

IS THERE A MAINTENANCE POLICY?

BY

REAR-ADMIRAL H. D. NIXON, M.V.O., C.ENG., F.I.MECH.E., M.I.MAR.E.,
F.INST.PET.

I very much enjoyed Lt.-Commander Wightman's article in the December, 1971, issue of the *Journal*. I noticed that the most frequently mentioned single point in his article was our lack of knowledge about the maintenance task. He talked about the need for more feedback of information; about a communications ring main for all those involved in every aspect of the life cycle of a ship and its equipment; about our inadequate knowledge of unpredictable corrective maintenance and the hope of transferring some of this into the predictable area by improving our knowledge of its characteristics. He was thus talking about the need for the Ship Upkeep Information System approved by the Admiralty Board in 1969 and promulgated in DCI 1144/69. I spent three years of my life talking about the same thing when I was Director of Fleet Maintenance from 1968 to 1971 and sometimes met the same responses that he and CREA Marsh complain about; I quote: 'the people with whom he was attempting to communicate appear to want not to be involved'. However, one must remember that a communications system, however important, is only a sub-system and the question which is the title of his, and my, article still needs to be answered.

Definitions

In order to focus attention on what we are talking about, I take as the meaning of the word 'maintenance', the definition given in DCI 926/70 which is:

'All work done to assure or restore a specified material condition or level of performance'.

We ought to have before us the meaning of the related word 'upkeep' which is defined as:

'All resources required to assure or restore a specified material condition or level of performance'

Maintenance therefore means work done for the above quoted purposes by ship's staff, base staff and dockyard staff both during routine and emergency periods of ship, system or equipment downtime and operational time. It comprehends the total spectrum of this type of work done at sea and ashore and the total spectrum of supporting staff, services and material provided for upkeep in the Controller's and Chief of Fleet Support's areas of responsibility. The maintenance task can be looked upon as the final activity resulting from organizing upkeep resources for particular purposes. It needs to be subject to review using an information system.

Organizational Aims

Now the question asked is whether such a complex activity has a policy for its overall guidance. As Director of Fleet Maintenance, I did not inherit such a policy nor part of it. However, the then Chief of Fleet Support made it clear that the aim of his organization, of which I was a part, was 'to provide the optimum operational availability of ships for the Fleet'; optimum because it is, for example, always possible to increase investment in dockyard maintenance resources beyond a cost-effective point. Taking my cue from above, I therefore preached that the aim of maintenance was to provide the Command with the designed performance and availability of ships and their equipments.

We intended to make this aim or policy explicit in the Upkeep Manual, BR 1313, which had undergone a lengthy and frequently interrupted gestation period which I finally terminated by issuing it expunged of all the proposed material except the description of the Planned Maintenance System. However, at that time, we were concentrating our efforts mainly on the early part of equipment life cycles by developing, during the design period, what should become for the Types 21 and 42, their system and equipment upkeep policies.

Upkeep Policies

These upkeep policies were, as a result of close scrutiny of the design, to lay down how, when, where, by whom and with what the maintenance tasks for the wide variety of equipments in a ship should be undertaken, i.e., much of what Lt.-Commander Wightman advocates in his article. This would be done by use of an Upkeep Code system which is applied in accordance with the principles of maximizing the availability of equipment, system and ship, minimizing work on board and particularly ship's staff work, centralizing the repair of equipment and achieving the foregoing in the most cost-effective way. Upkeep policies would of course differ greatly depending upon the type of equipment to which they applied. There could be no common upkeep policy but a common maintenance policy might emerge from equipment upkeep policies.

Factors Affecting the Maintenance Task

It is not at all obvious how a common Maintenance Policy might be stated because the maintenance task is subject to the influence of major factors such as wide-ranging organizational policies like Refit or Repair-by-Replacement or the extended use of SYMES range equipments, a change in technology such as introducing gas turbine propulsion, automated action information systems, guided missile developments and so on, which affect all the characteristics of the resources needed, including those of that most important one, maintenance manpower.

