SSN REFIT STUDY OR WHAT'S IN A NAME?

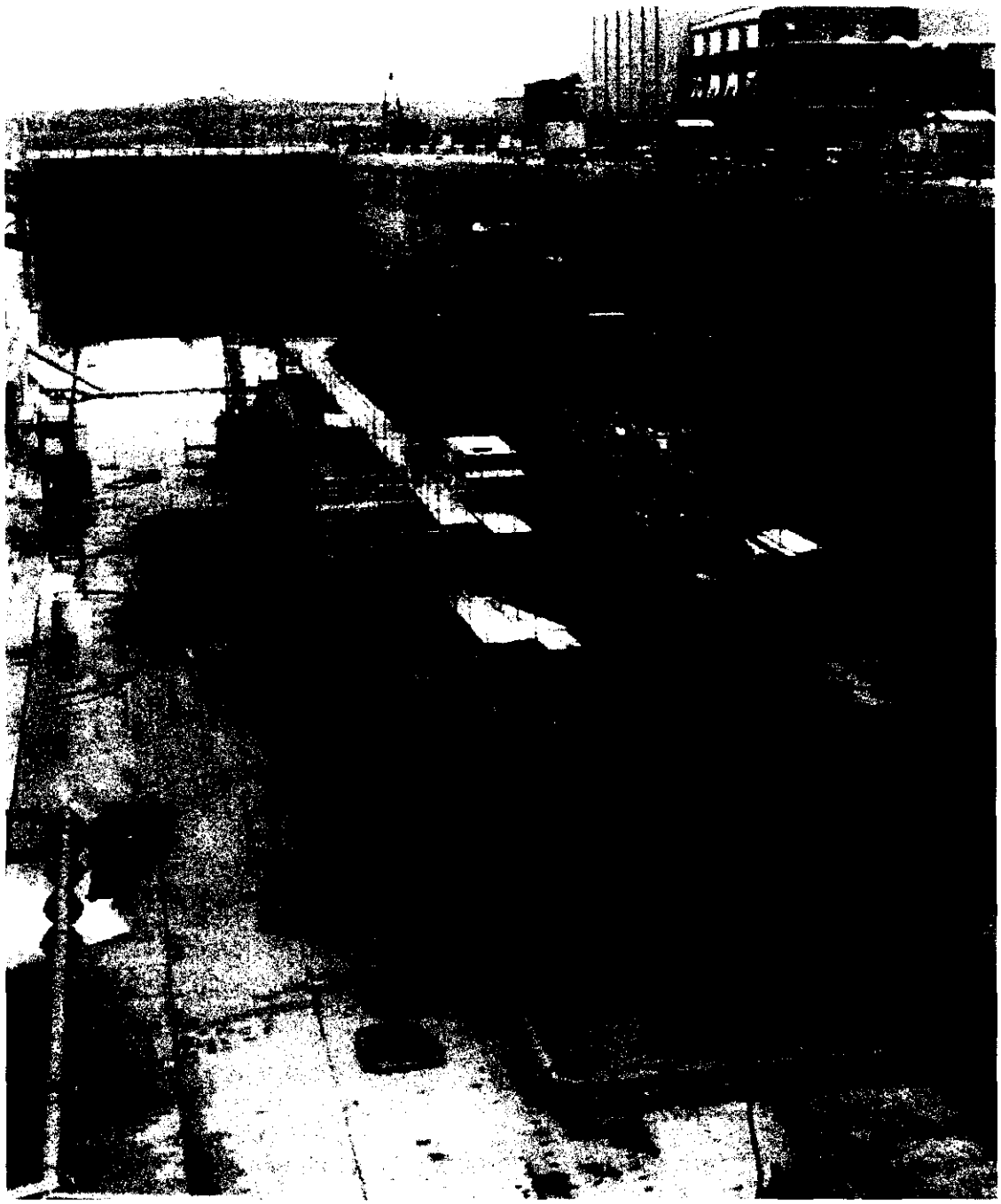
BY

H.L. MATHERS, BSc, MSc, CEng, FRINA, MIMgt, RCNC
(*Ship Support Agency—AD/SMD*))

For years we have comprehensively stripped down our submarines at those broadly regular points in their lives we have called refits. I say broadly regular, because the periodicity has gradually extended over the years so that now it is now more than double the original design intent. In 1995 we began serious studies into the capacity of the submarine systems to accept further extensions and discovered only a small number of critical parts whose safe working life reached a cliff edge at or around the periodicities currently applied. The immediate result of the studies was to recommend specific measures, which allowed short-term extensions of operating periods to ease the difficulties the submarine upkeep programme was experiencing due to a shortage of nuclear certified docks.

