

RATS FOR SUBMARINES

DEVELOPMENT OF A TOOL CONTROL SYSTEM

BY

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Introduction

In the early 60's, the Fleet Air Arm introduced a form of tool control, based on the need to account for each tool used during the maintenance and repair of an aircraft and its equipment.

New machinery is expensive and vulnerable to damage by the use of incorrect or worn tools, and more especially to the careless leaving of hand tools inside machines on closing up. Such consideration caused the Marine Engineering Advisory Panel in the late nineteen sixties to call for an investigation and the introduction of tool control. A trial under the supervision of H.M.S. *Sultan* was set up in four frigates, the satisfactory outcome of this trial resulting in the approval by the Admiralty Board in 1973 for the introduction of the Rationalized Tool System (RATS) for Provision and Control in Type 21 frigates.

As a result of the early work in the surface fleet and the resulting recommendations, provision was made to the Flag Officer Submarines for a comparable scheme for submarines. Trials were set up in one SSBN and two *Oberon* class SSKs (FMST Report No. 10/82 T Dec. 1975). The satisfactory outcome of these two trials and the lessons learnt has led to the design and development by the Director of Engineering Support (Naval) of the Surface Ship System for new construction submarines. This redesigned Rationalized Tool System will be introduced initially in H.M.S. *Trafalgar* and Class.

Shortcomings in Tool Control

Under current arrangements in submarines, ratings are issued with a standard tool kit of common user hand tools for their own use, the content of the kit depending on their trade or specialization. The custody and maintenance of these kits thereafter being their own responsibility. These kits are backed up by special but infrequently used and expensive tools held in the submarine for issue within departments as required and returnable on completion of the job.

The following are major shortcomings in the system:

- (a) Many of the tools in kits remain unused whilst on issue.
- (b) Each person being responsible for the maintenance of his own tool kit, and at his own expense if losses occur, tends to encourage the less careful workman to use incorrect and defective tools.
- (c) The increasing need for tools to be accounted for before and after completion of certain maintenance tasks is not easy with the current tool containers.
- (d) Tool kits can be idle for up to a third of their useful life during periods when ratings are under training or borne for administrative duties.
- (e) Some tool kits need to be portable and yet secure against losses. Current tool rolls (See FIG. 1) and tool boxes (See FIG. 2) do not always meet these requirements.
- (f) The current internal design of a tool box can act as a specific noise source.



FIG. 1—TOOL ROLL

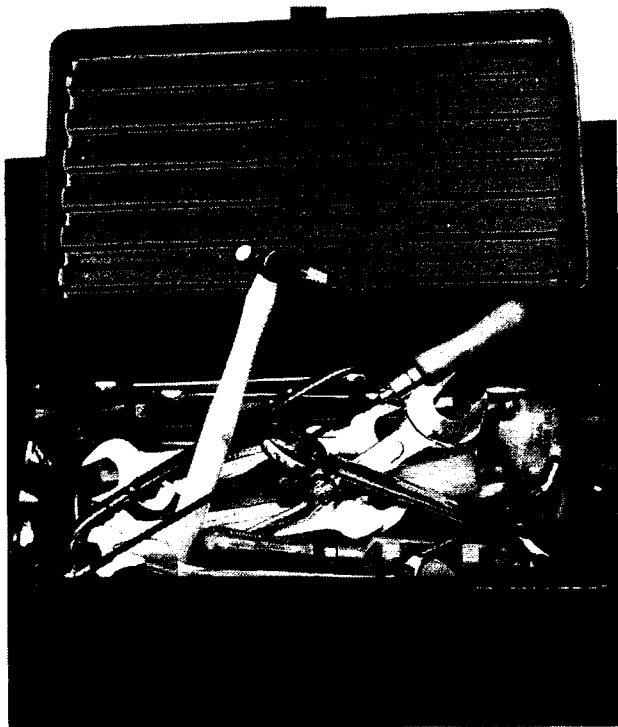


FIG. 2—TOOL BOX

achieve this (human nature being what it is) they prefer to use their own personal tools. This may not always be possible with large tools, but a small personal tool kit is desirable for all technical ratings.

Savings in provisioning of tools and in replenishing stocks is important in this cost-conscious age. Gone are the days when the Chief Stoker managed to obtain a treasure trove of tools from a store on the jetty!

