THE MANAGEMENT OF TECHNICAL SUPPORT INFORMATION FOR THE FLEET

BY

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1982 IS INFORMATION TECHNOLOGY YEAR!

So what, one may ask, has that to do with us Poor Souls at sea and ashore struggling to keep the Fleet running in an era of acute financial constraint? The answer is quite a lot, because better support information, readily available in the right place at the right time, without having to search for it, must mitigate that struggle. The 'new science' of Information Technology is defined as the use of technology to aid the processing of information in the work environment.

A New Option

The Fleet in the past has faced some deep-rooted fundamental problems in the support information area, of long standing, that defied solution with old manual methods of managing such information at its shore source. Now we are seeing a revolution in information management with 'data base' computer systems, communicating word processors, microform, video tape, 'electronic mail' and the rest, all in common use in the competitive world of commerce and industry. These are heady and glamorous concepts that are of little use (indeed of positive harm) unless applied wisely with a clear understanding of the need being addressed, and the unarguable advantages accruing to the user, particularly in such a hostile environment as a warship. There is thus good reason why such concepts in technical management have been slow to appear at sea, but very little excuse why they are not widely adopted ashore where the initial action has to be.

In common with many government departments, those HQ activities in the Procurement Executive (PE) and the Naval Staff concerned with technical support of the Fleet have in the past been, and still are, handicapped by slow and ponderous procedures for acquiring modern information technology aids to management, and a general ignorance of what the potential for improvement is. There is a natural and human reluctance to abandon administrative procedures that have their roots in the quill pen and brown docket era serviced by aging messengers pushing wooden trolleys down long corridors. There is, in particular, a chronic lack of a new breed of executive called an 'Information Manager', skilled in information communication systems analysis and well versed in the cost-benefits of the rapidly expanding inventory of equipment to aid him. The wrong, or obsolescent, information-processing equipment supplied against a poor understanding of the real or changing need can be found. The lack of flexibility of the first and second generation 'monolithic' main frame bureau computer services has had something to do with this. There late conversion in some areas to 'interactive transaction processing' mode using a keyboard and screen on individual workers' desks has helped to restore confidence in areas where this has been successfully achieved.

Fortunately the staggering developments in the capabilities of comparatively cheap mini-computers applied to administrative data processing and shorter

procurement times recently introduced for these machines* is presenting all those in Fleet Support with a new option to improve efficiency. This option is being vigorously pursued in many areas, but so often, up to very recently, unilaterally by single line managements with little thought of sharing data bases or transferring data from one to another to add value to the others efforts. Possible improvements in the every-day environment are dramatic—for example, France is seeing a changeover from the use of hard-copy telephone directories to a policy of providing each user and call-box with an on-line visual display.

The Government created 1982 as 'Information Technology Year' to bring home to us all that there are opportunities of major significance to be grasped, and if we do not then we cannot hope ever to be competitive in either war or peace again. In comparison with other countries, our home information technology industry suffered an adverse balance of payments of £300 million in 1980 and that is projected to grow to £1000 million a year by 1990 unless there is a radical change of attitude and emphasis in the production sector. Such change of attitude and emphasis is every bit as important to the Navy and its support processes as to the civilian sector, and it is to that change that this article is dedicated.

Some Common Factors

A fundamental requirement for any Ship Support Agency ashore is to know of what any particular ship they are addressing is made. This is of crucial importance to the stores organizations, who get their information from a variety of agencies for whom such definition is a way of life—those that compile IPC's, 'E' lists, and provisioning schedules. To be able to match the right technical publications, test schedules, maintenance schedules, and drawings to the exact material state of a ship is a natural requirement for ship's staff, FMG's, dockyards and HQ staffs. Such matching has traditionally been a problem for two main reasons:

(*a*) Before the Defence Review, change in the material state of ships was endemic, both by A and A and modification procedure, with far-reaching consequences. The news of those consequences was not always available in time to all that needed it. Very often the inventory of support information and stores on board a ship did not catch up with the reality until well on in a commission, despite constant effort by the shore agencies concerned. The main reasons for this state of affairs lie in the sheer complexity of the manual information exchange process, the many shore agencies concerned, and the split in accountabilities for the support function between Fleet, Procurement Executive, and CFS. Such split accountability is particularly evident in the management of high value and complex UxE and depot spare machinery (DSM) assets where the modification state of the asset is important to its subsequent support on board ship. Such a situation is particularly evident in the ship equipment area and a prime example of this is diesel engines. Through-life accountability for most aspects of a particular mobile asset inventory in the Army, RAF, and Naval Air Command is usually centred on one agency, with correspondingly fewer administrative information exchange problems. The centring of the tri-service through-life accountability for helicopter engines on FONAC is a particular illustration of a good management system.

