THE ACCEPTANCE BUSINESS

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ABSTRACT

Ship Acceptance consists of tests, trials and documentation to ensure satisfactory completion of a new vessel. Fleet Acceptance of a new system or equipment throughout design and introduction ensures that it is fit for purpose. This article describes the present arrangements for both, indicating how they may change, concentrating on the procedures for submarines.

Introduction

Until relatively recently there have been two sides to the acceptance duties carried out by Commodore Naval Ship Acceptance (CNSA): firstly the acceptance of new construction ships and submarines from their shipbuilders and secondly the 'Fleet Acceptance' of weapon systems. To these have since been added the Fleet Acceptance of a number of platform systems. At the same time ship acceptance is in the process of evolving to cater for the situation where warships are procured through a Prime Contract Management Organization to whom the shipbuilder will be sub-contracted. This article describes the present arrangements and suggests how some of them may be expected to change in future. It concentrates on the procedures for submarines. Those for surface ships are largely similar, are also changing and may form the subject of a future article.

Ship Acceptance

Anyone appointed to stand by a submarine under construction can look forward to an experience both fascinating and challenging. As well as becoming accustomed with, and qualified on, a new set of machinery, he will become familiar with a variety of engineering techniques and learn much about the fundamentals of his ship that are impossible to see in a normal running boat. He will witness an assortment of steel shapes, fittings and equipment being welded together and transformed into a being that can take him round the world carrying the potential to give good account of itself in a conflict should the need arise. Added to all this, he will meet some or all of the staff of Captain Submarine Acceptance (CSMA) (FIG. 1).

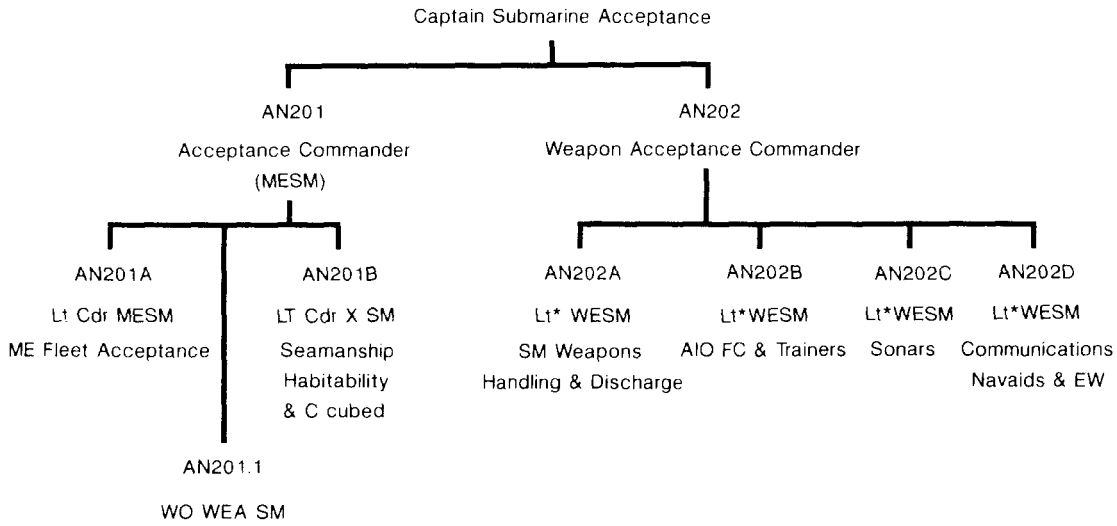

FIG. 1—THE STAFF OF CAPTAIN SUBMARINE ACCEPTANCE

During his time standing by he can expect to experience a busy programme interlaced with acceptance activities as follows:

- *Construction*. This will already have started by the time the Engineer Officers join. Typically the MEO and WEO, together with a small selection of key Senior Rates, join a year before launch (earlier for a first of class): the DMEO, DWEO, AMEOs and remaining engineering ratings join later, followed by the rest of the ship's company.
- *Launch*. Following the last UK submarine slipway launch, the ceremony of launching has been replaced by that of 'naming' which takes place a few days after the submarine has been lowered into the water on the shiplift. Another consequence of building submarines on the horizontal floor of the Devonshire Dock construction hall at Barrow is that there is no longer the urgency to float the submarine to get it upright as required for the installation of the reactor core. This is now done in the hall, where staying on in the covered environment greatly benefits working conditions on external fittings and tiling.
- *System Testing*, leading up to Reactor Cold and Hot Operations, Steam Range Testing and Power Range Testing as well as the basin dive.
- *Pre-Contractor's Sea Trials Inspection (Pre-CSTI)*. This is carried out by a team led by CSMA's Acceptance Commander with co-opted support from a selection of specialists in FOSM, CSST etc. It examines key safety, security and habitability aspects to establish that the vessel is fit in these areas to proceed to sea. This provides some of the evidence to support PNO's signature on the Seaworthiness Certificate that authorizes the shipbuilder to take the submarine on CSTs.

- *Contractor's Sea Trials* (*CSTs*), during which the Ship's Company operate the submarine for the shipbuilder. Unlike surface ships, submarines require the weapon system to be largely complete by CSTs. This allows the torpedo tubes and submerged signal ejectors to be fired when the submarine is conducting deep trials and the sonar to be operated to check the safety of the return to periscope depth.
- *Defect Repair Period*, incorporating Opening-Up Inspections, of which there are relatively few in submarines compared with surface ships in recognition of the fact that much of the machinery has already been run up to full power and opened up for inspection in the Submarine Machinery Installation and Test Establishment (SMITE) at Barrow before being installed as a unit into the submarine.
- *Terminal Date Inspection* (*TDI*). Terminal Date was originally the date on which the submarine was capable of proceeding to sea under her own power. In practice it is the date by which all work should be substantially complete, leaving only the application of the final 'finish'. The inspection is conducted by CSMA supported by a team of specialists similar to that used for the Pre-CSTI. It runs over a two day period (although it will be more for the VANGUARD Class due to their larger size) and examines the whole submarine, looking closely at any outstanding defects and trials. Provided the submarine passes, the inspection is followed by the Preliminary Reading of the Form D448.
- *Form D448*. this is an omnibus listing of all the outstanding work, trials, stores, documentation, concessions etc. It is in two parts. Part 1 deals with those items directly attributable to the build contract and, hence, generally a shipbuilder liability. Part 2 covers other items such as defects in the design which may be a MOD liability. The reading establishes that there is no doubt over the liability for each item and that the responsible authority undertakes to complete it within a defined timescale. In chairing it, CSMA is guided by PNO on the detail of the Build Specification and by the Project Manager on other contractual matters: he attempts to remain broadly neutral, so that he can be regarded by both sides as an honest broker.
- *Final Inspection* (*FI*). This normally follows approximately one month after TDI. Until recently, the contract for a submarine build was largely 'cost plus', meaning that, provided there was no chance of it making him suffer penalties by missing a key milestone, the shipbuilder was happy to accept extra work and minor changes to the design. Latterly however contracts have been negotiated which are predominantly 'fixed price'. This has tended to make the shipbuilder more cautious over the time spent on achieving a good finish or on making minor changes requested by Ship's Staff unless these are covered by a Change Notice issued by the Project Manager (or a Local Change Notice issued by the PNO). Such changes frequently appear difficult to justify within a tight budget due to the high extra cost of the drawing changes and administrative overheads. These factors have resulted in CSMA finding more defects at FI in standard of finish or where minor items are not 'Fit For Purpose', with the result that two submarines recently failed the inspection. The inspection lasts a day and is followed by the First Reading of the D448. This is the first formal reading and it is signed by the relevant authorities to certify that all known deficiencies have been included and to substantiate the verbal undertakings for completing the outstanding work.
- *Commissioning* usually takes place at the shipyard between FI and the Programmed Acceptance Date (PAD).

