Defence (3)

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SECRETARY OF STATE

Weekend Box

MO 26/3

18th March 1980

Dear Mike,

TORPEDOES

Thank you for your letter of 21st February 1980, enclosing a copy of a paper by the Editor of Jane's Fighting Ships on Torpedoes.

The enclosed commentary has been prepared under the directions of my Secretary of State, who has asked me to forward it to you. Our comments are directed in particular to Captain Moore's review of the British record in producing heavyweight and lightweight torpedoes. We have not gone into detail on future Soviet submarine capabilities (speed, depth of dive etc) since there is a good up to date summary of the position in paragraphs 3 and 4 of the report by officials circulated under cover of OD(79)17.

Yours sincerely,

David Omand

(D B OMAND)

M Pattison Esq

TORPEDOES:

COMMENTS BY THE MINISTRY OF DEFENCE ON CAPTAIN MOORE'S MEMORANDUM

GENERAL

It is thought that much of Captain Moore's information comes from articles in the British and American press, together with material culled from US torpedo manufacturers, overlying his own experience as a former submariner. He appears out of touch with the level of technology achieved in the British torpedo industry since his retirement from the Service in 1972. His judgements of operational capability seem to involve matching current generations of weapons against a future and developing Soviet threat which has yet to be fully validated.

2. The record of torpedo development in the United Kingdom has not been good but real management improvements have been introduced progressively. The Torpedo Procurement Executive was not a committee, as Captain Moore implies, but a project team formed to manage the Mk 24 programme and it did its job without proliferating paper or meetings. The Mk 24 MOD 1 TIGERFISH heavyweight torpedo (launched from submarines) gives every indication that it will meet the operational requirements of the Royal Navy when it enters service this year. We are confident that the lightweight STING RAY torpedo (launched from ships or aircraft) will do so also.

HEAVYWEIGHT TORPEDOES

3. All weapons systems in high technology fields have some limitations. Of those alleged by Captain Moore for the TIGERFISH MOD 1, a swim-out capability (ie, where the torpedo leaves the tube under its own power) was not an operational requirement; nor do we regard it as a disadvantage to rely on energy discharge (where the torpedo is ejected from the tube under pressure). The length of guidance wire, whilst always a compromise, is adequate for the maximum effective engagement range of the torpedo.

4. For the future, feasibility studies for a successor system to TIGERFISH have been conducted in response to the changing threat, for entry into service in the late 1980's. The choice between a British or American weapon has yet to be made; indications are that both could meet the new requirement. Apart from industrial considerations, a British solution would have the advantage of being based largely on STING RAY technology thus benefiting from the considerable investment in the project.

10

5. STING RAY is expected to be the most effective weapon of its kind in the world when it enters service, both over the relatively shallow European continental shelf - a most important operational area for our anti-submarine forces - and in deeper waters down to its Staff Requirement depth of 760m. In deep water trials in November 1979 it achieved 900m. It is believed (from recent evidence) that the titanium-hulled "ALFA" Class, to which Captain Moore refers, can operate at faster speeds than other Soviet submarines and possibly as deep as 1000 metres. To this extent STING RAY, when it enters service (planned for 1983), might suffer some limitations in terms of a reduced speed advantage, depth and penetration against the "ALFA", but the latter is not expected to be deployed in significant numbers during the 1980s; moreover there is still much uncertainty in our knowledge of the ALFA's capabilities and likely place in Soviet operations.

6. These limitations do not invalidate our acquisition of STING RAY, the Naval Staff Requirement for which takes into account the forecast speed and depth capabilities of the vast majority of the Soviet submarine fleet in the 1980s and indeed the 1990s. STING RAY's powerful on-board computer will enable it to locate and destroy enemy submarines quickly in both deep and shallow water (with a particular emphasis on its capability in the latter). The future heavyweight torpedo (paragraph 4 above), which is intended to enter service some years after STING RAY, will be designed to achieve greater depth and speed. Improvements to STING RAY that may be required in due course could in turn include increased speed and depth (neither the sealing of the propeller shaft nor the strength of the hull inhibit the possibility of designing for greater depth), but such improvements will have to be founded on a review of a range of factors including more certain knowledge of the "Alpha" class than we now possess.

