PERSONAL AND CONFIDENTIAL

Prof - Griffiths

(PLEASE PASS QUICKLY)

262/12

No

10 DOWNING STREET

17/12/85

From the Principal Private Secretary

17 December 1985

F - Short for Ships

BROAD-BEAMED WARSHIP DESIGN

I have discussed with you how we might follow-up the matters raised in the attached dossier of papers about the Court case of Osprey Ltd. against British Shipbuilders which the No. 10 Policy Unit has assembled. You suggested that you might ask a senior retired official from the Department to investigate, in a discreet but thorough way, the matters referred to in the dossier and to prepare a report.

I have now discussed this with the Prime Minister and she agrees that you should proceed as you have suggested. She has stressed that the matters referred to in the Policy Unit's dossier need to be investigated urgently and that a report on them should be quickly prepared. She believes also that your Secretary of State, if he has not already done so, should give his urgent personal attention to this matter.

Could I therefore leave it to you to proceed in this way. We should, of course, wish to see a copy of the official's report, together with your Department's recommendations for action on its findings.

N L WICKS

Sir Clive Whitmore, K.C.B., C.V.O.

PERSONAL AND CONFIDENTIAL

f - Short fat Ships

PERSONAL AND CONFIDENTIAL

MR MONCKTON

24 January 1986

cc Professor Griffiths

SHORT FAT SHIPS

Following our conversation the other day, I have tried my hand at editing your dossier in such a way that it could be made available to the independent "umpire", and possibly to the MoD as well, without damaging relations between the Policy Unit and the MoD. I happen also to believe that rephrasing the dossier with the above objective in mind would also assist you to convince an independent umpire, and ultimately, the Naval Architects, ie you should address the objective facts of the case, as you understand them, rather than criticise the Bath MoD staff, for evasions, inconsistencies, and so on. The language, in my view, needs to be objective, and neutrally phrased, purged of loaded terms like "errors", "deliberately misleading" and so on. I think also that the narrative style of the history of the case should not carry over into the analytical discussion in Annex C.

In regard to the substance of Annex C, I have redrafted fairly substantially, with the following points in mind:

1. Annex C should take on board Bath's comments to us, both in discussion and in subsequent correspondence. Bath will present this material to the investigator, anyway, so it is in your interest to present as balanced an account as you can.

2. There ought to be a discussion of the S90's savings. The increased cost of the T23 is interesting in its own right, but it only assists your case directly if you can demonstrate that the S90 would reduce these costs significantly. I have suggested an approach to this in the paper, which draws on TGA analysis.

3. I don't quite see where your discussion of the correlation factor gets you. It is not clear to the reader why Bath's assumptions have biased the analysis to the disadvantage of the S90, especially in view of their latest views. I would suggest that you drop this item, unless it can be made clearer.

4. The conclusions of Annex C need further thought, as I am sure you will agree. It should not be, in my view, that Bath have practised to deceive, but that there is an objective discrepancy between Bath's analysis and a convincing alternative - a discrepancy which merits a full-scale modelling of the short, fat hull-form.

NICHOLAS OWEN

(Dec '85) NO

F-Short Fat Ships

PRIME MINISTER

BROAD-BEAMED WARSHIP DESIGN : COURT CASE INVOLVING THE NAVY

You may recall that we minuted you some two years ago about the Thornycroft, Giles "Osprey" and "S90" designs for fast, cheaply-built, "short, fat" offshore patrol vessels and frigates. In the light of recent developments, we have asked Percy Cradock for his advice and he has said we should warn you of what is in the wind.

Background

In April, 1981, Osprey Ltd. began a court action against British Shipbuilders, alleging theft of copyright and incorporation of Mr. Giles' designs in the Hong Kong Patrol Craft without his permission and without payment to him.

The preliminary rounds of the case, which have attracted a great deal of publicity, have been won by Osprey Ltd. British Shipbuilders have admitted theft of copyright and unlawful testing of the designs, but claim that the designs are worthless and that they were not incorporated into the Hong Kong Patrol Craft. British Shipbuilders have also admitted destroying evidence and a judge has called their behaviour "deceit piled upon deceit".

The MoD's involvement in the theft of copyright

It now seems that the Ministry of Defence, which handled the procurement for the Hong Kong Patrol Craft, had close knowledge of the unlawful testing before, during and after the tests, and that Osprey Ltd. have found out. MoD may even have paid for a substantial part of the testing.

On 21 December 1980, there was a meeting at Ship Department, Bath, between Mr. Kenneth Rawson, then Chief Naval Architect, and Mr. Jack Daniel, the British Shipbuilders executive in charge of the Hong Kong Patrol Craft project, to discuss the Osprey design. Evidence was subsequently doctored in an unsuccessful attempt to conceal the fact that this meeting took place.

The unlawful testing was done at the Vickers tanks at St. Albans and Dumbarton from late December 1980 to September 1981. There is evidence that Mr. Rawson at Bath received results from these tests in April 1981, though he has since denied this. British Shipbuilders unsuccessfully falsified evidence in order to suggest that Mr. Rawson could not have received the test results because the tests had been done after the date on which he was said to have received them.

There is also evidence that knowledge of the unlawful tests reached a very senior level at the Ministry of Defence.

Nick Owen and Christopher Monckton visited Bath on November 6 and were told that the MoD wished to distance itself from the case against British Shipbuilders. MoD officials said this was not something the MoD had ever seen or had any part in: later they said they might have received some results from the Vickers tests on a personal basis.

The court case

Osprey Ltd. have assembled what they regard as substantial evidence of the MoD's involvement and may very shortly amend the pleadings to include a request for exemplary damages, over and

above the commercial damages of more than £1m which they are seeking. One of the grounds for exemplary damages - a rare technique - is malfeasance by those in high places. The amended pleadings may name MoD personnel.

The full trial has been set down for January 1987, in the run-up to the next General Election, and will take 45 days. There is bound to be much media interest. If any involvement of the MoD is proved, the embarrassment of the Government will be acute: the plaintiffs have repeatedly asked for the help and protection of Ministers and have not got the assistance they wanted.

If the case were to be settled out of court before the pleadings were amended, the MoD's involvement need not become public.

We **recommend** that you should invite Michael Heseltine and Leon Brittan to let you have a full account of the position as they see it.

Could the designs be useful to the Navy?

Lord Hill-Norton, a former First Sea Lord, has set up an unofficial committee to find out whether the broad-beamed designs are as cheap and as quick as the inventors claim, MoD and British Shipbuilders claim the designs are no good. Private backers of a project to win the Blue Riband for a transatlantic crossing in the Spring of 1987 using the new hull-form think otherwise. We shall brief you when Lord Hill-Norton sends you his report.