- *Acceptance Cruise*, which normally starts with Final Machinery Trials and any sea trials not completed on CSTs. The former would ideally have been completed before TDI, but in view of the tidal/draught limitations of both Barrow and Birkenhead, coupled with the passage time to a deep water diving area, and the reduced extent of opening-up mentioned above, this requirement is waived as impractical. There follows the Final Machinery Demonstration when the submarine is shown off to Captain Submarine Acceptance, after which, if successful, CSMA, with the agreement of the Project Manager, authorizes the submarine's Commanding Officer to sign for acceptance of the submarine on behalf of the MOD from the Shipbuilder. After this the submarine surfaces, hoists the White Ensign and proceeds to the Work-Up base.
- *Guarantee Period.* CSMA chairs the Final Reading of the D448 to ensure that all defects outstanding from build and any arisen during the Guarantee Period (usually 12 months from Acceptance) plus any design deficiencies and other shortcomings have been or are being satisfactorily addressed.

Other CSMA Ship Acceptance Activities

Because of the experience gained by the staff of CSMA in their Ship Acceptance duties, coupled with the fact that they are usually amongst the more seasoned submarine operators, they are employed to give independent advice to the submarine platform and equipment projects. This starts during the early life of a project with providing contributions to the Staff Requirement (Sea) (SR(S)), attending various design working parties, commenting on the Design Policy Papers, attending inspections and audits of the fifth scale model, full scale mock-ups and any CAD modelling as well as answering a variety of questions. Towards the end of the design phase the nature of the questions changes to one of 'We cannot quite achieve the specification in this area (e.g. minimum deckhead height) without additional cost and the following drawbacks . . . —will it nevertheless be acceptable?' Here, since most submarine design involves a degree of compromise, CSMA has to take a balanced view and hope that his judgement withstands the test of time.

Because of the need to work closely with the submarine and equipment projects CSMA is co-located with them and is a member of the Sea Systems Controllerate (SSC). It could be argued that this detracts from his need for independence from the projects or for proximity to the ultimate customers in C-in-C Fleet/FOSM whose interests he represents. However the practicality of the need for a close working relationship with the project where CSMA can put his experience to maximum effect is overriding. It is for this reason that, in the current discussions on the forthcoming division of the SSC into a procurement element and a separate Naval Support Command (NSC), a strong case has been made for CNSA to remain in the SSC/PE.

Fleet Acceptance

Fleet Acceptance is the process whereby a new system or equipment is scrutinized throughout its design phase and introduction into service to ensure it will achieve fitness for purpose. What does this mean? At first sight one might think that it is limited to an examination of performance. However, most of us probably know of equipments that might have had adequate performance but were initially condemned because they lacked reliability or spares, there was no course for the operators/maintainers or the handbook wasn't available.

Fleet Acceptance sets out to provide answers to the following questions:

(*a*) Does it work?

(*b*) Can it be operated?

(*c*) Can it be supported?

Thus although performance is very important, it is just one of ten parameters to be examined. These are:

(*i*) Performance, which includes an assessment of the potential output promised by the design at the drawing board stage and of that demonstrated by the production equipment on test at the manufacturer's works as well as that of the final equipment when installed on board to see if it provides the performance expected by the Staff Requirement.

(*ii*) The requirements for its installation in the ship and setting-to-work, including support from other ship systems, e.g. electrical/hydraulic power, cooling, etc.

(*iii*) Its operability, control, human factors and complement requirements.

(*iv*) Compatibility, i.e. its impact on and its susceptibility to the submarine conditions both internally, e.g. electromagnetic interference, access routes, etc., and externally, e.g. ranges, cranage and docking requirements.

