheads. The practice has therefore been adopted of employing Lead Shipbuilder Support Contractors (LSBSC) (i.e. the support division of the Lead Yard Shipbuilder) to obtain the EIP.

In theory it may be expected that the equipment orderer carries some weight in obtaining information and furthermore is in a better position to ensure that the information is correct. Whilst this strategy has produced some improvement, particularly with regard to accuracy, there are still difficulties. All shipbuilders now seem to accept that there are better prospects in Support than in Shipbuilding, but some are only slowly beginning to give weight to the priorities of the support division within the company, and thereby giving the support division the influence it needs with suppliers.

Output. An EIP can be used to clarify or obtain any item of information. However, in the case where an EIP is used as the starting point for a PS-IPC, the requirement is for a list of (sub) assemblies, general arrangement drawings/circuit diagrams and a Recommended Spare Parts List (RSPL)—which must define to drawing Issue No. Level[6]. The RSPL is the starting point for Ranging and Scaling (R&S).

Birth of an Allowance

Ranging and Scaling

Ranging and scaling is the process whereby the identity and quantity of the items that are required to support an equipment is calculated. For 'small' equipments the equipment supplier is required to make a judgement as to the range and scale of items that will be needed:

(*a*) For routine servicing/preventative maintenance by Ship's Staff, scaled as appropriate to one equipment in any period of 90 days of vessel operational time. To be carried on board.

(*b*) To support one equipment for two years. To be in addition to that at (*a*) and held ashore.

(*c*) To recondition ten equipments to 'fully serviceable'. To be held ashore.

If the suppliers' recommendations have been obtained through a contract on an LSBSC then a Responsible Engineer of that contractor vets, and adjusts if necessary, the recommendations. This activity is intended to take account of the operating situation of the equipment, as well as to act as a quality control on the supplier's submission. For 'large, expensive, reconditionable' equipments, an assessment of the stock of the complete items that are required to fill the spare-and-overhaul loop is required.

Difficulties. The procedures used to range and scale components to support a New-to-Service equipment are based on:

(*a*) Data provided by the manufacturer (on the RSPL), using no particular method, often in complete ignorance of the operating environment;
(*b*) An Upkeep Code provided by the equipment sponsor, which defines the 'when, how and who' with respect to the reconditioning of the whole equipment and its major sub-assemblies.

Ideally a Planned Maintenance Schedule and/or Upkeep Evaluation may also be available, but in practice these are produced too late to be used. If any Reliability Studies are conducted (by the manufacturer) during equipment development then it is presumed that the manufacturer has made use of such studies to derive his RSPL.

And what of the R&S of equipment already in service, when it is used in a new application? In theory the R&S should be reconsiderd in the light of a different Upkeep Policy. In practice this is too difficult. After all, the policy is one IPC *per equipment*, not *per application*.

There have been no significant recent changes to R&S practices, but there has been a decline in the buy per equipment, due to the contractorizing of the Dockyards. Upkeep Codes have been redefined in the area of the 'when' and 'by whom'[7] to cater for less 'U x E' (provided by DGST(N)) and more 'Refit for Ship' (provided by the refit contractor). DGST(N) effectively ranges and scales for the overhaul of equipments where he places the contracts for such activity in the course of providing Contract Repair Support Stock.

The Effects of these R&S procedures can be measured using Equipment—Related Stores Usage Information (ERSUI). A recent study[25] concludes that either a saving of £M10 per annum could be made across the surface fleet by reducing stock (and the manpower to look after it), or the accuracy of R&S could be increased by more than 17%, for negligible expenditure, by using operating experience to 'close the loop' and amend PS's/E Lists.

Output. The end result (of R&S) is the numbers in the allowances columns of the Spare Parts List for Codification (SPLC). In parallel with the R&S activity are the Codification and Initial Buy of those items which are not already in the DGST(N) inventory.

Codification

New-to-service items identified by the R&S activity as being necessary have to be Codified, bought, and introduced into the DGST(N) inventory. When the NSNs are available, the items may be delivered to DGST(N) and the IPC and PS can be produced. Codification is undertaken by the cataloguer under a Royal Naval Codification Agency (RNCA) contract which gives him 90 days to do the job, and pays him by the line entry.