BRIAN GRIFFITHS

CHRISTOPHER MONCKTON

F - Short Fat Ships

DOSSIER ON SHORT, FAT SHIPS : CONTENTS

FLAG ITEM

A Introduction: memorandum from CM to Brian Griffiths.
B Chronology of the court case against British Shipbuilders.
C Commentary on information provided by Bath to CM and MO.
D Summary of Bath's errors compared with the probable truth.
E Notes of meeting at Bath attended by CM and MO, 6 Nov 85.
F Note from R.L. Garwin to CM, 28 Mar 85.
G Minute from Chief Naval Architect to Sec/C of N, 9 Jul 85.
H DSAC Hull Committee report on S90, 18 Jul 83.
I Letter from Admiral Bryson to Sir John Charnley, 16 Jan 82.
J Letter from K.T. Rawson to D.L. Giles, 13 Apr 81.
K Unit production cost of Type 23 Frigate: Bath's figures.
L Letter to The Times from Michael Sanken re Blue Riband.
M Blue Riband: parallel powering & displacement calculations.
N Chart showing measured towpoint rise (lower graph).
O Histogram comparing NMI & Yard powering figures for S90.
P "The New Dreadnought": the S90 concept explained by TGA.

Index nominum et rerum

AZTECA: Earlier and smaller version of Osprey (qv) for Mexico.
BATH: Ship Department, Bath, the Navy's ship design unit.
BHC: Westlands' test-tank, used by TGA (qv) for short, fat ships.
BRYSON, Admiral Sir Lindsay: author of paper on T23 (qv) design.
BS: British Shipbuilders, who admit theft of Osprey copyright.
GILES, David: designer of the "Short, fat" ship.
CONDOR: Slightly enlarged Osprey (qv).
DANIEL, Jack: BS (qv) executive i/c Hong Kong Patrol Craft.
DAVIES, John P.L.: Director of Contracts, Surface Ships, 1981.
FIELDHOUSE, Admiral Sir John: Controller of Navy 1980-1, CDS.
HALL RUSSELL: The BS (qv) shipyard that built the HKPC (qv).
HASLAR: Admiralty Marine Technology Establishment & testing-tank.
HILL-NORTON, Lord: Former 1SL, chmn, unofficial S90 committee.
HKPC: Hong Kong Patrol Craft, perhaps based on TGA designs.
JENKINS, David: Chief Naval Architect, BHC (qv).
MANDEVILLE, R: Personal Assistant to Jack Daniel (qv).
MOOR, David: Superintendant of Vickers' (qv) testing-tank.
NMI: Now British Marine Technology, a test-tank used by TGA.
OSPREY: 55-metre TGA (qv) short, fat patrol vessel.
PROCUREMENT EXECUTIVE: MoD division which bought the HKPC (qv).
PEACOCK: Hong Kong Patrol Craft, perhaps based on TGA designs.
RAWSON, Kenneth: Chief Naval Architect, Bath, 1979-82.
ST. ALBANS: location of Vickers' (qv) testing-tank.
SHAPCOTT, Sidney: Former air, surface & submarine weapons chief.
SIRIUS: Name of the S90 90-metre "short, fat" warship design.
S90: the TGA (qv) version of the Type 23 Frigate.
TGA: Thornycroft, Giles & Associates, the "short, fat" company.
THORNYCROFT, Peter: partner of David Giles (now inactive).
TT BOAT DESIGNS: a Giles company holding the Azteca copyright.
TYPE 10, or T10: An early Destroyer form designed for max. 21 kt.
TYPE 23, or T23: The official £200m RN frigate of the late '80s.
TYPE 2031 or TYPE 2057: submarine-detecting towed-array sonar.
VICKERS: A BS subsidiary whose tank was used for unlawful tests.
YARD Ltd: The consultants used by MoD to assess the S90 design.

+

A

PROFESSOR GRIFFITHS

SHORT FAT SHIPS

The problem

The Government may come under very strong and very public criticism in the Spring of 1987, when the 45-day trial of the state-owned British Shipbuilders in a civil action brought by the inventors of a new form of warship hull is set down for hearing.

The Conservative Party prides itself on being the Party of defence, yet the story of the short fat ship, which will emerge as the trial unfolds in the run-up to the next General Election, will be presented in the media as a story of Ministerial helplessness and inaction despite repeated pleas to successive Defence Ministers by the inventors for help against deceit, malice, theft and incompetence not only in British Shipbuilders but also at highest levels in the Royal Navy.

Information unearthed to date indicates a) that the Navy, in the persons of some of its officers and servants, may now be joined as defendants in the court action, to the potentially acute embarrassment of the Government; b) that the Director of Public Prosecutions may have to intervene as the case proceeds, with criminal prosecutions resulting; and c) that the reputation of the Government could be seriously damaged.

The opportunity

The Navy has formally rejected the designs of Thornycroft Giles Ltd. for a new warship hull on the grounds that the hull could not perform as the inventors claim. Its reasons for that rejection will be interpreted by the media as scientific incompetence compounded by a malicious refusal to admit their errors.

However, if the designers are right, the Navy could have more ships, better ships, faster ships and cheaper ships; and export orders could be won from all over the world. If the Government were now to check the work of the naval civil servants who have rejected the idea, much embarrassment could be avoided. If the idea proves to work, the credit could reflect on Ministers. If not, little is lost and the matter will be closed.

Background

In the Spring a contact who knew that I had done some investigative journalism in the defence field gave me an outline of the short fat ship controversy, on which David Pascall, a former member of the Policy Unit, briefed the Prime Minister a couple of years ago, and on which there has been much recent comment in the media. The work has I have done on this question has been mostly spare-time, since its significance in defence and political terms was not at first clear. This dossier sets out what I have found.

History

Peter Thornycroft and David Giles are the joint inventors of a radically new form of ship hull, shorter in length and broader in beam than conventional hulls, which uses more fuel but is a) cheaper to build and maintain and b) faster through the water. The inventors claim that their hull design, if incorporated into naval patrol vessels and frigates, could save the Royal Navy large sums over the next 20 years, while giving it the advantage of having the fastest ships afloat.

The Royal Navy disagrees. The report of the Hull Committee of the Defence Scientific Advisory Council (18 July, 1983) rejected the new hull-form. Since then, the Ship Department at Bath, which Nick Owen and I visited last week to discuss the report, has been deterring other navies from taking the idea seriously. Both the New Zealand Navy and the Pakistan Navy had expressed strong interest in the design, but Bath told them it would not work and the orders they might have placed were lost. Although it is not yet clear to me whether the inventors' claims for their design are justified, it is clear that the DSAC report is based on many errors, including an elementary but not obvious mistake by a Chief Naval Architect.

H
E
F

Admiral of the Fleet the Lord Hill-Norton, a former Chief of Defence Staff and First Sea Lord, thinks the inventors are right. In March this year, he established an unofficial committee to look into the reasons why the Navy rejected the new designs. The lunch at which the committee was formed was held at my club, and one of the managers, who was the host, asked me to attend. I did so, but am not, of course, a member of the committee. The members are: Lord Strathcona (former Minister of Defence Procurement); RV Jones (former scientific adviser to Winston Churchill, author of "Most Secret War" and a director of the Centre for Policy Studies"); Dr. Richard L Garwin (scientific adviser to the US Government on defence matters); and Sir Terence Conran (Habitat: interior layout).