(*b*) Effective through-life support, based on a clear understanding of a ship's equipment fit and of the support requirements of that fit, starts at

*CCTA Computer Circular 111

the shipbuilder as the place where it is all got together as an entity for the first time. For the supply of a ship's inventory of stores, such a total and detailed view needs to be available to DGST(N) two years before ship delivery. That it never is, to the extent that all first-of-class or first-of-batch ships delivered in the last few years have suffered severe initial shortfall. Apart from the complexity of the Ministry of Defence processes mentioned above, common both to the management of change and for new constructions, there are a further set of problems that bedevil new design, new ships, and new equipments going into them. These can be distilled into two broad groups:

(*i*) Problems attendant on the screening of design information to extract through-life support implications and act on them in time.

(*ii*) The difficulty of obtaining assurance from system and equipment manufacturers that what they are supplying against a shipbuilding contract is what was ordered and, if not, what the differences are, again in time to act on the resulting information.

Much of the problems in (*i*) and (*ii*) above lies in human nature and commercial expediency. Shipbuilders do not order equipments any earlier than they need to so as to conserve both cash flow and storage space prior to ship fit. This is usually too late to supply the Ministry with the configuration assurance they need. There is no profit in expending more resource than necessary on distilling through-life support information out of shipbuilding production information since the build contract never has through-life contract implications as well, unless some very clear and deliberate clauses are put in allied to an equally clear profit generator. There is usually a greater profit margin in cutting steel than in cutting paper on a Ministry contract. British shipbuilders have traditionally seen their task as producing ships to be supported by someone else (the first owner) and, until recently, have never seen the potential of profits in product support. (Unlike for instance the car industry, where the first sale is often a 'loss leader' to be recouped by a captive clientele with spares sales for the next ten years or more). This latter view may be illustrated by the fact that there is not a Product Support Director on the board of British Shipbuilders or its subsidiaries. The capturing of 'configuration definition for through-life support' is a down-stream activity from design, sometimes looked on in shipbuilding design offices as a menial task of little consequence to the main stream task of production—and even rewarded with a lower salary structure to rub salt into the wound. All such things have produced in the past an atmosphere unconductive to dynamic results for the through-life owner like MOD, however much we may wish it. Latterly, enlightened management in British shipbuilding has seen to it that support activities get a better deal and such benefits accruing are already being felt.

The Way Ahead with Fundamental Problems

The foregoing considerations have been addressed to the main areas of concern—the compiling of an accurate, timely, and relevant definition of what constitutes the 'supported ship' and its through-life support requirements on initial build (as distinct from information needed actually to build it) and, secondly, the requirement to keep that record up to date on material change through-life, and make that record 'visible' in a timely effective way to all that need it to do their business cost-effectively.

If improvements are to be striven for in these two main areas, they must be matched to improvements in the way people go about their Fleet Support business, particularly in the way that support information 'copy' is handled again in a cost-effective way with ever-squeezed resources. The key to all

things (unlocking doors that have remained obstinately shut over the years) is the Information Technology (IT) now available to us, coupled with an organization that is both capable of, and willing to, exploit it. Therein lies the rub: it is the organization that needs to be sorted out first. Very fortunately some shortcomings have been well recognized over a long period and strong steps have already been taken to put our house in better order.

Some years ago, in recognition of then current problems, a series of high-level studies into support were convened under a Material Support of the Fleet (MSOF) Steering Group consisting of the Directors General Ships, Weapons, Stores and Transport, and ACFS (later to be DGFSP&S) under the latter's chairmanship. These studies were instrumental in the achievement of much good work across a wide front of co-ordinated effort; it was therefore decided last year to formalize and continue this activity as the Naval Engineering Support Policy Steering Group (NESPSG) with the original membership plus Chief Executive Dockyards and Director of Engineering Support (N). To be included in the new group's area of interest was the steering of support information systems policy and requirements. The group met formally for the first time in December 1981.

Whilst not removing the fundamental nature of the division of responsibility for support engendered by the PE/CFS/Fleet organization, this steering group has the potential to smooth over the problems of a 'cake cut this way' and introduces greater elements of co-ordination, particularly as far as the area of support information systems requirements is concerned. It has been proposed that the group's brief in this area be discharged by a specific number of nominated Directors who have 'Support Information Management' functions within the terms of reference of the line managers reporting to them, all acting in some formalized concept. There is thus introduced the concept of a Group of Support Information Directors drawn from all organizations interested in Fleet Support and serviced by a corps of 'support information managers' working to them as part of normal line business.

These 'Information Managers', mentioned earlier in the article, are people with a new grouping of skills now appearing in modern commerce and industry. They are the people that know about, and can exploit, modern information technology on the one hand and on the other are firmly grounded in the practicalities of the every day task addressed and can recognize the needs of the information management systems involved. They are people in middle line management who have additional Systems Analysis skills, coupled with up-to-date knowledge of how to go about business in the most cost-effective way. Every executive engineer in the information communication field needs to be one of these people, bringing a professional and flexible approach to a unique grouping of traditional specialist disciplines. Marine and mechanical engineers finding themselves so involved for the first time, as is often the case in Fleet Support, need only remember that they have been trained (or should have been) to have a total systems approach to problems and to keep an open and enquiring mind. Knowledge of modern information technology's potential can be learned. Attitudes of mind are more difficult to change. It is heartening therefore to see such people emerging (uniformed and civilian) in the Naval Service, even if only by force of circumstance and appointment and not from a deliberate training policy.