The prime object of a NATO Item Identification is to establish the identity of an item by an enumeration of the physical and/or performance characteristics which render that item unique and reflect the true item of supply concept[8].

Difficulties. Codification is an exacting procedure which requires detailed information, the provision of which suppliers do not always see it in their interests to supply.

RNCA has no direct responsibility for the procurement function and therefore any action taken to establish identification by true manufacturer and reference is without prejudice to any procurement policy other MOD branches may recommend[9]. The main equipment supplier produces source control drawings to indicate in specific technical terms the identity of a 'bought-out' item that is required to be purchased from specified sources, and that may be required as a spare to support the guarantee. These drawings may form part of the procurement specification for the supplier when ordering from sub-contractors. There is plenty of scope for such drawings to frustrate, either

deliberately or coincidentally, the codification process. Firms with vested interests (all of them) may wish to evade the use of British Standard, Def. Spec., or Ministry Spec. items on the grounds of cost or otherwise . The MOD aims to purchase items which were originally 'bought out' by an equipment supplier, direct from the supplier's source. Although the equipment manufacturer's resistance to this may be acceptable in some circumstances, e.g. when special operations or tests have to be performed on the item before use, there is usually no good reason why MOD should not buy direct. Due to the calculated manner in which equipment suppliers use their own drawing reference in spares lists etc., the true manufacturer's reference and identity is lost, often to the great concern of the item manufacturer! On occasions copyright has been alleged to have been breached.

Whilst not part of the Codification process, items are allocated Management Codes—which define the Inventory in which the item will be held—at the same time. As soon as the NSN is available the item supplier (who by now has the order for the hardware and is waiting for the NSN before it can be delivered) is informed. It is not unknown for the relevant Inventory Manager to disagree with the Codifier's assessment of the Inventory allocated, too late to divert the hardware. Furthermore, there are difficulties caused by the fact that allocation is based on function, rather than construction—hence the former allocation of D86 Machinery Control System PECs to Eaglescliffe, rather than Copenacre (a situation which has been changed).

The Effects of the above difficulties—delay, duplication and confusion are apparent, but the true origins are not always recognized. It can, for example, take a very long time (years) to produce a large SPLC, and yet Codification only takes 90 days. What is not always clear is that it is the demands of Codification that require the information, and that gathering this information happens before codification starts.

Contractors are paid cost-plus to gather the information, but on a (fixed price) line basis for codifying. The process would benefit considerably from better communication between the MOD Contractor managers, and the equipment Sponsors and/or Users, to:

(*a*) question the requirement for, say, the last 10%—bearing in mind the flaws in the R&S procedures defined above;

(*b*) put off the items that are actually required, for later amendment action to the IPC-PS.

The whole process, from equipment order to support available, will have taken 27 to 54 months. But there is a faster method, known as Initial Procurement By-Pass Procedures.

Initial Procurement By-Pass Procedures

Initial Procurement By-pass Procedures (IPBP) are a relatively recent invention, first used on the T2400 submarine. They comprise Interim IPC-PSs and Cargo Spares. They are only applied to a First-of-Class (where, on average, about 50% of equipment is usually new-to-service), and with DGST(N)'s agreement. As IPBP will affect few Users because of its limited application, it will not be discussed at length. It will not be difficult to appreciate, however, that cutting corners in the early stages produces downstream work, mainly of the re-referencing and re-stocking variety, when the full procedures eventually catch up. This will be particularly relevant to the Cargo Spares, which will not have been rationalized.

Refinement of the Allowance

Creation of On Board Allowances and the Consolidated Allowance List (CAL) is undertaken by DGST(N) from the raw data supplied in PSs. The PS is

produced before the IPC, or the User would be in a position to demand items that CRISP did not recognize. The PS is produced in a consolidated form (one line per Item of Supply) and the CAL is produced in a rationalized form (allowance decided by total item population).

For the first two years of an Item of Supply's supported life, the spares allowances are defined by the PS in which it appears. At the end of this period the actual usage rate will become apparent. Clearly the accuracy of this information will depend on the number of applications, and will be affected by 'running-in' considerations. The usage information will improve with experience, but two years is considered a reasonable first iteration. After two years have elapsed from the vessel entering service, the CAL may be 'sparedexed' (see below).

