SECRET FILE No. S- 1271-8 VOL. 1

DEPARTMENT OF NATIONAL DEFENCE

ANTI-SUBMARINE COMMITTEES
A/S DEFENCE OF STRAITS
CAN/UK/US STUDY GROUP

FOR CROSS REFERENCES SEE INSIDE COVER

ROUTING				P.A. & B.F. ENTRIES				REGISTRY ONLY	
REFERRED	REMARKS	DATE OF PASS	INITIALS	DATE OF P.A.	INITIALS	DATE OF B.F.	CANCEL B.F.	DATE RECEIVED	IN-SPECTED
Staff DUSW		31-5-60	[illegible]						
Staff Dir Plans				15.6.60	DB			JUN 15 1960	
Dir Plans	PER REQUISITION CR AUG - 4 1960			28.9.60				SEP 29 1960	
DNOR	[illegible] CR NOV 25 1960			6/1/61	[illegible]			JAN - 6 1961	[illegible]
[illegible]		[illegible]							
Staff	PER REQUISITION CR FEB 17 1961			20/2/61	[illegible]			[illegible] 20 1961	
Staff	PER REQUISITION CR FEB 26 1962								
[illegible]		20/3	PC	28/3/62	PC			MAR 2 [illegible]	
DNFER	PER REQUEST CR DEC - 2 1963			10/12/63	[illegible]				

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"B.F." — DO NOT HOLD THIS FILE WHEN LAPSE IN ACTION MAY EXCEED 48 HOURS.

CR 1 [illegible] (M-8759-560)
HQ. 2-815-CR 7

SECRET FILE No. S- 1271-8 VOL. 1

FILE NUMBER: S. 1271-8 VOL.1

CLOSED VOLUME

VOLUME 2 FOLLOWS

NO FURTHER CORRESPONDENCE TO BE PLACED ON THIS FILE

CR 19

EMJ:LR

P.A.
ext.

NSTS ~~6101-13~~ Vol. 5
NSS 1271-8
RCAF S098-105
(STAFF)

P.A.
15/6/60

DEC 29 1959

CHIEF OF THE AIR STAFF

REPORT OF STUDY GROUP FOR ANTI-SUBMARINE DEFENCE OF THE GREENLAND-ICELAND-UNITED KINGDOM (G-I-UK) LINE

Reference is made to my letter NSS 1271-8 (STAFF) dated 26 June, 1959 concerning Canadian representation on the above noted Study Group.

2. Forwarded for your retention is the attached report of the Study Group. It would appear that the main points to be resolved from the Canadian point of view are the Command structure and the degree of Canadian participation.

3. Reference should also be made to my letter NSTS 6101-13 (STAFF) dated 19 July, 1957 enclosing the policy statement resulting from a conference held in Norfolk 25 - 26 June, 1957 on this same subject. This statement includes in part "The Royal Canadian Navy and Royal Canadian Air Force hold the position that they have a great interest in the finally selected system. At the proper time both the Royal Canadian Navy and Royal Canadian Air Force will consider the assignment of forces."

4. It is proposed to discuss this report at the next Sea-Air-Warfare Sub-Committee meeting.

Original Signed By
H. G. DeWOLF
Chief of Naval Staff

(H.G. DeWolf)
Vice-Admiral, RCN,
CHIEF OF THE NAVAL STAFF

Despatched by
N. Sec.
83
Date
Time 29/12/59

Enclosure

SECRET

NSS 1271-8 (Staff)

MEMORANDUM TO: ACNS(P)

GIUK STUDY GROUP REPORT

Reference (a): GIUK Study Group Report 8-10 July 1959.

It would appear that the main points to be resolved are the Command Structure and the degree of Canadian participation.

2. To achieve the above it is suggested that this report should be tabled before the Sea/Air Warfare Committee.

for R. Turnbull

(Jeffry V. Brock)
Commodore, RCN
ASSISTANT CHIEF OF THE NAVAL STAFF (AIR & WARFARE)

Ottawa, Ontario.
21 December 1959.

SECRET

NSS 1271-8 (Staff)

MEMORANDUM TO: ACNS(A&W)

DEFENCE OF GREENLAND-ICELAND-UNITED KINGDOM STRAITS

Reference (a): Study of A/S Defence of the GIUK Line (FF 12/ GARLANT. Ser.0013 dated 18 July 1959).

Appendix "A": Comments on Recommendations.

The report (reference (a)) of the CANUKUS Group which studied anti-submarine defence of the Greenland-Iceland-United Kingdom (GIUK) Straits has been read with considerable interest. Some of its recommendations, if adopted, would generate sizeable force requirements.

2. Comment on each recommendation is attached at Appendix "A".

(R.W. Timbrell)
Captain, RCN
DIRECTOR OF UNDERSEA WARFARE

Ottawa, Ontario.
21 December 1959.

SECRET

Appendix "A" to
NSS 1271-8 (Staff)
dated 21 December 1959.

RECOMMENDATIONS

A. Long Range Programme

(i) Provide a fixed system supported by minimum mobile forces capable of a 300 nautical mile detection in the area immediately south of the GIUK line.
(ii) Establish a fixed system immediately north of the Faeros-Shetland line. (Note: This system should be capable of being converted into an active system when the state of the art has progressed).

Comment - It is not likely that an Active System will be available before 1965, otherwise a reasonable programme.

B. Peace (Today)

(i) Determine the type and scale of shipping survey required for operation of an effective surface plot. This should be accomplished by using medium and high level aircraft making continuous photographs of radar displays.
(ii) Provide air defence destroyers in barrier patrol with additional A/S equipment such as LOFAR, CODAR, VDS and EER.

Comment - This appears to be logical and reasonable.

C. Alert

(i) Establish immediately an aircraft laid long-life JEZEBEL sonobuoy barrier to the south of the GIUK line.

Comment - Not yet available.

(ii) Provide 48 long range aircraft for this mission.

Comment - A new CANUKUS commitment - forces not yet allocated.

(iii) Sail up to 18 SSKs to establish mobile A/S barrier.

Comment - It is thought that there may be a number of USN SSKs already on the barrier.

(iv) Augmentation to 60 aircraft and 72 crews after 10 days.

Comment - A new CANUKUS commitment - forces not yet allocated.

D. War Tomorrow

(i) Augment the forces required under the Alert condition by 3 SSNs.
(ii) Lay deep moored minefields off the headlands.
(iii) Activate any portion of the fixed system that may be installed.

Comment - A reasonable addition to the forces required under the Alert condition.

SECRET

NSS 1271-8 (Staff) CR-PA 75/60

MEMORANDUM TO: DNI

STUDY ANTI-SUBMARINE DEFENCE OF THE GREENLAND-ICELAND-UNITED KINGDOM (GIUK) LINE

Reference (a): GIUK Report dated 8-10 July 1959.

Appendix (A): List of Assumptions Extracted from the Report.

The Joint RCN/RCAF present Concept of Operations assumes the S.S.G. type submarine will be a major threat to Canada and develops a plan for the deployment of all our Maritime Forces to counter this threat which is in an area close to our coasts.

2. This is fundamentally different to the GIUK Barrier concept. In addition the GIUK Study's first assumption is that general war is improbable and this implies that the S.S.G. threat to Canada is very little, if it exists at all.

3. Thus, since in the past, we put all our efforts to countering the S.S.G., it would therefore appear that we have over-emphasized this threat.

4. It is requested that comments on the following may be forwarded:

(i) Has the S.S.G. threat been over-emphasized in the past?
(ii) For what submarine problem should plans be made?

for (R.W. Timbrell)
Captain, RCN
DIRECTOR OF UNDERSEA WARFARE

Ottawa, Ontario.
27 October 1959.

A considerable amount of information sought here is contained in a later voluminous report by DNI 2 May 60

SECRET

Appendix (A) to
NSS 1271-8 (Staff)
dated 27 October, 1959.

ASSUMPTIONS

1. General War is improbable, but Communist actions short of general war will continue. The greatest threat to the Free Nations of the world is attrition - attrition in the economic, political, cultural and military fields. No Free World Nation can survive if the Communists control the seas. Since the submarine is useful to the Communists in all their efforts toward world domination, the submarine is one of the greatest threats to the Free World; therefore, anti-submarine efforts such as the Greenland-Iceland-United Kingdom (G-I-UK) anti-submarine (A/S) barrier are of utmost importance.

2. From the Free World point of view, A/S effort should be directed to all Communist submarines without undue emphasis on the SSG. All types of submarines have capabilities against shipping and threaten control of the seas. Submarine launched surface to surface missiles are a threat only in the general war situation.

3. An A/S barrier at the G-I-UK line will provide the best capability to account for Communist submarines entering the Atlantic.

4. That the Communists possess a technical capability to produce nuclear powered submarines by 1965 in sufficient quantity to require this study group to consider that factor in its deliberations.

5. That technical advances will be made in the period to 1965 toward quieting both conventional and nuclear submarines. Further, that Communist advances in technical areas will approximately equal those achieved by nations of the Free World.

6. Any system selected for the G-I-UK A/S barrier must be capable of detecting and classifying 25% of nuclear powered submarine transitors operating in quitest mode in a continuous unalerted condition. Additionally, the system must, when suitably augmented, provide a 50% capability of detection and classification against the same target, when in the alerted condition, and have a 50% kill capability in war.

NSS 1271-8(STAFF)

ROYAL CANADIAN NAVY

Ontario

8 December, 1959.

AIR DEFENCE OF THE STRAIT OF GIBRALTAR

As requested in an addendum to your letter S1-2-18-11F dated 28 May 1959, receipt is acknowledged of Copy 7 of Med. 007071/14 dated 1 January, 1959.

NAVAL SECRETARY

Senior Naval Liaison Officer
(UK Services Liaison Staff)

To FMO
For Despatch
Date 8 DEC 1959
Initials

With the Compliments

of the

Senior Naval Liaison Officer

(United Kingdom Services Liaison Staff), Canada

It would be appreciated if receipt might be acknowledged of Copy No.7 of Med. 007071/14 dated 1st January, 1959, forwarded under cover of SNLO UK 's S1-2-18-11F S31/59 dated 7th May, 1959.

on S 1271-8

Hegault
NCR
1/6/59

SECRET

NMWS 8100-1 Vol. 4

Our file ref. 5071 823.

DEPARTMENT OF NATIONAL DEFENCE

CANADIAN JOINT STAFF

CANADA

Reply to:
Naval Member

2450 Massachusetts Ave., N.W.
Washington 8 D.C.
U.S.A.

4 November, 1959

CANUKUS STUDY GROUP - ANTI-SUBMARINE DEFENSE OF THE GREENLAND-ICELAND-UNITED KINGDOM (G-I-UK) LINE

References: (a) NMWS 8100-1 dated 22 July, 1959
(b) CANAVHED Message 301721Z October, 1959

Enclosure: (A) - The Study CANADA, UNITED KINGDOM, UNITED STATES (CANUKUS) ANTI-SUBMARINE DEFENSE OF THE GREENLAND-ICELAND-UNITED KINGDOM (G-I-UK) Line (Copy No. 34)

9-11
~~DUSW~~

Submitted for the information of Naval Headquarters, as requested in reference (b), is enclosure (A).

for COMMODORE

The Naval Secretary

Attention: DUSW

REC'D. IN DUSW
9 Nov. 59

Referred to Staff
NOV
File No. S1271-8
Chgd to Staff 20.4.59

CAFA 510

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DEPARTMENT OF NATIONAL DEFENCE
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FOR CLASSIFIED MESSAGES ONLY

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			TOPSEC	
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PRIORITY			CONFID	
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FROM
CANAVHED

ACTION ADDRESSEE/S
CANAVUS

INFORMATION ADDRESSEE/S
CANAIRHED

ORIGINATOR'S NO.

AVA CO 0 '59

REFERENCE NMWS 8100-1 DATED 22 JUL 59 NOTAL PD
REQUEST ADDITIONAL COPY OF REPORT OF CAN UK US
STUDY GROUP ON GREENLAND ICELAND UNITED KINGDOM
LINE BE FORWARDED AS SOON AS POSSIBLE FOR USE
OF CANAIRHED PD

D.D. Boyle

C/A 29/..

ORIGINATOR	TELEPHONE	DATE - TIME GROUP	FILE NO.
E.M. Jones LCDR E.M. JONES - DN (PLANS)	6-8937	301721 Z	NSS 1271-8 (STAFF)

SECRET

NSS 1271-8 (Staff)

MEMORANDUM TO: D/ACNS(A&W)
ACNS(A&W)

GIUK STUDY GROUP REPORT

Reference: (a) GIUK STUDY GROUP REPORT - 8 - 10 July, 1959.

Appendix: (A) Precis of the GIUK Study Group Report dated 30 October, 1959.

It is obvious that there is no single detection system in existence or likely to be in existence in the near future that will give anything like a 100% capability.

2. The Study Group has recommended a system to give a 25% capability; the results of which will be regarded as a sample.

3. In time of war it is recommended to add mobile forces to the barrier to increase the capability and add kill-potential to it.

4. The only system available today that has a reasonable detection and kill-capacity is a combination of all A/S vehicles and systems. This will probably hold true for quite a number of years. Therefore, the recommendations of the Study Group are concurred with.

5. There are two main points to be resolved:-

(a) Command Structure - NATO or National or CUSRUG etc.

(b) Degree of Canadian Participation - 48 Argus a/c required full time.

6. As the Maritime requirement is only aircraft from Canada, suggest this go to the Sea/Air Warfare Committee.

NOTE:- The RCAF does not have a copy of this report. Understand Plans have asked CANAVUS for the copy they kept temporarily, for issue to RCAF, HQ.

(R.W. Timbrell),
Captain, RCN,
DIRECTOR OF UNDERSEA WARFARE.

Ottawa, Ontario.
30 October, 1959.

SECRET

4302

Appendix (A) to
NSS 1271-8 (Staff)
dated 27 October, 1959.

ASSUMPTIONS

1. General War is improbable, but Communist actions short of general war will continue. The greatest threat to the Free Nations of the world is attrition - attrition in the economic, political, cultural and military fields. No Free World Nation can survive if the Communists control the seas. Since the submarine is useful to the Communists in all their efforts toward world domination, the submarine is one of the greatest threats to the Free World; therefore, anti-submarine efforts such as the Greenland-Iceland-United Kingdom (G-I-UK) anti-submarine (A/S) barrier are of utmost importance.

2. From the Free World point of view, A/S effort should be directed to all Communist submarines without undue emphasis on the SSG. All types of submarines have capabilities against shipping and threaten control of the seas. Submarine launched surface to surface missiles are a threat only in the general war situation.

3. An A/S barrier at the G-I-UK line will provide the best capability to account for Communist submarines entering the Atlantic.

4. That the Communists possess a technical capability to produce nuclear powered submarines by 1965 in sufficient quantity to require this study group to consider that factor in its deliberations.

5. That technical advances will be made in the period to 1965 toward quieting both conventional and nuclear submarines. Further, that Communist advances in technical areas will approximately equal those achieved by nations of the Free World.

6. Any system selected for the G-I-UK A/S barrier must be capable of detecting and classifying 25% of nuclear powered submarine transitors operating in quitest mode in a continuous unalerted condition. Additionally, the system must, when suitably augmented, provide a 50% capability of detection and classification against the same target, when in the alerted condition, and have a 50% kill capability in war.

SECRET

SECRET

NSS 1271-8 (Staff)

on Plans.
MEMORANDUM TO: ~~DNPO~~

STUDY ANTI-SUBMARINE DEFENCE OF THE GREENLAND-ICELAND-UNITED KINGDOM (GIUK) LINE

Reference (a): GIUK Report dated 8-10 July 1959.

Appendix (A): List of Assumptions Extracted from the Report.

The GIUK Study appears to be of considerable worth and its validity appears to be good. However, its assumptions differ with those of the past.

2. Your comments are requested on the validity of the assumptions.

for (R.W. Timbrell)
Captain, ~~RCN~~
DIRECTOR OF UNDERSEA WARFARE

Ottawa, Ontario.
27 October 1959.

DUSW - These assumptions are in accord with latest intelligence estimate CANUS 59.
- DN Plans is preparing a paper for PPCC on the report
30/10.

SECRET

F. Peacetime experience is required by AEW aircraft if they are to be used on the barrier in war.

G. Forces to be used should be allocated now.

H. A/S barrier aircraft all weather capability including blind landing equipment to operate from Iceland and Northern UK.

J. In time of Alert or War, combine mobile forces and fixed systems.

K. Maintenance of barrier in war depends on the ability to operate aircraft in the face of enemy opposition.

L. Deep moored minefields would augment the barrier.

RECOMMENDATIONS

These are grouped under four headings, namely (a) Long Range, (b) Peace, (c) Alert, and (d) War Tomorrow, and are of four pages in length.

Very briefly they are:-

(a) Long Range - Fixed system supported by minimum mobile forces capable of a 300 mile depth of detection.

(b) Peace - Surface shipping plot being kept up-to-date by present AEW aircraft. Fit all barrier aircraft and ships with all known A/S equipment.

(c) Alert - Establish an aircraft long life JEZEBEL sonobuoy barrier. Provide 48 long range patrol type aircraft in order to maintain 6 aircraft on station. Sail 18 SSKs to establish a mobile barrier.

