

TOWARDS MORE EFFICIENT USE OF NAVAL MANPOWER

BY

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INTRODUCTION

Management and Manpower Utilization

$$\begin{aligned} \text{BM} + \text{SM} &= t \\ \text{BM} + \text{SM} + \text{MV} &= T \\ T - t &= \text{MV} \end{aligned}$$

where: BM = Basic Manpower Measurement—a fixed time allowed for a man with a stated degree of skill to carry out a specified task to laid down standards under ideal conditions with all tools and information available, without interruptions apart from those involved in normal relaxation allowance.

SM = Situation Manpower Measurement—a fixed time allowed to carry out additional work. e.g., the removal and replacement of any obstacles, and to overcome the physical difficulties arising from the siting of the equipment in a specific situation.

MV = Management Variable—a variable time which is the result of deficiencies, alterations and interruptions in the arrangements made to carry out a specified task.

t = Task target time.

T = Total time taken on task.

From the above can be derived:

$$\frac{T}{t} \text{ or } \frac{t}{T} \times 100$$

which could be used as indices or measures of managerial efficiency.

It is not at present possible within the Royal Navy to measure managerial efficiency by any direct or objective means. While the Navy does not as yet make use of direct systems of measuring managerial efficiency of manpower utilization, various oblique assessments of the present situation give rise to opinions that managerial efficiency is low rather than high, and that manpower utilization is perhaps nearer poor than good. It must however be apparent that managerial efficiency has a direct bearing on manpower utilization which in turn influences the number of men needed to man a ship. Hence improvements in managerial efficiency could lead to reductions in complements or reduced hours of work.

The fundamental managerial activities are:—

- (a) Gathering facts about resources and aims
- (b) Collating and analysing facts
- (c) Deciding, against a background of facts, the best course of action to take in order to satisfy defined aims.

Making the assumption that naval managers were given a system for planning and controlling the allocation of tasks, a manpower accounting system, and

facts regarding the times needed to perform tasks, it should be a comparatively simple exercise to identify and analyse the components of MV and initiate actions to improve the utilization of the very expensive manpower resources. Improved utilization of these resources in an atmosphere of high motivation should permit:

- (i) The same number of men to perform more tasks than at present
- (ii) A smaller number of men to perform the same tasks as at present
- (iii) Some advantageous combination of (i) and (ii).

In the present-day climate of ever rising rates of pay and a possibly shrinking labour force it is vital to the Royal Navy that naval managers should always be on the alert to improve the efficiency of manpower utilization. The implications of $\frac{\text{work output}}{\text{manpower input}}$ in order to bring about such improvements should be constantly examined.

These improvements will not however be brought about by exhortation; the managers must be provided with the right tools.

THE NAVAL MANPOWER UTILIZATION UNIT (NMUU)

The NMUU was set up to consider some of the manpower problems confronting the Royal Navy, the original study being set in the context of the Leander Class frigates. The Leanders now represent the largest number of potential ship-years the Navy is likely to have for years to come; hence they pose the biggest single ship-borne manpower problem. The object of this study is to define and measure the work load of these ships so that future decisions concerning the use of manpower can be based on measured data. The study covers all the operating and maintenance tasks identified in this class of frigate (see DCI(U)1406/69) and includes among other aspects:

- (a) Identifying in detail the tasks necessary to achieve approved performance standards
- (b) Establishing standard methods for each task
- (c) Assessing skill levels and time factors.

The task of the NMUU as outlined above is very much concerned with the provision of some of the managerial tools needed in the manpower utilization field. In this article it is intended to discuss one such tool, the Job Information Card, its description, production, uses and some of the benefits which may be attributed to it. Although in the interests of simplicity this tool will be discussed in the context of the E2 Maintenance Planning and Control System, the reader will recognize the potential for application in other areas of as yet undocumented and less precisely defined work.

THE JOB INFORMATION CARD (JIC)

The principle underlying the JIC has been in existence for some years and is manifest in Forms S2027 and S2027a, Job Method Cards and Continuation Sheets, which are described in BR 1313, Ship Upkeep Manual, in relation to flight-deck machinery. In this context they are specified for use when the work content of the scheduled item consists of several stages which require independent checks as the work progresses. Other examples of Forms S2027 and S2027a have been in use in the Fleet, certainly since 1962, in relation to the maintenance of weapon equipments; in this sphere, where applicable, the attention of maintenance personnel is drawn to their existence by annotating the foot of Form S2011, Maintenance Schedule Sheets, with the words 'Job methods are associated with this schedule'.

In order that the method information derived from the NMUU study might be made readily available for use in *Leander* Class frigates to gain some early advantage in the more efficient utilization of manpower, the details of tasks, methods, time factors and skill levels were at one time written up in the established Form S2027, S2027a format.

Subsequently, the NMUU were informed that a handbook specification to Joint Service Requirements was being developed by the Ship Department and the Ship Maintenance Authority for the Guidance of Messrs Vosper Thornycroft when producing the Support Documentation for the Type 21 frigate. Joint consultation between DG Ships, the SMA and the NMUU resulted in the Job Information Card, a modified Form S2027, which now forms the basis of the Type 21 Frigate Maintenance Documentation System and has been used since for all NMUU maintenance documentation.