Sparedex

Sparedex is the process whereby allowances are optimized in the light of User experience. Items have been given Importance and Reason-for-Use (RfU) Codes during the generation of the SPLC, and these are used, in conjunction with usage rate and cost to arrive at a Figure of Merit (FoM) for each item. By arranging the items in FoM sequence a line can be drawn above which items will be included in the OBA. The positioning of this cut-off is determined by a series of dummy (computer) runs which assess the consequences in terms of cost saving versus availability. What Sparedex does *not* mean is a reduction in the number of spares carried, indeed it normally will produce a large increase in numbers of cheap items and a small decrease in numbers of expensive items.

Difficulties associated with Sparedex procedures are many: Firstly, an equipment sponsor may decide to make all items for that equipment 'non-sparedexable' in the belief that R&S procedures produce a more valid requirement than usage figures, or because he does not have confidence in his procedures for allocating correct RfU Codes. This is more a practice with weapons equipment sponsors, where the cataloguer allocates codes, than with platform equipment sponsors, where codes are allocated within DGME by technically competent personnel. Secondly, there are great difficulties assessing item usage per equipment. In fact this can only be achieved (by DGST(N)) where the item is unique to an equipment on the given vessel; this was one of the original reasons behind the collection of ERSUI (i.e. Equipment Related) data. Thirdly, the procedure allows fleet-wide changes of policy which can lead to imbalances within inventories. As DGST(N)) finds he has an unexpected demand on some items and an overstock situation in others the accountants are likely to insist on disposal of 'overstocked' items. Fourthly the usage rates are obviously peacetime-based, and a rule-of-thumb that wartime consumption will be double peacetime rates has to suffice when push comes to shove.

The Effect of these difficulties is to undermine the effectiveness of the Sparedex procedure. Making an item non-sparedexable has the effect of increasing the impact of the procedure on the other items. Unbalancing the inventory demand has caused 'fudge' or 'smoothing' factors to be introduced which limits the effectiveness, but the biggest problem by far is the failure to relate item usage to equipment. A fleet-wide rate of usage is calculated and this rate is used, in effect, to amend the scaling for all equipments that have that component as a 'sparedexable' item. Consequently vessels that have a high usage rate may have their allowance reduced, and vessels that have a low usage rate may have extra added.

ERSUI shows that Sparedexing a CAL offers a maximum of 10% improvement in item availability from 45% to 50%. There is clearly plenty of scope for further improvement.

Recent developments. Sparedex procedures are constantly under review; the subject is a statistician's delight and trials, both on paper and actual, are always in hand. One of the more obvious possibilities is direct access to ERSUI (held on NESS 1) by CRISP, but this will have to await development of the Naval Logistic Information System in, say, ten years time. In the meantime attempts are being made to operate Sparedex on a 'Class' and even a 'Ship' level basis. The recent developments that currently impact on the User, however, concern Land and Load lists, and Class Items.

Land and Load lists are produced as required, such as after refits or every six years, in order to define the differences between the latest version of the CAL, i.e. taking into account latest Ship Fit Definition (SFD) and the version with which the vessel is working. One unfortunate effect of Sparedex is that the addition or removal of one item has a ripple effect on the items with a lower FoM, and consequently huge listings are generated which largely amount to the requirement to adjust the stockholdings by one or two per item. The listing has always been advisory but the procedure has now been revised to delete such minor amendments.

Class Items were items that were being added to vessel's CALs on the basis of the items having been ordered at least twice per class, and costing less than £300. This was seen as a very useful improvement to spares availability, and the items proved to be in popular demand. Unfortunately the practice has been stopped, because the items were the subject of special treatment, i.e. were added to sparedexed CAL, and the continuing requirement for any item was not clear. These extra items were in effect 'rogues' which called for too much administrative effort, because there was no known basis for the requirement. Users therefore need to be aware that they will have to follow recognized procedures (see later) to have such items included in the CAL in future.

Output from the Sparedex process should be a (slightly) more effective CAL in terms of spares carried per equipment fit. However Sparedex can do nothing to help if the equipment fit is wrongly defined, i.e. if the SFD is incorrect. The SFD is an output from the Master Record Centre (Ships) (MRC(Ships)).