(d) War Tomorrow - Implementation of items in (c) above, reinforce the barrier with 3 SSNs. Plant deep minefields.

Appendix (A) to
NSS 1271-8 (Staff)
dated 30 October, 1959

PRECIS OF THE GIUK STUDY REPORT

AIM

The Study was to provide practical long term recommendations for detection, classification, tracking and localization of the enemy submarines transitting the GIUK line, in peace, at the time of an alert, and in war. In addition, recommendations were required for the best combination of forces in the event of "War Tomorrow".

ASSUMPTIONS

1. General war is improbable.
2. A/S effort should be directed to all types of enemy submarines without undue emphasis on SSGs.
3. The GIUK Barrier will provide the best capability to account for Communist submarines entering the Atlantic.
4. Nuclear submarines are to be considered as they will probably be produced in quantity by 1965.
5. Advances in quieting of submarines will be made during the period up to 1965.
6. The system must be capable of detecting 25% nuclear submarines operating in quietest mode, unalerted, and when the system is suitably augmented, have a 50% capability against alerted targets.

CONCLUSIONS

A. The system showing the most promise is a passive acoustic, shore-based system (Fixed System).

B. In war a greater degree of warning is required for the NW approaches of the UK which requires an addition to the system.

C. Target date for completion - 1962-65.

D. A surface plot of all shipping is required.

E. An electronic countermeasure capability should be retained in ships and aircraft and used to the maximum.

SECRET

NS 1271-8 (STAFF)

MEMORANDUM TO: D/~~ACNS~~(A&W)

The brief prepared by LCdr. Ellis is too brief and for that reason, no doubt, does not give a clear picture of the discussions. Attached is copy of notes prepared by the DOR(N) representative at the meeting. While these notes were prepared for internal circulation in DOR(N) they may succeed in giving a clearer picture of the proceedings.

2. The full report of the meeting is held on File NSS 1271-8.

3. Paragraph 7 (c)(i) of LCdr. Ellis' brief should substitute wartime for peacetime. The peacetime overall detection capability was only expected to provide a detection capability of 25%. If sufficient maritime aircraft were available this could be temporarily raised to 50% during an alert period. In wartime it is recommended that sufficient mobile forces (including SSK's) should be added to raise the detection capability to 75%.

4. The remarks of RADM Martin about the SSG are given in the complete report and are also stated in paragraph 9(e) of the DOR(N) notes. This reflects the increased attention being given in US military circles to limited war capability, and a growing conviction that systems which are designed to meet the unlikely general war situation will leave us open to "attrition" type actions. The following quotation from a speech by Mr. Gates, Under-Secretary of Defense and former Secretary of the Navy, illustrates this point of view.

"The cold and limited war problem is not simple, but it is vital to understand it. In a limited war situation, the Navy must maintain a capability to use either nuclear or conventional weapons to the controlled degree necessary to achieve the objective. More funds are required for this purpose. More accent on its importance is needed. This support will have to come from the elimination of certain of the very expensive mass-destruction, single-purpose weapon systems which have a priority of claims against our national resources."

5. I agree with DUSW that a more senior officer should head the Canadian delegation. Since long term planning is involved this should be a Naval Headquarters Officer.

J. S. Vigder

(J.S. Vigder)
DIRECTOR OF OPERATIONAL RESEARCH
(Navy)

Ottawa,
11 September, 1959.

SOSUS chain to be based in Scotland (not Iceland)
JSV.

SECRET

DEPARTMENT OF NATIONAL DEFENCE

MINUTE SHEET

Referred To	REMARKS To be signed in full showing Appointment, Telephone Number & Date
DHlo	Pse have a brief prepared on this study. — [signature] 5/8

DND. 317

000052

PA

DEPARTMENT OF NATIONAL DEFENCE

MINUTE SHEET 1271-8

NS 1271-8

SA # 775

Referred To	REMARKS To be signed in full showing Appointment, Telephone Number & Date
DORN	What are your general impressions of the report - with particular emphasis on para 7. (c)
	8/9
For the file	
	DUSW is preparing a report as a result of a detailed study of the final report of this exercise
PA. 27/10/59.	

SECRET

NOTES ON THE

GREENLAND-ICELAND-UNITED KINGDOM STUDY GROUP

ARGENTIA, NEWFOUNDLAND

8-10 July, 1959

by

K.R. Kavanagh

DIRECTORATE OF OPERATIONAL RESEARCH (NAVY)

15 July, 1959

NOTES ON THE GREENLAND-ICELAND-UNITED KINGDOM STUDY GROUP ARGENTIA, NEWFOUNDLAND, 8-10 JULY, 1959

by K.R. Kavanagh

Directorate of Operational Research (Navy)

INTRODUCTION

This study group was the first on a Tripartite basis (UK, US, and Canada) to discuss the problem of anti-submarine surveillance barriers in the Greenland-Iceland-United Kingdom area. A similar study group dealing with the Straits of Gibraltar was held in 1958, although Canada did not send delegates to this meeting. However, the proceedings were of interest to Canada in relation to similar problems of surveillance nearer North America.

2. The G-I-UK gaps are, of course, the most convenient entrance to the Atlantic Ocean for submarines of the U.S.S.R. Therefore, the study of surveillance and/or barrier requirements for these areas is of extreme importance. The purpose of the study group was based on the following general directive suggested by the Chief of Naval Operations:

> "To provide practical long term recommendations for detection, classification, tracking, and localization of the enemy submarines transiting the Greenland-Iceland-United Kingdom line, in peace, at the time of an alert and in war.
>
> "In time of war these facilities, when combined with suitable weapons, should provide the means of destroying enemy submarines.
>
> "In time of peace they should provide positive and accurate means of detection and classification.
>
> "When producing these recommendations, thought should be directed towards fulfilling these requirements in the period 1962-1965.
>
> "Concurrently, recommendations are to be made on suitable combination of presently available forces to achieve the most effective degree of ASW readiness in the event of 'war tomorrow.'"

3. The agenda for the meeting is summarized in Appendix "A" and consisted of presentations from the three countries covering the status of ASW forces and equipment, descriptions of research and development, and proposals for A/S systems for the G-I-UK area. Only the US delegation presented a complete plan covering the present and future requirements, and this became the basis for more detailed discussions in three smaller study groups during the second day of the meeting. During the final day the proposals resulting from the three study groups were the subject of general discussion and revision, and will form the main recommendations of the meeting.

4. It is not intended to discuss in detail all of the papers presented at the meeting. However, some of the more important items will be summarized, comments will be made on possible roles for Canadian forces in this area, and the main conclusions and recommendations of the meeting will be outlined. Complete proceedings of the meeting will be available as soon as possible, and in the meantime draft copies of all the papers are held by the delegates.

...2

5. Canada's delegation was a small one representing Naval and Air Force headquarters, as well as CANCOMARLANT, FOAC, and MAC (two RCN, two RCAF, two civilian).

6. The British delegation included RN and RAF officers and civilian scientists, while the USN delegation was composed mainly of USN officers plus two civilians from ONR and OEG.

7. Names and positions of those attending the meeting are given in Appendix "B".

OPENING REMARKS - RADM MARTIN

8. RADM MARTIN welcomed the representatives, explained the social arrangements and administrative details, and ~~thereon~~ after presented a short discussion of the operational activities conducted from Argentia, including the activities of the Navy, Air Force, and Coast Guard. The Admiral discussed in some detail the Atlantic Barrier operation, the ASW functions and the Long Range Ice Reconnaissance functions of his command. The high cost of operating the barrier was mentioned and the hope was expressed that an increased ASW capability might be achieved to take advantage of these units already on station.

9. Admiral MARTIN expressed appreciation of the friendly and cooperative relationships that Canada, the United Kingdom, and the United States enjoy. He further commented as follows:

(a) "General war is improbable. Communist actions short of general war will continue. The greatest threat to the nations of the free world is attrition--attrition in the economic, political, cultural, and military fields. The submarine is useful to the communists in all their efforts toward world domination.

(b) "Importance of shipping to the free world. A very large percentage of all overseas movement is by ships. No nation of the free world can survive if the Communists control the seas. Therefore, A/S efforts such as the G-I-UK barrier are of importance to all the free nations.

(c) "The submarine is the greatest military threat to the free world.

(d) "Anti-submarine warfare is a problem to which all the free nations--even small ones--can and should contribute. It is an extremely difficult problem, however, if all the free nations contribute their share we can retain control of the seas.

(e) "The SSG is a formidable weapon. It's surface to surface missile function, however, is applicable only to the general war situation, therefore we should not become pre-occupied with the SSG. As the threat to control of the seas is paramount to the free world our ASW effort should be directed toward all submarines, including the SSG which has capabilities other than firing missiles.

(f) "The G-I-UK anti-submarine barrier through which we may be able to account for most of the Communist submarines entering the Atlantic to threaten shipping is of importance to all nations of the free world--particularly to those bordering on the Atlantic.

...3

(g) "There are many unknowns in the ASW field. The capabilities and limitations of some equipments having promising application to an anti-submarine barrier have not been determined. This study group, nevertheless, must come up with finite recommendations to provide guidance to commanders who may have to establish the G-I-UK barrier tomorrow. Decisions must be made very soon to achieve an effective and efficient barrier in the 1962-65 period. Our recommendations must give the best advice available NOW to accomplish this."

CANADIAN PRESENTATION -

10. Unfortunately, the Canadian group met together for the first time just 24 hours before leaving for Argentia, and the choice of delegates was even then not firmly established. Consequently, there had been no coordinated approach to the preparation of Canada's presentation prior to the week of the meeting. It is certain that meetings of this importance deserve a much greater effort, if Canada is to play an important role in ASW planning and operations.

11. However, the delegates were in a position to know most of the necessary background, and the resulting Canadian brief summarized the status of RCN and RCAF ASW forces and their equipment, and emphasized Canada's general agreement with the concept of A/S surveillance barriers for the G-I-UK area. No complete solution to the problem was presented, but certain Canadian developments were mentioned which may have some application (e.g., the Argus aircraft, DDE's equipped with long range sonar, and future equipment such as VDS and helicopters, etc.).

12. It was also pointed out that Canada's mobile ASW forces are normally assigned to national commanders, but in wartime nearly all are committed to NATO. This transfer to NATO could take place during an increased alert, therefore, the merits of a CANADA-UK-US arrangement versus, or along with, the NATO arrangement for employment of forces of a barrier will have to be considered.

13. The only proposal for the future made by Canada was the RCAF Moored Buoy System for large area surveillance. A brief outline of the proposed system was given, along with details of the experimantal program which is soon to commence. This paper aroused many questions on the advantages and disadvantages of the system and experimental results will be awaited with interest in all three countries.

[redacted]

...4

s.13(1)(a)

Pages 58 to / à 60

are withheld pursuant to section

sont retenues en vertu de l'article

13(1)(a)

of the Access to Information Act

de la Loi sur l'accès à l'information

[redacted]

Fishing Boats Potential in Cold War

31. This short paper recommended that the potential surveillance capability of the NATO fishing fleets be further explored. Many of these vessels are equipped with fathometers, Loran, two-way radio, and some European fisherman employ "fish-finders" which can serve as limited sonar.

Operational Aspects

32. The SSK/aircraft barrier principle has been tested by several exercises conducted by ASDEFORLANT. Also, the SOSUS network along the Atlantic coast has been tested by a year of coordinated operations.

33. The SSK/aircraft barrier with SSN back-up was proved feasible and highly effective in each of three operations: ASDEVEX 1-58, during the Lebanon crises, and durimg LANTBEX 1-59. Weather and sonar conditions were excellent during these operations and it is realized that results will be less optomistic in the bad weather usually typical of the area. Further trials are planned in a season of poor weather and sonar conditions.

34. From the results to date, COMASDEFORLANT conclusions may be summarized as follows:

(a) SSK/aircraft barriers are feasible and highly effective for detection and classification;
(b) Communications were marginal but improved with practice;
(c) During periods of poor weather the spacing of SSK's may have to be decreased;
(d) Navigation facilities in certain areas left much to be desired;
(e) Primary problem requiring solution is an all weather capability for contact investigation;
(f) Addition of LOFAR/CODAR to submarines and surface craft, and JEZEBEL equipment to aircraft should help solve investigation problem.

35. In addition to the proven capability of the SSK/aircraft barrier, other types of barriers, though not yet tested, appear feasible to COMASDEFORLANT:

(a) Equipping of AEW barrier ships with LOFAR/CODAR and expendable or anchorable buoys (and a helicopter);
(b) Air barrier using JULIE/JEZEBEL equipment. This will be tested during the summer of 1959;
(c) Coordinated SOSUS/submarine barrier controlled by a mother ship in an area adjacent to the SSK's. Both SOSUS and SSK detection data relayed to the ship for coordination of localization efforts.

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Mobile Force Requirements for an A/S Transit Barrier System in the G-I-UK Line

36. This paper described an OEG study of mobile force requirements. The results are summarized below:

Barrier Force Requirements

On Station Units	Detection	On Station Units	Kill	Area Force Requirements
3 WV-2 18 SSK 3 DER 4 VP	60%	3 WV-2 18 SSK 3 SSN 4 VP	30%	15 WV-2 18-36 SSK 3-6 SSN 48 VP 3-6 DER
3 WV-2 9 SSK 3 DER 3 VP	35%	3 WV-2 9 SSK 3 SSN 4 VP	20%	15 WV-2 9-18 SSK 3-6 SSN 48 VP 3-6 DER

37. The above results are a rough average for several transit tactics and snort cycles considered. The use of the WV-2 aircraft was suggested as a means of keeping track of surface contacts obtained and investigated by the VP aircraft. The DER's could maintain the surface plot based on information from the WV-2 and VP aircraft. The WV-2 and DER's could continue to serve in their AEW capacity as well. The SSN's would be added as back-up when required to greatly increase the kill capability of the barrier.

38. The paper was concluded by pointing out several important factors not considered in the study. For example, the enemy might send SSK's to attack barrier units, and a one to one exchange rate would have to be assumed in this case, thus requiring further forces in reserve to maintain the barrier. Various tactics to feint or spoof certain sections of the line, or attempts to overwhelm one section by large numbers of transitors would require consideration.

Misconceptions about Destroyers

39. This short paper outlined several misconceptions which amount to the freezing of destroyer capabilities and tactics at the WW II level, in the face of steadily increasing submarine performance. Some of these points are well worth considering from the point of view of Canadian ASW ships.

40. The idea that destroyers must dash about in submarine waters at high speed to avoid being torpedoed was considered at least partially wrong by COMDESLANT. They are changing their tactics, and "will stop, leap-frog, or do anything to enhance capabilities."

41. The belief that destroyers cannot get good sonar performance at high speeds can be largely overcome by improved dome design, noise reduction, etc. This point was illustrated

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clearly by a comparison of the $200,000 cost per ship for 15 db improvement in source level by the RDT modification to SQS-4 sonar; and a cost of only $60,000 for an improvement of 20 db by noise reduction. It was emphasized that much remained to be done in the field of noise reduction, dome design, and altering of tactics to give the destroyer a greater sonar capability, both active and passive.

42. The need to shift to long range kill methods is important to overcome the long-lived misconception that destroyers must pass over, or nearly over, a submarine to complete an attack. Several of the long range systems were described briefly (i.e., drone helicopters with MK 43 torpedoes, ASROC, MK 37 torpedo, etc.)

43. The final misconception mentioned was that destroyers are inherently poor sonar platforms. Such programs as VDS, the AN/SQS-26 with bottom-bounce and convergence zone capabilities, the use of JEZEBEL buoys laid and monitored by destroyers (the BIG DASTARD System), and the possible development of very deep(12,000 feet) hydrophones from sonobuoys should greatly alter the capability of the destroyer as a sonar platform.

Project ARTEMIS

44. The last paper briefly reviewed the progress of Project ARTEMIS which has the goal of determining the feasibility of ocean surveillance by LF active acoustic means.

US Proposed Solution

45. The U.S. solution was presented under three headings: Peace (Now), Peace (Long Range), and Alert or War Tomorrow. During the second day of the meeting these proposals became the basis for detailed discussion and revision in three smaller study groups, each composed of officers from the three countries. Finally, the entire group met together on the last day, for point-by-point consideration of the resulting draft proposals.

46. The conclusions and recommendations of the G-I-UK Study Group will be available as soon as possible in printed proceedings of the meeting. However, the following, based on the draft proposals and on notes taken during the final discussion, will give a close indication of the recommendations of the meeting.

RECOMMENDATIONS FOR A/S DEFENCE OF G-I-UK LINE

A. Peace (Now) -

47. The following recommendations refer to steps that should be taken now for peace-time operations:

(a) Intensify exercises in the G-I-UK area to further the effectiveness of the A/S Barrier under varying conditions.
(b) To gain peacetime ASW utility from the AEW Barrier operation, if one is established on the G-I-UK line:
  (i) Provide Air Defence Barrier ~~types~~ ships with additional ASW equipment such as LOFAR, CODAR, VDS, and EER as a matter of urgency.

