

# THE REFIT OF A WARSHIP IN A COMMERCIAL YARD

BY

COMMANDER R. K. LONGLEY, O.B.E., C.ENG., M.I.MAR.E., R.N.Z.N.  
*(formerly Senior New Zealand Representative for the refit  
of H.M.N.Z.S. Southland)*

## PART I—PREPARATIONS

### Introduction

In October 1981 the New Zealand Government approved the acquisition of two LEANDER Class frigates from the U.K. Ministry of Defence. H.M.S. *Bacchante*, a standard Batch 3 LEANDER, was handed over to the Royal New Zealand Navy a year later and commissioned as H.M.N.Z.S. *Wellington*. She subsequently steamed to New Zealand for a two and half year Modernization Refit at H.M.N.Z. Dockyard in Auckland. The second ship, H.M.S. *Dido*, a Batch 1 Ikara LEANDER, was handed over on 18 July 1983 and was renamed H.M.N.Z.S. *Southland*. This ship underwent a five month Normal Refit at Vosper Shiprepairers, Ltd., in Southampton.

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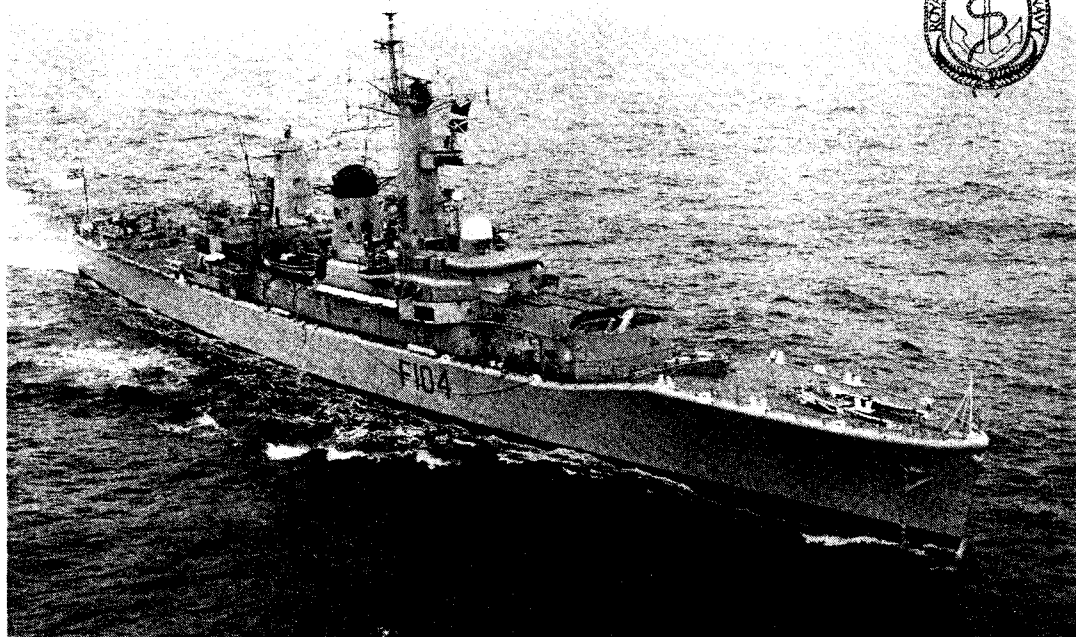


FIG. 1—H.M.N.Z.S. 'SOUTHLAND'

The aim of this first part of the article is to outline the preparations required for the commercial refit of a warship in the U.K. Although our experience has been gained from the refit of a particular ship in a particular repair yard, the preparations have been treated in general terms so that the article presents the case for any warship in any repair yard.

### Shiprepairers v. Shipbuilders

A very important point about shipbuilders and shiprepairers that needs to be realized, even though on the surface it appears to be self-evident, is that, whereas shipbuilders may be experts at building warships and shiprepairers may be experts at refitting merchant ships, neither are experts at refitting warships. A combination of their skills is necessary. In general terms the shipbuilder has the skills necessary to work on the weapons and communications equipments and systems, while the shiprepairers have the capability to undertake hull and mechanical repair work. Shipbuilders are more used to detailed and long-term work programmes, whereas shiprepairers have a more versatile workforce geared to fast, short turn-round work with little detailed planning required. Also, the shiprepairer is more likely to employ casual staff.

### Overseeing Services

The services of the Principal Naval Overseer (PNO) Southampton were obtained on an agency basis for provision of the necessary overseeing and quality assurance expertise. The small New Zealand input consisted of myself as the 'Delegate', or Senior New Zealand Representative, and two people from the H.M.N.Z. Dockyard at PTO 1 and PTO 2 levels. Between us we covered the marine, constructive and weapons disciplines, and were integrated into the PNO organization. This was a deliberate policy decision to ensure there was only one overseeing group dealing with the contractors and not two, which could have opened the way for the contractor to play one off against the other.