Lord Hill-Norton, who as an Admiral of the Fleet remains on the active list and has the right of access to the Prime Minister, is likely to insist on exercising it by presenting his report in person. The report will probably be complete before the end of the year, and when it comes in we should put a brief on it. The report will probably say that, though claims of enormous cost savings are extravagant, there are some savings and the military capabilities of the new hull-form are very much worth having.

The inventors have initiated a legal action against British Shipbuilders for alleged theft of their designs and incorporation of the essential features of the short fat ship in the Peacock class of naval patrol boats for Hong Kong. My investigations indicate that, although the Royal Navy has claimed that it did not know of a detailed tank-testing programme conducted by British Shipbuilders in the Vickers tanks at St. Albans and Dumbarton, in fact a) the Navy took an interest in the tests from the

outset; b) the results of at least some of the 2,900 test runs which were carried out without the inventors' knowledge or permission were reported to Bath directly: c) details of the tests which had not been made public were known to very senior naval personnel. The Navy could now be joined as defendants in the case. The present Chief of Defence Staff, Admiral Sir John Fieldhouse, a friend of the Prime Minister, was Controller of the Navy at the time when Bath were involved in the unlawful tests.

Two issues arise, each of which will be addressed in turn:

1: to what extent will the court case damage the Government politically? If there is a strong risk of justifiable public criticism, what should the Government do now to put matters to rights before the court case is heard in 18 months' time?

2: are the inventors right in their claim that their hull-form works, and that it will go faster at less cost than present ships? If they are right, should the Government ask the Royal Navy to test and build ships to the new design?

1 : Could the court case damage the Government politically?

The attached chronology of events relevant to the court case is a more complete statement of what has gone on than is, to my knowledge, available anywhere. Some of the material has been taken from preliminary rounds of the case, all of which have been won by the inventors. The rest has been gathered from various sources who had better remain nameless. I think it is accurate. B

The chronology contains indications a) that British Shipbuilders breached the copyright of the inventors in building and testing models of their designs without their knowledge or consent (BS admit this); b) that certain features of the design have been incorporated into the Hong Kong Patrol Craft without the knowledge or consent of the inventors and without any payment of royalty to them; c) that the Royal Navy, whose Procurement Executive and Ship Department had responsibilities for the Hong Kong Patrol Craft tender, knew what was going on. I

The previous publicity which this affair has attracted (hundreds of column inches in the national Press, including a leader in The Times, and substantial TV coverage, including two major programmes devoted exclusively to the subject), indicates that the court case will attract a great deal of public attention. I cannot think that the Government, which the inventors have repeatedly approached for help, will come out of the affair very well if the case comes to trial. The inventors, though a small company, now have sufficient funds to fight the case to the end. There is bound to be very strong criticism along the lines that those who take the advice of knaves are themselves fools. As the party of defence, we do not want this sort of story in the run-up to a General Election.

2 : Does the design work?

Until a full-scale, 90-metre prototype of the inventors' short, fat design is built, it will be impossible to be certain about the inventors' claims that the ship will travel surprisingly fast for a given installed power, that it will handle as well as or better than a conventional ship and that it will cost less.

However, it is already clear that 55-metre versions of the vessel (the Osprey class, now in service with the Danish Navy, and the Peacock Class Hong Kong Patrol Craft, which incorporates the essential features of the Osprey design) are performing excellently, and are achieving maximum speeds in full scale which are greatly in excess of tank-test predictions.

Furthermore, recent testing at BHC/Westlands and projections at the Swedish firm of Kamewa on behalf of a consortium which hopes to use the design in an attempt to break the Blue Riband record for a transatlantic crossing by using a 60-metre short, fat ship has indicated that, if water-jet propellers and sufficient power are installed, the 90-metre version of the design could achieve a maximum speed approaching 60 knots, or twice the current maximum speed of British warships. L,M

The fact that the design has attracted the £10m necessary for such a project, and that two reputable naval establishments have considered the project potentially viable, must count in the design's favour. The ship which may break the Blue Riband record will weigh less than 800 tonnes: a conventional ship to do the same would have to weigh at least 10,000 tonnes. M

As for the Navy's reasons why the design should not be adopted for full-size frigates, the attached commentary on the information given to us by Ship Department, Bath, last week suggests that the case against the design is far from open and shut. I wonder whether it is possible that the Navy's dislike of the design is born not merely of innate conservatism but of a desire to indicate by its unenthusiasm that it took no interest in and had no knowledge of the tests done by British Shipbuilders? Certainly, the information we were given has proved to be unreliable in almost all significant respects. C D

Bath correctly stressed the importance of seakeeping, but made considerable efforts to minimise the importance of speed and cheapness, the other two major claims of the inventors.

I have talked to Sidney Shapcott, formerly Deputy Director of the Admiralty Surface Weapons Establishment at Portsdown Hill, Director of Underwater Weapons at Portland and Director General of Air Weapons and Electronic Systems, because his experience covers air, surface and submarine warfare.

He said that <u>speed</u> was very important, particularly in bad weather, because bad weather affected submarines much less than it affected the surface ships which were trying to catch them.

"We ought to be looking at something in excess of the maximum speeds achieved by the other side. We would be living in a fool's paradise if we believed we could do anything with vessels that could not make that sort of speed. It is my firm belief that we should be looking for something that can match that.

"Speed is very important, particularly because we can't provide the numbers of ships that other navies can provide. Since our numbers are obviously restricted, we should be looking for something that is very fast and can get where we need it quickly. It would have to be unconventional in some way or another."

I asked about the price of ships. Mr. Shapcott said: "I am in favour of a few good ships and a lot of cheap and nasty ones - cheap for us and nasty for them. I've been round this and looked at it from every angle: even Sea Wolf, which is my baby, is not going to provide you with 100% protection. So if you can't fight back you've got to be able to run. It's useful to be small, cheap and manoeuvrable."

So the case in favour of the new designs is not proven, but the case against it is not proven either. The speed of the S90 would be a military advantage, whatever Bath may say, and if either that speed can be achieved at the same price as the Type 23 frigate or the same speed as the T23 can be achieved at less cost the idea would have considerable merit for future frigates.

If the Blue Riband attempt is successful, the design will attract interest and orders from all over the world. It would be a pity if Britain, as with so many other inventions, lost the use and development of this one.

Recommendations

1 : **The court case:** If you accept the implications of the evidence set out in the attached chronology, you will agree that a) the Prime Minister should be warned of the possible involvement of the Royal Navy in a spectacular court action during the run-up to a General Election, for one of our duties is to give warning of danger ahead; b) that if British Shipbuilders could be persuaded to settle out of court quickly the involvement of the Navy in the case need not emerge. I understand that the designers would have got around 4% of the contract price of the Hong Kong Patrol Craft if they had been paid for the use of their design in the usual way. And they would want their legal costs on top. B

2 : **Evaluation of the design:** If you accept my interpretation of Bath's position, you will agree that their strictures against the designs are ill-founded. Hence a) it would be worth the Navy's while to conduct a proper standard methodical series of tests on models of the Thornycroft, Giles hull form, with the knowledge, consent and co-operation of the designers and without any involvement of Bath, to examine in particular the hydrodynamic lift, correlation factors and overall propulsive coefficient which may make this hull-form surprisingly fuel-efficient at high C

speeds even at 90-metre warship scale; b) if the tests are sufficiently promising, a prototype S90 hull could be built.