The JIC has a number of pre-printed headings and a number of additional headings which are inserted in the text in a given order, being spaced to suit the necessary volume of written material; the details of the method to be used when carrying out the task follow on from these pre-determined headings as will be seen from FIG. 1.

Thus the JIC becomes a means of communicating information to manager and worker alike, specifying *who* should do the task and *how* it should be done. The JIC will in time be recognized as Category 5 Technical Information complementary to Category 6 Information (Work Schedules) which will set out *what* planned tasks are required and *when* they are to be carried out. Further information on these categories is to be found in JSP 182, Specification for Technical Publications for the Services, which is amplified in the Development Documentation System range of publications.

THE JIC WRITING PROCESS

As explained earlier, for the purpose of this article the JIC is being discussed in relation to the E2 Maintenance Planning and Control System; it is however emphasized that JICs can be written for any other task of the type that, in theory, when so treated will enable the man to complete the job without interruption. At the present time JICs are being written mainly for items of engineering preventive maintenance.

The data required to enable JICs to be written to the specification implied in FIG. 1 are derived from a number of sources as shown in TABLE I.

<i>Source</i>	<i>Comments</i>
Published Material	BRs, CBs, Makers' Handbooks, DCIs, Forms S2021, Forms S2022a, PILs, NS Catalogues, PM Schedules, etc.
Observation	Observe tasks being carried out and identify the need for tasks to be carried out
Experience	Senior ratings draw on their experience of carrying out or supervising tasks; They also draw on the experience of others who have either carried out or supervised tasks.
Scalar Diagrams	The construction of activities scalar diagrams at task level in many cases reveal the task elements that should be carried out; they serve as checks on the overall content of a task and assist in determining the logical sequence of task performance.

TABLE I

JOB INFORMATION CARD		SCHED. No. R6/1A A3	MAINT. OP. No.		
EQUIPMENT TITLE Automatic Surface Plotting Table JYA Series			REL. H/BK. BR 1173 Series		
RELATED MAINTENANCE Concurrently with R6/1A/4M2 Inspect Earth Bonding Straps.			USERS REF.		
ASSOCIATED MAINTENANCE			SKILL	No.	TIME
			REM 2	1	10 Min
JOB DESCRIPTION Check Earth Bonding Continuity			NET WORKING TIME		
<p>SAFETY PRECAUTIONS If overstamped HAZARD, ship or personnel at risk; CHECK LOCAL ORDERS. Under no circumstances must Earth Straps be disconnected before all power supplies are first removed at source.</p>					
2. <u>MANPOWER PLANNING DATA</u>			Hrs.	Mins.	
a. Elapsed Time			-	10	
b. Work Content : Manhours			-	9	
c. Manpower allocation chart - None.					
3. <u>STORES AND SPARES</u>					
None.					
4. <u>TOOLS AND FACILITIES</u>					
0557/AP 6496 Bridge Megger Resistance Tester			(1)		
Test leads with crocodile clips attached			(2)		
0568/940-0856 Crocodile clips (For Test Leads)			(2)		
5. <u>ADDITIONAL HANDBOOKS/BR REFERENCE/DRAWINGS</u>)					
6. <u>SURVEY CRITERIA</u>)					
7. <u>SETTING TO WORK AND TEST DATA</u>)					NONE
8. <u>OTHER INFORMATION</u>)					
<u>JOB METHOD</u>					
1. <u>Prepare Bridge Megger</u>					
a. Remove megger from case.					
b. Put control switch to "Bridge", Range Switch to " $\div 100$ ".					
c. Connect test leads to "Line" and "Earth" terminals and short together.					
d. Balance bridge to find resistance of leads. Adjust megger resistance to add 0.05 ohms to this value.					
					2/.....
Sheet 1 of 2 Sheets		NMUU	ORIGINAL (MARCH 71)		

FIG. 1—THE JOB INFORMATION CARD

The process of writing JICs requires the creation of an environment in which facts are readily available and an inquisitive attitude prevails. The 'fact' part of the environment is established by the creation of a comprehensive library of information which is readily available to authors of JICs, reinforced by close liaison between such organizations as the Ship Maintenance Authority, the training establishments and the Admiralty Surface Weapons Establishment, from whom facts can be obtained and opinions sought.

It therefore follows that the authors need to be people of the appropriate specializations who have a deep knowledge and understanding of the equipments and tasks for which JICs are to be written; these people must themselves be capable of establishing and sustaining the liaison with people in the other organizations.

The 'questioning' part of the environment is established by training people of appropriate specializations in work-study discipline at the heart of which is the concept of critical examination of the problem, by skilful interviewing, observing, charting, estimating and logical thinking.

The first phase in the JIC writing process is to identify and select the tasks for which JICs are to be written which, in relation to the E2 system, is usually carried out at the level of a planned maintenance schedule. Factors governing this identification and selection are the information contained in the SMA booklet on Typical Times for PMS Items and the guidance on priorities given by the SMA and Fleet Technical Staff derived from analyses of maintenance problems and areas of high manpower utilization.