Some Examples of Present Initiatives

Examples of this successful blending of common sense engineering, systems analysis, and data administration can be seen in the small administrative computer systems now addressing tri-service helicopter engine management at FONAC mentioned earlier, and another to manage submarine maintenance

systems and data feedback at FOSM Gosport. Both exploit the potential of inexpensive mini-computers, and direct input and output of data by visual display to the desk bound operative. It is only a small step to couple the data organizing ability and disc storage facility of these machines to word manipulation, and we have a word processor that can communicate text and data to a similar system at a remote site, thus linking a geographically dispersed system typical of naval technical support to one common data base in a cost-effective way, allowing single responsibility and effective management.

Whilst there will always be a place for large and expensive main-frame computers with their capacity for massive data manipulation and storage, the growth area as far as individual workers in Fleet Support are concerned has got to be in well chosen, properly analysed small computer operations giving an 'intimate' and 'user friendly' service to the individual without his having to call on an army of data preparation, data input, and software management experts in the course of his normal transactions.

An example of a successful blend between the massive main-frame system and the 'intimate' personal administrative computer is the CRISP-OASIS initiative. CRISP stands for 'Comprehensive RNSTS Inventory Systems Project' and concerns the updating of DGST(N) computerized stores accounting processes ashore, utilizing a federation of three ICL2900 series main-frame computers sited at Eaglescliffe, Ensleigh, and Devizes. These computers will have peripheral 'packet switching' devices and data terminals all over the country to points where stores transactions take place. The main aim of this system is to achieve 'total visibility' of the vast national stock inventory at any time, leading to reduced stocks and cost-effective management.

One of the functions of CRISP is to generate the 'Consolidated Allowance List' of ships' stores, known to most as the CAL or more formally the D1206. Taking the known 'supportable' Ship Fit Definition and its associated provisioning lists for each equipment and system (and the difficulties of obtaining these accurately has been mentioned earlier), computer programs apply 'operational-need' characteristics to each item required for breakdown maintenance. Essentially this characteristic is Benefit divided by Cost. The computer then consolidates (reduces) numbers of common items held, and prints out a CAL in operational essentiality order. This process is known as SPAREDEX III and the result is a SPAREDEX CAL, a sleeker more cost-effective animal than previously supplied to the Fleet. In order to receive and respond to this 'CRISPER' service, automation of the receiving end in every ship is planned.

OASIS stands for 'Onboard ADP Support in Ships' and aims primarily to replace 'SAGA CARDS' with a mini-computer. The computer will be loaded with the new SPAREDEX CAL by magnetic tape transfer direct from CRISP computer output. The account will then be 'live' on board and subject to normal minute-by-minute manipulation through visual display keyboard terminals in stores offices, stores, and workshops. A similar system, developed quite coincidentally, is scheduled to go into all U.S.N. ships, and known as SNAP 2. These will replace all the normal administrative manual and paper processes traditionally carried out on board in the stores area.

The OASIS computer will be a DEC-PDP11/24 in most units of the Fleet and a DEC-PDP11/44 for larger applications afloat and in Fleet bases. The prototype is presently running for software proving, and the first of some eighty machines are planned (subject to Admiralty Board approval) to come to the Fleet starting in 1983. The hardware is about the size of a two-drawer filing cabinet with a typewriter and television set on top, and a printer alongside. There will be three to five 'Visual Display Units' in a vessel of frigate or SSN size.

Although initially put on board for Supply Department benefit to improve efficiency, the advent of this administrative data processor in ships will mark the start of a fundamental change in the way ships' technical departments, particularly ME, conduct their day-to-day administrative affairs, and it is as well to get used to the idea now. Ships' complements are ever under pressure to reduce in size, and automation of machinery, equipments, and systems are hastening that trend. In future, there will be even less time to carry out administrative processes involved with creating, curating, retrieving, and communicating information of whatever form, and this is where the OASIS machine will help with deliberately in-built spare capacity.

Firstly, there is the intrinsic stores enquiry, order, and issuing service to the technical departments. With OASIS, technical staff will key in their stores query or demand direct on their own local VDU. If an enquiry, the computer will immediately be able to reply (in 'real time') whether a store is available or on order. If a demand, the request will be automatically passed to the appropriate VDU stores operator for issue action. For those items not available, the computer will automatically print the necessary stores demand for mailing ashore. This whole transaction is to be conducted on a 'Job File' basis into which the maintainer will be required to key an end use for the store (a particularly identified equipment or system) and why he wants it (such things as planned overhaul, minor breakdown, insurance, OPDEF, or whatever), together with calendar date of incident, if of a failure nature. This extra information, apparently redundant to the demand process, is deliberate. Because of the absolute discipline of 'No Job File-No Store' with a computer-driven system, it is possible to have a very much higher degree of data capture on 'routine' equipment failure than has ever been possible before. Armed with the additional information, the computer will assemble automatically 'equipment related stores usage information' (ERSUI) and send it ashore by magnetic tape transfer to the Naval Maintenance Data Centre (NMDC) at Portsmouth without re-keying or transcription on board. This availability, reliability and maintainability (ARM) related system is a logical automated development of the very successful Fleet Trial 'CODE NL' carried out recently by the Weapons Department concerning stores usage data capture from weapon system maintainers in selected ships.