7. As for compatibility, STING RAY will be capable of employment from a full range of launch platforms on RN ships and helicopters and Royal Air Force fixed-wing aircraft. It does not use the American Mk 32 launching system as suggested by Captain Moore, although that system could be modified quite easily for firing. This question does not arise for the Types 22 or 42 (mentioned by Captain Moore), as these ships will have the British STWS 2 tube-launch system specially designed for STING RAY but also capable of firing Mk 46 weapons when required. The need for IKARA to be capable of carrying STING RAY is recognised and is under consideration.

21 February, 1980.

BF 5/3/80

The Prime Minister recently met the Editor of Jane's Fighting Ships. As a result of their conversation, Captain Moore has sent the Prime Minister the enclosed paper on Torpedoes.

The Prime Minister would be grateful for your Secretary of State's comments on it.

M. A. PATTISON

B.M. Norbury, Esq.,
Ministry of Defence.

10 DOWNING STREET

PRIME MINISTER

The attached letter from Captain Moore encloses a paper on torpedoes.

Would you like us to seek Ministry of Defence comments on the paper?

18 February 1980

18 February 1980

I am writing on behalf of the Prime Minister to thank you for your letter of 15 February, with which you enclosed a paper on torpedoes.

I know that the Prime Minister will be most interested to see this.

M. A. PATTISON

Captain J.E. Moore, R.N.

JANE'S
YEARBOOKS

JANE'S FIGHTING SHIPS

from the Editor
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PPS

The Right Hon Margaret Thatcher
No. 10 Downing Street
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London SW1

Your reference | our reference | date 15 February 1980

P/18

Dear Prime Minister,

It was most kind of you to ask my wife and myself to Chequers and we did appreciate it very much. As my wife had returned home only a week before after a long period in hospital it gave her a great lift to visit such a glorious place in such excellent company on a beautiful, almost spring-like, day. I do thank you most sincerely.

I enclose a paper on torpedoes which I realise is more than you asked for. I felt that a recapitulation of part of that weapon's history over the last forty years might be a help to you in understanding the doubts that a number of us feel over present claims. The total failure by the British over several decades to produce a single worthwhile torpedo had a pervasive effect on the high morale so necessary in submarines and caused a marked lowering of the Royal Navy's general anti-submarine capability. The introduction of the American Mk 46 saved the day and thank goodness our abilities in this direction were never tested in war.

The torpedo armament of the navy is only one aspect of the whole in which worries over ship design, submarine design, data handling and display in this era of incredible advances in micro-processor techniques are dwarfed by concern over the ability of an over-swollen ministry to cope with modern problems. The mess of self-generated paper work resulting from inflated staffs and a massive committee structure ensures that no longer is there any possibility of the naval staff, or ministers for that matter, to have what Winston Churchill desired for his original naval support, "the time to think."

The torpedo paper is designed to allow you to consider the Stingray section as a separate entity which can be added to the longer piece to give an overall picture of the situation.

Yours sincerely

John Moore

T O R P E D O E S

by

CAPTAIN J.E. MOORE, R.N.

T O R P E D O E S

Introduction

During the early part of the last war we had one aim which was shared by our opposite numbers in German and American submarines - the replacement of our torpedo designers by people who could provide us with weapons which would be accurate and effective. There was nothing more frustrating than finding, after penetrating a destroyer screen and achieving a perfect firing position, that the torpedoes failed to explode, hit the bottom or, sometimes, circled round and pursued one's own submarine. In the case of the Germans considerable advances had been made by 1942 and in 1945 65% of the torpedoes used by US submarines were of the Mark 18 Type, an electric torpedo developed from a captured German G7e torpedo. British submarines were still using the Mk VIII, a development of a design produced by the R.N. Torpedo Factory in 1928, propelled by a semi-diesel engine, with the possibility of the electric driven Mk XI, although the latter was rarely encountered.