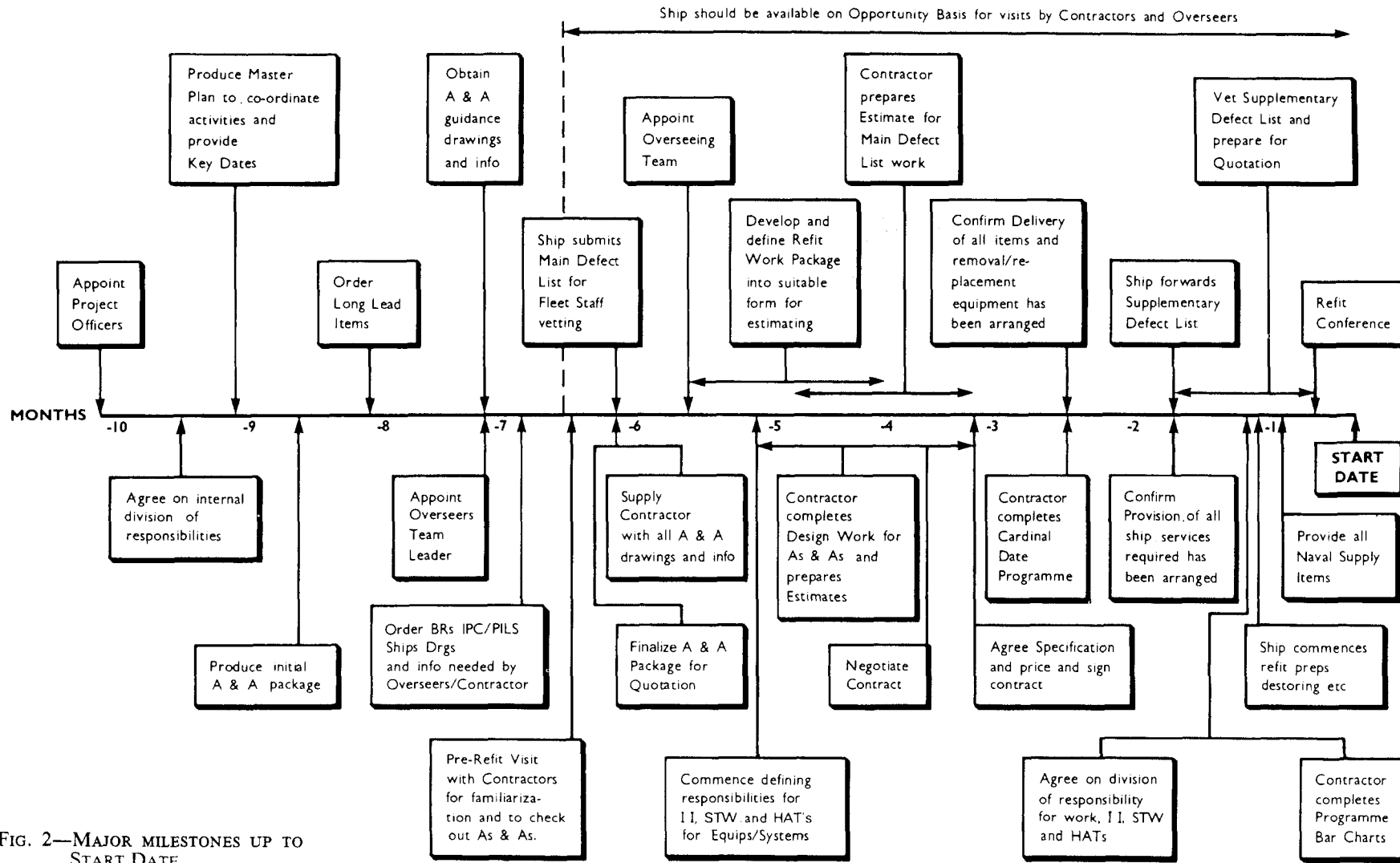


FIG. 2—MAJOR MILESTONES UP TO START DATE

The total number of overseers in the refit team was ten, with the full back-up of the PNO organization being available as required, including the Naval Weapons Manager. The services of the Weapons System Tuning Group and Captain Weapons Trials were also obtained on an agency basis. In effect, therefore, our organizational set-up was basically the same as it would be for a R.N. Frigate undergoing a similar type of refit.

### **Financial Aspects**

There are different degrees of cost responsibility for the various types of contracts. At one end of the range is the 'firm fixed price contract' under which the parties agree that the contractor assumes full responsibility in the form of profit or loss for all costs under or over the firm fixed price. At the other end of the range is the 'cost plus a fixed fee contract' where the profit rather than price is fixed and the contractor's cost responsibility is therefore minimal. In other words, 'firm fixed price' means the contractor has all the risk, whereas 'cost plus a fixed fee' means that he has no risk. In between are various incentive contracts which provide for varying degrees of contractor cost responsibility.

Our contract was a firm fixed price one. This ensured that the contractor had the maximum profit incentive for effective cost control and contract performance. The contract price was not subject to any adjustment by reason of the cost experience of the contractor in the performance of the contract, nor was any allowance made for inflation etc. However, extra work not included in the specification, whether new work or arising from survey, was costed separately and individual firm fixed prices agreed.

### **Milestones**

FIG. 2 shows the major milestones leading up to Start Date. It is based on the assumption that tenders are not required and a prior decision has been made on which contractor will do the work. The more important milestones are as follows:

- (a) Pre-refit visit.
- (b) Developing and defining the Refit Work Package.
- (c) Supplying the contractor with information.
- (d) Defining responsibilities.
- (e) Negotiating the contract.
- (f) Cardinal Date Programme.

### **Pre-Refit Visit**

In this case the pre-refit visit does not mean the one made by a Fleet Staff as part of a normal Dockyard refit procedure, whose main purpose is to determine the material state of the ship thereby ensuring that an accurate defect list can be forwarded. Rather, it means a visit made by the project officers, overseers team leader, and the contractor.