If such automated stores usage records can be related in some way to historical records of system and equipment performance relative to pre-set parameters, a most powerful system for ARM statistical analysis ashore presents itself. The advent of computer-driven 'secondary surveillance systems' of propulsion and hull systems machinery on board gives this chance to capture such pre-set parameters as they occur, carrying out simple data process on them, and passing ARM-significant material to the OASIS-ERSUI tape record on a calendar date basis. For example, on a particular date, the port forward Ventura diesel generator, with 3500 hours on the clock since major overhaul, had exhaust temperature excursions above a pre-set norm and cracked a turbo blower casing requiring a spare replacement: this is the sort of group of facts that could be routinely captured and sent ashore without administrative labour being involved on board. It may not have involved OPDEF reporting procedures.

For the first time, such a system can not only pin point with precision availability 'sore thumbs' routinely, but also ascribe cost to them in terms of the purchase price of the stores consumed. In a limited budget scenario for support, this information is valuable to enable designers to decide where to put modification and redesign effort. The problem may be to make sure that shore managements responsible for design sponsorship do exploit and drive this breakthrough as if it were their very own system on which their lives depended. It is no use providing the facility if it does not patently result in an enhanced

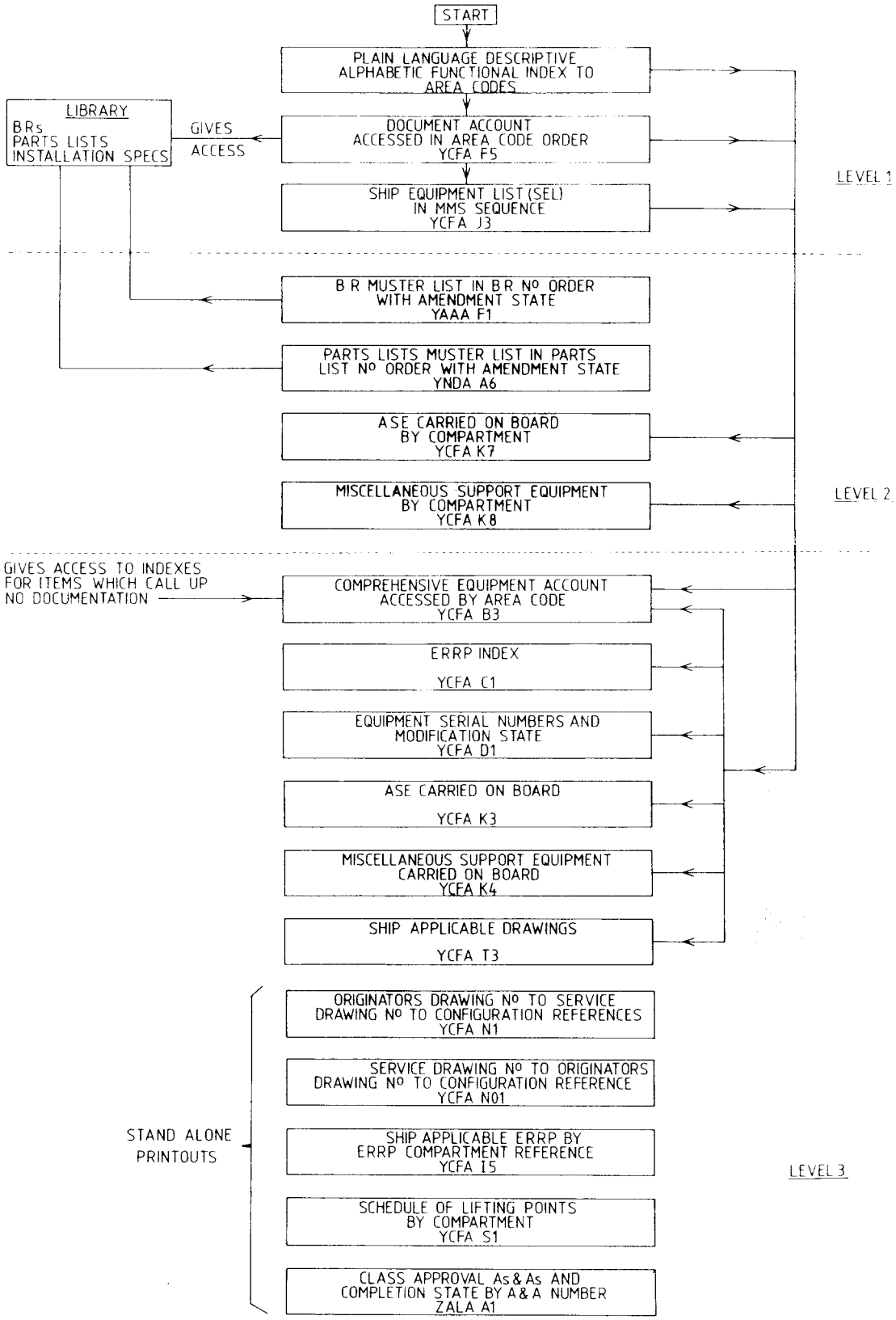

FIG. 1—PRINTOUT STRUCTURE FOR SHIPCIST

Fleet availability. This was the fundamental reason why such previous initiatives as SUIS foundered and this situation should not be allowed to re-occur.