Having made a selection and identified the tasks, the PMS is critically examined for the purpose of bringing to light any inconsistencies, illogicalities, out-of-phase periodicities, nugatory work, etc. This critical examination frequently reveals that PMS items can be eliminated or combined, thus leading to potential reduction in the demands made on manpower and also directly to reduction of equipment down-times with consequent improvements in availability. All proposals which arise from critical examination of the PMS at this stage are submitted on Forms S2021 to the SMA or the Design Authority, as appropriate, who consider the proposals against the background of defect data and current maintenance principles and policies.

The next phase in the JIC writing process is to establish the present method of carrying out each item in the PMS. The method established as a result of observing an item being carried out or by interviewing a reputed expert will be given further critical examination. The purpose of this is to ensure that the best method of carrying out the work is developed, and to determine the resources needed, the time that should be allowed and the constraints that surround the item. In this phase of the process, the task arising from the PMS item is reduced through a scalar diagram to its component elements so that analytical estimating techniques may be used to arrive at the times needed for each step. The proposed method for carrying out the overall task is now examined for logical sequence so that any redundant elements or movements may be eliminated.

Each step of the proposed method is again analysed to provide further information under the following headings:—

- (a) What, if any, safety precautions need to be specified?
- (b) Does the task require more than one man?
- (c) What, if any, difference is there between the work content, i.e., the total man-hours required to complete the task, and the elapsed time?
- (d) What stores and spares are required?
- (e) What tools and facilities are needed?

- (f) What, if any, additional handbooks, BRs, references or drawings are required?
- (g) Is there a need to establish survey criteria, i.e., fits, tolerances, performance figures? This information provides a datum for use in deciding maintenance action in accordance with the agreed Upkeep Policy Code. If and when a deterioration rate is established, survey against specified criteria can be used to decide how soon maintenance action will be needed.
- (h) What, if any, setting to work and test data need be specified? Setting to work and test data are for use after installation of a new or reconditioned unit and would normally appear only on those JICs relating to installation or replacement procedures.
- (j) What, if any, essential information not covered by the previous headings needs to be included to ease the task of the manager or worker to carry out the work efficiently, e.g.:
 - (i) Observance of damage control states
 - (ii) Need for the ship to be steady
 - (iii) Restrictions during flight-deck operations.

Possible improvements in equipment design to reduce manpower demands or equipment down-time may result from this critical analysis: requirements for non-provisioned tools are identified and inaccuracies in publications are discovered. Recommendations for any necessary changes are submitted on Form S2022.

The assembled information is now examined to determine who should carry out the task. At present, skills analysis techniques are rather coarse and imprecise although attempts are being made to develop a matrix approach which would permit a skill profile to be drawn as a result of task analysis which could then be compared with a man profile derived from an analysis of the relevant rating/specialization population in order to facilitate the matching of men and tasks. In the absence of such a tool the assessment of who should carry out a particular task is made by two persons unconnected with the study of the task who draw on their experience of what is currently being taught in the training establishments and their knowledge of the performance and capabilities of ratings in the Fleet; in this way the degree of subjectivity in the assessment is minimized. It has been found in practice that, having reduced a task to its elements and analysed the tools and necessary test equipment, etc., the 'mechanical' aspects of the task can almost always be carried out by a person of lower rate and skill than that traditionally used. Elements of responsibility or data interpretation may however warrant the employment of a rating of higher rate or skill than that required for the mechanical aspect of the task. The level of skill and rate assessed as necessary is taken into account when finalizing the Method section of the JIC.

The JIC writing process, illustrated in diagrammatic form in FIG. 2, is at present carried out within the NMUU to a discipline imposed by the use of a purpose designed set of forms. These forms are part of an internally designed task recording system which sets out the activities of all the people concerned with the production of JICs and ensures that they are correctly aligned with planned maintenance schedules, book amendments and Forms S2021 and S2022.

Once the method content of the JIC has been finalized and written up for the appropriate level of rate and skill, the total of the analytically estimated elemental times is established: these are further treated by the addition of relaxation and policy allowances. These times represent BM, (basic manpower measurement). Because there is a lack of standardization of equipment fit