It is the first look at the ship that the contractor will have had. It is extremely important to ensure that the best use is made of the time, because much of the future planning, design effort and estimating will be based on the knowledge gained during this visit. The contractor's team must be shown in detail the equipments, systems, or structures on which As & As will be undertaken and all problem areas must be discussed in depth and resolved on the spot wherever possible. They should also be shown all major planned maintenance or defect work that it is known will be undertaken, to ensure they have a feel for it when they prepare their estimates.

To ensure they have a full appreciation of the need, the contractors should also discuss the provision of services for keep-alive and setting-to-work requirements with the ship's staff. These are vastly different to the requirements of merchant vessels and without obtaining some on the spot feel the contractor might not fully appreciate the real need or the total requirement. Even though the provision of these services will form part of the specification, it is better if the contractor has obtained a feel for the requirement.

You will have noticed the word 'feel' has been used several times because, without diminishing its importance, that is all that can be obtained at this stage. If it is at all possible the ship should be made available for visits by the contractor and overseers as often as possible. The more they can visit to check on details the better will be their estimates, work descriptions and material and resource planning, and the feel will be replaced by knowledge. It is important to appreciate that since everything has to be costed it must be specified in detail.

### **Specification**

This leads into the next major milestone which is developing and defining the work package, or specification. A simple example will demonstrate what is required to convert the main defect list from naval to commercial terminology from which definitive quotations can be made. The description of a planned maintenance item in the Defect List would be 'To overhaul relief valve'. This becomes:

- (a) Remove valve from system and transport to workshop.
- (b) Strip and lay out for survey by Overseer.
- (c) Clean valve, machine and lap, renew gaskets/seals as necessary, and re-assemble.
- (d) Carry out any additional work detailed by the Overseer under supplementary work.
- (e) On completion of re-assembly, carry out water pressure test to ... psi, then demonstrate operation of relief valve at ... psi. Overseer to witness.
- (f) Transport valve back to ship and re-install in system.

It should be noted that supplementary work will be required to be raised on this item to cover any repairs or replacements resulting from the survey. This will be a very busy period for all concerned, as the thickness of the specification will be two or three times greater than that of a ship's main defect list.

In addition to items translated from the main defect list, items will also have to be raised to cover the following:

- (a) Care and maintenance of equipment under repair until Acceptance.
- (b) Demonstrating that the repair and installation work has been properly carried out to the required standards.
- (c) Method of acceptance of equipments and systems.
- (d) Provision of all services required by the ship.
- (e) Specific safety precautions.
- (f) Responsibilities for docking, watertight integrity and stability.
- (g) Man aloft or Radhaz procedures.
- (h) Ship cleanliness.
- (i) Developing and maintaining the required programmes.
- (j) Monitoring progress.
- (k) Documentation required.

Once the work description translations have been completed, they should be passed to the contractor as soon as possible so he can complete the estimates and prepare his quotation. The specification should be made up of good

definitive work descriptions because this will reduce the number of queries raised during the refit and the amount of supplementary work required. The value of having the ship available for visits by the overseers and contractor should now be evident.

### **Supply of Information**

The contractor requires a full supply of information to ensure he knows what he is quoting for. This includes:

- (a) Copies of the ship's as-fitted drawings identified as being relevant to the work being undertaken.
- (b) All information on As & As and Modifications including drawings, data packs, and supply details of equipment being provided.
- (c) Copies of all BRs and Defence Specifications or Standards quoted in the specification.
- (d) Copies of PILs or IPCs for equipments being overhauled.
- (e) Any other information thought to be relevant.

This information needs to be available before the overseers start preparing the specification and must be available to the contractor before he receives it.

The requirement to have all necessary information available on time, and the procedure established for the speedy supply of any other information found to be necessary, cannot be over-emphasized.

### **Defining Responsibilities**

One of the most surprising aspects that became evident during the early part of the preparation period was the need to identify and define the weapons setting-to-work (STW) and HATs requirements, although these occur during the later stage of the refit. However, the formalized nature of the work, the need to ensure that appropriate skilled personnel and resources are available when required, and the problems inherent in an overall programme for system linking, dictate that an early resolution of responsibilities is required. Initially this should take the form of a list of all weapon equipments (regardless of whether or not they will be worked on) which identifies the organization that should be responsible for setting-to-work. Each responsible organization can then start resource allocation and identifying possible areas of conflict.

This list should then be expanded as information becomes available so that it includes the contract authority and who the work is to be done by for both refit work and subsequent setting-to-work. When this is known, and each group has determined its individual requirements, then the differences have to be resolved. Once the conflicting requirements between refit work and setting-to-work have been resolved, then the system linking conflicts can be resolved, which in turn will mean further changes have to be made to the refit work timescales.

The next stage is to draw up a complete programme covering Installation Inspections (II) and HATs in addition to the above. All of this scheduling must be completed before Refit Start Date so that everyone knows exactly what is required of them, and where they fit into the overall scheme of things before they start work.

Similar planning should also be done for the electrical and marine engineering sides, but this does not have to be as detailed, or to the same depth, as for the weapons side.

### **Contract Negotiations**

The need for having a good, well-defined and fair contract is obvious. Even though there are many standard contract clauses available, each contract is

different and at the time of signing there will have been many changes made to the original draft contract. The negotiations will take a lot of time and effort and will involve a reasonably large number of people with a wide range of expertise. The contractor will concentrate on being well represented by experts on the financial, commercial, and contractual or legal side, with technical and planning expertise being available as required. In addition to having the same level of expertise in the same areas, the naval team needs to be well represented on the technical side to ensure detailed aspects are covered, as well as ensuring the contract price fairly reflects the work detailed in the specification.