Maturity of an Allowance

MRC(Ships) Vessels

The MRC(Ships) assumed responsibility for SFD for Type A spare gear hardward purposes on 5 November 1985 (for those vessels for which it catered) and this responsibility was extended to cover the distribution of IPCs in July 1987. For vessels not catered for by the MRC(Ships) the responsibility for SFD remains with ME412 in Bath.

The difficulties associated with maintaining an accurate SFD have not been changed by the fact that the records are kept on a bigger computer than before. If the procedures that are necessary to keep the record up to date, such as feedback from refitting authorities for example, are not followed, then the record becomes inaccurate. The resources allocated to the MRC do, however, make it likely that the record is more accurate than when it was a low priority by-product of the IPC-PS production process. The effect of an inaccurate SFD will be an inaccurate CAL and IPC distribution.

The final stage of the change-over of responsibility for SFD was the ending of publication of current applicability listings in IPCs[10]. As these were as much as three years out of date, and therefore only misleading to the User, their abolition was overdue. Users should not be misled into believing that any such listings as still exist have any claim to accuracy.

Non MRC(Ships) Vessels

Type A vessels for which MRC(Ships) is not responsible, such as submarines, TON Class minesweepers and survey vessels, still have their SFD defined as a by-product of the IPC-PS process though MRC(Submarines) should be in a position to take over for new SSBNs and T Boats before long. A Ship System and Equipment (SS&E) Listing is maintained for these vessels, and is available for Users on demand from DGME(ME 410). The information is reflected in the Class Listing of IPCs Applicable, which is distributed every six months. The SS&E List is essentially a report generated from a database maintained as record of actions taken in response to RNEICs. It is a management tool, and is not designed for any other use.

Compared with the MRC(Ships) Database, the SS&E List is, and will remain, very limited in content and accuracy. It does no more than catalogue IPC-supported equipments, arranged by system. It does not, for example, give the DGST(N) equipment Scale identification. As for accuracy, the SS&E List input is restricted in scope and therefore there is limited opportunity for detecting ambiguities in information supplied.

Over recent years, the SS&E List has evolved from a hard copy listing which was used to update a computer record on an occasional/as required basis, to a computer database which will produce an up-to-date print-out on demand. As far as the User is concerned the result is a much quicker response to a request for a print-out.

Technical Support

Technical Support for an allowance is the responsibility of either the equipment supplier, the shipbuilder, the SSC Ship Section or the DGME specialist section[11], depending on who was the original sponsor and the stage in the life cycle. During production of the PS a Production Officer Code is allocated to the equipment[6] and to each new item of supply, identifying the DGME section that will provide through-life technical support.

The least demanding management activity in an allowance's life cycle is to decide to have it created, either by introducing an equipment as an Embodiment Loan Item or by permitting a Shipbuilder to introduce it as a Shipbuilder Supply Item. It is then necessary to ensure the requirements are met—basically that all support actions have been taken, with supporting paperwork, in order to shift responsibility along the chain.

There are so many ways that the intent of the previous two paragraphs can fail to materialize that it is verily a case of being easier to drain the swamp than to avoid the crocodile. The fact that support is rarely seen as 100% means that responsibility tends to meander rather than pass smartly from one agency to the next, and the fact that an item of supply is the responsibility of a Production Officer who may have no responsibility for the equipment in which that item is causing concern, are the unsubstantial building blocks on which this edifice stands.

The effect of these organizational shortcomings on the User is considerably less than might be expected. They must result in internal inefficiency, and probably in delays, but rarely seem to be responsible for lack of operational availability of vessels. Certainly the DGST(N) technical section at SPDC Eaglescliffe solve a lot of problems, perhaps the rest of the answer lies in Storob?

Old Age of an Allowance

The older an allowance is, the more it is likely to become obsolescent, and the more difficult will it be to find someone interested in its well-being. There are

many problems that may occur during the life of an allowance, and the longer it has been in existence the more difficult will they become to resolve. If the solution in the past has been a modification to the equipment then there are likely to be inaccuracies in the CAL, as accurate SFD with respect to modification states does not yet exist. Efforts are being made to improve this and some Users will already be on the six-monthly data update cycle which is started by the Surface Flotilla Engineering Data Centre before a convenient refit. If the solution was an A&A, then the CAL is more likely to be correct.