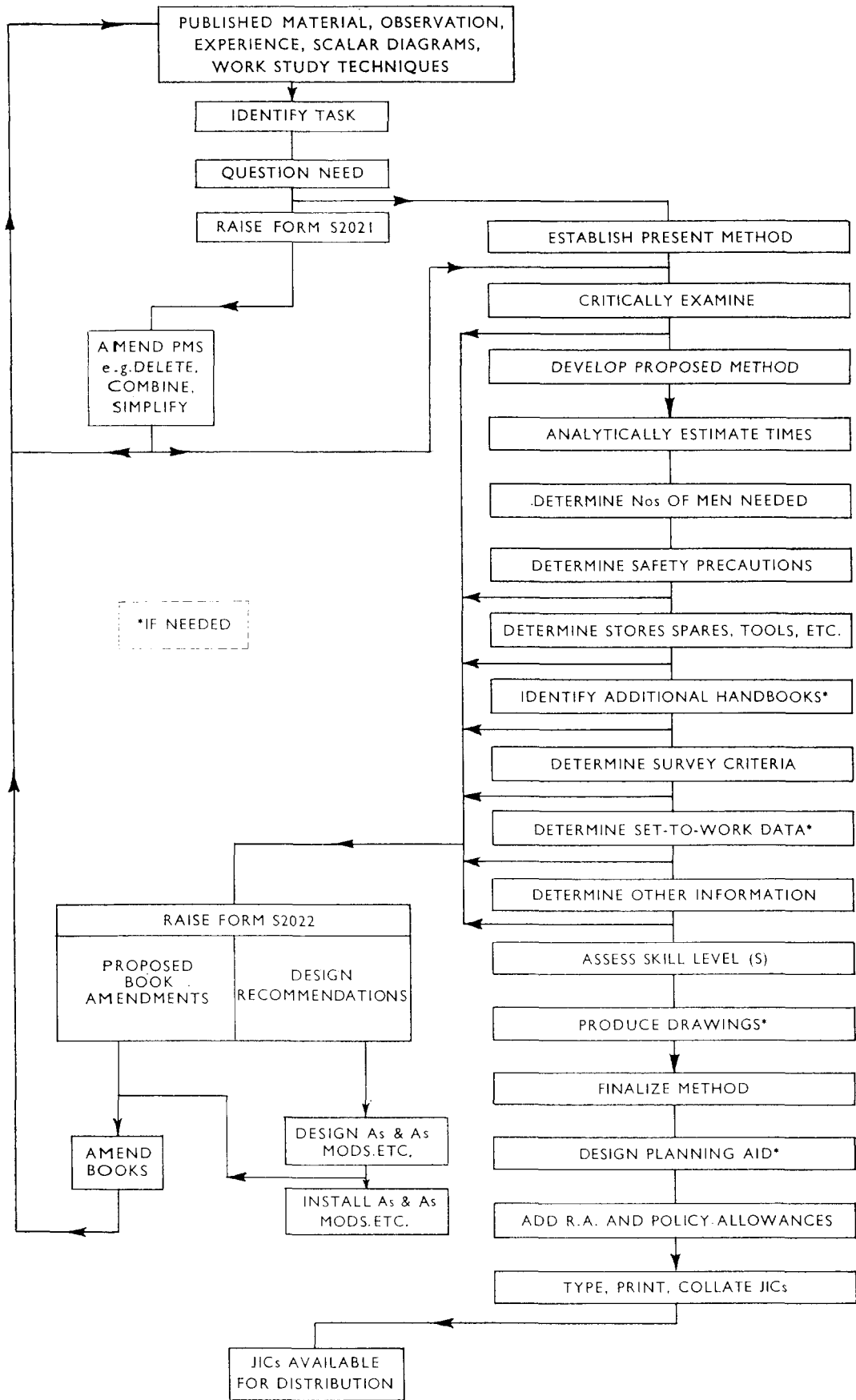


FIG. 2—THE JIC WRITING PROCESS

between ships of the same class it is not at present possible to write JICs or to calculate times for these varied situations; for the present it will be necessary for ship's staffs to produce their own situation methods and estimate their own SM (situation manpower measurement) times.

INSTALLING THE JOB INFORMATION CARDS

As stated earlier the JICs originated by the NMUU are written as the *who* and *how* amplification of the *what* and *when* of the E2 Maintenance Planning and Control System. To date the available JICs have been installed in 13 *Leander* Class frigates and this essentially simple task has been carried out by a small team of NMUU personnel.

The purpose of JICs is to provide additional information to both management and men; this purpose is not achieved until a mechanism exists whereby the JICs arrive in the hands of the right people at the right times. As such a mechanism already exists as an integral part of the E2 system, this with only minor modifications is used as the vehicle in which JICs are installed and used. The installation task in respect of maintenance schedules and items is small as it is only necessary to insert the appropriate JICs in the plastic envelopes in place of the maintenance instruction cards. The installation task for servicing schedules and items is slightly more involved as the E2 system does not at present make use of plastic envelopes or instruction cards for servicing. In the installation of JICs for servicing items, light alloy boxes are provided which house the plastic envelopes containing the appropriate JICs; where JICs have not yet been produced, servicing instruction cards are inserted in these plastic envelopes. The servicing instruction cards are essentially similar to the existing maintenance instruction cards and have printed on them the item extracts from the servicing schedule. To bring the planning and control of servicing items more closely in line with the procedures used for maintenance items, servicing planning sheets are now being introduced in place of the existing servicing plans.

USE OF JICs WITHIN THE E2 SYSTEM

All the information contained in the JIC (See FIG. 1) is necessary to the man doing the maintenance or servicing task. Most of this information is also needed by the management for planning, controlling, co-ordinating and organizing the work programme. In this context the management task is taken as that falling within the authority and responsibility of the Head of Department, Central Planner, Section Planners and Supervisors.