Details of our contract have not been included because contracts are confidential documents and each one will be unique in that it covers the individual customer and contractor's requirements for the specific work being undertaken. An important side issue is that if you, as the customer, have major equipments being supplied by a separate contract, then special care must be taken to ensure that each reflects the needs of the other. Generally, the contract for equipment supply should have a clause covering the consequences to the refit of late delivery of the equipment in the form of high liquidated damages.

### **Cardinal Date Programme**

As previously mentioned, shiprepairers are not used to detailed long-term planning, and from their point of view a normal refit for a warship is a long-term job. Some shiprepairers might be geared up to run networks on computers, but this would appear to be the exception rather than the rule. The general approach seems to be a 'handrauclic' planning system based on a Cardinal Date Programme (CDP), which is supported by a number of associated bar charts. The CDP should show about 200 milestones; any more and it would be covering too much detail and its value would be lost. Key milestones and items of major work should then be identified from the CDP, then bar charts made up for them. Although the contractor would be obliged to provide these, obviously a large amount of time and effort is required to check them and to have amendments incorporated. It should be recognized that the planning department will be a very small department, probably forming part of the drawing office, estimating and records group.

### **General**

Several other important areas that are not in themselves milestones but need to be addressed during the preparation period are:

- (a) *Financial Control.* A Delegate with full financial control of money allocated to the refit needs to be appointed, together with a deputy having delegated powers to act in the Delegate's absence. The procedures for the authorization of any stage payments related to refit progress, and payments for supplementary work arising during the refit, will form part of the contract.
- (b) *Approval Procedures.* The procedure for approving supplementary work will also be specified in the contract, but the method of day-to-day working for originating, authorizing, providing quotations for, and approving supplementary work needs to be finalized before Refit Start Date. Whatever method is used, it must ensure that the procedure will be a speedy one, particularly for work arising from survey.
- (c) *Monitoring and Controlling Expenditure.* The method of achieving this also needs careful consideration. The contractor will be obliged to provide statements of the total amount of money spent at specified

times, but the Delegate has to put this in a form that will allow him to project future expenditure. A relatively simple graphical representation was finally settled on which showed the amounts that were:

- (i) fully agreed and approved for payment;
- (ii) committed in the sense that the work will be done, but full agreement has not been reached on price;
- (iii) still being prepared for quotation by the estimators and whose value has to be assessed by some means or other.

The amount of money committed in the real sense is the sum of all three.

- (d) *Repair and Test Documentation.* This covers dimensional inspection charts, test certificates, and HATs and SATs trials sheets. They need to be obtained, checked, prepared, and presented to the contractor for his action or information as soon as possible.
- (e) *Quality Assurance.* The QA standards will be specified in the contract, but the standards have to be decided upon before the contract is finalized. Shiprepair yards in the U.K. undertaking the refit of a warship would be cleared to Def. Stan. 05-21 and Def. Stan. 05-24. Def. Stan. 05-21 covers the quality management of the whole organization, and is needed when design work is required or the equipment is very complex. Def. Stan. 05-24 covers the management of the in-process inspections, and is needed when the design definition is complete. From the contractor's point of view QA costs money and he will recoup this through his overheads, i.e. in the price charged to the customer. It is, therefore, wasteful of money if a higher QA standard is specified than is required. Our solution was to specify 05-21 for Alterations and Additions and 05-24 for repair work. The contractor's arrangements for compliance with these standards should be set out in a quality plan.

## Conclusion

The preparation period for a commercial refit is a very busy and varied one. There are many points of detail that have to be noticed, thought about, and resolved. For a refit in a naval Dockyard most of these would be covered by the normal routine that has evolved, and by the organization itself. But this is not the case where a warship refit is not the norm and where everything has to be costed, which in turn means that everything has to be defined and specified in detail.

The first part of this article has tried to provide an insight into the preparation required for the commercial refit of a warship. Versatility, careful planning, maximum utilization of resources, and establishing good working relationships are the key elements in endeavouring to ensure that at Refit Start Date all preparations have been completed. To meet this deadline all parties must work together, learn from each other, have a positive attitude, and adjust their standard working practices and approaches to cover the new situation that each is faced with. The times shown in FIG. 2 could appear to some to be excessive but, if all of the above elements and practices are to be achieved, it will prove to be a very tight timescale.



## PART II—THE REFIT ITSELF

### Introduction to Part II

Whereas Part I treated the preparations required in general terms so that it presented the case for any warship in any repair yard, for practical reasons this second part will be specific to the refit of H.M.N.Z.S. *Southland* by Vosper Shiprepairers, Ltd., in Southampton.

Having said that, however, the aim is not to present details of the actual work undertaken, but rather to give an insight into the experiences gained concerning the differences between a commercial refit and one undertaken in a naval Dockyard. Different factors play a greater or lesser role in a commercial refit and it is these differences and their consequences that will be stressed throughout this article. It should be noted that some of the problems encountered would only pertain to an overseas customer and might not necessarily be applicable to a R.N. warship undergoing a similar refit.