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(ii) Provide AEW Barrier aircraft with the following capabilities:
(a) Surface Surveillance - This may be provided by modifying the APS-45 Height Finding System and adapting the BELLHOP equipment (terminal automatic relay equipment)
(b) Sonobuoy Monitoring and Telemetering (two ARR-52 receivers, 2 telemetering devices. Could monitor 12 buoys at once, telemetering to a central collection point, ship or shore based).

(c) Allocate, stabilize and train as a unit now, those forces to be used on the picket line in the event of an alert.

(d) Provide mobile forces to be used in the G-I-UK area with the following:
(i) Reliable on-line communication facilities,
(ii) Reliable communication facilities between submerged submarines and aircraft, and
(iii) Navigation aids and automatic blind landing systems for aircraft (also improved navigation for SSK's)

(e) Investigate the feasibility of equipping and organizing NATO fishing fleets in contributing to the surface plot and to assist in detection and reporting of unfriendly submarines.

(f) Conduct oceanographic, hydrographic and acoustic surveys in order to develop information required for effective operation of the picket line.

(g) Intensify efforts on study of submarine noise characteristics.

B. Long Range (Peace) -

48. The following recommendations were agreed upon for setting up a surveillance system not later than 1965:

(a) Provide a system capable of continuously achieving a twenty-five percent detection and classification of all types of enemy submarines including nuclear powered operating in its quietest mode. It must be possible, in a period of alert, to increase this capability to fifty percent by augmenting mobile forces as required.

(b) For economic reasons, the system must be fixed. The present state of the art clearly indicates that initially this must be a passive acoustic shore based system. This will have use in conjunction with and/ or conversion to future active surveillance systems.

(c) The most suitable location of this system is currently considered to be in the area South of the Greenland - Iceland-United Kingdom line; it is considered the system developed should provide a depth of detection of 300 nautical miles. In order to give a greater

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degree of early warning in war, against submarines proceeding towards the North West approaches of the United Kingdom, it is considered desirable to cover an additional area to the North of the Faeros-Shetland line. This would probably be operated only in war or during exercises, because in this area of high fishing activity, investigation of contacts would be too costly in peace time.

(d) Full use will be made of coaxial cable techniques which will allow the termination of all cables at a common shore terminal in Scotland.

(e) Fixed and mobile systems, including permanent and semi-permanent moored-buoy systems, should be continually examined with a view toward decreasing or increasing emphasis on the various systems as developments indicate.

(f) Minimum mobile investigating forces for the fixed systems will require two patrol aircraft at readiness in Iceland, and one patrol aircraft at readiness in Northern UK. These aircraft should assist with classification by investigating contacts evaluated by the fixed system as possible submarines.

(g) A special survey of the proposed area should be conducted to ascertain the feasibility and requirements for a surface ship plot. This could lead to increased requirements for patrol aircraft.

(h) Start immediately and conduct necessary surveys and political negotiations for site locations, and phase production and installation program with a view toward completion not later than 1965.

C. Alert/War Tomorrow (Mobile)

PEACE:

49. In peace with currently available forces it is not practicable to maintain on station a mobile force on a continuing basis indefinitely to provide A/S surveillance on the G-I-UK line. However, the present AEW line if moved to this area could be provided with some A/S surveillance capability.

ALERT:

50. At the time of an alert, which is assumed to be a period of increased international tension, the duration of which cannot be predicted, the following measures would achieve the aim:

(a) Establish VP aircraft-laid long-life JEZEBEL sonobuoy barrier to the southwest of the AEW picket line. The minimum force requirement is estimated to be 48 aircraft, with a large effort initially, decreasing when SSK's reach the area. These aircraft should be based as near as practicable to the area of operation.

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(b) Sail immediately available SSK's (up to 18 in number) in order to establish mobile SUBAIR Barrier in the G-I-UK area.

(c) The optimum barrier in time of increased tension or war should combine both mobile and static surveillance systems.

WAR:

51. In time of war the above SUBAIR barrier should be reinforced by three SSN's. The extent to which this barrier can be maintained in war will depend mainly upon our ability to continue to operate VP aircraft in this area in the face of enemy opposition. The ability to use bases remote from the area might be a deciding factor in maintaining the SUBAIR barrier. In this context we wish to draw attention to the very long range capability of the ARGUS aircraft which enables it to operate effectively in the G-I-UK area from distant bases.

52. It is believed that provided certain conditions are fulfilled, these forces (when SSK's are equipped with BQR-4A sonar and MK 37 torpedo or equivalent, and aircraft with JULIE, JEZEBEL, and active/passive torpedoes) would achieve the following detection and kill probabilities:

(a) Overall detection rate of 75%
(b) Kill rate (i) aircraft + SSK-15%
(ii) with SSN back-up, a further 15%.

These detection and kill rates may be much lower against nuclear submarines.

The conditions are:

(a) That no significant improvement in the noise characteristics of Russian submarines takes place during the period in which the stated SSK and aircraft capabilities apply;

(b) That account be taken of periodical exceptionally bad acoustic and weather conditions during which very poor results might be obtained;

(c) That the effect of any successful Russian countermeasures such as "ruse de guerre" or offensive action is discounted; (e.g., S/M action against SSK's, particularly by nuclears);

(d) That aircraft bases are available in spite of enemy opposition.

Recommendations 1962-1965

53. The following should receive high priority now:

(a) Improve SSK capability by fitting of latest long range VLF sonar.
(b) Intensify development and production of long-life JEZEBEL sonobuoys for barrier purposes.
(c) Provide operationally acceptable base facilities,

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Recommendations 1962-1965

53. (c) cont'd.
including pre-stocking of necessary logistics for 4 augmentated VP squadrons (60 aircraft with 72 crews) in the G-I-UK area. One of the bases should be located in the Northern UK.

(d) Detailed study of communication and navigation facilities for operation of the force.

(e) Examine and decide upon the appropriate command structure for immediate activation for exercise purposes or in times of increased international tension or war.

(f) The fixed systems should establish a priority of stations so as to activate what may be available at the time of an alert or in war.

(g) Consideration should also be given to the establishment of A/S minefields to re-inforce the barrier line.

NOW

54. It is recommended that the above plan for the establishment of a mobile surveillance system be studied and eventually included in current defense plans. These plans should be exercised from time to time by such forces as are allocated.

GENERAL COMMENTS AND SUMMARY OF THE MEETING -

55. It was apparent that the US delegation had done a great deal of work in preparation for this meeting. In addition, they came prepared to make complete proposals in response to the suggested directive from CNO. The UK delegation was not in a position to do this, although their descriptions of their own work during Project CORSAIR contributed much to the meeting in the way of points to be considered for any proposed surveillance barrier for the G-I-UK area. The Canadian brief was limited to an outline of current ASW forces and their equipment, with mention of some developments of possible use in a barrier concept (i.e. Argus aircraft, destroyers with long range sonar, VDS, and helicopters, and the RCAF proposal for a long-life moored sonobuoy system).

56. The US recommendation for a fixed passive surveillance system south of the G-I-UK line received the general approval of the meeting, but the UK group especially was emphatic in pointing out the difficulties of the area. Their own CORSAIR program was stopped in 1957 because of the feeling that a passive system was not promising enough to continue development in the face of the fishing boat problem, and the likelihood of increasingly quieter enemy submarines. The US representative from BUSHIPS was more optomistic regarding the ability of SOSUS to overcome classification problems. Until such time as active systems are available it was felt that a passive system was worth while.

57. It was generally agreed that a mobile barrier consisting of SSK's and VP aircraft (with back-up by SSN's as required) was the best solution in time of an alert or war. However, it is not economically feasible for a continuous barrier in peace-time. Therefore, the fixed passive system with support from VP aircraft was recommended.

58. Until this system is in operation it was recommended that the ASW capabilities of the present AEW barrier forces (WV-2's and DER's) be improved. There is apparently consideration being given to moving these AEW forces from the Argentia-Azores line to the G-I-UK line. The importance of allocating, stabilizing, and training as a unit now, those forces to be used in the SSK/aircraft barrier in the event of an alert, was emphasized. Other factors such as provision of improved communication and navigation facilities for mobile forces, investigation of possible use of NATO fishing fleets, conducting of oceanographic, hydrographic and acoustic surveys, and increased efforts on study of submarine noise characteristics are all steps that should be taken now.

59. There was little or no mention made of the possible use of ASW destroyers, such as the RCN operates, in a surveillance barrier role in the G-I-UK area. The only mobile forces considered were SSK's, SSN's, VP aircraft, and the DER's and WV-2 aircraft of the present AEW line. Therefore, from the point of view of the RCN, what contributions could be made? In the case of the RCAF, the Argus aircraft could be a suitable contribution because of its long range. (Much greater than any current US aircraft of this type). If the G-I-UK barrier becomes a reality, even more consideration will then have to be given to other possible routes for enemy submarines (e.g., under the Arctic ice through the waters of the Canadian Archipelago). Canada may be able to contribute in various ways for studies in these areas.

60. If action is taken as a result of the recommendations of this group (and the earlier Gibraltar study group), it will be necessary for Canada to determine what contributions should be made. This will, of course, depend upon the decisions made regarding the appropriate command structure (i.e., US-UK-Canada alone, or under NATO). It did appear at the meeting, that the US is ready and willing to commence with such a program, and assistance in any form from Canada, and the UK would be welcomed.

APPENDIX "A"

AGENDA OF MEETING

A.M. Wed. 8 July

(i)	Opening Remarks	RADM W.I. Martin, USN
(ii)	Canadian Brief	LCDR Ellis, RCN
(iii)	A Proposal for a Moored Sonobuoy for a Large Area Surveillance	S/L G.G. Agnew, RCAF
(iv)	Discussion	
(v)	UK Introduction	Capt. I.L.M. McGeogh, RN
(vi)	UK Presentation	Mr. R.J. Gossage
(vii)	British Acoustic Investigations	Mr. A.G.D. Watson

P.M. Wed. 8 July

(viii) Discussion of UK papers

US Presentation

(ix)	The Threat - SACLANT Intelligence	CDR G.E. Everly, USN
(x)	Status of Systems and Equipment, Surface, Submarine, Fixed	CDR J.P. Kelley, USN
(xi)	Status of Air Systems and Equipment	Capt. S.L. Prickett, USN
(xii)	Fishing Boats Potential in Cold War	LCDR R.S. Gerney, USN
(xiii)	Operational Aspects-Tests of SSK-aircraft barriers and LOFAR Systems	LCDR D.D. Dunton, USN
(xiv)	Analysis of Force Requirements	Dr. L.S. Mason, OEG
(xv)	A Proposed Solution - US Position	CAPT F.N. Klein, USN
(xvi)	Discussion	

A.M. Thurs. 9 July

(xvii)	Misconceptions about Destroyers	CAPT E.P. Bonner, USN
(xviii)	Project Artemis	Mr. AN Pryce, ONR
(xix)	General Discussion of US papers	

P.M. Thurs. 9 July

(xx) Consideration of US proposed solution under three headings by study groups composed of UK, US and Canadian Delegates.
Group 1 - Long Range (Peace)
Group 11 - Alert/War Tomorrow (Mobile)
Group 111- Peace (Now)

A.M. Friday, 10 July

(xxi) Detailed discussion and revision of study group conclusions and recommendations.

P.M. Friday, 10 July

(xxii) Visits to cable - laying ship, AEW barrier ship, and Sound Surveillance Station (under construction).
(xxiii) Final Meeting--1500-1700.

APPENDIX "B"

ASW STUDY GROUP CONFEREES

Rank	Name	Command
	UNITED STATES	
RADM	W.I. Martin	COMBARFORLANT/COMAEWINGLANT
CDR	H.M. Cocowitch	NAVAIRLANT (FAW-3)
LCDR	D.D. Dunton	ASDEFORLANT
MR.	A.W. Pryce	ONR
LCDR	R.S. Cerney	OP 714
CAPT	S.L. Prickett	BUAER
LCDR	R.T. Diedrichsen	OP 312
CDR	J.P. Kelley	BUSHIPS
CDR	R.L. Dahllof	OP OOIL
CAPT	C.M. Robertson	OP 332E
CAPT	E.P. Bonner	DESLANT
LCDR	V.D. Maynard	DESLANT
CDR	E.P. Huey	SUBLANT
CAPT	R.F. Dubois	COMSUBDEVGRU TWO
CDR	G.E. Everly	CINCLANTFLT
CDR	M.C. Kelly	ASDEFORLANT
DR.	L.S. Mason	OEG
CAPT	F.N. Klein	OP 554
	UNITED KINGDOM	
CAPT	I.L.M. McGeogh	RN DUSW
CDR	E.D. Symes	RN
MR.	R.T. Gossage	Asst. D Phys Res.(Admiralty)
MR.	A.G.D. Watson	ARL
MR.	W.E. Dawson	Oper. Res. Dept.(Admiralty)
W/C	P.W.L. Burgess	RAF C.C. Oper. Req.
W/C	E.K. Paine	RAF Mar. Ops. (Air Min)
MR.	J.R. Vezey	Oper. Res. RAF C.C.
	CANADA	
LCDR	R.L. Ellis	RCN SOCD CANCOMARLANT
MR.	J.R. Longard	Command Scientific Officer
LCDR	E.M. Jones	RCN HQ DNPO
S/L	G.G. Agnew	RCAF HQ DMO
MR.	K.R. Kavanagh	RCN HQ DOR(N)
F/L	R. Hicks	RCAF MAC

NSS 1271-8 (Staff)

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Issue by D/ACNS(now)

MEMORANDUM TO: ~~ACNS~~(A&W)

A/S DEFENCE OF STRAITS - GIUK STUDY GROUP

A meeting of the representatives of Canada, United States, and United Kingdom to consider the defence of the continent of America by a Greenland-Iceland-United Kingdom barrier was held at Argentia under the chairmanship of the Commander of the U.S. Barrier Forces, Atlantic. Three international groups were formed and discussed three situations:-

(a) A long range peace time plan.

(b) An "Alert" and a "War Tommorrow" situation.

(c) A short term peace situation.

2. As a result of these discussions two points came out. One is that the "Silent" submarine is with us now in the form of the British PORPOISE Class submarine, and secondly that the ASW effort should be directed against all types of submarine, and not just against missile-firing submarines.

3. To help combat this threat, with particular reference to the Russians, it is recommended that a SOSUS chain be established now to a depth of three hundred (300) miles south of Iceland (presumably based in Iceland, though not stated). When the situation calls for an "Alert" state maritime aircraft fitted with Jezebel and SSKs should be added, and in War SSNs as well to increase the kill rate.

4. This air effort should be based in Iceland or Scotland, with its own command structure, noting that most forces are consigned to NATO.

5. At meetings such as this, where matters of high strategy and planning are deliberated, it would appear desirable that Canadian representatives be led by a more senior officer, preferably from Naval Headquarters.

for (R.W. Timbrell),
Captain, RCN,
DIRECTOR OF UNDERSEA WARFARE.

Ottawa, Ontario.
26 August, 1959.

SECRET

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DUSW.

The file number
for this correspondence
has been changed to
1271-8. Would you
please change the
file number on your
memo accordingly.

Ed Leclerc
Sec DNPO
18/8/59

REC'D. IN DUSW
21 Aug 59

COPY

MCACS: 1271-1
15 July, 1959.

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BRIEF OF MEETING
OF
GREENLAND, ICELAND, UNITED KINGDOM STUDY GROUP

Reference: (A) N.M.W.S. 8100-1 dated 28 May, 1959.

INTRODUCTION

Representatives of the Maritime forces of the United Kingdom, United States and Canada met in Argentia, Newfoundland, to implement the content of paragraph 4 of reference (a). The representatives convened under the chairmanship of Commander Barrier Forces Atlantic, Rear Admiral W. I. MARTIN, U.S.N., at 0830 8 July, 1959, and concluded their deliberations at 1715 10 July, 1959. The national chairmen were as follows:

UNITED KINGDOM:	Captain I.L.M. McGeogh, R.N., Deputy Director Under Sea Warfare. Admiralty.
UNITED STATES:	Captain F. N. Klein, U.S.N. Bureau of Aeronautics, Washington.
CANADA:	Lieutenant Commander R. L. Ellis, RCN, Staff of Canadian Maritime Commander Atlantic.

2. Rear Admiral MARTIN welcomed the representatives and briefed the gathering on:

(a) The operation of the present Newfoundland Azores barrier.

(b) The cost of operating the barrier.

(c) His impressions that general war is improbable, and the greatest threat to the free world is attrition in the economic, political, cultural and military fields.

(d) The importance of shipping to the free world.

(e) The submarine being the greatest military threat to the free world.

(f) The view that, although the SSG was a formidable weapon, the threat to the control of the seas is of paramount importance, therefore our anti-submarine effort should be directed toward all submarines.

3. The Canadian brief was presented by the writer and it was followed by a presentation on the "Moored Sonobuoy", Squadron Leader G. G. AGNEW, R.C.A.F. being the speaker. Captain McGEOGH gave a short introduction to the United Kingdom outlook after which two papers were presented; one dealing with the Admiralty experience in the Scotland Area, the other dealt with Admiralty acoustic investigations in the area North of the Shetlands. The United States representatives delivered six papers relative to the subject under study and finally a proposed solution to the problem. It appeared by the delivery of some of the six papers that the various arms, ie, air, SSK, surface and SOSUS were in competition rather than being complementary to each other.