The Management and JICs

In the E2 system the Master Plan, Central Planning Boards, Section Planning Boards and Servicing Plans relate mainly to the maintenance/servicing requirements and the periodicities at which they should be carried out. JICs provide information related to the employment of men. From FIG. 1, it can be seen that the JIC is tied into the E2 system through the PMS Item Numbers, the Equipment Title and the Job Description. The men are introduced into the work system through the specification of skills, numbers and times. Further planning and allocation details are given under Manpower Planning Data. Use of the above information in conjunction with the E2 plans and planning boards should enable the management to achieve greater planning precision, improved manpower allocation and more positive control of manpower resources.

Instances where two or more tasks could with benefit be carried out at the same time on the same equipment or system possibly by people from different departments or sections, or where two or more tasks should be linked together because they are carried out in the same compartment, are drawn to the atten-

tion of the management in the block headed 'Related Maintenance'. This information permits further refinement of planning/controlling which in turn should lead to greater departmental co-operation and co-ordination, improved rates of manpower utilization through reductions in walking times and to a reduction in equipment or system down-times with corresponding increases in availability.

The minimum precautions necessary to eliminate all foreseeable risks to men, equipment, system or ship are specified under the heading 'Safety Precautions'. The JICs are over stamped 'Hazard' where the safety of ship or personnel are at risk. The inter-departmental co-operation and co-ordination which is sometimes called for in the observance of these precautions leads to a safe system of work for personnel.

The resources—stores, spares, tools, facilities, handbooks, drawings, etc.—are listed on the JIC under the headings numbered 3, 4 and 5. Foreknowledge by the management of the availability of these resources allows better overall planning, permits early identification of replenishment problems, reduces manpower wastage and consequently improves the probability of matching intentions and achievements. The allocation of the right resources to the right men at the right time reduces the chance of causing the damage and defects which result from the use of improvised tools and makeshift spares. This timely provision and allocation of resources also leads to greater confidence in the management. Co-operation between departments and managerial co-ordination may develop to a stage where JICs can be passed to the Supply Department for the verification of the availability of resources and eventually perhaps for the making up of resources packs which will be ready for the maintainer before the allocation of the task.

'Survey Criteria' and 'Setting to Work Test Data' are listed under the headings numbered 6 and 7. Such information is expected to appear on a limited number of JICs only. Where survey criteria is provided, it should be related by the management to data already obtained during the course of planned maintenance and used to plot the deterioration and wear rates from which failures can be predicted. This enables spare gear to be obtained and preventive work to be put in hand in a timely manner so leading to greater system/equipment availability and improved manpower utilization. The setting to work and test data will give the management the control data needed to ensure a satisfactory installation or replacement procedure. As well as achieving manpower economies, it also removes some of the frustrations which arise when carrying out the prolonged test runs with numerous adjustments which are required after installing or replacing some equipments thus leading to further reduction in equipment down time.

As it is not always possible to slot all the required information into one or other of the foregoing headings, space is made for additional information in a block headed 'Other Information'. This block is also used to draw attention to the necessity for working together with other departments or sections, to cases where positive supervision is necessary and also to where there is a requirement to report at specified stages of the job.

All the information on JICs is derived during the course of writing the job method. The management should see that these pre-conditions are satisfied if the task is to be carried out smoothly. If the work is allocated to the correct person, adequately supervised and the detailed information given under 'Job Method' is followed, the management is assured that the task is done to a standard method with predictable end results.