### General Timescale

The refit commenced with the ship entering No. 6 dock at Southampton on 19 July 1983, where she remained until 9 November. This length of time in dry dock was not dictated by underwater hull work requirements for *Southland*, but rather by constraints in flooding the dock imposed by the requirements of the other ship she shared the dock with, the luxury yacht *Abdul Aziz* which Vospers were fitting out. Marine Engineering HATs commenced in early November and the ship sailed for the first day of sea trials on 22 December. *Southland* was accepted from Vospers on 10 January 1984 on completion of Platform SATs and sailed to Portsmouth shortly afterwards for Weapon SATs which were completed on 28 February.

The total time for the refit and all SATs was, therefore, just over seven months which reduces to an effective time of just under seven months when the Christmas leave period and a formal ship visit to Hamburg are taken into account. This is believed to be a significant achievement especially when the following factors are considered:

- (a) It was the first time that the firm had totally refitted a warship or that the R.N.Z.N. had been involved in the commercial refit of a warship.
- (b) The general feeling shared by the overseers and ship's staff was that the total work done during the refit was about one third as much again as would have been done in the same time during a normal Dockyard refit.
- (c) The total number of commercial firms involved in refit work was 51 and our equipment was spread throughout the length and breadth of the country.
- (d) Many critical items of spare gear had to be obtained from New Zealand because we could not obtain them from U.K. sources within our required timescale.
- (e) During the HAT Basin Trial severe chloride contamination of the feed system occurred with the starboard boiler reaching a salinity level of over 400 p.p.m. in a matter of minutes. This meant that at that late stage of the refit the starboard main boiler had to be fully internally cleaned, condensers tested, and the feed system checked and cleaned, which obviously caused a substantial delay to the SATs Programme.

### Differences

As will be appreciated, there are many differences between the methods of working and way of doing business for a commercial shiprepair yard when

compared to those of a naval Dockyard. The main differences are:

- (a) *Expertise.* The Dockyards know the equipments fitted in the ships and have, over the years, overhauled each of them many times. The Dockyard workforces, therefore, know the idiosyncrasies of each equipment, short cuts in specific overhaul techniques and the various modifications that have been incorporated (or should have been incorporated), all of which, together with the large information and design data base that has built up over the years, means they should produce a good end product the first time. On the other hand, the shiprepairer's expertise covers different equipments and they obviously have to undergo a learning curve process for the unique features of equipments and systems for warships. Most of these differences were caught up in the overseeing net, but some did slip through and only came to light during HATs or SATs, necessitating rework. The main point to make here is that the shiprepairer is not familiar with equipments or systems that are unique to warships and a greater input is required in these areas from both the overseers and ship's staff. Specific areas of expertise that we have come to rely on from the Dockyard can need careful and detailed research and checking to ensure all points are covered. One should, however, utilize as fully as possible the shiprepairer's wide ranging general engineering expertise, particularly their greater knowledge of different repair options and the latest products available.
- (b) *Planning.* As already mentioned planning was a simple affair involving a Cardinal Date Programme and associated bar charts. These formed the basis of discussion at fortnightly progress meetings and were revised as the refit progressed. In the event this unsophisticated system worked well and required little input from either party. As a total of over 7000 work items was raised and listed, and the workload of the overseers would not have permitted sufficient study of a more complex system, any planning system approaching the complexity of a Dockyard one could have caused a blurring of the overall picture.
- (c) *Flexibility.* One of the main reasons the simple planning system was effective was the flexibility inherent in Vosper's workforce. Indeed one of the major advantages of a shiprepairer is this flexibility which allows them to react very quickly to additional work or problems which arise during the refit. Vosper's workforce was able to be directed to priority work and to work whatever overtime was required (up to a total of 24 hours a day seven days a week, normally excluding Fridays after 1530) without any fuss and to work hard and fast to complete the task. They also accepted that casual labour might need to be employed to complete their former tasks. Whenever additional staff were required they could be obtained on a temporary basis from other yards within British Shipbuilders, or on a weekly notice basis from the pool of unemployed labour in Southampton. All labour is fully utilized.
- (d) *Financial Control.* This is the major difference between a Dockyard and a commercial refit and this aspect will be covered in more detail later. Suffice it to say at this stage that every job has to be specified in detail, costed, and approved.
- (e) *Services.* Whereas in a Dockyard all services are immediately available, this is not so in a commercial repair yard. Services that need to be provided to meet warship requirements are stabilized shore power, chilled water, and load barges. General ship services such as a Tank Cleaning Vessel (TCV), crange, shore steam, HP and LP air (including dry air for use in ship systems particularly wave guides), and lub oil

flushing arrangements also need to be provided as required.

- (f) *Defect Recording.* Although Dockyards also need a defect recording system, this point has been mentioned in this section because it needs more consideration in a commercial refit. This is because everything has to be paid for and it is more important to ensure that when accepting an equipment or compartment all jobs associated with them are completed. A considerable period of time was spent on this during the refit preparation period, but even then our system had to be modified during the refit. The main point to consider when deciding on the recording system to be used is that no matter how the job was originated, at the time of acceptance all jobs connected with that equipment or its associated system must be readily identifiable. Also these must be able to be correlated with all other jobs in that compartment and sometimes with a whole ship system.