Conclusion

Bath have not been forthright with us. Mr. Giles has. I have asked him several very difficult questions and he has gone to great trouble not merely to answer them but to back up his answers with authoritative facts from reliable published sources. Furthermore, his answers have usually been supported by everyone except Bath. Though he is a small-scale operator whose presentation of his case has been rather disorganised, it is clear to me that a grave injustice has been done to him and that, to the extent that it is proper and possible for us, we should see to it that the injustice is put right.

CHRISTOPHER MONCKTON

13 November, 1985

B

THE THEFT OF COPYRIGHT IN THE OSPREY DESIGNS

British Shipbuilders have admitted breach of the copyright of Osprey Ltd. in its designs, but have said that the designs are worthless and have offered only £100 in compensation. The designers have started court proceedings and have won every round so far. The full trial will take two months and has been set down for January, 1987, before Mr. Justice Whitford in the High Court. The full story, which shows that the Navy as well as British Shipbuilders were implicated in the theft and testing of the designs, is set out below:

1978: It became known that the Hong Kong Government wanted to buy five patrol craft to replace existing vessels. The Procurement Executive in London were put in charge of the contract. In 1978/9 Thornycroft Giles suggested to the Procurement Executive that their Osprey short fat ship might be a suitable design for the Hong Kong Patrol Craft and other naval vessels.

29 May 1980: David Giles of Thornycroft Giles visited the Vickers testing-tank at St. Albans. He met Mr. David Moor, the superintendent of the tank, who was most affable and offered to do a full design appraisal of the Osprey design. He asked to see a copy of the Osprey lines-plan and Mr. Giles said he would agree to that if his fellow-directors gave permission. A further constructive meeting took place on 16 June.

20 June 1980: Having obtained permission from the directors, Mr. Giles took the Osprey lines-plan to Mr. Moor at St. Albans and showed it to him. ~~Mr.~~ Mr. Moor asked if he could take a copy and was told that would not be possible. He then asked if the copy could be left with him for a day or two, for inspection by other people at the tank. Mr. Giles agreed after asking for and getting a written undertaking of confidentiality.

27 June 1980: Mr. Moor wrote to Mr. Giles returning the lines-plan and saying that he had "not seen in it any feature which warrants any further special investigation at this stage".

August 1980: The Procurement Executive issued tender documents for the Hong Kong Patrol Craft (HKPC). The tender specified a length of about 60 metres, a displacement of 600-700 tonnes, a service speed above 25 knots and two heavy-duty marine diesels of 7200 horse-power each. On 23 October 1980 Mr. Jack Daniel of British Shipbuilders, who had unsuccessfully been trying to design a hull-form capable of meeting the stringent specifications of the contract, asked his personal assistant, Mr. K. Mandeville, that he "would like to have views on whether the Osprey design could be adopted ((sic)) to meet the HKPC Naval Staff Requirement and still be considered to be Osprey".

Mid-November 1980: Mr. Daniel gave instructions to Mr. David Moor for the building and testing of a model of the Osprey patrol craft, without the knowledge or permission of the inventors.

Friday 21 November 1980: An entry in the diary of Mr. Daniel shows an entry mentioning an "Osprey meeting at Bath". The entry has been crossed out and the words "Did not take place owing to non-availability of KJR" (Kenneth Rawson, then Chief Naval Architect and Deputy Director, Ship Design) **added.**

Monday 24 November 1980: Mr. Mandeville, Mr. Daniel's Personal Assistant, wrote to Mr. Rawson as follows: "At our meeting on Friday you said you required certain information. Here it is." This letter, taken with the diary entry, makes clear a) that the meeting did take place; b) that Bath were interested in the Thornycroft, Giles designs; c) that Mr. Daniel was anxious to see to it that Bath's involvement was kept secret.

December 1980: the Hall Russell shipyard, which had tendered for the HKPC contract, engaged Vickers Shipbuilding and Engineering Ltd., a subsidiary of British Shipbuilders, to design a suitable hull form. Mr. Moor had overall supervision of the project, though he had no previous experience of designing such a hull.

11 December 1980: Mr. Daniel told Mr. Moor to speed up the building and testing of the Osprey model, and repeated this instruction, emphasising urgency, on 12 December. In mid-December Mr. Moor told Vickers' Ship Model Experiment Tank Division at Dumbarton to build a model of the Osprey from the lines-plan and four models of the Azteca, an earlier and smaller version of the short, fat ship. The Osprey model was no. 2219 and the four Azteca models were numbered 2208, 2209, 2210 and 2217. Later Mr. Moor told Dumbarton to build a further Osprey model from the lines-plan. This model was numbered 2225.

Late December 1980: Vickers began designing and building model hull-forms for the Hall Russell Hong Kong Patrol Craft, as follows: Model 2224 drawn 22 December and built 24 December to 12 January; Model 2226 drawn 18 January 1981 and built 21 January to 31 January; Model 2230 built 30 January to 2 February. These models were based not on designs supplied by Hall Russell but from Vickers' own experience. Models 2224 and 2230 were derived from the Type 10 destroyer-form and Model 2226 was derived from an unrelated design of 1976. None of these designs were found able to meet the stringent specification for the Hong Kong Patrol Craft. Design non 2226 was forthwith abandoned. The other two models, based on the Type 10 destroyer form, would have been unable to meet the 25-knot speed requirement, since the Type 10 was intended only for a maximum speed of 21 knots if built within the other tender requirements.

January 1981: Dumbarton delivered the six Osprey and Azteca models to Vickers at St. Albans, where extensive tank-tests were carried out at the same time as the tests on the Hong Kong Patrol Craft hull-forms. The test results, plus full-scale trials data for the Osprey craft "Havørnen", British Shipbuilders would have known that an enlarged Osprey was capable of meeting the tender requirements for the HKPC.

11 February 1981: Mr. Daniel visited St. Albans to watch a tank-test on the Osprey model run at a simulated 30 knots. He paid no other visits to St. Albans during the testing of the Osprey and Hong Kong Patrol Craft designs.

16 February 1981: Mr. M. Stephens of BHC telephoned Mr. Giles to remonstrate that "you are running the 1/10 scale Osprey model at the Vickers St. Albans tank without our knowledge". BHC were at that time conducting tests for Thornycroft Giles on the design. Mr. Giles replied that his 1/10 model of the Osprey was in its shed at Bembridge. Mr. Stevens insisted that a large Osprey model was being run at St. Albans. Mr. Giles told him that this was certainly being done without the authority of Osprey Ltd.

24 February 1981: Mr. Giles had a meeting with Dr. A. Morrall of the Nautics Branch of NMI, who had also been testing Osprey models on behalf of Thornycroft Giles. Dr. Morrall confirmed that St. Albans were running the large Osprey model and said that, at the same time, they were testing an HKPC design for Hall Russell in accordance with their contract of December 1980. Mr. Giles said he thought the design work was supposed to be finished by 4 November 1980. Dr. Morrall insisted that the model was for the HKPC and that it was still too slow to meet the stringent Naval Staff Requirement. Mr. Giles decided that the best plan would be discreetly to let it be known in British Shipbuilders circles that he knew of the St. Albans tests of his design, in the hope that they would voluntarily confess to him what they had done, rather than making accusations which might result in their destroying all the evidence. He spoke to Mr. Graham Day of the University of Nova Scotia, who was due to visit St. Albans in the near future, and hinted that St. Albans were testing the Osprey model.