As a bonus, OASIS will have a 'word-processing' software package, enabling the VDU keyboard to be used as an electronic typewriter with memory store and pre-format capabilities. There will be one 'letter quality' document printer as output peripheral which will make the physical production of such things as defect lists over a period of time less of a chore. By exploiting machinery automation, secondary surveillance, and the word processor, such things as ship running returns can be produced semi-automatically.

Comprehensive Indexing of Support Data

It is planned to exploit the existing historical data storage and on-line retrieval capability of the computer's 'Winchester Disc' technology to hold a comprehensive index to support information generated for configuration-managed ships by the Master Record Centre at Messrs Yarrow Shipbuilders Ltd., and later by a similar centre being proposed for new design submarine classes (starting with NDSSK) at Messrs Vickers Shipbuilders Ltd. These comprehensive indexes are being called SHIPCIST for surface ships and SUBCIST for submarines.

In essence, SHIPCIST is a development of the paper printouts of equipment, document, tools, and drawing listings presently supplied. These printouts were never designed to address uniquely the requirements of ship's staff, but rather a 'fortuitous' fall out from the Configuration Managed Build Process. Through Fleet Minor Trial 'TTQ', the Ministry has sought user comment on how best these records be restructured for ease of access, compactness, and general 'user friendliness'. FIG. 1 shows the range of printouts presently available and subject to the trial. Level 1 records are those used in every day business to retrieve support information, level 2 is mainly for muster purposes, and level 3 in deep specialist information that only needs occasional reference. After restructuring and refinement, these records will be supplied to ships initially as computer-derived micro-fiche (COMFICHE) and on advent of OASIS as a magnetic tape transfer.

Microform

Putting information to ships on microform is part of a general overall strategy to change over from hard copy to microform for support documents. Whilst there will be little effort expended in converting existing hard copy to the new medium, the Fleet can expect an increasing proportion of new material in this form particularly for new-design new-construction vessels.

An article by Commander B. J. Austin giving a detailed view of the minroform programme for the R.N. follows this one.

Shore Support Data Networks

If the SHIPCIST concept, as a through-life support management tool, is to be of lasting worth both to ships and technical staffs, base staffs, and dockyards, it must be precise, correct, and timely and subject to regular update. This presupposes that the relevant shore Master Record is in an equal state of grace at all times, something it will patently not be unless the whole Navy Department system dealing with support consequences of material change contributes to that update in an equally precise and timely way with correct new data. It must do this in a labour saving, cost-effective way that does not tie up significant capital resource over and above that already employed.