### **Problem Areas**

Every project has to have some problem areas. The main ones encountered during this refit were:

- (a) *Ship Cleanliness.* One of the major disadvantages of undertaking a refit in Southampton was that no TCV was available. This meant that all tank and bilge cleaning had to be done by hand and portable equipment which requires more personnel over a longer period of time than if a TCV is available. From the shiprepairer's point of view cleaning is included in overheads and is non-productive and, therefore, costs him money. Added to this is the fact that cleanliness in machinery spaces is not as important to merchant ship owners with whom shiprepairers normally deal, as it is in warships, as anyone who has seen the conditions in many merchant ship machinery spaces can vouch. Therefore, a great deal of continual attention needs to be paid in this area. As cleanliness of accommodation areas and general compartments equates closely to the requirements of passenger liners, they are presented in a good clean condition, but this is more the result of a final effort after all work is completed rather than high standards maintained throughout, so continual efforts throughout the refit are required in these areas also.
- (b) *Lagging.* During the later part of the refit lagging became a problem. A greater appreciation of the potential problem in the earlier stages of the refit would have reduced, or eliminated, the effects of this. Vospers have a very small number of ladders, whose standard was reasonable, and they had to employ sub-contractors, whose standard was not very high, to do a significant proportion of the work. The result was that towards the end of the refit there was too much lagging work remaining which conflicted with trials requirements. The problem is two-fold and not only requires lagging in wake of the contractor's refit work to be clearly identified to ensure that it is done, but also includes all that additional lagging work throughout the ship that should have been in the defect list but was not, and also that in wake of ship's staff repair work. As all work has to be paid for it all has to be identified, no matter how small, and control of this early on in the refit is essential if it is all to be satisfactorily completed.
- (c) *Spares.* For a Dockyard refit there is, generally, little problem with spares. We had continuing problems over them throughout the refit. Commercial sources had to be tried first and only if the spares were not available from them could the MOD stores system be accessed. Supply

to us was then subject to them being available after all R.N. priorities were met, which is a fully understandable requirement. Failing these two avenues we would then have to go back to New Zealand. This latter course had to be followed many times and it is very gratifying to note that in all cases the spares were able to be provided. A very surprising aspect to me about spares, though, was the general lack of availability of them from commercial sources. A large number of mechanical equipments were sub-contracted out by Vospers to the various manufacturing firms. Few of them held what could be called a reasonable level of stocks for overhaul repairs. In several cases they did not even hold common range items and if standard nuts and bolts were required at less than their minimum order number then they would manufacture them themselves at some considerable cost to us. Sometimes we were fortunate and spares were diverted to us from other contracts, both domestic and international, to meet our short timescale requirements. The availability of spares from the manufacturers needs to be carefully examined at the earliest possible opportunity and their method of supply and time of delivery established. This is more so for mechanical than weapons or electrical equipments.

- (d) *Sub-Contractors.* While speaking of sub-contractors it is worth making a further point about them. By their normal standards work done for us had to be completed in a short timescale. Again mainly on the mechanical side, very little work undertaken by sub-contractors in their workshops was completed by the time requested. Although our required completion times were accepted by them when they undertook to do the work, most of them had to be chased up and pressured by Vospers as the prime contractor and, on occasions, by ourselves as the customer. It must be pointed out, however, that this criticism does not apply to the setting-to-work engineers who worked onboard the ship, and this was particularly so for the weapon and electrical sub-contractors whose work and attitude could not be faulted.

### **Working Relationships**

One of the most pleasing aspects of the project was the harmonious working relationships that prevailed between all groups throughout the project. There is no doubt that this played a major factor in the satisfactory completion of the refit and in ensuring that it was completed within the overall project timescale. One of our main areas of concern had been possible problems resulting from trade union acceptance of Vospers/ship's staff work demarcations. Although theoretically it should have produced no problems because the only work allocated to Vospers was that approved by us, in practice this might not necessarily have been fully accepted by the workforce or unions. In the event no such problems arose. Vosper's personnel and ship's staff worked alongside each other and in many cases on the same jobs together. One good example was the overhaul undertaken on the 40 mm Bofors gun mountings which was undertaken by ship's staff inside Vosper workshops. This allowed us to have more of the ship's staff arrive earlier and, therefore, have a greater amount of work completed during the refit.

This attitude also percolated to all of the sub-contractors and MOD personnel who worked on the ship. It enabled everyone to feel that they were part of one unified team striving to achieve the common aim of completing a satisfactory refit on time. We were fortunate that this attitude prevailed, but this might not necessarily be so for any similar projects. However every effort should be made to try and make it so, because not only is the work more rewarding, but also substantial benefits will be gained.

### **Accommodation**

Another area that we were fortunate in was that ideal accommodation was available adjacent to the refit berths. Throughout the refit both the overseers and ships staff were accommodated in one two-storey building. The top floor housed the overseers, ship's officers and senior ratings and had a large conference area. The bottom floor housed the duty watch sleeping and dining facilities and the stores organization. As the numbers of junior ratings increased during the refit this was supplemented by the addition of two Portakabins adjacent to the building for changing, stand-easies and additional showers. This group accommodation contributed to the feeling of being part of one team. If group accommodation is available, then accepting segregated accommodation because it is the cheapest option would create unnecessary difficulties and not be cost-effective.

### **Trials and Setting-to-Work**

For a commercial refit a large number of personnel from the various firms that have been involved in the overhaul of equipment are involved in setting-to-work and trials of that equipment. As previously said, the services provided by these personnel were excellent and there was absolutely no problem in obtaining people at very short notice. The main point that should be mentioned here is that they are expensive and sufficient money must be set aside for them. The charges range from £150 to £290 per day per person plus overtime and transport expenses. These daily rates are also charged for the time they are travelling, so one person with two days total travelling time could cost about £900 for one day onboard. This means that careful planning is required to try and ensure that wherever possible the time they are required for can be fitted into one large block rather than several smaller ones.