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4. The points considered noteworthy which emanated from the above papers are:-

(a) Admiral Martin's view that effort should be directed to all submarines and not only SSG's.

(b) The conclusion drawn by a United Kingdom representative that the era of the quietened submarine is on us now in 1959, and will not wait until 1965 or even until 1962. This conclusion is based on the success of

(i) the noise reduction programme carried out in the Porpoise class submarine;

(ii) the reduction in snorting time required in that class of submarine, therefore the probability of detection has been reduced drastically.

5. A further paper describing the progress of Project ARTEMIS was delivered by a representative of the Office of Naval Research, Washington. The project was described as a Long Range Active Sonar which takes advantage of deep sound channels. It was stated that trial equipment for this project would be installed off Bermuda in September, 1959.

6. Following a question period, three international groups were formed. Each group was headed by one of the national chairmen and charged with making recommendations on what should be done under three categories, ie.,

(a) A long range peace time plan.

(b) An "Alert Situation", and a "War Tommorow" situation.

(c) Short Term Peace, or "NOW" situation.

7. A direct result of the deliberations of the three groups are the ensuing assessments and recommendations in brief:

(a) <u>THE THREAT</u>

Complete agreement was reached that the submarine in all its roles, anti-shipping, missile carrying SSK, etc. poses the major threat to the free world, and that a knowledge of the number of USSR submarines entering the Atlantic in peace time would be most valuable.

(b) <u>RECOMMENDATIONS</u>

The complete study group recommended that a surveillance barrier across the Greenland-Iceland-United Kingdom line be instituted in three phases.

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7. (Cont'd)

(b) (Cont'd)

(i) Peace

Establishing a fixed SOSUS type chain to the south of Iceland to cover a depth of 300 miles. Continue to assess the effectiveness of the system in the light of submarine development and the development of the detection systems, ie., Active Long Range Sonar, or moored long endurance sonobuoys.

(ii) Alert

Immediately add maritime patrol aircraft with Jezebel capability followed as soon as possible with SSK's to co-operate with the aircraft.

(iii) War

Station SSN's as a backup for the SSK aircraft team to increase the kill rate. No profitable employment was seen for surface ships in this barrier concept except for air defence picket ships, who should be given a better anti-submarine capability than at present.

(c) CAPABILITY

With present available weapons and detection systems the above recommendations when implemented should provide:

(i) A peacetime overall detection capability of 75%.

(ii) A wartime kill capability of 15%.

(iii) With the addition of SSN's a kill capability of 30%.

(d) OPERATION

It is proposed to operate the mobile force from air bases in Iceland, and/or Northern United Kingdom. The necessity to utilize more distant bases could be a deciding factor in maintaining the barrier in Wartime. In this regard, cognizance was taken of the long range capability of the Argus aircraft.

The information from this barrier was considered to be a most useful addition, if not the key, to a wartime plot of enemy submarines.

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7. (Cont'd)

(d) OPERATION (Cont'd)

The setting up of such a force for either exercises or continuous operations will require that an appropriate command structure be implemented; noting that most forces are now scheduled for employment by NATO.

(Sgd) R.L. Ellis

(R. L. ELLIS)
Lieutenant Commander, RCN.

SECRET

EMJ:MES

NSS 1271-8 ~~8100-1 TD-9208~~
(STAFF)

MEMORANDUM TO:
~~1 INFO~~
1. ~~ACNS(P)~~
~~3 DUSW~~
~~4 DOR(N)~~
~~5 ACNS(A & W)~~
~~6 VCNS~~
7 ~~CNS~~

CNS: The paper "Misconceptions about Intrigues" is most interesting 28/12

STUDY GROUP OF ANTI-SUBMARINE DEFENCE
OF THE GREENLAND-ICELAND-UK STRAITS AREA

The attached report is an advance copy and has not yet been officially approved by anyone other than the Chairman of the Study Group, Rear Admiral W.I. Martin, USN, Commander Barrier Forces, Atlantic. The term "Alert" in the context of the report means a time of increased tension as well as a formal alert.

2. The deliberations of the study group were guided by the remarks of the Chairman at the opening and during the meeting. The salient points of these remarks were:-

(a) The USN concept does not subscribe to an all out nuclear attack and 30 day war, i.e. MC 48 concept. Because of deterrent parity, general war is improbable and the greatest threat is one of attrition in all aspects. This concept is also receiving active consideration by the US Government. ?

(b) The USN is not preoccupied with the SSG and their direct threat to North America. It is primarily concerned with submarines in general and their threat to shipping.

(c) The almost complete reliance of the free world on the safe and free use of the seas make the submarine the greatest military threat.

(d) The most effective anti-submarine system can be achieved in the entrances to the Atlantic through which USSR submarines must proceed. This will primarily be through the G-I-UK area.

(e) To reduce the advantage of surprise the movements of these submarines must be accounted for in peacetime, hence the immediate requirement for the barrier.

(f) The establishment of the barrier should be the requirement of every free world nation, particularly those bordering the Atlantic. Every nation who can contribute should do so.

RECD. IN DUSW
19 Aug 59
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3. The essence of these remarks became the assumptions of the study group (TAB A).

4. The Canadian brief (TAB B) and comments during the study noted:

(a) There is no objection to the concept of the G-I-UK barrier in peacetime.

(b) Canada was bound to NATO and the Admiral's comments concerning no all out nuclear exchange and a war (or wars) of attrition were contrary to NATO policy to which Canadian forces are tuned.

(c) Once undetected access to the Atlantic through G-I-UK gaps is no longer available, other entrances under the Arctic Ice through waters of Canadian Archipelago may be used.

What about around Cape Horn? easy for a nuclear S/M?

(d) The co-ordinated employment and command of anti-submarine forces in the Atlantic in peacetime through a Canada-UK-US arrangement, in conjunction with the employment and command in wartime by SACLANT would require resolution nationally.

5. The contribution that Canada might make to an ASW line in the G-I-UK area would be primarily in a maritime air patrol role.

6. In the UK brief (TAB C) and comments, it was pointed out that the problem of committed forces and command was also of concern to the UK. Experimental work has been conducted in the UK end of the line for several years and is continuing. The Admiralty believes that the era of the quiet submarine is now here and a policy decision has been made to stop work on passive fixed systems and transfer British Research and Development to study of possible active fixed systems.

7. The UK delegation were particularly pleased to note that protection of shipping, and not the SSG, was uppermost in the minds of the USN.

8. The conclusions are noted in TAB D. Those of particular concern to the RCN are:

(a) The system showing the most promise of achieving continuously, with reasonable economy, a 25% detection and classification capability (considered to be lowest peacetime "sampling rate" to provide estimate of submarine activity) against all types of enemy submarines including nuclear powered operating in quietest mode within 1962 - 1965 time period is a passive acoustic shore based system (Fixed system) with minimum mobile (air) investigating forces.

Para. 8 (Cont'd)

(b) Forces to be used in the G-I-UK A/S barrier in the event of an alert should be allocated now, provided with the best equipment, stabilized and trained as a unit.

(c) The optimum G-I-UK A/S barrier in time of increased tension (alert) or in war should combine both mobile forces and fixed systems.

9. The recommendations (TAB E) of particular concern to the RCN are:

(a) Provide a Fixed System supported by minimum mobile forces.

(b) Intensify development and production of long-life Jezebel buoys (low frequency passive listening).

(c) Intensify development of the permanent/semi-permanent moored Sonobuoy system.

(d) Allocate, stabilize and train as a unit now those forces to be used on the G-I-UK A/S barrier in time of alert. Examine and decide upon appropriate Command structure.

(e) Organize NATO fishing fleets to assist in detection and reporting of unfriendly submarines and reporting their own positions.

10. A paper of interest to the RCN titled "Misconceptions About Destroyers" is attached. This was presented to the Study Group but not included in the report.

E.M. Jones

(E.M. Jones),
Lieutenant-Commander, RCN,
ASSISTANT STAFF OFFICER (STRATEGY).

O T T A W A,
14 August, 1959.

SECRET

Our file ref. NMWS 8100-1

9208

DEPARTMENT OF NATIONAL DEFENCE

CANADIAN JOINT STAFF

CANADA

Reply to:
Naval Member

2450 Massachusetts Ave., N.W.
Washington 8 D.C.
U.S.A.

22 July, 1959

STUDY ANTI-SUBMARINE DEFENCE OF THE GREENLAND-ICELAND-UNITED KINGDOM (GIUK) LINE

Enclosure: (A) COMBARLANT Ser 0013 dated 18 July, 1959 with enclosure.

Submitted for the information of Naval Headquarters is enclosure (A), which has been received from the Commander Barrier Force, U.S. Atlantic Fleet, and contains the record of the CANUKUS Study Group, which was held in Argentia, 8-10 July, 1959.

DUSW 2
28-7
ACNS(A&W) 3
ACNS(P) 1

2. It is not known whether further U.S. comments will be sent concerning this Study, but it is assumed any such comments will take the form of follow-up action.

3. One copy of the Study is being retained for the present by the Naval Member.

COMMODORE

The Naval Secretary
Attention: ACNS (A&W) & ACNS (P) (with copy No. 35 of enclosure (A).

Copy to: Canadian Maritime Commander, Atlantic (with copy No. 36 of enclosure (A).
HMC Dockyard,
Halifax, N.S.

Referred to Staff
1271-8
JUL 27 1959
File No. 8100
Chgd to Secret Tallee

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Ser 0013
18 July 1959

SECRET

From: Commander Barrier Force, U. S. Atlantic Fleet
To: Canadian Joint Staff, Washington 25, D. C.

Subj: Anti-Submarine Defense of the Greenland-Iceland-United Kingdom (G-I-UK) Line; study of (U)

Ref: (a) CNO ltr ser 0020 1P31 of 25 May 1959

Encl: (1) Canada, United Kingdom, United States (CANUKUS) Study (3 copies) (S)

1. Enclosure (1) is the CANUKUS anti-submarine defense of the G-I-UK line study prepared in accordance with the general directive contained in reference (a).

2. These advance copies are furnished for your information, however, they must be accepted with the understanding they bear no sanction at this time from any superior command.

3. Upon removal of enclosure (1) this letter is downgraded to Confidential.

W. I. MARTIN

SECRET

THE STUDY

CANADA, UNITED KINGDOM, UNITED STATES (CANUKUS)

ANTI-SUBMARINE DEFENSE OF THE

GREENLAND-ICELAND-UNITED KINGDOM (G-I-UK) LINE

CANUKUS STUDY GROUP

Headquarters Commander Barrier Force, U. S.
Atlantic Fleet

U. S. Naval Station, Argentia, Newfoundland

8-10 July 1959

COPY NUMBER 35

Enclosure(1) to COMBARLANT serial 0015 dated 18 July 1959

TABLE OF CONTENTS

APPENDICES

I. Heading. CANADIAN-UNITED KINGDOM-UNITED STATES (CANUKUS) STUDY

Commander Barrier Force, U. S. Atlantic Fleet

U. S. Naval Station, Argentia, Newfoundland

Date: 8-10 July 1959.

II. Subject. CANUKUS Study Group, convened for the purpose of studying the Anti-Submarine Defense of the Greenland-Iceland-United Kingdom (G-I-UK) Line.

III. Problem.

A. To provide practical long term recommendations for detection, classification, tracking, and localization of the enemy submarines transitting the G-I-UK line, in peace, at the time of an alert and in war.

1. In time of war these facilities, when combined with suitable weapons, should provide the means of destroying enemy submarines.

2. In time of peace they should provide positive and accurate means of detection and classification.

3. When producing these recommendations, thought should be directed towards fulfilling these requirements in the period 1962-1965.

4. Concurrently, recommendations are to be made on suitable combination of presently available forces to achieve the most effective degree of anti-submarine readiness in the event of "war tomorrow."

IV. Assumptions.

1. General War is improbable, but Communist actions short of general war will continue. The greatest threat to the Free Nations of the world is attrition - attrition in the economic, political, cultural and military fields. No Free World Nation can survive if the Communists control the seas. Since the submarine is useful to the Communists in all their efforts toward world domination, the submarine is one of the greatest threats to the Free

World; therefore, anti-submarine efforts such as the Greenland-Iceland-United Kingdom (G-I-UK) anti-submarine (A/S) barrier are of utmost importance.

2. From the Free World point of view, A/S effort should be directed to all Communist submarines without undue emphasis on the SSG. All types of submarines have capabilities against shipping and threaten control of the seas. Submarine launched surface to surface missiles are a threat only in the general war situation.

3. An A/S barrier at the G-I-UK line will provide the best capability to account for Communist submarines entering the Atlantic.

4. That the Communists possess a technical capability to produce nuclear powered submarines by 1965 in sufficient quantity to require this study group to consider that factor in it's deliberations.

5. That technical advances will be made in the period to 1965 toward quieting both conventional and nuclear submarines. Further, that Communist advances in technical areas will approximately equal those achieved by nations of the Free World.

6. Any system selected for the G-I-UK A/S barrier must be capable of detecting and classifying 25% of nuclear powered submarine transitors operating in quietest mode in a continuous unalerted condition. Additionally, the system must, when suitably augmented, provide a 50% capability of detectio[n] and classification against the same target, when in the alerted condition, and have a 50% kill capability in war.

V. <u>Facts Bearing on the Problem.</u>

1. Forces of the Tripartite Group, Canada, United Kingdom and the United States are heavily committed.

2. The cost of maintaining an A/S barrier consisting entirely of mobile forces in the required strength on the G-I-UK line on a continuous basis over an indeterminent time span is prohibitive.

VI. Discussion.

A. The CANUKUS (G-I-UK) study group met at Headquarters, Commander Barrier Force, U. S. Atlantic Fleet, U. S. Naval Station, Argentia, Newfoundland at 0830 on 8 July 1959 and adjourned at 1700 on 10 July 1959. A list of the representatives of the three countries is contained in Appendix I. The excellent qualifications of the various representatives for this particular assignment is indicated by the listing of the functional title of each representative under the "Present Duty" column in Appendix I.

B. The meeting was opened by a message of greeting from the Chairman, Rear Admiral W. I. MARTIN, USN. In addition to his greeting he charged the study group and established the pattern for the discussion. The full remarks of the Chairman are contained in Appendix II.

C. Following the remarks of the Chairman the meeting proceeded with the formal presentations. Canada was the lead off nation, followed in turn by the United Kingdom and the United States. The following prepared papers were given:

1. Canadian Brief.

   LCDR R. L. ELLIS, RCN — Appendix III

2. A Proposal for a Moored Sonobuoy for Large Area Surveillance.

   SQD/LDR G. G. AGNEW, RCAF — Appendix IV

3. United Kingdom Brief.

   CAPT I. L. M. McGEOGH, RN — Appendix V

4. U. K. Status of Systems and Equipment Applicable to the General Directive of the Study Group.

   Mr. R. J. GOSSAGE — Appendix VI

5. British Admiralty Acoustic Investigations.

Mr. A. G. D. WATSON — Appendix VII

6. Presentation of Shipboard and Fixed Sonor Systems.

CDR J. P. KELLY, USN — Appendix VIII

7. Status of Air Systems and Equipment.

CAPT S. L. PRICKETT, USN — Appendix IX

8. NATO Fishing Fleet Potential in A/S Surveillance.

LCDR R. S. CERNEY, USN — Appendix X

9. Operational Aspects of Mobile and Fixed Systems.

LCDR D. D. DUNTON, USN — Appendix XI

10. Mobile Force Requirements for an Anti-Submarine Transit Barrier System in the G-I-UK Line.

Dr. L. S. MASON, OEG — Appendix XII

D. Formal presentations were followed by discussion of possible solutions to the problem of the A/S defense of the G-I-UK line categorized into the following groups. Each of the categories are listed with a summary of the discussion immediately following:

1. Accepted degree of barrier effectiveness.

a. Discussion.

(1) Assumption 6. indicates that the accepted level of barrier effectiveness in an unalert condition against a nuclear powered submarine operating in its quietest mode was 25% detection and classification. It was considered that 25% was the lowest "sampling rate" which would, in peacetime, provide a realistic estimate of Communist submarine activity.

(2) A requirement to increase this rate to 50% was assumed for alerted and wartime conditions, and was so established in order to achieve a kill rate of sufficient magnitude to be an effective deterrent and to provide depleting attrition to the enemy submarine force.

2. Considerations of Fixed and Mobile Barriers Applicable to the G-I-UK Line.

a. Discussion.

(1) For military reasons, it is most desirable that a mobile barrier force be used to provide for defense of the G-I-UK line. Certain aspects of mobile force operation, however, make this impractical. The following discussions set forth aspects of fixed systems upported by mobile forces and of a barrier comprised entirely of mobile forces.

(a) Fixed System with Mobile Investigative Forces (advantages).

1. When a requirement for CONTINUOUS peacetime surveillance must be fulfilled, a fixed system, combined with minimum mobile units provides the most economical means of establishing an anti-submarine barrier. This economy is realized not only in the initial installation, but, more important, in continuous long term operation.

2. Though fixed systems now available are passive, a growth potential to provide an active capability can be included in preparation for the time when a quiet submarine can be placed in operation by the Communists.