27 February 1981: Mr. Rawson told Mr. Giles that there was still a possibility of persuading the Procurement Executive to consider a tender with the Osprey design. This indicates that the design for the Hong Kong Patrol Craft was at this stage far from complete.

13 March 1981: Mr. Martin Court, an employee of the Navy's Haslar testing-tank, visited St. Albans. At that time, the only tests being done at St. Albans were those on the Osprey models and on the Hong Kong Patrol Craft.

20 March 1981: Vickers produced a report on the tests of model no. 2219, entitled "A design for a twin-screw patrol-boat". The document did not mention that the design was owned by Osprey Ltd.

March 1981: Vickers/BS produced a comparison of the performance qualities of the Type 10 hull-form and the Osprey form.

26 March 1981: Mr. Rawson, the Chief Naval Architect and Deputy Director of Ship Design at Bath, told British Shipbuilders that Mr. Giles had found out that the Osprey tests were being conducted.

27 March 1981: Mr. Daniel wrote to Mr. Giles confessing to the St. Albans Osprey model tests. Osprey Ltd. decided to take legal action. On 8 April Mr. Thornycroft and Mr. Giles visited the St. Albans tank to inspect the Osprey model.

3 April 1981: Osprey Ltd. issued a writ in the High Court alleging breach of copyright by British Shipbuilders. In correspondence and meetings up to the end of June, Osprey Ltd. complained of the building and testing of the Osprey model and sought undertakings that it should not be repeated. Legal advisers to British Shipbuilders said the building and testing had been done with Mr. Giles' implied permission merely for evaluating his claims for its performance. In these exchanges British Shipbuilders led Osprey Ltd. to believe that only one Osprey model had been built (no. 2219) and concealed the existence of Osprey model no. 2225 and of the four Azteca models.

Thursday 9 April 1981: Notwithstanding the writ, Mr. Moor gave instructions for further extensive tank-tests of Osprey no. 2225 as a matter of extreme urgency. These tests, which were carried out without the knowledge or consent of Osprey Ltd., took place from 11-27 April.

Friday 10 April 1981: Mr. Kenneth Rawson, Deputy Director of Ship Design at Ship Department, Bath, wrote to Mr. Giles saying that his Department still had further studies to complete before being able to decide whether the Osprey design was feasible for larger ships. At the same time, Dumbarton were testing the Osprey and Azteca models day and night and at weekends. That weekend, Mr. Rawson obtained some data from Dumbarton on the basis of which he drew a curve in his own hand, replicating an anomaly in the tonnage of the vessel. Subsequently, when British Shipbuilders realised that Thornycroft Giles had obtained a copy of this curve, they produced a telex purporting to show that the particular tonnage of which Mr. Rawson had drawn the curve was tested on a later date. However, the carriage-logs (data-cards fixed to the models under test) indicate that the tonnage for which Rawson drew his curve was in fact tested on the weekend on which he drew the curve. The telex, purporting to give instructions for the order in which the tests were to be carried out, may, therefore, have been fabricated after the event.

Saturday 11 April 1981: The British Shipbuilders test-tank at Dumbarton carried out a test on an Osprey model running at 380 tonnes (=373.996 tons). Dumbarton recorded this test not as "374 tons", the correct rounded figure, but as "373 tons".

Monday 13 April 1981: Mr. Rawson wrote again to Mr. Giles, saying that the studies had now been completed and that the Osprey design would not perform as its designers claimed. He attached a graph showing a resistance-curve for the Osprey at "373 tonnes". In fact, no test of the Osprey designs was ever done at this tonnage, either by British Shipbuilders or by BHC and NMI, to some of whose results were lawfully available to Mr. Rawson. It seems clear that Mr. Rawson had been given the results of the

J

"373 tons" test at Dumbarton over the telephone and had assumed that "373 tonnes" was intended. One key point on the graph can only be calculated by using the very low propulsive coefficient of .51 for the Osprey calculated at St. Albans. Later, a telex from British Shipbuilders apparently giving instructions for the order in which the tests were to be done implied that the "373 tons" test was not done until Tuesday 14 April. However, the carriage-log of the Dumbarton tank (a card fixed to the model under test, bearing its technical details and the date, and later filed for reference) shows that the 380 tonnes (or "373 tons") test was in fact done on Saturday 11 April. The telex may, therefore, have been a fabrication made in an attempt to conceal the fact that Mr. Rawson, and through him Bath, received the data.

April 1981: Several documents relating to the Osprey tests were destroyed in "a bonfire at Bath", according to a senior former employee. British Shipbuilders were later found to have destroyed documents also. Throughout April, despite the writ, testing of an Osprey model continued at St. Albans. At this time, Mr. Giles approached Lord Trenchard, the Navy Minister, and asked for his assistance.

30 April 1981: At a meeting at St. Albans, Osprey Ltd. made it clear that they intended to proceed with the case. Mr. Daniel said that the design for the Hong Kong Patrol Craft had been completed by 4 November 1981 and that the Osprey testing had therefore had nothing to do with it. The following day, although it is contempt of court to destroy evidence, Vickers, on Mr. Moor's orders destroyed the Osprey model they had been testing.

6 May, 1981: As a response to Lord Trenchard's request for an assurance that the Hong Kong Patrol Craft had not been based on the Thornycroft, Giles designs, Mr. Daniel wrote to Mr. John Davies, Director of Contracts (Surface Ships), as follows: "It is a matter of record that it (the HKPC design) was finished by November 4, 1980." However, Mr. Davies had written to Hall Russell, the builders of the HKPC, in February making it clear that he was aware that the HKPC was still being tested at that time and that the design had not even been started in 1980.

June 1981: The Government announced that Hall Russell had been awarded the contract to build five offshore patrol vessels for Hong Kong. Subsequent publication of design details showed that the design was similar to the enlarged Osprey in dimensions, displacement, performance and hull form.

3 July 1981: At a High Court hearing before Mr. Justice Mourse, Osprey Ltd. were granted an injunction against British Shipbuilders restraning them from using any information obtained from the Osprey model tests in any design, of whatever size; and an Order for Discovery, an Order for a Speedy Trial, and costs.

July to September 1981: Further models, nos. 2254A, 2254B, 2255 and 2265, were tested, based on the Osprey designs, and a final

hull form derived from them was submitted to Hall Russell for the "Peacock" class of HKPC vessels, which was submitted to the Procurement Executive in February 1982. The vessels were built and are now in service. Their speeds, well above tank-test predictions, are wholly imcompatible with the Type 10 hull-form from which British Shipbuilders say they are derived, but wholly compatible with results for the Osprey. Although the hull-form of the Peacock Class ships is not an exact copy of the Osprey lines-plan, the Peacock hull-form has certain characteristics which are unique to the Osprey Ltd. designs, and it is capable of unusually high speed for its length, beam and displacement.