Post-War

In the immediate post-war years it became evident that the submarine could be a most potent anti-submarine weapon system if a suitable torpedo could be produced for this purpose. Sonar systems were improved but not before time. The dived speed of submarines had been dramatically increased from 8-9 knots to 16-17 and, when USS Nautilus put to sea in 1955, this figure rose to over 20 knots for virtually unlimited periods. By 1967 the Soviet navy was commissioning submarines capable of 30 knots and, in 1970, they had built the first of the "Alfa" class. This submarine clearly posed major problems and it is only in the last few years that the class

has gone into slow series production. With a titanium hull giving a diving depth of some 3,000 feet (as opposed to the more general 900-1,000 feet) the "Alfa" is apparently capable of 40 knots. No doubt this is an extremely expensive boat to build but, it has proved that modern technology is capable of providing boats which are faster and deeper diving than very nearly all Western torpedoes, whether they be launched from ships, aircraft or submarines.

Current US situation

The use of torpedoes for surface ship engagement under conventional rules was finally brought to a halt by the introduction of surface-to-surface missiles. The torpedo became, primarily, an anti-submarine weapon for surface ships, although remaining the main armament for all purposes for submarines until the introduction of missiles which could be launched when dived.

The USN introduced the Mk 37 torpedo in 1957 primarily for submarine use, a weapon which, with various modifications, could be used as a free-running weapon with its own sonar set to home on to the target or as a wire guided weapon, also with sonar homing. In 1968 work on this torpedo was put in hand to improve its speed, range and acoustic homing capability - the result was the MT-37C conversion kit now supplied to such countries as Canada, Netherlands, Norway and several others, which includes a new Otto-fuel propulsion system to replace the electric motor.

In 1960 the Mk 45 (Astor) torpedo was introduced for submarine use. With a range of about seven miles this is a high speed weapon which can carry a nuclear warhead. Five years later a second nuclear weapon was introduced into US submarines, SUBROC. This is part of a complex weapon

system designed for use in nuclear propelled submarines, the solid-fuel motor providing supersonic speed once the missile has left the water, carrying a nuclear depth-bomb to a maximum range of 30 miles.

In parallel with these developments was one initiated in November 1956. This was for an anti-submarine torpedo of high performance, its original title being EX-10. By 1968 it had been decided that it should also have an anti-ship capability and a production contract for this dual-purpose weapon was awarded to Gould in July 1971. The fifteen years of research, development and trials have produced the most efficient Western torpedo in current production. Its speed of ~~50~~ 55 knots comes from a gas piston engine using Otto fuel with a pump-jet propulsor in place of the normal propellers. Wire guidance in the latest (Mod 3) version is provided through a two-way link (Telcom) which was introduced in 1977 and this provides a continual control until the torpedo's own homing equipment can take over. In the case of a wire failure the torpedo can still carry out its task which includes multiple re-attacks if the first attack is unsuccessful. With a range of about 25 miles and a diving depth of 3,000 feet this torpedo now provides US and Australian submarines with the most effective weapon available, one for which Gould have further plans for improvement. These include a reduction of the required length by two feet due to the use of modern micro-processor techniques, which could result in the provision of more fuel and, hence, greater range. In addition probable improvements of the present acquisition range (4,000 yards at 40 knots) could mean the removal of the need for wire guidance, thus providing either a shorter torpedo or a longer range weapon. These are short term advances; in the longer term the ADCAP (Advanced Capability) plans suggest a 40% increase

in horse-power to give increased speed and range as well as an increased diving depth of 4,000 feet and an enhanced shallow water capability.