(*v*) Its susceptibility to the environment which the SR(S) requires the submarine to withstand, e.g. temperature, shock, etc.

(*vi*) ARM.

(*vii*) Upkeep and Support requirements which include the necessary level of stores, documentation, special tools, requirements of Fleet Maintenance Bases and Dockyards, and training facilities.

(*viii*) Standards and Specifications that it is required to meet.

(*ix*) Safety, i.e. whether it creates a hazard to the crew such as noise, radiation, fire, etc., and, if so, whether adequate precautions have been taken.

(*x*) Security.

Fleet Acceptance Procedure

Fleet Acceptance is applied to all weapon systems that are new to service and, with a reduced scope, to equipments which have already seen service but are going to sea for the first time in a new class of warship. The procedure, which is laid down for weapon systems in SSCP 53, starts with the Project Manager drafting the system's Agreed Characteristics (AC). He can start once the Requirement has been endorsed. The AC expands the relevant clauses of the Requirement into a comprehensive description of the capabilities of the type of equipment he proposes to procure and against which the results achieved by the end product can be assessed. The document covers the headings listed above. The AC forms an undertaking between the Project Manager, on behalf of the PE, and DOR(Sea), for the Defence Staff, and is accordingly signed by both parties as well as by the Acceptance Authority.

As soon as the AC has been issued, the Acceptance Authority raises an Acceptance Questionnaire (AQ). This includes questions covering every aspect of the AC and any other checks necessary to establish the equipment's fitness-for-purpose. Each question starts by recording the reference which establishes the criteria (e.g. an NES specified in the procurement contract or AC), followed by the reference of the Test Form or trial that will demonstrate that the standard has been met. It then serves as a medium for monitoring the accomplishment of

each characteristic. This is managed by an Acceptance Committee chaired by a CSMA officer and attended by representatives of the authorities responsible for each aspect of the procurement, operation and support of the equipment. When the system/equipment is eventually presented for its Installation Inspection, Harbour and Sea Acceptance Trials (carried out on weapon systems by CWTA, another part of CNSA) the test results are assessed by the Acceptance Committee as part of the evidence to support CSMA's recommendation of Fleet Acceptance to C of N.

The Value of the Fleet Acceptance Process

It is from the wealth of experience that this committee concentrates on the procurement arrangements and potential shortcomings of the equipment that the organization gains its strength. Most Project Managers value the discipline of Fleet Acceptance because they realise that it helps them to acquit their responsibility for co-ordinating total system provision, particularly in areas such as stores, training and documentation which are peripheral to their main activities in the Sea Systems Controllerate.

Added to that is the fact that by dint of the Acceptance Authority making an early declaration during the design phase of the questions to which answers will subsequently be sought and the standards by which they will be assessed, it is possible for the Project Manager to make any necessary change to the equipment whilst this can still be easily achieved, rather than discovering it later when change has become both expensive and disruptive. The essence of the value of the Acceptance Authority is not simply to appear at the end of the day and issue a pass or failure but, by applying its knowledge and experience early, so to influence the project as to ensure success. The Acceptance process cannot inevitably guarantee to make an ailing project come good but it should always help the Project Manager to ensure maximum value from his available resources.

Fleet Acceptance of Platform Systems

In examining the history of how and why Fleet Acceptance evolved for weapon systems one finds that although the MOD Project Manager has always remained responsible for the design, much of the actual design work has for some time been carried out by contractors who frequently have delegated part of the design to sub-contractors. This meant that the people doing the detailed design work were several stages removed from the ultimate user. It was consequently not unknown for equipments to be produced with significant shortcomings in operability or support not being revealed until very late. The need to make changes increased cost and caused delay to the introduction into service. As a result, the Fleet Acceptance process was developed to provide visibility throughout the procurement to a body representing the interests of the eventual customer. Exposure of the procurement to the Fleet Acceptance discipline has helped to minimize occurrences of such shortcomings.