10 September 1981: Mr. Giles learned from the Editor of "Jane's Fighting Ships" that the design for the Hong Kong Patrol Craft had been done at St. Albans by Mr. Moor, and that the design had not been completed.

21 October 1981: British Shipbuilders were ordered by the High Court to discover documents relating to their tests of the four Azteca models simultaneously with the Osprey documents.

18 February 1982: At St. Albans, Mr. Moor gave Mr. Giles an account of the provenance of the HKPC design, including lines-plans and models with design features which could generate hydrodynamic lift under the hull, an idea which Thornycroft Giles had incorporated into their Osprey and Azteca designs but which was rejected (and continues to be rejected) as conventional wisdom.

16 June 1982: Admiral Sir Lindsay Bryson, who had succeeded Admiral Fieldhouse as Controller of the Navy the previous year, wrote to Sir John Charnley, Controller R&D Establishments & Research, as follows: "These contentions (Bath's views on the Thornycroft, Giles designs) have been based on standard methodical series for resistance and seakeeping trials conducted on the Osprey in model and full scale." The only standard methodical series of tests ever done on the Osprey was the unlawful series using six models and 2,900 test runs at British Shipbuilders' Vickers tank at St. Albans. The Bryson letter indicates the Navy's knowledge of these tests. I

5 November 1982: The Appeal Court granted an Anton Pillar Order against British Shipbuilders following the apparent disclosure of a third Osprey model in the St. Albans tank log, later discovered to have been an incorrect entry, though the matter is still being investigated. The Master of the Rolls, Lord Donaldson, said that the conduct of British Shipbuilders had given the appearance of being "deceit piled upon deceit".

14 December 1982: The following exchange took place in a Newsnight interview:

> **Interviewer:** "But supposing, if I may interrupt you, that Mr. Giles and Mr. Thornycroft demonstrate with their tank tests that you are wrong, what then? Will you accept their results?"

Admiral Sir Henry Leach: "No, because tank tests have been done and, I am sorry, they are not wrong. What Mr. Rawson has said is absolutely right. And there is nothing new, there is nothing novel, in this. It's rather like all sorts of exaggerated claims in the course of what I can only frankly describe as a really rather curious sales push."

July 1983: Mr. Giles was given an oral report of the results of the sea-trials of the Hong Kong Patrol Craft, which had, as he expected, proved to be two or three knots faster on trials than the tank-tests had predicted, exactly as had been the case with the Osprey and Azteca, from which Mr. Giles claims the design was derived. Subsequent inspection of the HKPC reveals a tell-tale hollow in the buttocks, which, together with the broad beam, is a notable feature of the Thornycroft Giles design. Certain features, such as the keel, had been changed in what Mr. Giles claims was an attempt to disguise the provenance of the design: the absence of a skeg in the HKPC caused undue rolling at sea.

6 February 1984: A letter from Mr. Cocks of Dowty to Mr. Giles said: "There is no doubt that the Navy is very upset by the affair" (i.e. the case against British Shipbuilders). Why the Navy, if they had no involvement?

11 April 1984: Osprey Ltd. were granted a Consent Order for further Discovery and Inspection covering all aspects of the Hong Kong Patrol Craft, the tank tests and the sea trials. The date of the full trial has now been set: it will be in the High Court for 45 days in the Spring of 1987.

28 June 1985: Mr. Giles wrote to Admiral Sir John Fieldhouse, then First Sea Lord and now Chief of the Defence Staff, to ask for a meeting "in order to acquaint you with matters which have arisen within the Osprey versus British Shipbuilders litigation since our last meeting, at which you expressed concern about the possible involvement of the Navy". Mr. Giles says that at that meeting Admiral Fieldhouse had asked to be told if the case should prove to involve the Navy.

2 July 1985: Admiral Fieldhouse replied to Mr. Giles as follows: "In the penultimate paragraph of your letter of 24 June in the context of your litigation with British Shipbuilders, you imply that I was worried about the "possible involvement of the Royal Navy". I firmly recall that you raised this possibility which I challenged, and specifically denied any knowledge of RN involvement. This remains the position and that is the limit of my concern." Both this letter and the previous one were copied to me at No. 10.

October 1895: The QC who had agreed to take on the case on behalf of Osprey Ltd. told them that, after a month's detailed examination of the evidence, he considered it likely that the Director of Public Prosecutions would have to intervene in the case.

9/12/85

f-Short fat ships.

MR. OWEN

LIST OF INCORRECT CHANGES TO NOTE OF MEETING AT BATH

The attached note sets out the incorrect changes which Bath have made to my note of the meeting. Would you be kind enough to send it to them, so that the record can be corrected?

The errors all tend to confirm that Bath are continuing to try to hide the facts a) that they were closely involved in the unlawful tank-tests on Osprey models at St. Albans; b) that their subsequent dismissal of the Giles designs, presumably as part of the cover-up, is based on unsound technical arguments.

The significance of the errors listed on the attached sheet is as follows:

Page 7 para 1 and page 8 para 3: The essence of Bath's argument that hydrodynamic lift has no beneficial effect below 40 knots is that the crossover-point of the Leander and S90 curves on the replotted Fig. 13 (resistance against speed) is at 40 knots. It was Mr. Wall, not I, who said that Giles' tests of towpoint rise (a way of measuring lift) had showed the towpoint rising above the centre of gravity at 38 or 39 knots. I went on to ask about whether, notwithstanding this high figure, there might be some benefit from lift at lower speeds. Mr. Wall replied that this was so, but that the benefit was still counteracted by the hull-configuration. He prayed the replotted Fig. 13 in aid.

Page 7 para 2: The Perry curve should, as I have now discovered, apply also to the Leander. It is almost certain that the Leander curve given as Fig 16 in Bryson's paper is the curve for the original Leander, which was 1m narrower than later versions, which had to be widened to give them stability. If the Perry curve and the S90 curves are correctly replotted from Fig. 13, the crossover point is not 40 knots, as suggested to us, but 28-29 knots.

Incidentally, I learn that building warships long and thin has given the Navy the following operational problems:
* Insufficient stability and reserve buoyancy: eg widening of original Leanders; T22s are very short of stability.

* Damage by excess longitudinal stress: eg breaking-up of stretched T42s; "belting" of T21s with steel to hold them together.

Page 9 para 1: Mr. Cox and Rear Admiral Thompson both said that some of the test results from St. Albans might have filtered through to Bath informally. Both statements have been omitted from the record. As we know, Bath helped to plan the tests, got results from them and passed those results up the line in the Navy.

Page 9 para 3: You will remember that, despite repeated questioning from me, Mr. Wall was unwilling to say that the phrase "standard methodical series" was normally applied to hull-forms. In fact, you had to interrupt because I had pressed the point so many times without success. The only standard methodical series of tests done on the Osprey form was the unlawful series at St. Albans.