The Management, BM, SM and MV

As more and more JICs become available to the Fleet so will the volume of

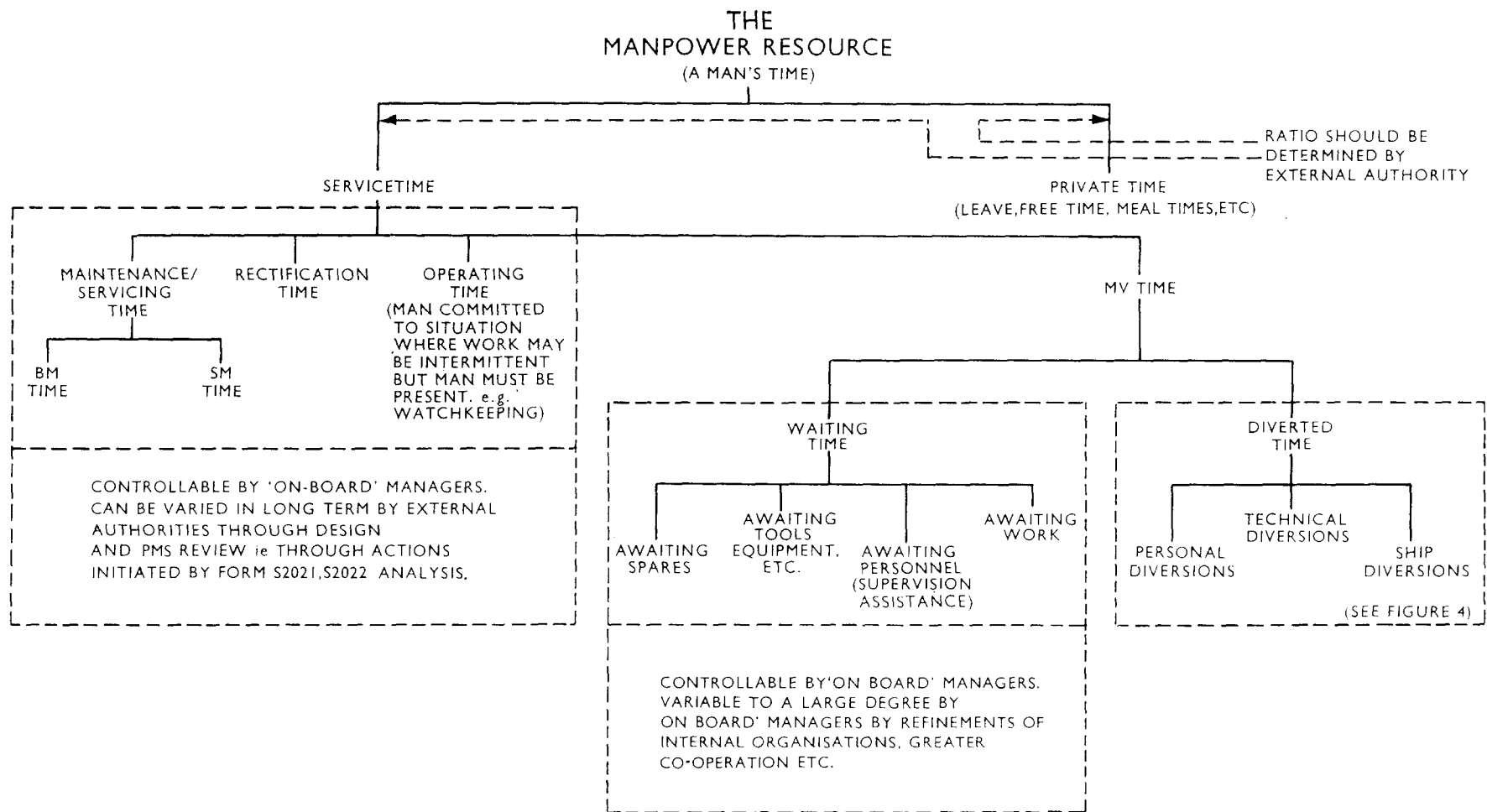


FIG. 3—UTILIZATION OF MAN'S TIME

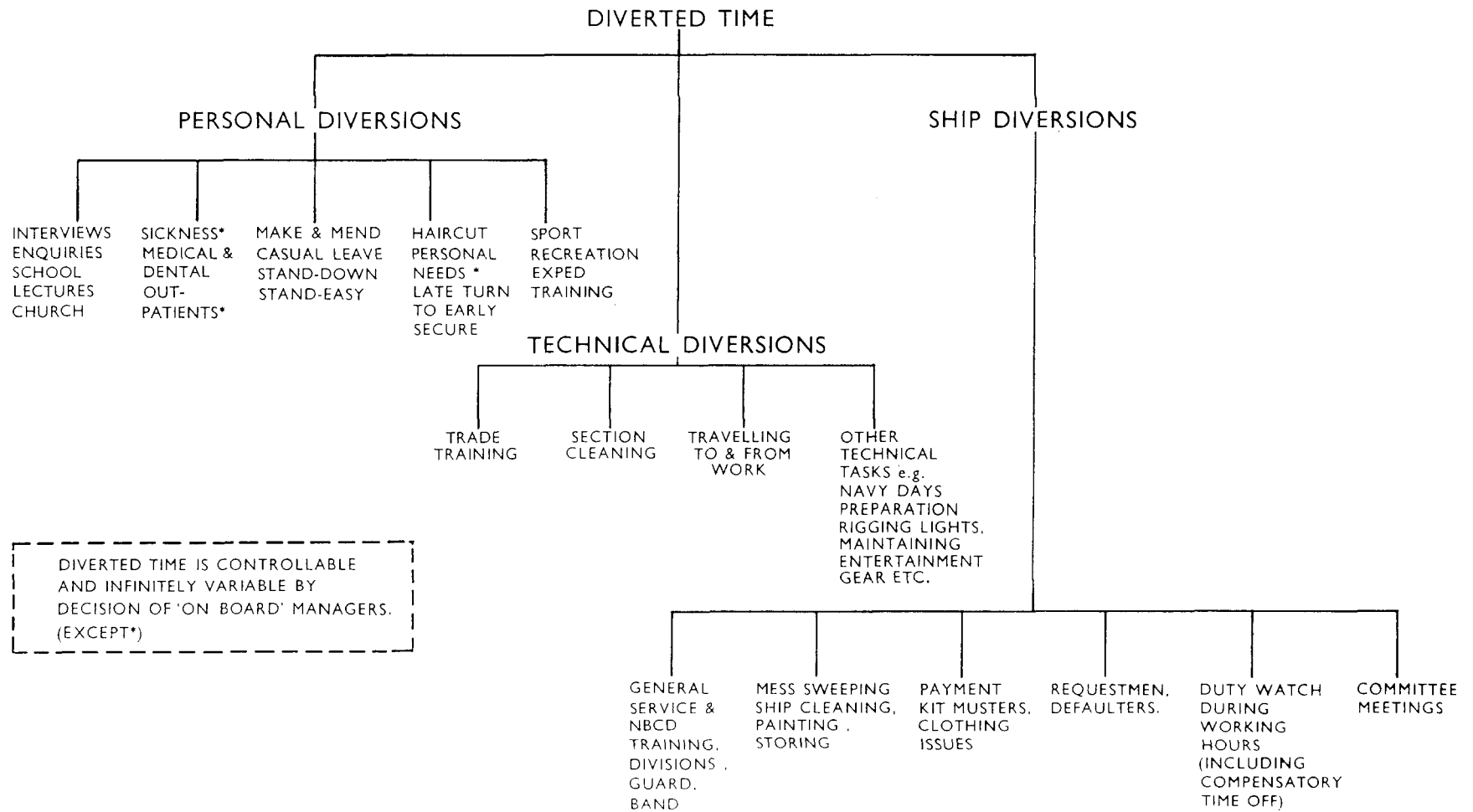


FIG. 4—UTILIZATION OF MAN'S TIME: DIVERTED TIME

BM data build up. The officers and senior ratings will themselves provide the SM data which, combined with the BM data, will give values for (t). The value of MV can then be obtained by subtracting target times (t) from the total times (T) taken on the tasks.

For the full exploration of MV, the management need to be provided with data outputs from a manpower accounting system. A practical and tried example of such a system is described in Fleet Work Study Report No. 3X/45 Part 2 (Final); this could be readily adapted for general use to provide BM feedback and identification of SM and MV manpower costs. The management would be stimulated to pay greater attention to problems of manpower utilization if they were to think in terms of the annual wages bill for the men over whom they have authority. The relationships between BM, SM and MV as components of the Service's share of a man's time are shown in FIGS. 3 and 4. From examination of maintenance servicing time and operating time (FIG. 3) it will be seen that the management can exercise control over the times spent on such tasks and is helped to do so by the BM times specified on JICs. The management has little if any freedom to vary the man-hours content of tasks in this area as these are to a large extent dictated by equipment design, planned maintenance schedules, drill books, etc. They can only bring about such changes by proposals on Forms S2021 or S2022 which are therefore only effective in the long term.

The management has however a considerable degree of freedom to exercise control over 'Waiting Time' except where it is attributable to non-availability of resources. All manpower wastages which are attributable to 'Waiting Time' are problem indicators for the management. Those which are identifiable as being due to the non-allocation of work or assistance can easily be dealt with by a change in the departmental organization, resorting in the final instance to the application of KITA, a technique familiar to students of Hertzberg. Wastages due to non-availability of resources can be lessened by better anticipation of requirements and closer liaison with the suppliers. As already stated JICs specify resource information and requirements for supervision and assistance.

Clearly the management can exercise control over 'Diverted Time'. This is the one area of manpower utilization which can be varied by the implementation of onboard decisions without reference to outside authority. Because 'Diverted Time' is the biggest single consumer of manpower the greatest savings can be made in this area for the least cost. This is the area of manpower utilization (FIG. 4) in which continual probing and refining of MV will lead to large manpower savings and effect improvements in morale and motivation.