Thus, an economical total systems concept is required for all existing data

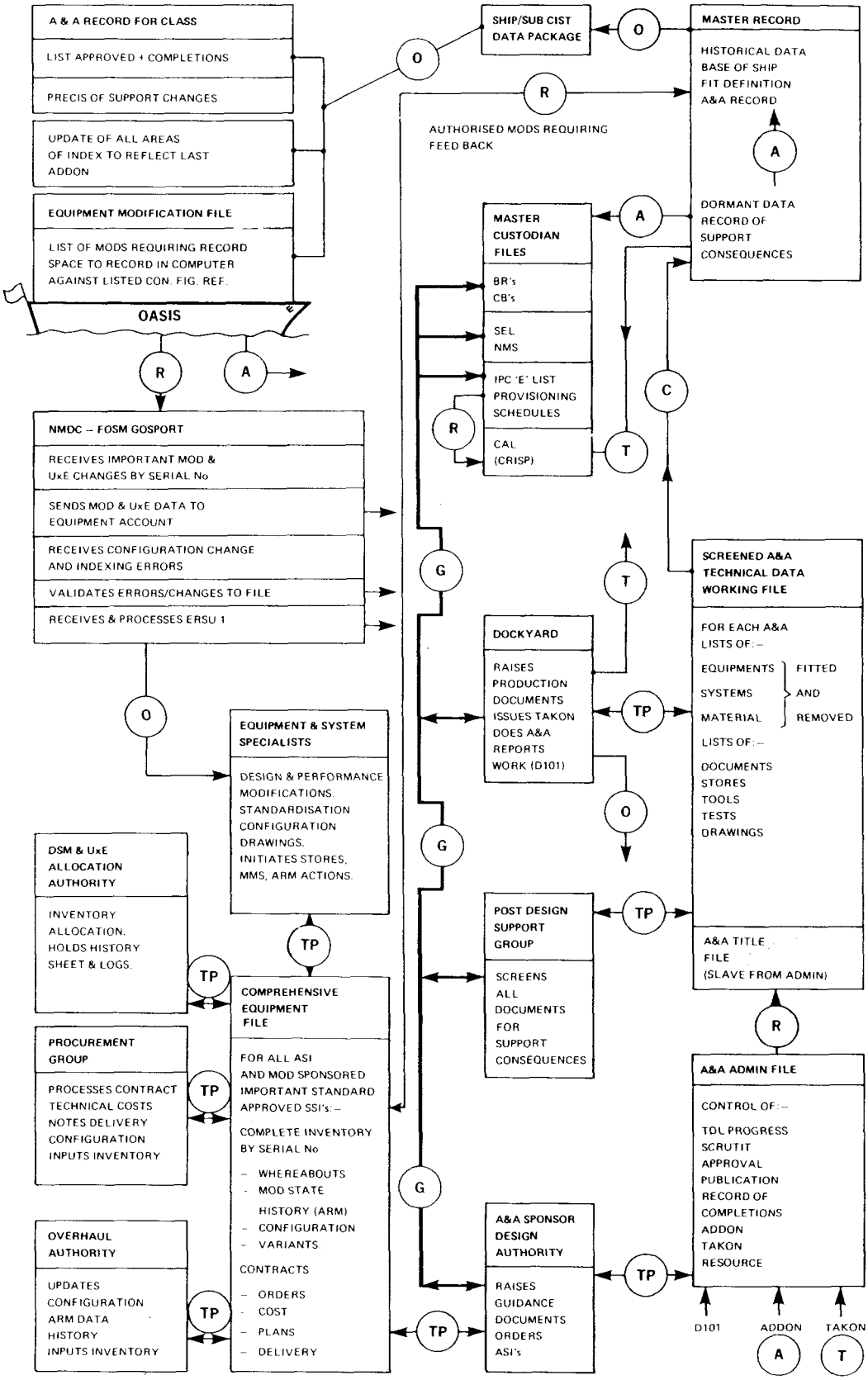

FIG. 2—CHANGE CONTROL SYSTEM FOR SHIPS

systems involved, both manual and mechanized. To implement such a system across directorate-and geographically-distributed boundaries requires acts of faith at all levels and a lot of voluntary co-operation, since there is no single accountable overlord at anything below Admiralty Board level. All this assumes that SHIPCIST is both precise, correct, and timely on initial delivery of the ship, and the difficulties of achieving that in the context of Ship Fit Definition have been highlighted earlier.

One of the most important concepts of a multi-directorate system like this is that there should be an identifiable 'owner' of every piece of data in the Master Record, with that 'owner' specifically responsible for its accuracy throughout the life of the vessel. These owners are called Master Custodians, and the ADP facility on which the data they 'own' is curated is called a Navy Level File. Getting people to accept responsibility for ownership can be a problem.

Notwithstanding all the difficulties that seem to be in the way, such a total system does exist and, like the British motorway system, is in a continual process of build and rebuild. Also on the same model essential links are missing, it may never be complete and may never be free of bottlenecks, but it works now in its fashion with the Type 22 frigate and there is both flexibility and necessary redundancy in the information paths. The traffic gets through somehow.

To illustrate what is involved in creating a continually moving 'data platform' of this sort, FIG. 2 has been drawn. This originally covered the whole end of an office wall, so is essentially simplified for this article. It covers the handling of the Master Record to cover the through-life support consequences of change by A and A on a ship level and change by modification procedure at equipment level.

FIG. 2 is a composite of four different information management systems presently existing. These are split between surface ships and submarines, and within that division further elements of sub-division between 'Platform Systems' (material largely design sponsored by DG Ships) and 'Weapon Systems' (material design sponsored exclusively by DG Weapons). Whilst all information management elements shown in the diagram exist somewhere in the Naval Service support area, only some exist in all four sub-systems and in some the function is duplicated by different services.

The 'foundation' of the network (shown top right of the diagram) is a computer-driven historical record of Ship Fit Definition through-life. As explained earlier, ship fit definition is more than what most people understand by the phrase 'configuration record' and for the purposes of this article can be taken as the data element structure indexed in FIG. 1. For surface ships, this record has been in course of evolution for many years, separately at Messrs Vickers Shipbuilders and Engineers Ltd. (VSEL), Yarrow Shipbuilders Ltd. (YSL) and Vosper-Thornycroft Shipbuilders Ltd. (VTSL). With the clearly demonstrated potential for efficient through-life update demonstrated by the latest at YSL for the Type 22 Class, this latter Data Base† system, run on ICL2966 computer, has been decided on for all future surface ship classes, and retrospectively applied as far as practicable to existing classes first built on VSL and VTSL systems. It is also hoped to apply the principle to LEANDER Class ships surviving the Defence Review. Apart from the Type 22 Class, the Master Record at YSL now contains Type 21 Class and Batch I type 42 records. The remaining Type 42s, BRECON Class, and INVINCIBLE Class are

†The term 'data base' is generally taken to mean a non-redundant set of data so structured that individual applications draw from it, and update it, but do not themselves constrain the structure or its content. In practical terms this means that however many times a particular element of data appears in different printouts, updating it in one updates them all. This is in marked contrast to conventional data file structures of older computer software programs.

planned to follow as resource becomes available. The facility at YSL is now generally known as the 'DG Ships Master Record Centre' and is described as holding the 'Master Record Data Base (MRDB)'.