Development for Submarines

The reduction in tool losses (and so cost to the Crown), the need for provision of the correct tool for the job, and the enhancement of provision to ensure availability of the correct tool were all arguments posed and accepted in the introduction of tool control to the surface fleet. All these arguments are

Design Parameters

In designing any tool control system, the need and the parameters must be clearly spelt out. In this design which is a development of the existing surface ship Rationalized Tool System, these may be summarized as:

- (a) All tools must be specified to suit the job and the equipment, i.e. tools required to carry out planned and corrective maintenance should be as important to the designers of equipment as the equipment itself.
- (b) Access to tools should be made as easy as possible to the maintainer to ensure that no work is left undone for want of the right tool. In an ideal world, this could mean that the necessary tools for work on, say, a motor generator should be located with or even strapped to the machine.
- (c) Tools should be mustered after the job to ensure that none have been left in the equipment (i.e. equipment safety). This should be made as easy as possible for the maintainer.
- (d) Generally speaking, maintainers take a pride in their work and to

equally applicable to submarines. However, specific development of the surface fleet system was necessary to ensure that submarines had a system that could be worked with ease.

Space (or lack of it in submarines), mobility through very compacted compartments, noise reduction compatible with the overall design of quieter submarines, sophisticated equipment associated with nuclear propulsion, the user/maintainer/watch-keeper aspects (everyone except perhaps the chef is a watchkeeper in submarines), all had to be considered before and during development of the submarine system.

We have all heard the old adage 'Bad workmen blame their tools'. Most maintainers take a pride in their work and each likes working with his own



FIG. 3—ME AND WE PERSONAL TOOL KIT BRIEF-CASES

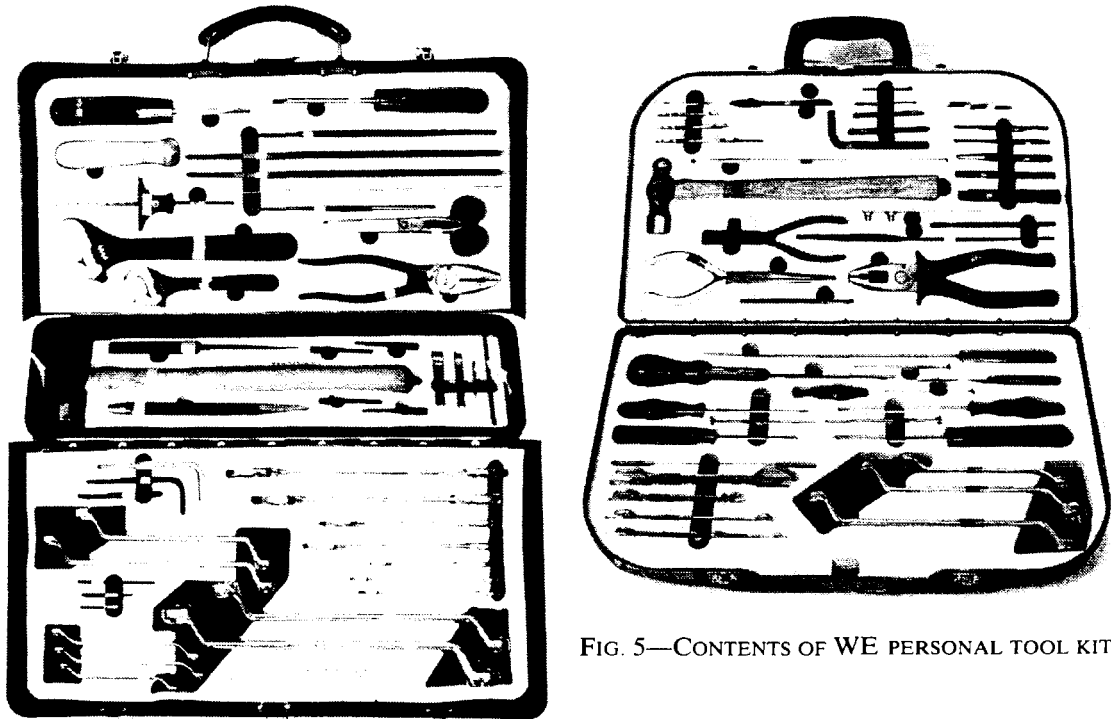


FIG. 5—CONTENTS OF WE PERSONAL TOOL KIT

FIG. 4—CONTENTS OF ME PERSONAL TOOL KIT

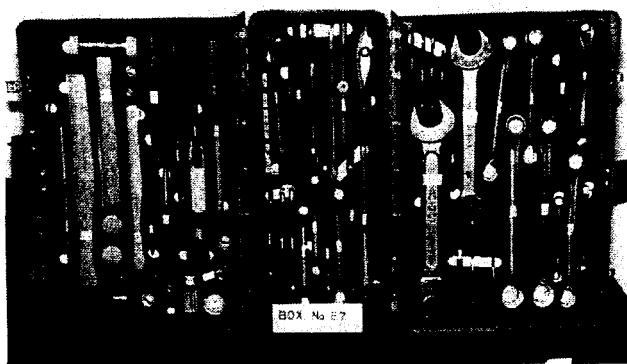


FIG. 6—'E'-TYPE TOOL BOX

and to junior ME and WE ratings. The 'E'-type box weighing about 20 lb (see FIG. 6) is issued to senior ME ratings. These are the smallest possible personal tool kits with sufficient significant tool holdings.