Page 10 para 1: Bath have tried to suggest that, at higher speeds, the (1+x) correlation factor might be substantially higher than their figure of 0.9. In fact, the probable range for the S90, according to recent BHC tests, is 0.76 to 0.83: and the Hong Kong Patrol Craft, which incorporates certain features of the Osprey, came out at 0.86.

In addition to the above errors, Bath have now "confirmed" that the top speed of the Hong Kong Patrol Craft is only 25 knots. In fact, an article in the Feb 1984 edition of the Naval Architect, written by the editor, calls the HKPC a "28-knot ship" and says it achieved speeds of "28 knots plus on trials". I have separate evidence that some of the trials produced top speeds above 30 knots. This error is important because Osprey Ltd. are claiming that the HKPC has features of their design in it. These features would account for the extra 3 to 5 knots of speed. The lower top speed given us by Bath is consistent with the performance of the T10 destroyer form, from which British Shipbuilders claim the HKPC was derived.

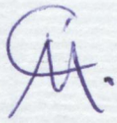
So I suggest the following action:

1) write to Bath enclosing the attached list of corrections and reminding them a) to send us the answers to our questions and b) to send us the interesting replotted curves from Fig. 13 which they have promised us.

2) ask for the HKPC trials results and data to be sent to us.

3) ask for whatever data are available on the Yarrow frigate, which is 6m shorter than the Leander at the waterline but which, for a speed of 33.5 knots, would require exactly the same BHP as an equivalent S90.

Depending on the answers we get from Bath, we shall have to consider what to do about their continuing attempts to give us information which, on subsequent checking, proves to have been incorrect. After all, they have had a signal from John Ledlie that we were not happy with what they told us, and they should not be sending us false figures for the HKPC, nor should they be trying to amend the record of what they told us in a manner which is inconsistent with the shorthand note.

CHRISTOPHER MONCKTON  9 December, 1985

f - Short fat Ships

MR. OWEN

NOTES OF MEETING AT SHIP DEPARTMENT, BATH : 6 NOVEMBER 1985

Some of the changes made to my note are incorrect:

Page 7 para 1 should read as follows, from "because":

"... because lift did not begin until about 40 knots. In answer to a question about how the 40-knot figure had been arrived at, Mr. Wall said that Thornycroft, Giles had measured the sinkage and rise of the towpoint. This only rose above the centre of gravity at 38 or 39 knots."

Page 7 para 2: Mr. Wall's statement that MoD had no reason to dispute the Perry resistance curve has been omitted.

Page 8 para 3: The words from "Mr. Monckton" onwards were not said here. Mr. Wall said them at the end of para. 1 on page 8, at which point the following words should be added:

"On being asked for a copy of the replotted Fig. 13, Mr. Wall agreed to send one but said that it should not be shown to Mr. Giles, who would say a) that Bath were using his data without permission and b) that they were using it in an improper way."

Page 9 para 1 should read as follows:

"Mr. Cox said that the tests had been done at St. Albans, with the agreement of Giles, and them used for other purposes. It was not something the Ministry had had any formal part in, though it would be difficult to say that none of the results had filtered through to Bath informally.

"Rear Admiral Thompson said that the Navy had done no trials, but that some information might have come the way of the Warship Department on a personal basis. There was no reason foru the Government to be implicated."

Page 9 para 3 should read as follows:

"In answer to a question about the meaning of 'standard methodical series', Mr. Wall said that it applied particularly to a series of tests done at Haslar on propellers, to represent the best efficiency one could get in open water. The term was used only in the context of open-water propeller tests.

"In answer to a question about whether the term could be applied to a series of models of hull-forms, with the same basic design shape but with varying dimensions, Mr. Wall said the term would not normally be used in this context."

Page 10 para 1 should end as follows:

"The amount of evidence was scanty, but Warship Department believed that the correlation factor, or (1+x) factor, could be as low as 0.9 for the short, fat ship."

CHRISTOPHER MONCKTON CM. 9 December, 1985

f-Short fat ships

SHORT FAT SHIPS : SOME QUESTIONS

1 **The square-cube law:** Let L be the length-scale factor, V the velocity factor, H the hydrodynamic lift and D the displacement factor. In a tank-test of a 1/25 scale model, let L=V=H=D=1. Then the expected results for a full-scale ship will be as follows: L=25, V=1, H=LxL=25x25=625 and D=LxLxL=25X25X25=15625. Thus, while lift (H) varies as the square of the length-scale factor (L), displacement increases as the cube. Is this what KJ Rawson, then Deputy Director of Naval Ship Design (Bath) meant when he wrote to Dr. Richard Garwin that favourable results on a 1/25 scale model of a Thornycroft Giles hull were irrelevant to the performance of a full-size ship because "lift increases as the square of the length scale (like the area), while displacement (weight) increases as the cube"?

2 **The speed-squared factor:** Is it true that, since the BHC and NMI tank-tests on the Thornycroft Giles hull were done at 1/5 speed and since hydrodynamic lift varies not only as the square of the length-scale factor **but also as the square of the speed,** the comparison between the performance of the model and the expected performance of the full-scale ship should read as follows:

	MODEL	SHIP	
L = LENGTH-scale factor	1	25	
V = VELOCITY factor	1	5	
H = HYDRODYNAMIC LIFT factor	1	15625 = LxLxVxV	
D = DISPLACEMENT factor	1	15625 = LxLxL	?

Does this mean that the lift - and the significance of lift - as measured on the BHC and NMI tank-tests of the Thornycroft Giles hull might be expected, ceteris paribus, to be achieved to the same degree on a full-scale geosim at full speed? And that, contrary to Rawson's original assertion, the square-cube law is no obstacle? Is it true, therefore, that the "complete agreement on the physics of dynamic lift" between Rawson and Garwin mentioned in the CNA's minute to Mr. Owen was, in effect, a concession by Rawson that Garwin's original position (summarised in the above table) was correct?

3 **Significance of hydrodynamic lift:** How is it calculated that the effects of hydrodynamic lift "would only be perceptable ((sic)) at speeds approaching 40 knots", as stated in the CNA's minute to Mr. Owen? What is the evidence for the assertion that "large ships would need to go very fast indeed to get into the region where lift was significant"? Is this assertion based upon Rawson's original reference to the square-cube law?

4 **Towpoint rise:** What are the results of the Navy's measurements of the rise and fall of the "towpoint" - the point at which the longitudinal centre of gravity and the thrust line coincide - on the Thornycroft Giles hull? Is Garwin right in saying that towpoint rise can be used as a measurement of hydrodynamic lift?

5 **Pressure under the hull:** Is it true that hydrodynamic lift occurs when there is high pressure under the hull? If so, what methods did the Navy use to examine the pressure-levels under the Thornycroft Giles hull (eg pressure-sensors; or holes in the hull)? What were the results of those measurements?

6 **Resistances compared:** Is it true, as Figure 13 of Admiral Bryson's paper indicates, that a Thornycroft Giles hull of the same length as a Perry class frigate, although having nearly twice the beam and operating at over twice the displacement, has a broadly similar resistance in pounds per ton of displacement up to a speed of V divided by the square root of L of 1.4, and offers less resistance at higher speeds? Does the Navy accept the resistance curve of the Perry Class frigate given in Fig. 13 of Admiral Bryson's paper?