An allowance dies with the demise of its final application. It is extraordinarily difficult to ascertain this event. Since it does not, by definition, affect the User, it will not be discussed further.

Changing an Allowance

It is clear from the foregoing, that there is a logical sequence of steps to take if an item of spare gear is not 'on the shelf' when required, viz:

(*a*) Check that it has an allowance in the CAL. If so, order stock. If not, then

(*b*) Check whether it is in OBD II but has been 'Sparedexed out'. If so, consider raising a 'Sparedex' 2022 for a Marine Engineering Spare[15] item, supported by a letter for a Marine Engineering Equipment[16] item. If not in OBD II, then

(*c*) Check MRC Print B3 to confirm that parent equipment is recorded as fitted in the vessel, if not then inform MRC of the error and order temporary stock until error is corrected and acted upon. (It is assumed that the IPC has somehow been obtained, or the item could not have been identified in the first place. If there is some doubt as to the availability of an IPC check MRC Print A6–G for a 'Y' in the 'IPC issued' field).

(*d*) If the equipment is known to have been recently introduced into service check that it has a scale identifier, which will indicate that it is (DGST(N)) supported. If it does not, then the equipment is still the responsibility of the Sponsor, and the cavalry will take a little longer to arrive.

(*e*) If the equipment is recognized by the OBD as fitted, but the component required is not listed then it has not been ranged and scaled for on-board usage. Consider whether the requirement can be overcome by other means, e.g. using next higher or lower item. If not, and the requirement is likely to be more than a unique occurrence, then raise a S130[17], and a 2022 recommending a change to the ranging and scaling and hence the scale allowance. If it is convenient, first discuss the matter with your Spares Coordinating Officer at Foxhill (ME410).

Future Developments

It must now be apparent that the provisioning of spares is a multi-faceted process and that, even without considering 'grocery' matters, there are so many different aspects to be considered, and therefore so many agencies involved, that the major brake on developing improvements is the difficulty of co-ordination between these agencies.

Changes, and hopefully improvements, that are made to the process of establishing and maintaining an allowance are therefore normally made as the result of one of the agencies concerned aiming to improve the efficiency of its own working practices. A broader perspective is required if further progress is to be made. More of the agencies responsible have to be brought within one authority at the lowest practical functional level of operations, and they must

not be divided at the highest level, e.g. between the Controller and the Chief of Fleet Support. Optimists consider that the Naval Support Command (NSC) will provide the solution; pessimists foresee it as being a discontinuous collection of obsolescent empires.

Integrated Logistic Support

Integrated Logistic Support (ILS) is in universal use in the USA, as outlined in DOD Directive 5000.39. The basic tool is Logistic Support Analysis (LSA)[13]. The importance of taking account of logistic considerations in the design is well understood, and has been described as a policy of 'designing for support', rather than 'supporting the design'. The use of LSA is already well established within some British companies in the Defence sector, mostly in the aerospace industry.

As defined in DODD 5000.39, ILS integrates the following aspects of support:

- Maintenance Planning.
- Manpower and Personnel.
- Supply Support.
- Support Equipment.
- Facilities.
- Technical Data and Documentation.
- Training and Training Equipment.
- Packaging, Handling, Storage and Transport.
- Computer Resources.
- Some users add extra functions (e.g. the RAF propose adding Logistic Support Resource Funding, and Logistic Support Management Information).

Essentially, therefore, ILS integrates functions which are the responsibility of many disparate agencies which at present are virtually autonomous, meeting occasionally in committee. Although ILS is mainly a Project tool, it cannot be effective if the culture does not exist for it to work. In other words the organization of the NSC will have to take account of the needs of ILS, and ideally will be organized along the same functional lines.

It is not the purpose of this article to discuss ILS/LSA, the ARM data on which it relies, and its potential effect on the User; sufficient for the moment to quote Lt. Gen. Henry Viccellio, Deputy Chief of Staff for Logistics and Engineering, US Air Force—yes logistics *and engineering*—concerning performance in the Gulf 'R&M is the key to making high sortie rates happen. The F-16C costs one fifth as much in spares as the F-111, and half as much as the F-15C. But the same fiscal environment that makes R&M imperative also makes it difficult. Spending now to save later is tough to sell'[13]. He might have added 'particularly to the Navy', because navies do not place a high priority on Logistics.