An almost incidental result of these same studies was the implication that, excepting some critical areas, a significant volume of the refit work might be unnecessary. Not revolutionary thinking perhaps, but previous attempts at reducing it had not been successful. Nonetheless by autumn 1997, with ever more stringent financial pressures we were bound to re-visit this with a vengeance.

Why had previous de-scoping exercises been largely ineffective? This was an important starting point. There seemed to be two separate and equally important strands:



SWIFTSURE CLASS SSN DURING REFIT

Firstly

Previous exercises had not been co-ordinated, but had been piecemeal—in today's vernacular, they had looked for the 'low hanging fruit'. In reality submarines are so tightly packed with systems and equipment that any effort to de-scope the refit of one item is bound to have an impact on those surrounding it. Typically there is the universal need to assure the integrity of underlying structure by inspection and re-preservation. But to gain access, systems are compromised.

Secondly

The shape of our organization has always kept those responsible for delivering the refit within cash ceilings separate from those responsible for defining the work package (the Design Authority sections). Inevitably previous exercises have been initiated from the Dockyards (until contractorisation in the late 1980s) or the former DGSR. The dynamics have always put the Design Authorities formerly in DGSM and DGME on the defensive. These early de-scoping attempts were driven by last minute budgetary or programme crises, and the Design Authorities did not have the capacity to give sufficient attention to the proposals to approve any but the least contentious. The grouping of key players within the SSA offered the opportunity to achieve a cohesive approach.

To improve our chances of success, a new de-scoping study had to be co-ordinated, comprehensive and organized so that the dynamics ensured that the Design Authorities were proactive in achieving the aims. In practice the latter was facilitated by measures taken within the SSA to ensure that all groups had a common view of the pressures on the corporate budget, and a common obligation to address them. Appropriate resources were also crucial, but we saw this in two parts:

- The application of the experience of a few individuals within the Design Authority sections to identify the possibilities for work reduction.
- The labour intensive graft to justify those with a safety implication.

On such a basis, at the beginning of 1998 a programme of assessments of every maintenance and revalidation item in the submarine systems refit work package began. (The TRAFALGAR class was the model.) The old adage 'the devil is in the detail' repeatedly proved true as the work progressed. Ultimately, however, it proved possible to compile a statement amounting to over 700 individual recommendations for work package reductions, which could be compatible with the overall de-scoped work package. They ranged from items which alone will save several hundred thousand pounds per refit to items which whilst they will save only a few pounds, need to be pursued to achieve a consistent result.

Apart from the pressures to deliver savings in refit costs, the exercise became possible because several separate initiatives were already in hand, which were in total alignment with the exercise aims. Additionally the multidisciplinary approach of the recent Commission Extension study, involving Warship and Equipment Project Managers, the Director of Naval Architecture (DNA) (now the Sea Technology Group (STG), and FOSM as the Customer of in-service maintenance support, provided an essential structure. These initiatives can be divided into three parts:

First

The most important of these was that of STG with DERA Rosyth to determine the inherent tolerance of the structural materials to defects. Drawing on this work, it was possible to make substantial reductions in the extent of hull survey. As a consequence demands to remove (and replace) acoustic and thermal treatments, internal furnishings and equipment could be drastically reduced. Without it, the overall impact of the de-scoping study would have been greatly reduced.

Second

The pursuit of techniques to re-validate high pressure air vessels in situ. It is not yet possible to confirm that such techniques will be mature for

full application in the immediate future, but the level of confidence that they will emerge has enabled the significant cost of *renewing* pressure vessels at refit to be saved. But importantly the sense of ownership of the objective to save money in upkeep has been nurtured amid this programme.