The brief-cases and E type boxes are constructed of laminated fibre glass (GRP) and fitted inside with a fire-retarded plastazote (expanded polyethylene foam) insert which is gouged out in shapes to enable tools to fit snugly. The fire-retarded insert which is a twin-coloured lamination has been developed to meet the stringent anti-fire and toxicity requirements of the submarine's totally enclosed environment. Padlocks and keys are provided for security.

The compartment tool boxes, constructed in cabinet form, are of strong, aluminium alloy with pull-out drawers. The drawers having inserts of the same fire-retarded materials as the PTKs. Due to space limitations within some compartments, they will be tailor-made by the shipbuilder to fit designated positions, and firmly secured in the compartment.

Rationalization

'Reform by elimination of waste in labour, time, and materials' is the *Oxford Dictionary* definition of 'rationalization'—or in this case simply 'The right tool for the job'.

Lists of tool holdings are produced for the portable and fixed tool containers. For the portable tool kits, these are based on the fixtures and fittings throughout the submarine (i.e. pipes, flanges, clips and fastenings, etc.) and, as these are now largely metric in the new design *Trafalgar* Class, metric tools will be used. The tool lists have been compiled to contain the tools required by the rating and his specialization and the work the maintainer is to undertake. Clearly the senior ME rating will require heavy spanners and wrenches while the radio and weapon maintainer will require such items as light screwdrivers and wire strippers.

The compartment tool boxes, however, will contain imperial and some metric tools, as many subcontractors of equipment are still building to imperial standards, the introduction of metrication being slow.

Much work has been carried out in achieving the tool holdings. The starting point must inevitably be the known equipment fit. From this, information on the specific tool, its size and shape, decided by the equipment manufacturer from a 'MAINTEVAL' (Maintenance Evaluation) carried out at the firm, is passed to MOD(PE). Rationalization of the tools within a specific compartment is finally carried out.

Manufacturing Process

On completion of the rationalization process, the major problem of fitting the agreed tools in the personal tool kits and compartment tool boxes is addressed.

tools. It was thus decided to issue each technical rating with his own personal tool kit (PTK), which would be on loan to him for the duration of his time on board, and to supplement these by compartment tool boxes (CTB) in designated compartments throughout the submarine. The PTK is a small brief-case weighing about 15 lb (see FIGS. 3, 4, and 5) and these are issued to senior WE ratings

To achieve this, a set of all the tools are demanded through DGST(N). These are laid out on templates representing the PTKs and CTBs, to give a rough estimate of the space required. After a more accurate check has been made at the manufacturer, a final layout is agreed.

The manufacturer makes an accurate sketch of the tool placings within the containers and, from this, produces a layout drawing. A wooden template is then made for use with the machine that is to gouge out the tool slots in the polyethylene foam insert.

PTK boxes are manufactured of GRP laminate by the same contractor as the inserts, and the CTBs are manufactured by the shipbuilder and inserts subsequently fitted into the drawers.

Finally each tool is marked with resistant hard wearing coloured plastic tape and etched to indicate its tool container.

Tool Control

Tool control is important. To a degree this has been simplified by the introduction of the Rationalized Tool System. RATS provides all departments with the correct tools for the job, supplied in lockable containers, the contents of which are silhouetted so that any missing tools can be noticed immediately.

At the end of a working period (or day in harbour), all tools should be returned to their respective stowages in their containers, and a thorough check of the contents made by the responsible personnel before the container is secured.

Responsibility for the efficient operation of the RAT System rests with the individual or custodian. The custodian is nominated by his head of department to be responsible for a tool container, be it a PTK or a CTB. The supply officer and his staff have ultimate responsibility for the provisioning and receipt of tools, replenishing and loss action of contents, and for taping and etching of new tools.

Keys to all PTKs and CTBs are held by the custodian and a duplicate held on a central RATS keyboard located close to the manoeuvring room of the submarine, a position that is always manned. Rounds and inspections will be carried out from time to time to ensure security and that contents are correct.

The Future

What of the Future? With the design for higher reliability of equipment and the need for greater availability, the requirement for planned and corrective maintenance at sea should shrink and thus hopefully the tool holdings for this maintenance. Levels of maintenance at sea should diminish and, with the age of the silicon chip and the mini computer, the move from rotating machines to solid state, the desire for built-in test equipment, and improvements in all-welded systems augers well for the replacement of the large heavy tool by the small handy screwdriver! Equipment fits and tool holdings should eventually be computerized for each class of submarine and it could be that the 5000 consumer hand tools required in the early 1980s for the SSN are replaced by a thousand light tools in the 1990s.