Logistics is a subject which, for good operational reasons, is much closer to the heart of the soldier and airman than to that of the sailor—after all, the Royal Navy's much-vaunted advantage in flexibility compared with the other Services is primarily due to our relative lack of dependence on the logistic supply chain. The army do no forget that Waterloo was 'a close run thing' because of logistic considerations. As a consequence of this the subject has a much lower profile in the RN, and is generally left to civilians; but also as a consequence of this we have the opportunity, if we are so minded, to benefit from the expertise and experience available in the other Services.

The Treasury and Chief of Defence Procurement (as of February 1991) requires ILS to be progressively introduced (throughout the MOD), using LSA (iaw Mil. Std. 1388) as appropriate[14]. Although the RAF is taking this enthusiastically, the effectiveness of this policy statement within the present RN organizational structures, and with negligible customer expertise, remains to be proven. A study has been undertaken[22]. The term ILS is likely to suffer many pragmatic definitions over the near term, and certainly there will be a lot of work to do before the User sees the full benefit. Nevertheless support considerations are likely to be given an increasing emphasis at earlier stages of projects even if it is only by ensuring that relevant decisions have to be explained, and may not merely go by default.

Conclusion

The User's Journal (*Journal of Naval Engineering*) reflects the limited exposure that the average engineer has to the matters discussed in this article. The last contributions [19, 20, 21] were short letters whose authors talked of the 'pantomine' of the procedures in use, and were clearly of the opinion that the subject could not possibly be made interesting. The last full article[24] was in 1973 and the writer was similarly concerned at the attention span of his audience. It is interesting background material.

The reader who has hung in thus far may agree with the writer that the subject has potential. Because of its breadth, there are almost limitless opportunities for doing it better. In the past, opportunities have passed us by as the MOD, with its ethos of in-house management of detail within strictly defined boundaries, and the contracting-out of broader management studies, has not been best suited to grasp them. Advances in the technology and techniques available (through computerization and modelling) have opened up the possibility of a whole new set of solutions, and the birth of the Naval Support Command provides the opportunity. The challenge is to optimize the solution and to manage the resources used in such a way that they form part of a coherent, *integrated* whole.

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APPENDIX—KEY TO ABBREVIATIONS

A&A	Alteration & Addition
CAL	Consolidated Allowance List
CNSWE	Chief Naval Weapon System Engineer
CRISP	Comprehensive RNSTS Inventory of Stores Project
CSO(E)	Chief Staff Officer (Engineering)
CSO(S)	Chief Staff Officer (Support)
DGA(N)	Director General Aircraft (Naval)
DGME	Director General Marine Engineering
DGST(N)	Director General Stores and Transport (Naval)
DGSW(N)	Director General Surface Weapons (Naval)
DGUW(N)	Director General Underwater Weapons (Naval)
DOD	Department of Defense
EIP	Equipment Information Package
ERSUI	Equipment Related Stores Usage Information
FLUBCON	Fuel, LUBricating oil & refrigerant gas CONsumption report
FoM	Figure of Merit
ILS	Integrated Logistic Support
IPBP	Initial Procurement By-Pass Procedures
IPC	Illustrated Parts Catalogue
LSA	Logistic Support Analysis
LSBSC	Lead ShipBuilder Support Contractor
MDG(N)	Medical Directorate General (Naval)
ME	Marine Engineer/-ing
MEO	Marine Engineer Officer
MRC	Master Record Centre
MSZ	Mod State Zero
NESS 1	Naval Engineering Support System 1
NSC	Naval Support Command
NSN	NATO Stock Number
NSR	Naval Staff Requirement
OBA	On Board Allowance
OBD	On Board Documentation
PS	Provisioning Schedule
R & S	Ranging and Scaling
RfU	Reason for Use
RNCA	Royal Naval Codification Agency
RNEIC	Royal Naval Equipment Identification Certificate
RSPL	Recommended Spare Parts List
SAR	Ship Activity Report
SDN	Service Drawing Number
SFD	Ship Fit Definition

SO	Supply Officer
SPDC	Spare Parts Distribution Centre
SPLC	Spare Parts List for Codification
SS & E	Ship System and Equipment
SSC	Sea Systems Controllerate
WE	Weapon Engineer/-ing