The other main point that should be noted is that enough money must be available at the end of the refit to ensure that all trials requirements can be adequately met. This would normally be the last money to be committed and it is better to have more trials personnel at sea than not enough. Not having one person at the right time could affect the whole trials programme, which invariably is a tight one, and this could result in delays to the overall ship programme as well as proving to be false economy by increasing the overall ship operating costs.

### **Supplementary work**

'Supplementary work' is that work arising during the refit which does not form part of the Contract Work Specification. It normally arises as a result of survey work but will also include the supply of services and materials by the contractor and any other work it is subsequently decided should be undertaken. As mentioned in Part I, all supplementary work was costed separately and individual firm fixed prices agreed. Overall the prices of about 20% of the total supplementary work items were negotiated and the remainder were accepted as being fair and reasonable.

The most important factor about supplementary work as far as it affects the work programme is the speed at which the work is specified, quoted and agreed. One can imagine the waste of resources if, after an equipment has been stripped and surveyed, the whole approval process has to be gone through before the repair and rebuild work can commence. The components would all have to be put aside in a box for, say, a two-week period until agreement was reached before work could continue and even then the job might be taken over by different personnel. To ensure that this did not happen we worked a separate system for work arising from survey. As this type of work had to be done and the only point to decide upon was the price, all work arising from

survey would be written up 'to issue' and work would continue on it without interruption. The estimating, provision of a quote, and approval processes would then go ahead in slow time. This worked extremely well and was a significant factor in the refit being completed within the overall project timescale. It must be pointed out, however, that for this to be workable a great deal of trust is required between the Delegate and his refit team and the commercial manager and his estimating department.

### Financial Aspects

The proportion of total refit money available was divided as follows:

- (a) Alterations and Additions — 22%
- (b) Main and Supplementary Defect List — 46%
- (c) Supplementary Work — 32%

The amount allocated for the contract specification, which included the As & As and defect list work, was finalized during the contract negotiations. The amount allowed for supplementary work can only be fixed by judgment. In a fixed price contract the amount for As & As will not alter unless the specifications for some As & As are altered. All additional work undertaken will be paid for from the supplementary work allowance. In our case the total cost of the supplementary work allowance and defect list work was split in the ratio of about 40:60. This proportion proved to be about right. In general terms it could be said that if the supplementary work allowance was less than about one third of the total, then some restrictions would have to be imposed, which could mean that some work which was previously deemed to be essential would have to be cancelled or that some survey work might not be undertaken.

One factor that needs careful control is the way the spending of this supplementary work allowance is spread throughout the contractual period. FIG. 3 shows how our committals were spread.

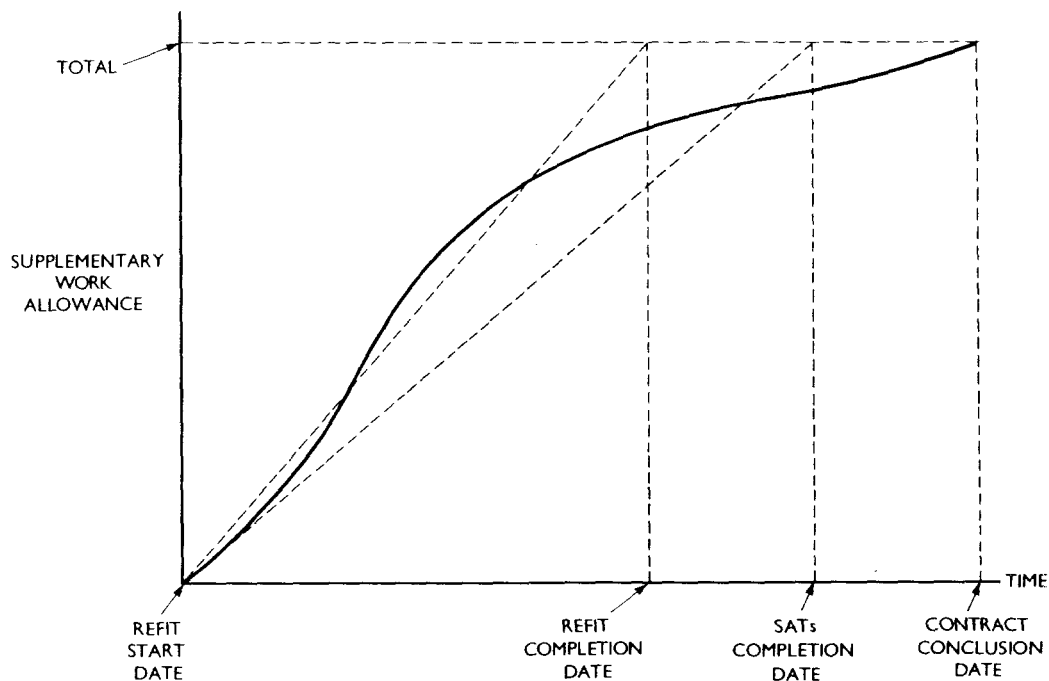


FIG. 3—SPREAD OF SUPPLEMENTARY WORK ALLOWANCE COMMITMENTS

It can be seen that the curve is S-shaped up to SATs Completion Date. The first portion rose slowly as surveys of structure and opened-up equipments were only just commencing. As more surveys were completed the slope of the curve increased and towards the end of the refit it decreased as by then most of the surveys had been completed. In this latter part of the refit the main costs came from trials requirements and the taking on of additional finishing work subject to available finance. It is during this period that the ship's company will have moved on board and a large number of requests for additional work will be made by them as they find out all the things they would like changed based on their new experience of living and working on board. The additional increase from SATs completion date to Contract Conclusion Date (i.e. the date of last payment) was due to the late finalization of many costs such as additional services, provisional sum adjustments, and defects and other costs arising during trials.