3. A passive fixed system is available now in the form of LOFAR equipment such as installed by the United States in the Atlantic and Pacific Sound Surveillance Systems.

4. Such a fixed system provides surveillance without excessive demands on the operating forces.

5. A fixed installation maintains a continuous all weather capability. While turbulence from severe storms may degrade LOFARGRAMS to an extent, the reduction of shipping and fishing activity compensates for thi degradation by reducing the number of noise sources.

(b) Fixed System with Mobile Investigative Forces (disadvantages).

1. A peacetime vulnerability exists in that fishing trawlers, anchoring ships and/or intentional grapnelling may disrupt or dislocat cables laid on the ocean floor. In wartime, protection against such actions can be taken, but in peacetime, freedom of the seas makes protection difficult to provide.

2. Any fixed system now in existence or likely to be developed in the future requires some type of mobile investigative force to classify, and, in time of war, to kill the transitor. Mobile forces also conduct surface surveillance.

3. A fixed system cannot be relocated in the event of relocation of the threat.

4. Any detection system can become subject to counter-measures such as spoofing or jamming. A fixed barrier however, may be at somewhat greater disadvantage than mobile forces when such actions occur.

(c) Mobile Barrier (Advantages).

1. By using mobile forces, flexibility of employment is retained. The location of the entire barrier may be changed at will, as may any portion or unit thereof. Mobile barrier forces may be shifted to other areas or to other purposes as the military situation dictates.

2. Units of a mobile barrier, being comprised of ships and aircraft, possess an inherent capability to carry and employ weapons with which to effect a kill.

3. Acts of hostility against mobile forces are more clearly defined, while in the case of fixed systems, acts bordering on hostility may be declared as accidental or inadvertant by the perpetrator.

4. Mobile forces have a demonstrated capability to establish and maintain a barrier for short periods in the G-I-UK line during exercises and periods of international tension.

(d) Mobile Barrier (disadvantages).

1. The cumulative cost in money, forces and personnel of a barrier composed entirely of mobile forces, with present or near future capabilities, would be prohibitive to support on a long term continuous basis in peacetime.

2. Mobile forces employed on such a barrier in peacetime are subject to degradation of effectiveness imposed by monotony and fatigue.

(2) In discussing and studying the above major points, the study group deduced that the basic decision, when considering continuous peacetime surveillance was resolved to: either the case of fixed installation supported by minimum mobile forces, or to reach the decision that continuous surveillance was not feasible in the forseeable future within peacetime economy.

3. Consideration of Fishing Activity in the Area of the G-I-UK Line.

a. Discussion.

In considering any detection and classification system for the G-I-UK area the problem of the fishing fleet becomes real and great. Fishing boats have diesel engines with signatures very similar to a submarine and they are concentrated in great numbers in the G-I-UK area where maximum A/S surveillance is required. In peacetime when no positive control is possible, the problem of the fishing boat is crippling. In wartime, depending on the situation, control of the fishing boat is still a problem. As beef becomes scarce the need for fish becomes greater. The location of concentration of fishing boats in the Norwegian Sea was an early influence on the meeting in deciding upon the location of the G-I-UK A/S barrier. In peacetime if a northward looking fixed system were installed, the investigative forces would be swamped trying to develope all contacts in the area. Further and related to the location of the barrier it was considered that Communist submarines might well be operating in the Norwegian Sea pursuant to normal routine training and the fact they were there would not necessarily constitute a significant threat. The combination of the above two lines of thought influenced the final location of the G-I-UK A/S barrier. Fishing activity will heavily effect the operation of a surface plot, however, it was considered that this problem could be partially solved by aerial reconnaissance in establishing the ecology of the fishing fleets, and this appears possible to achieve with existing forces with little expense during peacetime.

Another possible contribution to a solution of the problem is in organizing all NATO fishing fleets. A program appears possible that would provide these benefits. Knowledge of the locations of friendly boats would assist in maintaining a valid surface plot. By use of their own "fish finders" or by providing them with simple sonar and communication equipment, a valuable source of detection and reporting of unfriendly submarines potentially exists in the area of present concern. However, the group recognized that the competition among fishermen is keen and knew that one of the drawbacks to such a program would be the reluctance of fishermen to freely disclose their positions. This might be countered to a degree by providing weather data and safety through the advantages in availability of search and rescue.

4. Requirement for a Surface Plot.

a. Discussion.

The more the subject of the requirement for a surface plot was discussed, the more axiomatic it became that for any A/S barrier to be effective a surface plot was essential. The magnitude of investigation and classification is already so overwhelming a task that maximum elimination of friendly targets is mandatory. One of the ways the surface plot could be achieved is with the air defense barrier aircraft (WV-2) on station over each segment of the gap. One aircraft at an altitude of 10-12 thousand feet has a radar horizon of about 125 miles so that such an aircraft on station could provide surveillance over an area of 250 miles in diameter. A surface plot may be achieved in a number of ways. First the WV-2 is capable of maintaining the plot in its own CIC. A second method would provide terminal automatic relay (BELLHOP) transmissions from the WV-2 to a surface plot at some surface station such as a picket destroyer type (DER) or at a shore station. A third, and promising method would utilize radar scope photography of air defense barrier aircraft displays. Films brought to a common point would make possible a master plot of surface targets. Through this means, progress of ships, photographed at appropriate regular intervals, could be maintained current on a composite display.

If an air defense barrier should be established on the G-I-UK line in the near future some aspects of the surface plot may be possible of early realization. (A fuller discussion of the surface plot considerations is contained in Appendix XII.)

It is believed that, though not specifically a surface plot, all known Communist submarine activity should be recorded from all sources available and a plot maintained ashore in order that operational ecology may be developed and studied and all possible intelligence gleaned therefrom.

5. Peacetime Anti-Submarine Utility from Air Defense Barrier Forces.

a. Discussion.

Maintenance of certain air defense barriers is a continuing commitment. Air defense barriers and the equipment required in the air defense mission is not particularly compatible with anti-submarine operations. However, the air defense barriers are being maintained at high cost with corrosive effects on men, facilities, and equipment involved. The concensus was that a strenuous effort must be made in order to gain maximum feasible anti-submarine capability from this costly operation.

If an air defense barrier on the G-I-UK line is established, equipment is available that could give the air defense barrier aircraft some A/S capability. By modifying the AN/APS-45 height finding system and adapting terminal automatic relay equipment (BELLHOP) to the system surface, surveillance capability could be achieved. Further, sonobuoy monitoring and telemetering equipment could be added. This installation could be made with a small weight penalty, and its presence will not detract in any sense from the capability of the aircraft to perform its primary mission of air defense. A full discussion of the available equipment is contained in Appendix IX.

Surface forces in the air defense barrier are composed of DER's maintaining continuous station. At present little anti-submarine capability is realized from these ships due to station spacing and limitation of equipment installed. It is considered however, that appreciable improvement could be made in the ship capability by providing the DER's with the following:

(a) Variable Depth Sonar, which will permit employment of acoustic conditions below the layer and thereby increase, appreciably, detection ranges of installed sonar equipment.

(b) LOFAR and CODAR capability. In the present state of the art, AN/AQA-3 LOFAR/CODAR equipment, in conjunction with radio receiving equipment and aircraft sonobuoys would provide a passive capability to a radius of about 35 miles on a snorkeling submarine. This equipment, now used in aircraft under the code name JEZEBEL, is in production, and while it does have limitations, with the advent of moored buoy systems, might add considerable capability.

(c) Drone Anti-Submarine Helicopter. Sonobuoys are required in conjunction with the LOFAR/CODAR technique set forth above. A drone helicopter might give felxibility in buoy placement, as well as providing a weapon delivery system for long range attack.

(d) Explosive Echo Ranging. Though at present little application for explosive echo ranging for surface ships is foreseen, so little is required to provide this capability that, in conjunction with LOFAR/CODAR and the drone helicopter, some advantage may be gained for relatively little expenditure of funds.

6. Mobile Force Requirements.

a. Discussion.

After carefully considering the tool provided by the spectrum anaylsis of underwater sound commonly known as LOFAR, and realizing the possibilities of extracting more and more intelligence from the history and the signature as experienced is gained, the concensus of the group was that no system could be exclusively fixed. To fulfill the requirements of the general directive, under the condition of PEACE, ALERT and WAR, mobile forces would be required under all circumstances. In PEACE they will be required for investigation and classification. In time of ALERT they will be required for the same reasons in addition to their capability to bring the level of detection and classification up to the acceptable p entages. In WAR the mobile fo s will be required for all phases. Increased detection and classification, tracking, localization, and the ultimate - the delivery of the weapon for the KILL. With the basic assumption in mind that 25% detection and classification is the minimum sampling acceptable on a continuous unalerted peacetime condition, it was agreed that it is not feasible economically to attempt the job with only mobile forces over an undertermined time span - that might drag on for 10-20 years, who knows? Even with the fixed system accepted, and need for mobile back-up agreed upon, the matter of the undetermined number of years ahead heavily influenced the decision on what level of back-up was the minimum acceptable. The conclusions and recommendations that were finally generated are not so much what the group thought was required, but the force level that could reasonably be provided in the peacetime situation over the long haul ahead.

In considering the force requirements under the condition of ALERT and WAR TOMORROW force levels were generally thought of as the requirement prior to the installation of the fixed system.

A strong combination of mobile forces could provide the degree of A/S readiness required in the G-I-UK area and it probably is within the capability of the three nations involved to mobilize and provide them in periods of world wide tension (ALERT) or in WAR.

The forces selected for this task under both the ALERT and WAR TOMORROW condition are large, but they are the minimum that the group felt could do the job. For a fuller discussion of force requirements see Appendix XII.

The problems surrounding the employment of these forces was thoroughly discussed and covered such areas as basing, logistic support, improvement in all areas of communications and navigation facilities, and particularly the need for automatic blind landing equipment for aircraft operating on the A/S barrier from northern UK bases. As this barrier is mainly a submarine/air barrier the matter of submarine to air communication improvement is a matter of great urgency. It was emphasized that the need for development of tactics for mobile forces was great, and that tactics for utilization of active sonar techniques should also be developed if their use should become mandatory.

It early became apparent to the group that the extent to which the A/S barrier on the G-I-UK line can be maintained in war will depend mainly upon the ability to operate aircraft in the face of enemy opposition. The ability to use bases remote from the area might well be the deciding factor in maintaining the A/S barrier. The submarines should be able to maintain their stations with a low attrition rate. In this context the value of the Canadian Argus aircraft and the RAF Shackleton MK-3 with their long ranges and extended endurance came into clear focus as how long range aircraft with this capability may be essential to maintain the A/S barrier on the G-I-UK line. Details of the Argus capability are contained in Appendix III. The Shackleton MK-3 has an endurance of 18 plus hours in the A/S surveillance role.

7. <u>Shallow Water Surveillance.</u>

a. <u>Discussion.</u>

In any system selected as the A/S barrier on the G-I-UK line, as is the case of any A/S system be it fixed, mobile or fixed/mobile, at the present state of the art, they work better in deep water.

Control of the shallow water areas present a difficult technical problem, but such control would have a great advantage in narrowing the front and reducing the labor of the mobile investigative forces.

One of the means by which the shallow water problem could be handled is through magnetic detection. At the present time magnetic detection is possible in very shallow water (less than 150 fathoms). Magnetic detection devices may be more expensive than acoustic detection, but the classification problem is easier. Even as a very limited adjunct to the fixed acoustic installation any device that shows any promise is worth looking at.

The means most readily available for solving the shallow water problem, applicable to the wartime situation, is deep moored mine fields. A satisfactory mine for this purpose is avalable, (similar to U. S. MK-6, MOD-8 or later models with the same characteristics) but of course not now stockpiled in the quantities that would be required. However, they could be produced and plans prepared to sow deep moored mine fields adjacent to all main headlands on the G-I-UK line. These mine fields would have to be deep enough to be of no danger to surface shipping.

8. <u>General material improvement of vehicles, equipment facilities, etc., required for effective A/S barrier operation on the G-I-UK line.</u>

a. <u>Discussion.</u>

Throughout the deliberation of the G-I-UK study group the gambit of A/S requirements was run. While most of the discussion under this category applied to the vast and general subject of anti-submarine warfare improvement, solution of many of these problems would have a direct bearing on the effectiveness of an A/S barrier established on the G-I-UK line within the time span of the basic directive. As a matter of reference those items consuming a heavy portion of the groups discussions are listed.

(1) <u>Intelligence.</u> One of the most urgent items of operational intelligence needed is to determine source levels and line spectrum components of the radiated noise of Communist submarines. The group was aware that

limited efforts in this field are in being, but intensification is urgently required. An important adjunct to collection of intelligence is the determination, by estimates, calculations and every other means available, the noise levels of future conventional and nuclear submarines.

(2) Sonar Equipment. Until now, it has been a conception that destroyer types were limited to active means of detection. It is considered that a capability may exist in passive equipments such as the AN/EQR-2B for destroyers. (For further details, see Appendix VIII.)

(3) Noise Reduction. Noise reduction for destroyer types has been approached, not from the point of avoiding detection of the destroyer by the submarine, but rather to reduce the self-noise as a limiting factor in destroyer sonar. Hull damping, sonar dome damping and dome relocation have given reasonable gain at low cost. Noise reduction in submarines has been continuously under study, and great strides have been taken. An outstanding example is the British PORPOISE class with resilient mounted snorkel mast, main engines and quiet propellers.

(4) Active Fixed Systems. The U. S. Navy Project ARTEMIS and the Royal Navy Project VERONICA are research projects pointed toward active detection systems based on fixed installations. Representatives of both navies presented short briefs on the progress of these projects.

(5) Communication and Navigation Systems. The G-I-UK area is one in which electronic propagation is poor and in which climatology is unfavorable. Utmost effort must be made to provide reliable communication and navigation systems for both ships and aircraft and blind landing systems are considered mandatory to provide aircraft with a bonafide all weather capability in the G-I-UK area.

(6) Electronic Countermeasures. The group discussed improved electronic countermeasures equipment for aircraft. It was recognized that improvement in ECM equipment can be achieved in small increments. Peacetime economy, however, dictates that unless appreciable gain in capability is achieved in replacement, use of presently installed units to service-life end appears prudent. To deny the submarine the unrestricted use of his radar, effective A/S barrier operations will require that barrier ships and aircraft have an ECM capability.

(7) Base Facilities. A comprehensive review of base facilities which might be used for basing of both aircraft and ships is necessary. In this connotation, distant bases for long range aircraft must be thoroughly examined due to the numbers of forces required and the military reasons fully discussed earlier in this paper.

(8) Moored Buoys. Discussion was conducted at length on systems of fields of permanent/semi-permanent moored buoys with a LOFAR capability. The group strongly concurred that this system showed sufficient promise to merit accelerated research and development attention. (A full discussion of this system appears in Appendix IV.)

(9) Training. The formation and employment of the U. S. Navy Task Groups ALFA, BRAVO and CHARLIE have provided some insight into problems of A/S training. In this context, the study group considered formation of an A/S barrier force, to be allocated, organized, stablized and trained as a unit. This should include CANUKUS forces. It was also discussed that the command structure of the A/S barrier force be developed in peacetime.

(10) Oceanographic Forecasting. To insure that best use can be made of acoustic systems, an oceanographic forecasting organization was discussed to enable the operational commander to decide on the correct disposition of forces and to permit unit commanders to make the best tactical decision under prevailing conditions. What is envisioned here is oceanographic prognostication similar to meteorological forecasting.

(11) Area Priority. It was pointed out that once a barrier system is placed in operation, the Communist must find new avenues by which the vital Atlantic shipping lanes can be approached. Examples are under the Polar Ice Cap, north of Greenland and through the ~~Belle Isle~~ Davis Straits. This may dictate consideration of A/S defenses in other areas.

(12) Emphasis. The group considered it appropriate to emphasize that action is required now to start in some areas. The time element of the basic directive is so stated that delay is not permissible. Awaiting of research and development items is a luxury we cannot afford.

E. After considering the Problem, the Assumptions, the Facts, the formal presentations and the provocative discussions that followed, working groups were formed and a full day was devoted to formulation of tentative conclusions and recommendations under the following broad areas:

Group I. LONG RANGE (R&D), CDR J. P. KELLY, USN, Chairman.

Group II. ALERT/WAR TOMORROW (MOBILE), CAPT. I. L. M. McGEOGH, RN Chairman.

Group III. PEACE. LCDR R. L. ELLIS, RCN, Chairman.

Full composition of the above working groups is contained in Appendix XIII.

F. The last day of the meetings was devoted to presentations by the three group chairmen and the conclusions and recommendations of their working groups. Each paper was thoroughly discussed and the final conclusions and recommendations that follow as Parts VII and VIII of this study were arrived at by the concensus of the group with the most possible objectivity.

VII. Conclusions.

A. The system showing the most promise of achieving continuously with reasonable economy, a twenty-five (25%) percent detection and classification capability against all types of enemy submarines including nuclear powered operating in its quietest mode within the 1962-1965 time period is a passive acoustic shore based system (Fixed System).

1. The most suitable location of this system is at present considered to be in the area immediately south of the G-I-UK line.