A brief look at the way platforms are currently being procured reveals the same trend away from in-house design capability. Hence in 1985 the Management Boards of the two Deputy Controllers within Sea Systems Controllerate agreed to the need to set up a similar system for accepting platform systems and equipments. This decision led to pilot schemes being set up in the UPHOLDER and VANGUARD Classes, the Type 23 frigate and the Single Role Minehunter. These exercises achieved what they set out to do, which was to establish the procedures and refine the documentation. Any benefit they achieved to the chosen systems was regarded as a bonus and was not expected to be significant by virtue of the fact that, by the time the procedures had been introduced, the design phase for each Class was virtually complete with most of the mistakes

already discovered and put right. The pilot schemes are continuing in a reduced form with the guidance contained in SSCI 98/91.

The procedure of Fleet Acceptance of platform systems has been recognized by submarine Projects as being of potential value to them. This is evidenced by the fact that both Projects involved in Pilot Schemes consequently asked CSMA to conduct a structured acceptance of aspects of the submarine where they lacked confidence in their ability to achieve the end result. These were areas where they were finding management difficult—for example where there was more than one Directorate General involved, where the Requirement was ill-defined or where the research was incomplete. CSMA was pleased to be able to respond and the work done by the Committees he chairs in these areas has been recognized as a notable success.

The Future

With the advent of warship procurement via a Prime Contract Management Organization (PCMO) comes the need to consider ship acceptance at two, if not three, levels, viz:

(*a*) Acceptance of the submarine by the PCMO from his sub-contractors.

(*b*) Acceptance of the contract by the Project Manager from the PCMO.

(*c*) Acceptance of the total project by the Defence Staff from the PE.

The above levels may or may not be integrated with each other and with the Fleet Acceptance of the systems and equipment. Currently under discussion is an additional hand-over where some form of Acceptance process might be involved, namely for the transfer of 'mature' vessels from the SSC/PE to the NSC.

Before the demise of the SSN 20 Project in 1990, considerable progress had been achieved and agreement reached between the Project Manager, the PCMO (Underwater Management Associates—a consortium formed between VSEL, GEC, RR and BAe) and the Acceptance Authority to define the procedures for these activities. At that time it was felt that structured acceptance should be applied to some one hundred ME and WE systems. These were graded into a hierarchy of levels, viz integrated systems, systems, sub-systems, equipments etc. The decision as to whether or not each should have its own AC, AQ and Acceptance Committee was guided by the criteria given in SSCI 98/91, viz:

(*a*) Its importance to the prime role(s) of the vessel.

(*b*) Whether it contained a strong element of novelty.

(*c*) Where previous systems of this type had had a poor track record.

One thing which was clearly established was that Acceptance at the levels described above should all be to common standards. Another important agreement was that the documentation required for Acceptance would not be an additional layer on top of that already required to specify the vessel to the PCMO and by him to the shipbuilder: instead, both sets would be adapted so that one would satisfy both requirements.

Discussions have since been started for the 'Batch 2 TRAFALGAR Class' (B2TC) between the new PCMO (a looser grouping of the same companies) which is carrying out the initial studies phase, the Project Manager and the Acceptance Authority. The project is still in its infancy and has yet to decide on the relevance to B2TC of the agreements previously reached for SSN 20. A new issue to be settled for B2TC is that of design risk. In the past MOD has retained much of the design risk, but future contracts will require this to be transferred to the contractor. The contractor then has to decide how much he is prepared to spend on the design or the quality of equipment to reduce that risk. In all probability he will look for some reward for his endeavours. If this means achieving a better result—e.g. a more capable submarine with improved sonar

performance, reduced acoustic or magnetic signature—then the customer will be delighted and arguably, provided the Staff Requirement and the contract are written to cater for it, prepared to pay accordingly. But how this degree of achievement is to be measured, how the level of reward is to be determined and what the role in these decisions is of the Acceptance process are questions yet to be resolved.