Of all the differences between a commercial refit and one undertaken in a Dockyard, financial control and accountability is the greatest. Careful thought is required when devising the system for financial control. The system must ensure there are complete and easily maintained records of all work approved, under negotiation, or still with the estimators, all work cancelled and whether credits have been received, all provisional sums and whether final costings have been received, all reductions gained from quotes and all payments due and made. It must also show the trend of commitments and allow future trends to be forecast. These records must obviously be such that they can be easily audited and meet whatever Defence or Treasury financial regulations are required to be met. One advantage of a commercial refit is that at the end of the project you know exactly how much the real cost of that refit was. There are no hidden costs.

### **MOD Services**

As already mentioned the services of U.K. Ministry of Defence overseers and weapons setting-to-work and trials personnel were obtained on an agency basis. This is a good opportunity to make the comment that we obtained excellent assistance and co-operation from all the MOD(U.K.) personnel who worked directly for us, or from whom we requested help in some form or other.

### **Conclusions**

An obvious conclusion is that a commercial refit is different. This difference means that naval personnel involved have to think about more things than they would do normally, resolve more potential problems and work harder and for longer periods than they would in a Dockyard refit where the organization will cater for most things. Much more care has to be paid to matters of detail if everything is to be satisfactorily completed. Also, to make the most of the advantages that can be gained from a commercial refit, a flexible approach is required to match the flexibility of the shiprepairer's workforce.

The time and financial constraints imposed need to be taken into consideration when judging whether or not the refit was successful. Our refit was completed within the overall timescale and within budgeted costs. All work we wanted done was done (the total value of work cancelled because Vospers could not complete it during the remaining time available was less than £1,000). Vospers showed that they can undertake and satisfactorily complete a significantly larger amount of work than one would expect to be completed in the same timescale in a normal Dockyard refit. The overall conclusion is that we obtained good value for money and the refit was successful. However, success does not mean perfection. There were areas where improvements could be made and these have been noted in the article.

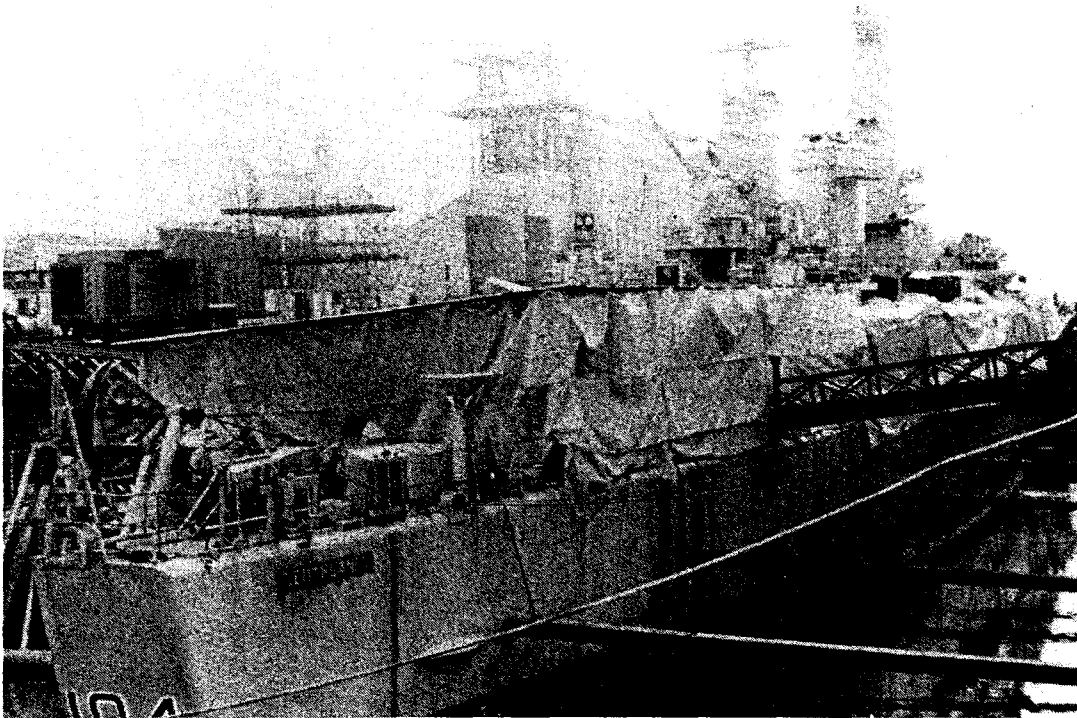


FIG. 4—H.M.N.Z.S. 'SOUTHLAND' DURING FLOODING OF THE DOCK. THE PROTECTIVE SCREENS NECESSARY FOR SECURITY IN A COMMERCIAL PORT CAN BE SEEN.

We gained much valuable experience by working with a commercial shiprepairer, just as they gained good experience by working with us. Between us we completed a refit that was marked by good working relationships and the feeling that every one of the many groups involved was working together as part of one unified team. This made a significant contribution to the overall success of the refit.

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