Third

The re-establishment of the Nickel Aluminium Bronze working group, which has re-opened discussion on acceptance standards and the use of contemporary NDE techniques to achieve revalidations in situ. Regrettably this will not eliminate the rejection of many castings at refit, because it cannot deal with the inherent susceptability of the material to localised corrosion. However again it has been important in establishing enthusiasm among Design Authority groups to find ways to save refit costs.

Finally of major significance was the growing application of Reliability Centred Maintenance (RCM), begun as part of the NSC programme to apply RCM widely across ship upkeep. For instance, studies on hydraulics and selected valves demonstrated that it was possible to apply the 'if it ain't broke don't fix it' approach to systems which hitherto had been religiously dismantled and re-constructed in refit. On further examination it was discovered that many of those traditional practices were driven by the degree of disturbance of those systems to complete other work on the submarine. If there could be effective work package de-scoping across the board, there were real prospects of eliminating system overhaul in favour of an RCM-based approach to maintenance.

Unfortunately however it is not possible simply to re-define the statement of requirements for a submarine refit. There are ranges of issues to be considered, some of which need to be resolved in order to enable the de-scoping to be put into practice. There are also others, which need to be pursued to sustain the integrity of the submarine support system.

Funnily enough, an important 'practical issue' is attending to the refit culture. With a work rate in refits of up to 30,000 manhours per week and more, it is essential to consider how the workforce and their management systems will cope with radical changes to the specification. On a basic level there is, for example, the question of effecting work control to assure the security of equipment not now removed from the submarine. This then leads to the control of maintenance, and the more complex issue of contracting for fair liability for defects which emerge either because of the condition on entry to refit or because of factors under contractor control. Assuming this can be resolved by contractual provisions and processes agreed in the project Quality Plan, there is the further complication of reconciling management of the equipment and system maintenance with the responsibilities of the submarine Commanding Officer for the safety of the submarine. Then, with new management processes in place, there is a large population of managerial and industrial staff who have radically to change their approach to put them into effect. A strong exercise of public relations with both MoD and Dockyard senior managers showing common commitment to this way ahead remains an essential element of implementation.

To continue to call the major upkeep period of a submarine a 'refit' would do little to signal to the parties concerned that a major change was in the wind. A side issue to the Refit Study was the contemplation of a new name that would reflect the new, task oriented project and hasten the required changes in culture. There was no place for any derivative of the word 'refit' and other core words such as 'revalidation', 'outage' and 'overhaul' were

considered. The USN preference for 'availability' was thought inappropriate! Ultimately the new project name was chosen 'Long Overhaul Period', or, if it will include refuelling, 'Long Overhaul Period (Refuel)' or LOP(R) for short.

Equally as problematic as culture management is shifting from easily defined acceptance standards derived from design documentation to standards, which reflect the reduced performance, we now find we can live with. On the face of it, it should be possible to derive from Ship Staffs' experience the operational performance they need. Typically, we know that no submarines operate their high-pressure air systems to the design working pressure because the compressors would be forced to work too close to their absolute design limits. We could, in this instance, lower the test pressure, for example (if it were of any benefit). However, in other places, the effects of reducing acceptance criteria have potential implications for long term reliability, and thus risk multiple equipment failure whose impact on submarine safety is extremely difficult to quantify in the absence of extensive Availability, Reliability and Maintainability models. If we look at the big picture, experience suggests that with established refit practice, the level of intrusion and shake up of the systems leads to an increased defect rate in the following commission. This certainly gives comfort to the de-scopers, and this needs to be held in balance with the sometimes more pessimistic results of more detailed analysis. There must be an elegant solution, we keep saying, which sustains confidence in submarine safety without interminable detailed analysis, but it is very elusive, and much work remains to be done.

The conclusions of the Refit Study have been warmly received and fed into the LOP(R)'s of HMS *Spartan* and *Trenchant*. It is recognized that much more still has to be done to establish the new culture, re-define acceptance standards in a contractually sustainable way, and verify the safety of the accumulated reductions. On the other hand we know very well that if we fail to grasp such opportunities, the ground setting will take so long we will never achieve the results. It is my hope that the changes in approach heralded by the Refit Study will not turn out to be a singleton exercise, but the momentum of the underpinning work will keep this at the centre of the submarine support thinking.