2. This system must have use in conjunction with and/or be capable of conversion to future active systems.

3. The minimum of mobile investigating forces for the fixed systems will require - two long range patrol aircraft at readiness in Iceland and one such aircraft at readiness in the northern United Kingdom. These aircraft should investigate and assist in classifying contacts evaluated by the fixed systems as possible submarines.

4. Concentration of fishing activity in the area of the G-I-UK line severely complicates employment of any detection and, more particularly, classification system in peace and to some extent in war.

B. In order to give a greater degree of early warning in war, against submarines proceeding towards the northwest approaches of the United Kingdom, it is considered desirable to cover an additional area to the North of the Faeros-Shetland line. For reasons of economy this system should be designed and installed concurrently with the G-I-UK system.

C. With the completion date of 1962-1965 for the G-I-UK system a requirement, a calculated risk must be taken and work started now on the fixed system. However, fixed systems and mobile systems including permanent and semi-permanent moored buoy systems must be continually examined with a view toward appropriately varying the emphasis on the selected system as developments indicate.

D. Effective operation of the A/S barrier on the G-I-UK line will require a surface plot. For this plot to be effective a relative idea of the shipping ecology of the G-I-UK area under normal peace time conditions must be obtained.

E. An electronic countermeasure capability, at least equal to that presently installed, should be retained in aircraft and ships, and should, in all A/S barrier operations, be used to the maximum.

F. Peacetime anti-submarine utility should be gained from the air defense barrier operations if an air defense barrier is established on the G-I-UK line.

G. Forces to be used in the G-I-UK A/S barrier in the event of an alert should be allocated ~~now,~~ NOW provided with the best equipment, stabilized and trained as a unit.

H. Effective G-I-UK A/S barrier aircraft operations will require realistic all-weather capability including blind landing equipment. Such equipment will be essential to sustaining aircraft operating on the from Iceland and northern United Kingdom bases.

J. The optimum G-I-UK A/S barrier in time of increased tension (ALERT) or in war should combine both mobile forces and fixed systems.

However, prior to installation of the fixed systems in the event of ALERT or WAR TOMORROW a strong combination of mobile forces could provide the required A/S barrier.

K. The extent to which the barrier on the G-I-UK line can be maintained in war will depend mainly upon the ability to continue to operate aircraft in the G-I-UK area in the face of enemy opposition. The ability to use air bases remote from the area might be a deciding factor in maintaining the barrier. (In this context the ARGUS aircraft with its very long range and the SHACKLETON MK-3 with its capability of 18 hours plus in the surveillance role are the only aircraft in being which could operate effectively from distant bases in support of the G-I-UK A/S barrier.)

L. Deep moored mine fields off headlands would be no danger to surface operations and they would augment the barrier in time of war by narrowing the front.

VIII. Recommendations.

A. LONG RANGE.

1. Provide a Fixed System supported by minimum mobile forces, capable of a 300 nautical mile depth of detection in the area immediately south of the G-I-UK line. This system should:

a. Be capable of achieving a twenty-five (25 percent detection and classification against all types of enemy submarines, including nuclear powered operating in its quietest mode, on a continuous unalerted basis.

b. Be capable of being augmented by additional mobile forces to increase the detection and classification to fifty (50) percent during periods of alert, with a fifty (50) percent kill probability during war.

c. Make full use of coaxial cable techniques which will allow the termination of all cables at a common shore terminal such as in Scotland.

2. Start immediately and conduct necessary oceangraphic, hydrographic, bathymetric, and acoustic surveys in the selected area south of the G-I-UK line.

3. Start immediately, political negotiations for site locations for the fixed system in the G-I-UK area.

4. Establish a phased production and installation program for the G-I-UK fixed system with a view toward completion in the 1962-1965 period.

5. Concurrently provide a fixed system similar to that described in paragraph A. 1. above in the area immediately to the north of Faeros-Shetland line.

6. Be prepared to stop work on the installation of fixed systems at any time the state of the art indicates a better system can be achieved within the time span of the general directive, 1962-1965.

7. Planning for installation of the fixed system should establish a priority list for the array locations in order that themost crucial units may be activated at time of an ALERT or in WAR.

8. Procure and stock pile suitable mines for laying deep moored mine fields off headlands in time of War.

9. Provide operationally acceptable base facilities, including pre-stocking of necessary logistics, including weapons, for sixty (60) long range patrol aircraft and seventy-two (72) crews or equivalent number of crews of non-U.S. Aircraft. One of the bases should be located in the northern United Kingdom.

10. The following research and development items should receive a high priority now:

a. Improve SSK capability by general (back) fitting of latest long range very low frequency sonar.

b. Intensify development and production of long-life JEZEBEL buoys.

c. Intensify development of the permanent/semi-permanent moored sonobuoy system.

d. Intensify efforts to keep abreast of radiated noise patterns as nuclear submarine become quieter.

e. Intensify efforts to develope active acoustic systems compatible with installed passive systems.

B. PEACE.

1. Determine the type and scale of shipping survey required for operation of an effective surface plot. This should be accomplished by:

a. Conducting a pre-G-I-UK A/S barrier statistical survey over a protracted period of time. This may be accomplished by utilizing long range patrol aircraft at medium altitude making a continuous photographic record of the radar display.

b. With technique similar to sub-paragraph 1. a, above, conduct widespread radar reconnaissance with high altitude aircraft.

2. Be prepared to gain peacetime anti-submarine utility from air defense barrier operations if air defense barrier is established on the G-I-UK line by:

a. Providing air defense barrier destroyer types with additional anti-submarine equipment such as LOFAR, CODAR, Variable Depth Sonar and Explosive Echo Ranging as a matter of urgency.

b. Providing air defense barrier aircraft with the following capabilities:

(1) Surface Surveillance. This may be had by modifying the AN/APS-45 height finding system and adapting terminal automatic relay equipment (BELLHOP) to the system.

(2) Sonobuoy Monitoring and Telemetering.

3. Allocate, stablize and train as a unit, NOW, those forces to be used on the G-I-UK A/S barrier in time of alert.

a. Examine and decide upon appropriate command structure.

4. Provide mobile forces to be used in the G-I-UK A/S barrier with the following:

a. Reliable on-line communication facilities.

b. Reliable communication facilities between submerged submarines and aircraft.

c. Best available detection and classification equipment in all units.

d. Best available weapons.

e. Improved navigation aids throughout the G-I-UK area.

f. Automatic blind landing systems for A/S barrier aircraft.

5. Intensify exercises in the G-I-UK area to further the effectiveness of the A/S barrier forces under varying conditions.

6. Intensify efforts to determine source levels and line spectrum components of the radiated noise of Communist submarines.

Being under [illegible] by [illegible]

7. Organize NATO fishing fleets to assist in detection and reporting of unfriendly submarines, and reporting of their own positions.

C. ALERT.

1. At the time of an alert the following action should be taken:

a. Establish immediately an aircraft-laid long life JEZEBEL sonobuoy barrier to the south of the G-I-UK line.

(1) Provide forty-eight (48) long range patrol type aircraft for this mission.

(2) Base the aircraft as near as possible to the operating areas.

2. Sail immediately available SSKs up to eighteen (18) in number in order to establish a mobile A/S barrier in the G-I-UK lihe.

3. Augmentation to sixty (60) aircraft and seventy-two (72) crews will be required after ten (10) days in order to maintain six (6) aircraft continuously on station in support of the A/S barrier.

4. In fulfilling the above requirement for 60 aircraft, utilization of the very long range ARGUS aircraft and long range SHACKLETON MK-3 aircraft should be to the maximum extent possible.

F. WAR TOMORROW.

1. If not afforded the alert period, first action would be the implementation of all items under ALERT above.

2. Arm all forces.

3. Reinforce the A/S Barrier established on the G-I-UK line under the ALERT condition by addition of 3 SSNs.

4. Provide logistic support and back-up forces to maintain continuously on station 18 SSK, 3 SSN and 6 Long Range Patrol aricraft.

5. Lay deep moored mine fields off appropriate headlands.

6. Activate any portion of the fixed system that may be installed.

IX CLOSING.

As Chairman I have this date reviewed and approved the CANUKUS Study of the anti-submarine defense of the Greenland-Iceland-United Kingdom Line.

The membership of this study group is highly qualified in their special fields and each made a significant contribution to the deliberations leading to the final report. The group, as a whole, was the most consciencious and hardest working with whom it has been my pleasure to work. Recognizing the immense scope, staggering complexity, and frustrating unknowns in anti-submarine warfare, this group dedicated itself from the outset to provide sound guidance in finite terms for superiors who are charged with making decisions in the A/S field. In asserting that we have accomplished this, I would have to follow it quickly with the statement that it has been done on the basis of best information available today.

There are many developments which promise improved submarine detection and classification. The value of some of these will be proven or disproven within the next year. In the light of this, it is prudent that the recommendations of this study group—some of which must be implemented almost immediately in order to realize a useful barrier in the 1962-1965 period—be reviewed by study groups, similar to this one, to insure the best barrier possible from the standpoint of effectiveness and economy.

W. I. MARTIN
Rear Admiral, U. S. Navy

Date: 18 July 1959

APPENDICES

LIST OF REPRESENTATIVES

(CANUKUS) CANADA, UNITED KINGDOM, UNITED STATES STUDY GROUP

ANTI-SUBMARINE DEFENSE OF THE G-I-UK LINE

Headquarters Commander Barrier Force, Atlantic

U. S. Naval Station, Argentia, Newfoundland

8-10 July 1959

Chairman

Name	Rank	Service	Present Duty
MARTIN, W. I.	Rear Admiral	U. S. Navy	Commander Barrier Force, U. S. Atlantic Fleet

Canadian Representatives

Name	Rank	Service	Present Duty
ELLIS, R. L.	Lieutenant Commander	Royal Canadian Navy	Staff Officer Oceanographic Systems, Office of Canadian Maritime Commander Atlantic HMC Dockyard, Halifax, N.S.
JONES, E. M.	Lieutenant Commander	Royal Canadian Navy	Strategy and Plans Section-Directorate Naval Operations and Plans - Naval Headquarters, Ottawa, Ont.
AGNEW, G. G.	Squadron Leader	Royal Canadian Air Force	Directorate of Maritime Operations - Air Force Head-Quarters, Ottawa, Ont.
HICKS, R. E.	Flight Lieutenant	Royal Canadian Air Force	Staff Officer Development and Evaluation, Maritime Air Command Headquarters, Hali-Fax, N. S.
LONGARD, J. R.	Scientific Officer	Defence Research Board of Canada	Command Scientific Officer on Staff of Flag Officer Atlantic Coast, HMC Dock-Yard, Halifax, also Scientific Advisor to CANCOMARLAN
KAVANAGH, K. R.	Scientific Officer	Canada Defense Research Board	Directorate Operational Research (Navy) Naval Headquarters, Ottawa, Ont.

United Kingdom Representatives

Name	Rank	Service	Present Duty
McGEOCH, I. L. M.	Captain	Royal Navy	Deputy Director of Under-Surface Warfare (Admiral

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Name	Rank	Service	Present Duty
SYMES, E. D.	Commander	Royal Navy	Undersurface Warfare Division (Admiralty)
BURGESS, P. W. G.	Wing Commander	Royal Air Force	Operational Requirements/Tactics, Headquarters Coastal Command, Royal Air Force
PAINE, E. K.	Wing Commander	Royal Air Force	Operations (Maritime) Air Ministry, London
GOSSAGE, R. J.	Senior Principal Scientific Officer	Royal Navy Scientific Service	Assistant Director of Physical Research (Detectio
VEZEY, J. R.	Mr.	Dept. of the Scientific Advisor to Air Ministry	Chief Research Officer, Headquarters Coastal Command
WATSON, A. G. D.	Senior Principal Scientific Officer	Royal Navy Scientific Service	Leader, Underwater Detection Group, Admiralty Research Laboratory
DAWSON, W. E.	Mr.	Royal Navy Scientific Service	Head of Antisubmarine and Mine Group, Dept. of Operational Research, Admiralty, London

United States Representatives

Name	Rank	Service	Present Duty
KLEIN, F. N., JR.	Captain	U. S. Navy	Head, Airborne ASW Weapons System Branch OP554 Office of CNO, Navy Dept. Washington 25, D. C.
DUBOIS, R. F.	Captain	U. S. Navy	Commander Submarine Development Group TWO
ROBERTSON, C. M.	Captain	U. S. Navy	Head, Current Operations Policy Branch (OP-332E) CNO Navy Dept. Washington 25, D.C.
BONNER, E. P.	Captain	U. S. Navy	Staff Commander Destroyer Force, U. S. Atlantic Fleet Ass't C/S for Operations-Plans

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Name	Rank	Service	Present Duty
PRICKETT, S. L.	Captain	U. S. Navy	Bureau of Aeronautics ASW Liaison Office, Navy Dept., Washington 25, D. C.
DAHLLOF, R. L.	Commander	U. S. Navy	Aviation Assistant to the CNO Executive for ASW Readiness (OP-001) Navy Dept., Washington 25, D. C.
EVERLY, G. E.	Commander	U. S. Navy	Staff CINCLANTFLT Ass't Defensive Plans Officer for ASW and Mine Warfare
HUEY, E. P.	Commander	U. S. Navy	Training and Tactical Officer Staff, COMSUBLANT, New London, Conn.
KELLY, M. C.	Commander	U. S. Navy	Plans and Command Liaison, COMASDEFORLANT Staff
COCOWITCH, H. M.	Commander	U. S. Navy	Fleet Air Wing THREE Operations Officer
KELLY, J. P.	Commander	U. S. Navy	Bureau of Ships, Sonar Design Section, Head, Fixed Systems Branch Code-680
FISHER, R. L.	Commander	U. S. Navy	Readiness and Staff Plans Officer, COMBARFORLANT
DIEDRICHSEN, R. T.	Lieutenant Commander	U. S. Navy	Antisubmarine Warfare, Fixed Systems, Office of CNO (OP-312El) Navy Dept. Washington 25, D. C.
DUNTON, D. D.	Lieutenant Commander	U. S. Navy	Surface Coordinator, Oceanographic Surveillance Systems, COMASDEFORLANT Staff
MAYNARD, V. C.	Lieutenant Commander	U. S. Navy	Staff, Commander Destroyer Force, U. S. Atlantic Fleet, Atomic Weapons Officer
CERNEY, R. S.	Lieutenant Commander	U. S. Navy	Head, Land Based ASW Systems Branch (R&D) Office, (OP-714) CNO, Navy Dept., Washington 25, D. C.

Name	Rank	Service	Present Duty
MASON, L. S.	Dr.	Office of the Chief of Naval Operations, U. S. Navy	Operations Evaluation Group (OP-03EG) (Operations Resear and Analysis)
PRYCE, A. W.	Mr.	Office of the Secretary, U.S. Navy	Office of Naval Research Head, Acoustics Branch, Code 411

GREETINGS BY RADM MARTIN

RADM MARTIN welcomed the representatives, explained the social arrangements and administrative details, and thereafter presented a short discussion of the operational activities conducted from Argentia, including the activities of the Navy, Air Force, and Coast Guard. The Admiral discussed in some detail the Atlantic Barrier operation, the ASW functions and and the Long Range Ice Reconnaissance functions of his command. The high cost of operating the barrier was mentioned and the hope was expressed that an increased ASW capability might be achieved to take advantage of these units already on station.

Admiral MARTIN expressed appreciation of the friendly and cooperative relationships that Canada, the United Kingdom, and the United States enjoy. He further commented as follows:

a. General war is improbable. Communist actions short of general war will continue. The greatest threat to the nations of the free world is attrition--attrition in the economic, political, cultural, and military fields. The submarine is useful to the communists in all their efforts toward world domination.

b. Importance of shipping to the free world. A very large percentage of all overseas movement is by ships. No nation of the free world can survive if the communists control the seas. Therefore, anti-submarine efforts such as the G-I-UK barrier is of importance to all the free nations.

c. The submarine is the greatest military threat to the free world.

d. Anti-submarine warfare is a problem to which all the free nations--even small ones--can and should contribute. It is an extremely difficult problem, however, if all the free nations contribute their share we can retain control of the seas.

e. The SSG is a formidable weapon. It's surface to surface missile function, however, is applicable only to the general war situation, therefore, we should not become preoccupied with the SSG. As the threat to control of the seas is paramount to the free world our ASW effort should be directed toward all submarines, including the SSG which has capabilities other than firing missiles.

f. The G-I-UK anti-submarine barrier through which we may be able to account for most of the Communist submarines entering the Atlantic to threaten shipping is of importance to all nations of the free world--particularly to those bordering on the Atlantic.

g. There are many unknowns in the ASW field. The capabilities and limitations of some equipments having promising application to an anti-submarine barrier have not been determined. This study group, nevertheless, must come up with finite recommendations to provide guidance to commanders who may have to establish the G-I-UK barrier tomorrow. Decisions must be made very soon to achieve an effective and efficient barrier in the 1962-65 period. Our recommendations must give the best advice available NOW to accomplish this.

CANADIAN BRIEF

SECRET

Canada does not disagree with the A/S surveillance barrier concept in the Iceland-Greenland-U.K. area in peacetime. If accepted such a system should be maintained at a high state of readiness as a routine type of submarine surveillance. This should be capable of immediate conversion to a surveillance and kill capability in wartime.