7 **Performances compared:** What are the Navy's estimates of a) resistance; b) propulsive efficiency; c) horsepower requirements for speeds from 20 knots to 40 knots, for the Leander, for the Perry Class frigate and for a Thornycroft Giles hull of the same displacement? And, in particular, what propulsive coefficient would be obtained by relating the Leander resistance given by Admiral Bryson in Figure 16 of his paper to trials results of a full-scale Leander in a similar condition, at 28 knots?

8 **Data discrepancies:** Admiral Bryson states in his paper that he "fully accepts the test data produced by BHC and NMI Ltd." for the Thornycroft Giles hull. However, there appears to be a considerable discrepancy between the test results produced by these two companies and YARD Ltd. NMI estimated that at 28 knots and a displacement of 2,600 tonnes, the power required for the Thornycroft Giles hull would be 35 Mw, while YARD's figure for a hull of only 200 tonnes more displacement was about 70% higher - about 59.5 Mw. Which is right, YARD Ltd. or NMI? What increased power would a Leander class frigate require for the same increase in displacement and making allowance for the fitting of a sonar dome, fins and fouling?

9 **Blue Riband:** What would be the minimum length, and hence displacement, powering requirement, build cost, fuel consumption and fuel cost of a conventional hull capable of crossing the Atlantic (say, 3,000 miles), without refuelling, at an average speed of 40 knots, carrying a reasonable payload?

10 **Hull characteristics:** Apart from the Thornycroft Giles hull, how many other hull types now in use in the Navy or worldwide, or under construction, planned or proposed, have all three of the following characteristics: a) a length-beam ratio of of less than 7 to 1; b) a length of more than 55 metres; and c) a hollow in the buttocks?

11 **Hong Kong Patrol Craft:** What was the absolute maximum speed achieved by the Hong Kong Patrol Craft on trials? What was the average speed at full revolutions? How did these figures compare with the tank-test predictions for this hull-form?

E.R.

12 **Performance of Thornycroft Giles design:** The Ministry of Defence, at a meeting at Ship Department, Bath, on 11 July 1985, accepted without any reservations the Thornycroft Giles estimates for the OPV III, based on precisely the same hull-form, size and tank tests as those for the S90 frigate proposal. Why were the estimates for the OPV III regarded as accurate and those for the S90 regarded as inaccurate?

13 **Maximum practical speeds:** What would be the maximum practical speed, given sufficient powering, achievable by a Leander Class frigate? And what is the Navy's prediction of the maximum practical speed achievable by the S90 hull form? How does this prediction compare with that of KaMeWa? What is the maximum silent speed of the Leander with a Type 2031 towed array? If the silent speed could be increased substantially, would there be any advantage, given the underwater speeds now being achieved by Soviet submarines?

14 **Type 23 frigate:** How many Type 23 frigates have been built? How many are firmly ordered? How are plans progressing for the Intermediate Frigate?

15 **The DSAC report:** Is it true that Mr. Meek, mentioned in the CNA's minute, is a former chief naval architect with British Shipbuilders, the first defendants in the litigation which Thornycroft Giles have initiated against various parties who, they allege, stole their designs? And was he at the same time Chairman of the DSAC Hull Committee which recommended rejection of Giles' estimates for the S90, based on the BHC and NMI taNK tests? And has he since become Director of NMI Ltd., refusing to endorse the sea-keeping, resistance and propulsion tests which that organisation had previously produced for the S90?

16 **Terms of reference:** Is it true that the S90 validation programme, as agreed my the MoD at a meeting with Thornycroft Giles on 14 July 1982, was to be a limited programme testing the design for resistance, propulsion and sea-keeping, with a simple outline design showing weapons-fit, rather than a fully detailed proposal? Is it true that, at the time of the DSAC Hull Committee's report, even this limited validation programme was incomplete, and that Thornycroft Giles' offer of an addendum to the outline originally presented was not taken up?

17 **Points of detail from the DSAC report:** Is it true that much subsequent evidence, some of which is incorporated in the S90 validation report to MoD, shows the conclusions in the DSAC report to have been premature? For instance, on weapons-fit, YARD Ltd. pointed out that the weapons-fit healthily exceeded that specified by the Type 23 NSR. And on weight, machinery and cost estimates, the Danish yard Frederikshavn Vaerft were prepared to guarantee weight, price, performance and delivery (Schedule to the S90 validation report to MoD). On engine-fit, did the proposed design have four engines in line abreast, as suggested by DSAC, or four engines in four engine-rooms, two forward and two aft, as claimed by Thornycroft Giles?

QUESTIONS FOR BATH

18 Would a sustained speed of 50-60 knots for up to 60 hours be an advantage in ASW operations? Would it also be an advantage if a towed-array platform could operate at 20 knots without propeller cavitation? And if a surface ship operating a towed array could be cheap and expendable by comparison with the submarines it is hunting?

19 What is the current average interval between replenishments at sea for RN frigates on ASW patrol in the North Atlantic?

20 For silent running in ASW operations with towed array, what is the greatest factor affecting hull-radiated noise at 4, 8, 10, 12, 15 and 20 knots? 0-12 : hull-rad. noise; 12-15 prop-cavitation.

21 What is the average daily fuel consumption in tonnes of a Leander Class frigate on ASW patrol in the North Atlantic, with and without a towed array? Based on RR figures for percentages of seagoing time spent at various speeds, the daily fuel cost of a 2,600-tonne Leander is £5169; of an S90 at 2,600 tonnes, £7,189. Assuming annual run-cost figures for RN frigates given in the 1984 Defence Estimates and D.K. Brown's estimate of 150 sea-days for RN frigates (Naval Review Jul 84), the daily running cost of a frigate is £105,000: thus the extra fuel cost amounts to 1.9% of this. £771m for 39 frigates. £105kpd×150d×20g = £315m op-cost, of wch £6m < 2pc.

22 May I see D/S/DSDD/.../80 & 81 (esp. 18 Oct 80 to 18 Nov 80, or 360-390)? Date of weekend is 10-13 April 1981. Fm Rawson? to Daniel

23 If a short, fat hull of the same displacement as an existing frigate were suitable, how much of the ?£140m.? build-cost of an existing Type 23 Frigate might be saved by the cheaper construction possible with shorter, fatter designs? And how much of the total through-life maintenance might be saved?

24 — How a cheap platform to be designed fm scratch given 6 or 7 yr lead-time for T23, which is now too costly, without a radical rethink of the hull-form, rather than reliance upon conventional form? [T23 Price 80m, now 120m, ?200m actually] Speculation

25 — What is the predicted abs. max. speed of the T23?
DK Brown says rising length is the biggest factor in rising cost. As length increases, Froude no. comes down, but ~~displacement, power, rises by~~ struc. wt. inc. by 1.3-1.4% to 1. As beam increases, struc. wt goes up by .95 to 1.

26 — What is a standard methodical series? Was one done on the S90? When? Where? With what results? How do the results compare with actual Ospray performance?

27 — What does stretched T42 (HMS Manchester et seqq) carry that Corvette type did not? Build-cost of ea. T42, yr by yr?