The Man and JICs

Full use by the management of the information provided on the JIC should ensure that the job is allocated to the right man and that he will be able to carry out the task in the manner specified under the heading 'Job Method' without hindrance and with the minimum of supervision.

The information given on the JIC under the heading 'Job Method' details how the job should be done step by step. This enables the man to make a useful contribution to the efficient running of the ship from which he should gain considerable satisfaction. As in many cases the use of JICs will allow him to carry out tasks which would traditionally have been done by his seniors, he will also experience a measure of job enrichment. This 'Job Method' information permits on-the-job continuation training to a common pre-determined standard.

The 'Time' specified on the JIC provides a target against which he can measure his performance. Proper observance of the 'Safety Precautions' ensures a safeguard against accident.

While the information on the JIC under headings 3 to 8 inclusive allows the

management to create a harmonious work system, it equally enables the man to be assured that resources have been made available, that conditions are safe before starting the job and that the desired result can be achieved.

OTHER USES OF JICs

Defect Diagnosis and Rectification

Many of the JICs so far produced in amplification of Planned Maintenance Schedule items contain a great deal of information that is of value in the field of defect diagnosis and rectification. These JICs can be used on their own or in support of FIMS techniques. For example, where an equipment has either failed or its performance has deteriorated, the JIC relating to the functional checking of the equipment will provide the best method of working through the check step by step until performance figures fall below an acceptable level thus narrowing down the area in which the fault lies; the same JIC is used when carrying out the functional check to prove that the appropriate corrective actions have been taken. In another example, a JIC may set out the method to be followed to gain access to a component which is to be inspected; if the component has failed, the task changes to 'component replacement' necessitating the use of a different JIC. The original JIC, however, can again be followed for re-assembling and subsequent testing of the item.

Complement Determination

Although it is not suggested that it will ever be possible to identify, document and time all the tasks to be carried out in a particular class of ship, all Planned Maintenance items and other scheduled work could be so treated. It would then be possible to synthesize a maintenance or other scheduled work programme and into this inject the BM times and skill levels from the JICs. A greater precision would then be introduced into the calculations of complements for the areas of work covered by the model.