Another factor which needs to be looked at briefly before answering the question posed, is the relationship of maintenance to availability. In the Navy Department Reliability Committee, of which I happened to be the first chairman, using the definitions in DCI 926/70, we accepted the view, widely held both in the UK and the USA, that:

$$\text{Availability} \propto \text{Reliability} \times \text{Maintainability}$$

i.e., an increase in availability can be obtained by either increasing reliability or maintainability or both. Thus a Maintenance Policy could be said to result from or depend upon the degree of reliability and maintainability achieved in the design.

This leads me to my last factor—that sordid matter of cost. Improvements in reliability can be very expensive—for research, better materials, more rigorous development, essential re-design, modifications, etc.—but must be considered as worth it for the present when it is realized that recent studies have revealed that about half the life-cycle cost of a ship is attributable to manpower, most of which is employed on maintenance of some sort or another including watch-keeping. Increases in reliability to reduce maintenance are sought by taking best advantage of changes or improvements in technology, by encouraging technical excellence in design and by post-design improvements. It is important to watch costs in this exercise in order to know when it ceases to be economical to pursue higher reliability. Similarly, the cost of improving maintainability needs to be watched.

In summary, the maintenance task in any one ship is affected by:—

- (a) The technology of the period during which it was designed
- (b) The reliability and maintainability of the design and any improvements made subsequently
- (c) The resources available for upkeep at the time of the design and their subsequent improvements
- (d) The efficiency with which the maintenance task is organized and executed
- (e) The cost of reducing it.

This task remains relatively static throughout the life of the ship, unless a major improvement is carried out within the life cycle.

The size of the task of the future will result from improvements in the above factors weighed against costs.

A Maintenance Policy

The maintenance task is thus affected by a wide spectrum of factors all of which are undergoing continuous change. What then should be our Maintenance Policy?

We are dealing with a complex subject and yet a comprehensive policy must be simple. To help simplify the matter, I suggest we divide it into two parts:

- (a) A policy to guide us for the present tasks
- (b) A complementary policy to guide us for the future within the period of the 10-year Long Term Costings.

Thus I suggest the following:—

Policy for maintenance of existing ships

To so organize and execute the maintenance task as to provide the Command with the designed performance and availability of ships and their equipments, making such improvements as can be justified on grounds of cost and effectiveness.

Policy for maintenance of future ships

- (a) Develop the most effective Upkeep Information System which can be afforded in order to provide a priority list of high cost aspects which need to be reduced (and in this I include ship, base and dockyard costs).
- (b) Seek applications of current or evolving technology which can be applied to reduce the maintenance task, particularly in high cost aspects.
- (c) Pursue higher reliability in system and equipment design until it ceases to be cost-effective as judged by diminishing returns in life-cycle ship costs.
- (d) Pursue improvements in maintainability by developing upkeep policies so as to cause more detailed review of designs at their formative stage.
- (e) Pursue improvements in the organisation, use and design of upkeep resources.
- (f) Pursue improvements in the efficiency with which maintenance work is carried out.
- (g) Improve the already high quality training organization by giving more emphasis to teaching how best to design for upkeep.

Like all broad aims or objectives, the above would need to be broken down into more detailed objectives for different parts and levels of the naval organiza-

tion. It will not have escaped notice that a policy for maintenance covers all Admiralty Board members' responsibilities.

Hopes for the Future

The Ship and Weapons Departments have already effected a considerable change in emphasis in the design field to produce a Configuration statement for the Type 42, Type 21 and all subsequent classes of major warship which will define the type of upkeep policy applying to each system or equipment, the removal route and the modification state. Also, considerable effort is going into the production of a Guide for Design for Upkeep and to making ships of one class identical. The whole business of upkeep is a Design Department responsibility as well as being a responsibility of the Departments of the Chief of Fleet Support and much is going on to try and make the upkeep task both more calculable and easier.

* * *

I hope that this has served to help answer Lt.-Commander Wightman's question. His question certainly caused me to concentrate my mind on writing down something which began to mature with the help and guidance of many others during a most interesting commission at Bath and which was not then explicitly stated.