Defence of straits is of special interest to Canada as once undetected access to the Atlantic through the Greenland, Iceland-U.K. gaps is no longer available, other entrances under the Arctic Ice through the waters of the Canadian Archipelago may be used and surveillance of these entrances will be necessary. Preliminary oceanographic and hydrographic surveys are being made in 3 of these and accoustic measurements have been made under the ice in one.

It is not our purpose to present a complete Canadian proposal or solution to this problem but rather to point out developments in which we are concerned and which may have an application. This can best be done by reviewing Canadian forces which are now available and their capabilities, followed by consideration of current and future developments applicable to this problem.

As you know, the Canadian operational organization in maritime warfare consists of an integrated RCAF/RCN staff headed by a Maritime Commander on each coast responsible to the Canadian, Chiefs of Staff Committee.

Anti-Submarine forces available to the Maritime Commander are:

An aircraft carrier with CS2F aircraft

Destroyer Escorts

Frigates

Argus long range patrol aircraft

The destroyer escorts are fitted with long and medium range hull mounted sonar, and attack sonar with Limbo and the MK 43 torpedoes. Operational endurance is approximately eight days at 14 knots.

Future equipment to be fitted in the RCN ships which will improve their capability include the Canadian designed Variable Depth Sonar and destroyer borne helicopter.

We believe that VDS has a particular application in G-I-UK area because of the adverse bathythermal conditions in summer and the problems of bad weather and high sea states in winter. Experimental trials are being conducted into the possibility of relaying lofar information from the CS2F to a shore station or attending ship to give this aircraft Jezebel capability. Interim Explosive Echo Ranging is installed in this aircraft and methods of improved navigation and display are under trial.

The Argus long range patrol aircraft is a vehicle which we believe can make an effective contribution to the barrier problem. If the integrity of the Icelandic bases is lost, then the ability of this aircraft to contribute to the barrier while operating from Canadian bases may be important indeed. If operations from the Azores-Iceland are also possible, then a proportionally greater contribution can be made.

A few details on the capability of this 148,000 lb aircraft may be of interest.

Endurance is in excess of 24 hours.

The aircraft carries 8,000 lbs of armament (i.e. 16 MK 43 torpedoes.)

100+ SSQ2B sonobuoys

104 Practice Depth Charges (Julie Bombs)

105 Practice Marine Markers

For Navigation the aircraft is equipped with ANTAC Integrated, Tactical Navigation System.

The aircraft now has a EER capability and in 1961 will be equipped with Jezebel.

In the near future, doppler and ASR 3 equipment will be fitted with an improved Julie capability that will greatly increase the data handling rate.

Studies have been conducted by the three countries on the use of the SSK/aircraft team in barrier operations. We believe that this concept is worthy of serious consideration as the best available system today. As you are aware, Canada cannot provide submarines for this purpose, however, the Argus long range patrol aircraft can be used in this concept. The provision of real estate by Canada for operational bases may be a contribution. It is appreciated that there remains several basic problems before the SSK/ aircraft team can be fully effective.

On a long term basis, however, due to force availability and cost, other surveillance systems could be more practical. From this aspect, Canada has conducted other studies aimed at providing an independent SOSUS capability for our long range patrol aircraft. Specifically this proposal deals with the concept of mooring long endurance sonobuoys over a wide area. As this may have direct bearing on the problem at hand I will ask SQD/LDR Agnew to present greater details of this shortly.

It appears that the only surveillance system which can be made available immediately is provided by mobile forces. These forces are in most cases assigned to national commanders for employment in their areas. In war-time, nearly all Canadian forces are committed to NATO control. The transfer of the Canadian forces to NATO could take place during an increased alert. Thus, the merits of a Canada-UK-US arrangement versus or along with the NATO arrangement for employment of forces of a barrier will have to be considered.

SECRET

By: Squadron Leader G. G. AGNEW, RCAF

Directorate of Maritime Operations

Air Force Headquarters - Ottawa

1. Admiral Martin - Gentlemen - before I outline Canada's Moored Buoy proposal I should detail the assumption that we have made and which lead us to such a proposal.

2. Assumptions that lead to the making of this proposal:

   a. What operational commander wants

      (1) Peacetime - general disposition.

      (2) Wartime -------------is O.K. for countering and dealing with targets.

   b. System must be able to transit from peace to war with a minimum of change and confusion.

   c. No augmentation of forces.

   d. Our peacetime role is to demonstrate a capability - so that it is a deterrent.

   e. No matter what system you propose, the aircraft is going to do the following up and will make the kill.

APPENDIX IV

A PROPOSAL FOR A MOORED SONOBUOY FOR LARGE AREA SURVEILLANCE

1. The concept of a long life moored sonobuoy is unique in that it is not dependent on an increased detection capability or on a principle of equipment design which has not already been proven. Instead, it makes use of two shortcomings of the airborne Jezebel system when air launched sonobuoys are used. The first of these is that the aircraft must fly to the position of each of the sonobuoys in order to launch the buoy. (Slide 1). The advantage of having the buoys already in place is evident from this slide where we see that to search this area using air launched sonobuoys would require six hours flight time by a 180 knot aircraft. To search the same area using long life moored sonobuoys would require only one hour because the aircraft can, using the sonobuoy transmitter as a link, monitor six sonobuoys at a time and thereby cover the same area in one hour. Thus, in its simplest form the long life moored sonobuoy increases the search rate of a Jezebel aircraft by a factor of six. The second shortcoming of the airborne Jezebel system using air launched sonobuoys is that to gain any information about an area the aircraft must return to the vicinity of the sonobuoy in that area in order to gain the information. In a moored sonobuoy one could provide information storage with compressed time read out so that the aircraft need return to each buoy less oftern, Thus leaving it free to be searching in other areas. From preliminary investigations it would appear that analysis equipment can be built which can display compressed time information at twelve times real time (Slide 2). The advantage of having the capability of storing information and reading it out to the aircraft and displaying it in the aircraft at twelve times real time is

evident from this slide where the square in the lower left hand corner represents the area that an aircraft can maintain under surveillance using sonobuoys which have no information storage capacity. The larger area is twelve times that of the smaller and is representative of what an aircraft could maintain under surveillance if the sonobuoys could store and hold the information until the aircraft returned to their vicinity. With this capability the Long Life Moored Sonobuoy has the potential of multiplying the capability of the airborne Jezebel system using air launched sonobuoys by an additional factor of twelve. Together these two factors multiply the capability of each aircraft by seventy-two.

2. Let us now inspect the characteristics of the Long Life Moored Buoy in more detail: (Slide 3).

a. Moored in any water depth.

b. Life - one year unattended.

c. Detection distance - equal to or better than the air launched specialized Jezebel sonobuoy.

d. Transistorized VHF receiver.

e. Two channel coded interrogator system.

f. VHF transmitter on the same frequencies as the current sonobuoys.

g. Single channel tape recorder with 120 mins storage capacity and fast read out.

h. Timing mechanism for programming the storage periods and serviceability checks.

i. Spare transmitter/antenna surface units.

3. (Slide 4). This slide is an artists conception of a possible configuration for the buoy. The mooring arrangement shown here is one which

was developed by Scrippe Institute of Oceanography for the U. S. Air Force. It is being used together instrumentation for measuring radioactive fallout in the areas surrounding atomic tests. It consists of an anchor and a sub-surface float held together by one-eight inch high tensile piano wire which has been specially developed for this purpose by Bethlehem Steel As you will notice, in this configuration we have proposed packaging most of the electronics in the sub-surface float. Only a small transmitter/ antenna unit is at the surface. This is proposed for three reasons. The first is that the greatest danger to these devices if they are properly designed is likely to be well or not so well wishing mariners who will spot them and bring them ashore in the hope of gaining some prize. By packaging most of the electronics below the surface, the surface unit can be made less conspicuous. The second reason is that if the main bulk of the device is housed in a less violent area below the surface of the sea then, the motion imparted to the surface unit, if it is light, will result in less strain on the mooring arrangement and thus better reliability. Finally, if the bulk of the components are below the surface it is conceivable to have replacement surface units so that when one is taken or destroyed in one way or another it can be replaced automatically. A weak link would be provided between the surface and the sub-surface unit. There is a group in the RCAF who feel that housing the bulk of the electronics in the sub-surface float is an unnecassary complication. Only development effort and subsequent operational experience will determine which design is correct.

4. A study of the effectiveness of a system using this buoy has been conducted. In this study a detection capability of fifty percent probability at a range of 35 miles against a snorkelling target (Slide 5) and fifty percent probability at a range of 10 miles against a 10 knot non-

cavitating nuclear submarine (Slide 6) has been used for the airborne Jezebel system. The confidence level for the capability of the system against the snorkelling target is very high, many hundreds of hours having been flown to establish it. Against the nuclear submarine the confidence level is not so high, however, the figure having been chosen from only one trial conducted by VX-1 squadron against the SSN Sea Wolf. Two assumptions were made in this study. The first was that the system must be capable of detecting 80 percent of the submarines in its area of responsibility at least once every 24 hours. The second was that the snort fitted submarine will snort at an average rate of one hour in eight during transit.

5. A few of the results of this study are outlined below:

a. One 180 knot aircraft continuously on task can maintain an area of 674,000 square miles under surveillance with a probability of detection of 80 percent on all of the snort fitted submarines in its area of responsibility.

b. One 180 knot aircraft continuously on task can maintain an area of 674,000 square miles under surveillance with an 80 percent probability that it will detect each nuclear submarine in its area of responsibility 1.58 times in each 24 hour period. The aircraft is more effective against the nuclear boat because although the nuclear boat is producing less acoustic energy than a snorkelling boat, it produces this energy 24 hours per day whereas the snorkelling target only snorkels a small percentage of the time.

c. To maintain the deep water areas of the Atlantic Ocean from Iceland to Cuba under continuous surveillance requires seven 180 knot aircraft continuously on task monitoring a total of roughly 6,000 sonobuoys. If one wished to maintain surveillance over a half or a quarters of this area the above numbers could be correspondingly reduced. To maintain one aircraft continuously on task requires a total of ten to twelve long range ASW aircraft. The reqson that only deep water areas are specified is that this is the only area where systems currently available cannot cover, and the mortality rate due to fishing operations may be prohibitive in shallow water areas.

d. The life expectancy of each buoy due to collision with ships based on a total of 5,000 ships at sea operating at random over the area is 305 days. However, since many of these ships operate in the shipping lanes which can be avoided, the average life of the buoys will be somewhat greater.

e. The cost of surveillance compared with other systems is: (Slide 7).

Cost in dollars per square mile per year

Continential Shelf Shore Station	111 dollars
Shallow Water Shore Station	51 dollars
Very Deep Water Shore Station	55 dollars
SSK (Hunter/Killer) Submarines	734 dollars
Aircraft/Moored Buoy System	42 ( )dollars

The figure in brackets after the Aircraft/Moored buoy costs represents the additional cost to the economy. It is the annual cost of the buoys and the necessary ship facilities for servicing them. One consideration might be that we already own and are employing more than sufficient aircraft for this task. In this case then, additional cost to the economy to accomplish the task, may become an over-riding factor.

6. Finally, there are a number of operational advantages arising mainly out of flexibility that make this system attractive. These are:

a. If the system becomes out-moded by some technological advance then the Moored Buoy system can be terminated with the loss of only a years supply of buoys.

b. Each buoy is a self-contained component of the system and thus must be tracked down and destroyed individually. No single action, such as cutting of a cable or cables, can destroy a large segment of the system

c. The buoys are sufficiently inexpensive as to make their location and destruction more expensive than their initial cost. Secondly, the loss of a percentage of the buoys does not seriously impair the effectiveness of the system because of the overlap of surrounding buoys. Since they are individual components, destruction of 25 percent of the buoys can not possibly deteriorate the system by more than 25 percent and because of the large degree of overlap the deterioration will be much less than 25 percent.

d. The aircraft can be moved quickly from one area to another. Even the new areas on the globe where moored buoys are not available somedegree of effectiveness can be established quickly using air launched buoys as an interim until moored buoys can be laid.

e. Currently, to maintain a level of effectiveness in the aircrews a form of synethesized training is devised. If this training could be done while contributing toward an operational role, this would be dollars saved.

f. The current communications problems which exist because one agency is gathering information which must be relayed to aircraft for action would disappear because of the single package.

g. Since the same vehicle is being employed for surveillance as is being used for localization and attack, the operational commander would have the flexibility of concentrating his forces on one of these roles for short or long periods at the expense of the other.

h. Finally, it is questionable whether any economy can afford to exploit the airborne Jezebel system with air launched sonobuoys. For example, Argus aircraft exploiting airborne Jezebel to the full would consume 400 air launched sonobuoys of the type currently available per crew per month. At a unit cost of 230 dollars, this represents a monthly outlay of 92,000 dollars per crew.

So much for the proposal - What are we doing about it?

To date we have spent $60,000 for the production of 12 long endurance buoys which will be configured and moored in mjch the same manner as I have attempted to illustrate on the blackboard.

There are however several exceptions.

(a) Will not be incorporating the tape recorder in these models which we are using essentially to prove out the philosophy, the technique, the electronics, and the mooring system

(b) The electronics will be installed in the surface unit

(c) Conventional batteries will be used and a life shorter than one year accepted.

In addition we have $200,000 in estimates for further developmen and a request in for research funds in the order of $250,000 in 1959 and $1,000,000 in 1960.

Details on these trial models are as follows.

(a) Surface unit containing the electronics - will be a fiberglass encased oil drum.

(b) Sub-surface float will be a Butane gas tank.

(c) The aircraft will call up a buoy on aircraft transmit using sequential tone keying. In practice, vibrating reeds are to be used and correctly coded signal must be transmitted to bring the buoy on the air. This will be done using a dial phone type of system in the aircraft.

We propose to place these buoys as follows:

(a) One in Bedford Basin in Halifax Harbour for contracto: trials.

(b) Three in the Halifax approach for accelerated life testing of the electronics from a shore based laborat now being established at Maritime Air Command Headquarters, 17 South Street, Halifax.

(c) Eight in deep water (over 2000 fathoms) for environmental testing and proofing of the mooring system. These buoys will be interrogated every 48 hours by our maritime aircraft.

Briefly then this is the proposal. I might conclude in saying we are aware of two problems. One is to effectively carry out the trials as outlined and to quickly aqaint you with the results. This we promise to do. The other problem was first pointed out to us during recent talks with Dr. ISELIN of Wood's Hole; who is to be COMBUOYLANT/ ?

Just give us the facts, please

ADDRESS BY CAPTAIN MC GEOGH

Admiral MARTIN and Gentlemen, I am just going to introduce the U.K. team. But first of all, I would like to say how very glad I am to be here and to thank you most warmly for the kindness of your welcome. The U.K. presentation will be given by Mr. GOSSAGE and Mr. WATSON and will contain up to date factual information which we have gained mostly in the fixed surveillance field, but there will be one additional matter for your consideration. I am very anxious to make it clear that we are dealing in fact and therefore as facts are hard to come by, we do not have very much to contribute, but what we do is fact. Now, factually, the most important thing that has happened to us in the last few years, probably since the last scientific policy meeting on this subject has been the advent of the Porpoise class submarine. The results of her noise trials are most significant. I am not going to give you the details now, I will leave that to Mr. GOSSAGE. I mention it, because, if you don't mind, I strongly like you to pay particular attention to these results. Admiral MARTIN has told me, and I entirely agree with him, that whereas one can make an intelligent estimate of enemy numbers and dispositions it is very difficult to make a qualative estimate of the characteristics of individual submarines or classes of submarines because you can not get the information you want. Therefore, it is prudent always to give the enemy, in a qualitive sense, the same capability as you have achieved yourself. On the one hand it will be most unwise to under-estimate him and think that he can't do what you can, and on the other it would lead you on a wild goose chase to give him credit for doing things and making technical achivements which you have not been able to make yourself.

Therefore; we think that in dealing with the capabilities of the enemy submarines that are our target, we should say to ourselves what have we achieved and the enemy credit or at least that. Finally, I must explain that we are here to contribute technically and scientifically as far as possible on any aspects of this problem which are relevant. We are not able to contribute formally, Naturally, we shall be glad to swop ideas over the bar, to any planning or operational concepts. But that is a different matter. I should like now to introduce Mr. GOSSAGE.

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ARGENTIA REMARKS - Mr. Gossage, U.K.

Admiral, Gentlemen:

It will be well known to many here that U.K. has given considerable attention to one particular section of the area with which we are concerned today, namely the Faeroes - Scotland Section. We have a good deal of information about this area. About the remainder of the area we have very little knowledge. Accordingly, and I feel it should be said at once - we are not in a position to respond to your invitation to propose a U.K. solution for the whole area. We shall however respond (to the best of our ability) to your invitation to describe the "Status of systems and equipment applicable to the general directive of the Study Group". We feel that this can best be done in two ways. Firstly, in this formal presentation, which we intend to keep fairly factual, and brief; and secondly, and we feel this will be much more important - by taking part in the discussion, and critical appraisal of the solutions proposed by the U. S.