The submarine service has never had a Master Record Data Base or a Master Record Centre. Such 'platform' records that exist evolved during the ship-building phase as print-outs of drawing and equipment listings, compiled as single computer files with limited cross-references, and have generally not been subject to central update by the shipbuilder. Very many contemporary 'live records' exist addressing single activities like maintenance, technical handbook supply, valve testing, datum pack drawings, supply of IPCs, etc., but they are not centrally co-ordinated against a master definition and thus can all vary relative to each other to some degree. These limitations cause a lot of hard work for support personnel in the submarine service, and by that means they are overcome.

These shortcomings, of long standing, have been recognized by both Ministry and VSL, and it is generally agreed that a Submarine Master Record Centre should be evolved at VSL starting with the new-design SSK project. It has also been agreed that the record be compiled on a dedicated new computer programmed with Data Base software and structured on the YSL Type 22 model. It is to be hoped that TRAFALGAR Class, presently being built under the old arrangements of single data files, can be transferred to the new record in due course. For SWIFTSURE Class, where records never were perfect in the first place and degraded since, there remains a problem which is being tackled by building a limited Data Base system on Bureau West computers from existing records. This is a very labour intensive task which, whilst sowing the seed of major long-term dividends, is inevitably slow.

For weapon systems generally, an adequate 'Master Record' of Ship Fit has existed for some years on DG Weapons 'Profile' ADP system. This record is due to be much enhanced to form the 'bottom line' of a many-tiered data management system, the 'top line' of which is resource modelling. To be run on a federation of new data-sharing mini-computers sited at major DG Weapons establishments, the system is being called 'PROFILE 77'. This system can be looked on as the 'Master Custodian' of weapon data, from which other systems, like the DG Ships Master Record MRDB, can draw information on a routine update basis with data on support consequences of material change.

There are several other 'Master Custodians' of support data originating indexes to material that they generate as part of their everyday management activity. Examples of these can be found in the distribution of BRs on a ship applicability basis, the building of maintenance management systems (MMS) for particular ships, and the provision of a consolidated allowance list of ships stores (CAL). All these separate 'Navy Level' computer-assisted activities must have routine communication links into the various master records to reconcile their view of what the vessel contains with the 'Centre's' view. Some of these Master Custodian files are shown upper centre of the diagram.

Such a confederation of 'Navy Level' ADP files and master records must be kept up to date by reacting routinely to change, and the diagram shows how they should (and in some cases do) do this for two major groups—equipment modification procedure (MODS) and alterations and additions procedure (As and As). Here again the concept presupposes that those responsible at the centre for these two activities have their own 'Navy Level' ADP files on which to record both 'Administrative Design' and 'Support Consequences of Change' details. For As and As, these files, in part, exist. DG Ships/DPT maintains a master record of submarine As and As published, completed (from ADDON signals (A)), taken on (from TAKON signals (T)), changes in

course of preparation (from TDL documents), and the resources required to execute them. This record is compiled in 'batch mode' on Bureau West Devizes (BuWEST) computer. It is due to be enhanced to 'transaction process' (TP) mode where individuals within the organization can key update data direct to the computer via visual display terminals (VDT) and have immediately processed results displayed ('real time' computing). Surface ship records curated by DG Ships/DNE are now being converted to a similar system. PROFILE 77 will have its own record for weapon As and As to control DG Weapons resource, and again there needs to be routine data exchange between these systems forming the Administrative Core of Change by A and A procedure. This 'core' is shown at the bottom right of the diagram.

Perhaps the most important activity in the whole change system is screening guidance and design information originated by the design sponsor and lead dockyard for through-life support consequences of change. This must be centred on a list of material, equipments, and systems to be removed and re-provisioned allied to all the necessary changes to support documentation, drawings, tools, test procedures, and stores. If this data is keyed to an ADP system, the master record can then be updated automatically once the change is either complete or, in the case of stores support, initiated by TAKON. Although perhaps the most important activity, it has been the slowest to develop utilizing ADP assistance.

For surface ships, such ADP assistance is now being provided at YSL starting with the Type 22 Class. In order to effect 'TP' data transfers in real time, VDTs linked to Glasgow have been placed in Devonport Dockyard and at Foxhill, Bath. This system processes both 'weapon' and 'platform' As and As, but the former to lesser depth. Deep-data processing of the technical and support aspects of weapon As and As is planned to be carried out on PROFILE 77. For submarine As and As, the administrative system presently run by DPT on BuWEST is planned to be expanded to include technical details and support consequences of change ready for the day when a Submarine Computerzised Master Record exists.