Other improvement plans have been introduced for the Mk 46 torpedo, of which Mod 1, which uses Otto fuel, was introduced into service in the USN in October 1965 for aircraft and ship use. The Mod 4 version of this torpedo is to be used in the Captor mine project and Mod 5 will be the improvement of those weapons now in service by the use of another conversion kit (NEARTIP). Further in the future of the Mk 46 are plans for an increase of the horse-power to 150 h.p., increased speed as well as an improvement of the diving depth to 4,500 feet. What is interesting is the fact that those torpedoes operating on Otto fuel engines have no problems with the propellor shaft seals because the exhaust is fed back to the after-body to pressurise that section. Other torpedoes such as the German SUT and the Italian Type 184, both electrically propelled, have yet to surmount this dilemma. The current plans for the possible replacement of the Mk 46 are centred on the Advanced Lightweight Torpedo (ALWT) design which is unlikely to be in service until the late 1980s.

The British Situation

After the Mark XI vanished without ceremony the efforts of the underwater group at Portland (now Admiralty Underwater Weapons Establishment - AUWE) were directed towards the production of a torpedo which would home onto a submarine. The first of these weapons, Pentane, achieved little success other than sinking a boat-load of senior officers in the Clyde. In 1950 the development which resulted in the Mk 20 (originally Bidda)

was begun. This was to be a dual-purpose weapon aimed against both surface ships and submarines, and the importance of the "anti-escort" role was emphasized by the provision of "short" tubes in the stern of the "Porpoise" and "Oberon" class submarines, specifically designed for the Mk 20. Regrettably two things happened - the surface homing capability proved to be inadequate and the torpedo itself was inclined to burst into flames in high ambient temperatures. The information to be set on Mk 20 was spindle set, a cumbersome and unreliable method. This was to be replaced by an umbilical cord method (Mk 22), Mk 21 having, apparently, vanished from sight. The Mk 22 concept was in the public eye for only a short time when "Grog", later to become Mk 23, appeared. This became well-known for several reasons but the primary one was that this was the R.N.'s first wire-guided torpedo. Other considerations which exercised the operators were difficulties with the wire-guidance system and the somewhat idiosyncratic behaviour of the electric batteries. In my own squadrons none of my commanding officers had any faith in the Mk 23 but were somewhat relieved to be told that it was primarily intended as a training version before the introduction of "Ongar", later to be known as Mk 24. This weapon was due to be in operation by 1964 - in fact it was such a disastrous failure that, following representations by the Flag Officer (Submarines), a 1969 Government Select Committee into MOD(N) research and development procedures was set up. The recommendations of this Committee included:

a) The cancellation of the Mk 31 lightweight torpedo programme which had already cost £5 million and was expected to cost another £10 million. In the event the Mk 46 was purchased from the USA to bridge this gap.

b) The transfer of Mk 24 design and production to industry.

c) The setting up of a committee under Sir Roland Baker (DG Ships) to find out what had gone wrong and recommend preventive measures in the future.

Amongst the findings of the Baker committee was that the failures had been due largely to inadequate documentation and that the way ahead should be plotted by a new body, the Torpedo Procurement Executive (TPE). Amongst its sub-committees was one dealing with the Mk 24 and, by 1971, the whole project had been farmed out to Marconi Space and Defence Systems Ltd (a subsidiary of GEC) who were vested with contractual responsibility for all torpedo manufacture in the future. Nevertheless it would not be surprising if sub-committees on such subjects as the Mk 23 do not gather from time to time. Other results of the ensuing witch-hunt were that a number of torpedo designers moved to other spheres and future torpedo design was borne ahead on a proliferation of paper and committee meetings. By 1978 the Mod 1 Tigerfish (ex-Mk 24) was in operational service in British submarines but it has its limitations;

a) It has no swim-out capability and requires energy discharge.

b) The basic technology is now about ten years old, although improvements are in hand.

c) The practice and warshot weapons are not interchangeable, the practice variety having half the range of the warshot.

d) The cost of the silver-zinc battery (about £60,000) is very high and the battery will last for only six practice runs.

e) The inboard wire dispenser is incompatible with any torpedo tubes or fire-control systems other than those in British submarines.

f) It is suggested that the total length of guidance wire is less than the torpedo's range.