Design Improvement

During the course of writing JICs, short-comings in the designs of equipment may be identified. In some cases lack of consideration of the principles of ergonomics adds to the demands that machines impose on men. The need to include safety precautions on a relatively high proportion of all JICs indicates a possible need to identify these hazardous situations earlier thus allowing their elimination during the design stage. Components have been found in equipments which in themselves serve no functional purpose but have lingered on from the development phase of the equipment life. JIC analysis identifies the nugatory work of servicing and maintaining such components and enables decisions to be taken to ensure that the necessary design changes can be made. Much still has to be done in the long term to identify and design out these problems and fit the task to the man. Many more problems could be identified by further analysis of JICs.

Logistics: Scaling and Provision of Resources

If a model was constructed to facilitate the calculation of complements the basic programme of which could be modified to accept input information of stores, spares, tools and facilities, their analysis would then enable the timely provision of the right quantities of the right resources with consequent reduction in the demands on ship's limited stowage spaces. The resulting reductions in stock levels and resources in circulation would lead to yet further financial savings. There might even be a manpower saving among those responsible for receipt, issue and accounting for resources in ships.

Identification of Training Needs

As already stated, in the process of writing JICs the best method of doing each task is developed and the appropriate skills are identified. It will be seen that if people are required to perform specified tasks in the Fleet and that if the JICs contain the details of how those tasks are to be carried out, the loop can be closed by designing courses based on the task analysis that has been undertaken in the course of JIC writing: task analysis as carried out by NMUU personnel is in fact essentially similar to the work currently undertaken by Training Analysts. Training needs have in fact been successfully identified in H.M.S. *Collingwood* by analysis of JICs. Manpower savings could be achieved in the sphere of course design in the Training System Model was modified to use JIC information thereby reducing the need for Training Analysts.

SUMMARY

The benefits that have been achieved or could possibly be achieved are summarized in TABLE II.

TABLE II

<i>Benefits</i>	<i>Comments</i>
Reduction of work loads	In the course of examining Planned Maintenance Schedules some 500 Forms S 2021 have been submitted so far: 75% have been agreed in full giving rise to potential savings of approximately 5 men per <i>Leander</i>
Standardization of methods and improvements in maintenance standards	Reduces elements of chance in job performance. Reduces possibility of maintainer induced defects. Reduces need for lengthy verbal instructions. Provides facility for on-the-job continuation training. Assists with identification of defects and gives more meaning to the analysis of defect data
Provides analytically estimated times (BM)	Enhances value of plans and facilitates control. Gives the man adequate allowances for relaxation when working conditions are difficult. Could provide basis for calculating complements.
Reduces waiting times	Management can identify and therefore reduce inter-departmental constraints. Resources availability can be confirmed prior to task allocation. Supervisory activity can be matched to worker activity. Manpower can be released for other useful work. Management efficiency is improved.
Reduces levels of skills required	Enables task to be given to ratings of lower levels of skill thus improving job satisfaction. Releases senior ratings for managerial/supervisory tasks leading to improved job satisfaction. Reduces financial costs for tasks. Enables junior ratings to undertake a wider range of tasks thereby broadening experience. Could lead to a reduction in numbers of senior ratings and possibly officers.
Provides safer system of work	Identification of safety precautions could lead to designing out hazards. Improved safety would improve morale.
Improvements in equipment/system design, BRs, CBs, PILs, etc.	In the course of JIC writing, possible design improvements and inaccuracies in publications are identified and reported on forms S 2022. The NMUU have submitted 37 design recommendations and 64 publication amendments in 18 months.

Improvements in allocation and matching of men, tasks and resources	The men and resources needed for tasks are specified on JICs; matching leads to reductions in waiting time.
Improvements in planning and control	Foreknowledge of the requirements for men, resources and times eases the planning activity, Control is improved by being able to verify that the right job is done at the right time.
Identifies training needs	Examination of methods, tools and resources employed provides basis for task analysis and course design in respect of 'need to know' content of courses. This examination also provides a basis for identifying where task contents, techniques, etc., are similar thus indicating a possible re-structure of such jobs.
Improves motivation	Improved clarity of purpose improves both motivation and morale.

Lord Kelvin is reputed to have said:

'When you can measure what you are speaking about and express it in numbers, you know something about it. But when you cannot measure it, when you cannot express it in numbers, your knowledge of it is of a meagre and unsatisfactory kind'

Although most Service people would endorse this statement in the context of systems and machines, not so many understand it in the context of manpower utilization. JICs and similar tools begin to give some meaning to the dial readings on the manpower utilization instrument panel, but changes can only be brought about by people. Having been provided with some of the ingredients of a manpower data system, the managers must apply themselves to the resolution of manpower problems with a vigour at least equal to that applied to the resolution of mechanical problems.

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The author does not claim that the substance of this article has in any way been totally developed by him. He has been influenced, guided and assisted by a considerable number of people. It expresses the personal views of the author and at this stage does not represent approved MOD policy for future maintenance documentation. The policy for this is still under review by the Director of Fleet Maintenance and Design Departments.