Even after all these systems are fully developed, there will always be manual and traditional document transfers of design and support information between the various line managements concerned. This is shown as a thick 'backbone' line running up the centre of the diagram.

On the left of the diagram is the Information System addressing control of equipment assets. In ADP terms, the central core of such a management structure is the Comprehensive Equipment File handling both design configuration, production, inventory, and change data. Such a file is essential if there is to be any hope of central recording of modifications carried out in the Fleet. Again, such a central ADP facility needs to be linked to peripheral Master Custodians of data pertaining to their own line management function. Four such are shown on the diagram linked to the record in TP mode for interactive minute-by-minute routine business. The management elements in this network also need to be linked by 'Communicating Word Processors' and FAX facilities for exchange of the hard-copy records themselves. Such a data system also needs to be accessed by A and A design sponsors in order to have up-to-date information on the equipments being fitted, as do the other support data Master Custodians.

Although the need for such a file structure and communication system has been evident for some time to control major equipment assets sponsored by DG Ships, very little progress has been made with the central file since first proposed in 1972. For DG Weapons sponsored equipments however, such a record is planned as part of the 'bottom up' approach of PROFILE 77, although the latter is not as yet (and may never be) planned to curate those

records of completed important modifications that require 'visibility' ashore. Such central equipment modification records on ADP facilities are normal in both the Aviation Services and the Army—the tri-service helicopter engine control facility (TECS) mentioned earlier being an example.

For the majority of equipment modifications in ships, it is not necessary to know ashore whether they have been done or not, particularly those that have no operational, safety, or stores support consequences. For these latter three groups however, the need for a routine and cost-effective system for capturing and curating such data ashore for further action is generally agreed. The submarine service records *all* modifications ashore manually on the general grounds of safety, and this is effected by exchange of signalled data with Fleet units. Surface ships are generally not required to report weapon system modification state to shore unless in special circumstances.

With the advent of central computerized records of important ship fit equipments in the R.N., it has been proposed that notification of those modifications subject to feedback from the Fleet be annotated against the Ship's Equipment List in the Master Record Centre by routine data transfer. Such notification, incorporated with the updated SHIPCIST print-out can be put into ships, firstly as Comfiche and later on as a magnetic tape transfer with OASIS.

The Use of OASIS for Feedback of Modification State from Ships

Taking from the MRDB the configuration reference number (CRN) of all equipments fitted in a particular ship for which modification state feedback is required, an empty 'pigeon hole' matrix can be generated magnetically in the OASIS computer into which ships' staffs can key equipment serial numbers against the provided CRN list, and then alongside the serial numbers the associated mod. numbers that SHIPCIST has indicated need reporting. The shipbuilder would fill up this matrix as far as he could on original equipment delivery, and it would then be up to ships' staff to key in changes as equipment is updated or subject to UxE, in the same way as they do now (or should do) into their Equipment Master File System.

The power of this ADP record comes with the possibility of 'dumping' the whole of this matrix record routinely to the Naval Maintenance Data Centre (NMDC) for collation with other ships records and transfer to the relevant shore Comprehensive Equipment File, an activity without clerical effort being required at any stage.

Once routine transfers of this type are established to, for example, CRISP for those modifications which have onboard stores consequences, the CAL can catch up on the actual update state of the ships' equipments fitted as a norm rather than very rarely as now. This is particularly relevant to DG Ships sponsored modifications, which are not assumed by DST(NS) to be incorporated automatically on publication as they are for DG Weapons modifications.

Other Feedback

This article has so far covered feedback of ERSUI, ARM data and mod. state. One other vital element is the feedback of perceived error in SHIPCIST in 'Fleet Time' either as 'original sin' put into the ship from the Master Record Centre, or as a consequence of some material change that has happended in Fleet Time. This feedback happens now (or should do) as a variant of S2022 procedure, but when OASIS is fitted it is planned that an 'error tape' be compiled as part of the day-to-day business of using the record when some inconsistency is discovered. The error tape can then be transferred along with other feedback tapes to NMDC on a routine basis for action.

Without this closing of the loop, the errors that there undoubtedly are (and

will always be) in a big ADP record will never get purified, leading to degrading of confidence and lack of motivation towards a precise, timely and useful system.

In Conclusion

The desirable features of any information communication system of the type described are precision, ease of use, cost effectiveness, flexibility, timeliness, and 'visibility' to all that need to use the data carried. It would be nice if it were also *simple,* but in a very large corporate activity, widely dispersed, dealing with the depth of detail this one addresses, it never is.

Whilst the Comprehensive Indexing System for support information may not be a Prince of Virtue in all these areas, the framework for a first-class service exists. With heightened political awareness of the potential of modern information technology to render cost-effective improvement, and the application of that potential in a steady evolutionary way, the Navy can have that first-class service, and afford it from the savings in time and effort that result from its use.

The views expressed in this article are those of the author and do not necessarily represent those of the Ministry of Defence.