Whether these problems lie behind the suggested "Experimental Development Vehicle (EDV)", "UK option", "Tigerfish Up-date" - the names seem to be synonymous - I don't know but, whatever the reasons, what appears to be on the agenda is a mixture of the front end of a Stingray shackled onto a Tigerfish mid-body and one of the four back ends of the US Mk 48 Mod 0 which have been imported. It would be interesting to know if these will all fit together but one thing is certain, the Mk 48 Mod 0 with the Sunstrand turbine will not produce more than 45 knots and the argument that it is quieter than the Otto fuel motor in the later Mk 48s is therefore academic. The speed advantage over the 40 knot "Alfa" class is insufficient and there is no evidence that this is the limit of Soviet capabilities.

STINGRAY

The cancellation of the Mk 31 torpedo, recommended by the Government Select Committee in 1969, forced the United Kingdom to adopt the American Mk 46 torpedo and the Stingray has been designed as the successor to the Mark 46. The minimum target for modern anti-submarine torpedoes is the Soviet "Alfa" class submarine, capable of 40 knots and a diving depth of 3000 feet. There is no evidence to suggest that these capabilities cannot be exceeded in the next decade or two. But even with the "Alfa's" current performance calculations suggest that any counter weapon would need a considerable speed advantage, possibly 55 knots, a depth advantage, possibly 4,000 feet, and a range of some ten miles. These figures allow for evasive action by the submarine and, therefore, a re-attack capability on the part of the torpedo.

Speed

The Stingray speed is reputed to be 45 knots, which, without a lot of luck, is insufficient to deal with a 40 knot submarine. This speed is also reputed to come from an 85 hp motor. To obtain a 10 knot increase in speed, assuming these figures to be eorrect, the cube function of the speed increase ratio would give a power requirement of 152 hp. The upgraded Otto fuel engine currently available is 150 hp - once again the question of the radiated noise of this engine as compared to an electric motor or turbine could be raised but the objections would seem to be outweighed by the speed advantage.

Depth

The Stingray is reputed to have a depth capability of 2,500 feet, insufficient to attack a submarine at 3,000 feet. Its shallow water capability

is indeed a great advantage but any self-respecting submariner who has a deep-diving capability in his boat will use every inch of that for evasion. Therefore Stingray could be effective within the continental shelf but would be ineffective in anything over about 400 fathoms. If this depth limitation is fact it may be due to either one or both of two factors - problems with the stern gland sealing or the strength of the hull itself. The use of an Otto fuel engine would overcome the former by the use of the exhaust to pressurise the after-body and the latter might be overcome by pressurising the whole body.

Homing Head

An increase of speed might require some re-engineering of the head although this will probably become clearer when full trials have been carried out.

Compatibility

It is worth ensuring whether Stingray can be carried by Ikara, currently fitted in "Leander" class conversions. If this is not so, due to it being heavier than the Mk 46, that particular A/S weapon will require separate provision of torpedoes if the Leanders are retained beyond a 20 year hull life.

If the extra weight poses problems for Stingray's discharge from Mk 32 torpedo tubes as fitted in the Types 22 and 42 (Broadsword and Sheffield classes) then it will have to be helicopter launched. Further problems would then arise in the Type 42 if its one helicopter were unservicable when required.

Comments

These remarks on the Stingray are based on what knowledge is available, both manufacturers and MOD (N) officials being somewhat reticent. If the facts as stated are wrong the argument is naturally invalid - if Stingray can run at 55 knots at 4,000 feet over a satisfactory range then its proponents have a cast-iron case. However, after nearly forty years association with submarines, forty years in which British designers have produced o nly one torpedo, the Tigerfish, which has any pretensions to operational efficiency (coupled with several disadvantages), it is difficult to accept current claims, which are not dissimilar in their enthusiasm to those expressed over past failures, until those claims are backed by satisfactory trial results.