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BRITISH ADMIRALTY ACOUSTIC INVESTIGATIONS

The British Admiralty has carried out a considerable body of investigations of the possibilities of acoustic detection of submarines in the area north of Shetland. As a result we have not arrived at anything that we can put forward as a promising solution to the problem, but, as well as proceeding some way in the development of equipment, we have arrived at a number of conclusions on the principles which, we beleive, must govern any sound surveillance system that is to operate in this area.

Our work began in August 1954, when a sound propagation trial was carried out in the Shetland-Faeroes gap. A second, more extensive, trial was carried out in April 1955. We had then already decided to set up an experimental station on the island of UNST, Shetland. The first three slides show the station as it is now, with the RAF radar behind it. The height of the hill is 900 feet and the station is at 700 feet. The underwater equipment was laid in August 1955. An extensive series of detection of propagation trials was carried out during 1956 and 1957. In October 1957 the experimenatl model of a first operational detection system, Type 191, of which Mr. Gossage has spoken, was installed at Unst and an evaluation trial was carried out with it in November-December of the same year. However, at this date, we had, as you know, already come to the conclusion that the value of a passive acoustic detection system for submarine detection in this area was likely to be limited. The Staff decided to throw the problem back to the research stage, asking the research workers to concentrate particularly on obtaining long-range active detection. The installation of the proposed Type 191 array has not pro-ceeded accordingly.

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APPENDIX VIII

The next two slides show some of the background work that has been done in the area: The bathymetric surveys carried out by the Hydrographer and the various propagation trials. This slide shows those trials which were taken into account in a summary made in January 1957. It includes some runs of the MEDEA survey and the REHOBOTH run, which was a joint effort, carried out immediately after our hydrophones had been laid on 31 August 1956. Since then further trials have been carried out, two in direct connection with Type 191 and one purely for research purposes. Bell Telephone Laboratories are also carrying out trials off Unst using charges dropped from aircraft and hydrophones of the 191 array. One trial was carried out in February 1959 and the second will be carried out in August. All of this work has been done in investigating the method of passive detection to which we give the name CORSAIR. Since the meaning of this word may not be known to you it may be well to try to explain it. CORSAIR is not the name of a piece of equipment, but properly of a research and development project, which began in 1952 and terminated in 1957. The purpose was to investigate and exploit the correlation method of detection; depending on the wide-band noise output of a submarine; and using widely spaced receivers to obtain good bearing accuracy and long intergration lines to enhance the signal detectability. This method depends on essentially different properties of the noise radiated by the submarines from that used by LOFAR, but the CODAR approaches depends on the same principle. The method is also embodied in Type 186, now being fitted to six British submarines. The correlation methods, as used in CORSAIR or CODAR or type 186 cannot provide any direct information on classification as can the LOFAR analysis of the very low frequencies, but it can more easily give bearing accuracy, bearing discrimination and in some cases tracking. Which gives the better detection performance depends on details of the noise output of the target, of the propagation at the site and of the hydrophone system used. Overall, we would say that LOFAR ought generally to win in the longest detection ranges over the deep oceanic paths, but the correlation methods can often complete successfully in the shallower water. In our work at Unst, we have had LOFAR equipment available and have used it during trials, but is should be noted that our hydrophone systems are not of a design best suited for the LOFAR frequencies.

The next slide shows a detection carried out using one of our research equipments. DICE I (DICE = DIGITAL CORRELATION EQUIPMENT) or hydrophones of the CAESAR station DOG, (at Bermuda) in February 1956. This uses an intensity modulated bearing - time display, has only two independent inputs and an integration time of only 5 seconds. The latest version DICE Mark II which we have recently constructed has 12 independent inputs and an integration time up to 1 hour or more, so that its performance is very much better. This slide, which can be taken as fairly typical, will show you that our method of detection can give useful results under good conditions. We now return to the Norwegian Sea.

During the past two years, we have carried out a careful analysis of the four main submarine detection trials which were done off Unst, and which cover summer, winter and intermediate water conditions and both the research and type 191 arrays. We have been able to account in considerable detail for the results, taking account of the known noise output of the submarine target, the sea background noise, the measured propagation and the properties of the arrays used. From this we have produced a comparison of the one shot probability of detection, in a period of about ½ hour with the signal-to-noise at the input to our apparatus, agreeing well with that we would expect theoretically. We therefore felt fairly confident in predicting the performance of our detection systems, against background noise, so far as we have propagation data for the site and season concerned. An example is shown in the next slide. The method has been applied successfully to a later trial (the evaluation trial of Type 191) and checks well.

This sort of prediction depends on knowledge of propagation conditions. It is worth while calling attention to one or two of the special features which we have discovered. Generally, there is a tendency for the propagation to improve slowly as one goes North, into the deeper water with the lower surface temperature. There is considerable variation with season. In the Southern part of the area, on the gentle continental slope a hydrophone may actually detect a source better when it is on the shallow rather than on the deep side. Even at the 500 fathom site of the 191 array, detection was solid right into shore and not much better at similar distances to seaward. This has a most important bearing on the separation of wanted from unwanted targets.

This is the core of the problem. The two years we have spent making an analysis of the detection records has been required mainly because in fact in all our detection trials it is not very usual for sea background noise to be the limiting factor. Intruding ships especially fishing vessels, generally form the background. This may be illustrated by the next two slides, from records taken during a semi-operational trial when our research equipment was manned by Naval officers and a submarine crossed the area performing maneuvers unknown to them. The detection equipment was used to direct an aircraft to make a dummy attack. The target was often identified and tracked correctly, but the effect of intruders was very marked. In the second slide, besides the usual unidentified vessels we actually have an unidentified submarine, which dived after being sighted by the patrolling aircraft. During one night more than 40 radar contacts were counted simultaneously on the PPI display of the shore radar.

The next two slides show the results of some attempt to come to grips with this problem of intruders. We have had air surveys during various of our trials, to determine the numbers and positions of surface vessels and have made analysis of some of these surveys. This slide shows two observation periods, one of 10 hours and one of 7 3/4 hours, one in autumn, one in the depth of winter. The next slide shows an attempt to summarize the results of 10 days of observation. Some typical air photos are shown in the next 3 slides. A further set of observations was taken during the evaluation trial of Type 191 from 27 November to 5 December 1957. During this period H.M. Submarine Truncheon carried out runs to North and South of the 191 array. The DICE I equipment was also used. Both equipments gave solid detection to 43 miles South, DICE I good detection to 45 miles North, 191 to 60 miles (and this should have been better). The tracks on DICE I have been analysed showing an average of 2.2 intruders on the display in any 2 hour period, with an average occurrence of new patterns at one per 2½ hours. It was common to have 5 on the display. Analysis of the air surveys and shore radar shows that during the trial a main fleet of about 12 trawlers was operating along the 100 to 150 fathom lines north and west of Unst on the good trawling grounds there. The variation in number of contacts in this fleet between 8 and 18 is probably accounted for those at the south west end not always being detectable on the radar due to clutter. Throughout the trial the weather was possible for trawling and was mostly very favorable for it. It appears that the trawlers of this fleet near to the hydrophone arrays were mostly large modern British ones. A number of Russian craft typical of the vast fleet based on Faeroes seem to have kept further to the south west until the end of the trail when they moved up to the north east end of the grounds on the departure of most of the British group.

It is known that much of the Faeroes based Russian fishing fleet often stays at sea for months at a time being supplied by a number of specially fitted supply craft bringing water, diesel fuel, salt and empty barrels and taking back the crudely processed catches. The daily charts show a number of these craft either working between Faeroes and the Shetland grounds or perhaps proceeding to or returning from Baltic ports. No large mother ships which are believed to work with the main Faeroes fishing fleet were identified.

Starting on 30 November, but especially on the following three days part of an additional fleet entered the area probably from the east. These are thought to have been mainly the smaller Norwegian craft which are increasingly basing themselves temporarily on Shetlands. These craft do not trawl but either fish with lines or seine nets or hunt sharks especially in calm weather. A number of unexplained small explosions heard on 1 December were probably caused by harpoon shooting from the latter.

A scattered fleet of mixed types and nationalities, mostly drifters, known to be operating to the east and north east of Unst during the trials was within the sea clutter of the shore radar.

With hardly an exception all fishing craft identified during the trial were diesel driven.

The aircraft searches also established fairly conclusively that a large area to the northward of the Unst arrays remains remarkably clear of shipping even when the Shetland trawling grounds are being intensively fished.

You will now, perhaps, understand why it is that it has taken us two years to produce our analysis of the detection trials. We wished to find the performance of our system in detecting a snorting submarine against sea background noise and we have succeeded in doing so, but only by a detailed winnowing out of cases in which it was possible, knowing the movements of the target submarine, to be sure that had been registered against a background of sea noise rather than against intruders.

We therefore state our first conclusion: The enemy already has a jamming or deception system in position to confuse the detection of submarines by passive means.

This does not, of course, mean that nothing can be done about it, but it is necessary to face up to this problem which is very difficult.

Our second conclusion arises from work along quite different lines. We have hitherto taken as standard a T-class submarine, though some have had quieter propellers than others. But we are now introducing a class of submarines - the Porpoise class, in which each source of radiated - and also of self - noise has been systematically treated. The results are shown in the next two slides. The reductions in radiated noise are very large, and in addition, the time in snorting has been greatly reduced, so that the probability of detection has been reduced very drastically. We are starting on some trials to verify these results, which are obtained on the noise ranges at Loch Goil and Loch Fine using our detection equipment.

The second conclusion, is this: The era of the quietened submarine is on us now, in 1959, and will not wait until 1965 or even until 1962.

Before considering the steps that we think are likely to be necessitated by these facts, I would like to summarize very briefly the research program on which we have been engaged since the termination of the CORSAIR program. The new program is named VERONICA, started in March 1958 and is to end in March 1961. In this program we have laid on the sea bed a projector at 900 cycles having an array of 66 elements in a rectangle 7 feet by 14 feet. This array is trainable on bearings in a tripod 18 feet high. The power output is expected to be between 60 and 80 kw. This projector, with two similar tripods carrying hydrophone arrays, was laid in May of this year in 20 fathoms of water in the Bristol Channel area. One hydrophone array is laid near the Projector, the other 70 miles distant, on the other side of the Channel. So far the projector has not been operated at full power.

The projector elements we have used are not suited for working at a depth greater than 20 fathoms, but we are studying various other designs to allow us to work at depths to 100 feet. We believe it may be possible to use a cable length of 30-40 miles for projectors of this kind. Our greatest difficulty is likely to be the problem of laying. We should have paper problems by the end of our program in March 1961.

The lessons we propose from our studies are the following:

1. The fishing and other vessels in the Norwegian Sea will give great trouble to any passive detection system. The majority of contacts are

likely to be classified "doubtful, possible submarine" from their LOFAR signatures.

2. Enemy submarines may be considerably more silent, at any rate by the end of the period considered, then the submarines for which the detection systems have been designed.

3. The detection system must have a high bearing discrimination to get a reasonable chance of showing the LOFAR signature of a target clear of those of other vessels.

4. A good front-to-back ratio is highly desirable.

5. Fixing by cross-bearings from different stations will assist in tracking, but can only be carried out if the bearing disemination is adequate.

6. A statistical survey of the vessels in the area should be carried out by periodic air surveys extending over a year.

7. In building up a library of signatures a dense air survey will be required, but possibly only over a limited part of the area.

8. A fairly dense air survey will be required continuously for the operation of the detection system.

9. Plans should be made to combine active detection elements with the passive system.

10. Consideration should be given to tying in mobile detection systems with the fixed system.

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Sonar Self-Noise

Thus far we have discussed means of increasing the power and efficiency of the SQS-4. Equally applicable, however, are efforts to reduce self-noise through the destroyer noise reduction program. The major sources of self-noise are flow noise from the water, bubble sweepdown and quenching, machinery noise and propeller cavitation.

Self Noise Reduction

A Bureau of Ships project to study self-noise, employing DESLANT ships, has disclosed information that major gains are obtainable first by operating a minimum number of noisy units of machinery, particularly auxiliary units in the forward portion of the ship, second by operating cross-connected on an after boiler, third by relocation of the dome forward from frame 52 to frame 25, and fourth by the application of hull-damping material in the vicinity of the dome. Hull damping, dome relocation and a limited amount of machinery isolation are being planned for the FRAM program, which commences this year. It should be emphasized, however, that results from these tests are thus far incomplete and we quite obviously have a lot more to learn. We may, for instance, reduce the effects of self-noise through isolation mounting or structural damping of the dome.

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Bottom Bounce and Convergence Zone Propagation

As submarine depth capabilities are increasing the detection problem is changing from a more-or-less two dimensional problem of area coverage to a three dimensional problem of volume coverage. An examination of possible paths of sound propagation to use for long range detection of submarines with a deep submergence capability will reveal that due to refraction, no direct path of transmission is generally available. In extremely deep ocean areas, of about 2900 fathoms, convergence zone propagation is available, which refocuses the sound in successive annular rings at intervals of some 30, 60, and 90 miles. In most of the ocean shipping lanes, however, the depth of water is from 500 to 2900 fathoms, which is suitable for bottom bounce operation. The criteria for bottom bounce and convergence zone operation are, fortunately, identical. Each requires low frequency and high power. All sonar systems under development embody these two important characteristics.

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Summary of Project Medea Survey Results and Systems Considerations for Sound Surveillance in the Norwegian Basin.

Chart I - Types of Surveys

Project Medea was charged with the responsibility for collecting bathymetric, accoustic and oceanographic data related to possible operational systems for detecting the transit of submarines through the area roughly defined by Greenland, Iceland, the Faeroe Islands, and Jan Mayen Island. The work was carried out during the summer of 1955 by an expedition involving 5 ships of the Navy and Coast Guard as well as 63 civilian scientists and technicians from 14 organizations. The expedition was at sea for three months, two of which were spent in the operating area.

The surveys were of three general types: hydrographic, oceanographic and acoustic. The responsibility of Bell Telephone Laboratories and Western Electric Co. was for Caesar type acoustic survey work.

Chart II - Hydrographic Surveys

The Norwegian Basin consists of the Greenland sea to the North and West and the Norwegian Sea to the South and east. Depths of over 2600 fathoms exist in the Greenland Sea. The eastern half of the Norwegian Sea has depths of over 2100 fathoms. Its western half has two troughs, one 1100 fathoms and the other 800 fathoms deep.

The basin as a whole is separated from the North Atlantic Ocean on the south by a series of ridges extending from Greenland through Iceland, the Faeroes and Shetlands to Scotland. The Greenland-Iceland ridge has a controlling depth of less than 350 fathoms, as does the 200 mile channel between Iceland and the Faeroes. The Faeroes-Shetland ridge has a narrow tortuous channel slightly greater than 400 fathoms. East of the Shetlands, the water is less than 200 fathoms.

In these areas, where the bathymetry is fairly complex, rather detailed soundings were made with DECCA navigational controls.

In the broad Norwegian Basin, precise navigational controls were not available, LORAN was of little use, and only random data were obtained. Bad weather severly limited operations in this area.

Chart III - Oceanographic Data

A major part of the effort was devoted to obtaining oceanographic data, with emphasis on the Greenland ridge.

The circulation of water in the Medea area consists mainly of (1) a warm current entering the basin from the souteast and leaving to the north and northwest; and (2) a cold current entering from the north and leaving to the southwest. Two water types take part in the circulation: (1) North Atlantic water, identified by high salinity and temperatures above 0oC and (2) Polar water of lower salinity and temperature below 0oC. Where-ever the two types meet the acoustic conditions vary greatly - from season to season and even from week to week. Below 500 to 600 fathoms the water column shows relatively little variability both with respect to time and position within the basin.

A study was made to establish the occurrence of bottom-limited sound propagation. In areas which are not bottom-limited, that is, where the bottom is below the bottom of the sound channel, propagation is generally superior. Sound velocity increases with increasing temperature, salinity and depth. Factors leading to bottom limitation are high surface temperature or salinity, and water so shallow that the pressure factor is not sufficient to boost the velocity in the cold bottom water enough to exceed the surface water.

It follows that bottom limitation is considerably more widespread in summer than in winter.

There are areas of the basin where the depth is sufficiently great and the surface water sufficiently cold so that transmission is either never bottom-limited or occasionally bottom-limited in later summer. In these regions sound transmissions is expected to be good.

Chart IV - Acoustic Surveys

Five sites were selected for acoustic studies:
North of the Faeroes, northeast of Iceland, northwest of Iceland, southeast of Jan Mayen, and north of Jan Mayen. No survey work was possible in the last two areas because of bad weather. Actually four sites were surveyed - the first three mentioned above and an additional site on the Iceland-Faeroes ridge.

Each site was investigated using a CW sound source with a resonant frequency of 97 cps and explosive charges. The courses of the source ship were laid out to provide both sutiable acoustic runs and bathymetric reconnaissance.

The surveys yielded data on transmission loss, the reduction in sound pressure between source and receiver. The loss was plotted as a function of horizontal range, or as a function of bearing in the case of arc runs.

In addition, the ambient noise was measured. Ambient noise is always present in the ocean and is due chiefly to interfering shipping - either nearby or remote - and wave motion at the surface. Ambient noise spectra were obtained periodically and samples at the source frequency (97 cps) were measured almost continuously throughout the survey operations

Since two hydrophones were used at each site, it was possible to obtain travel time differences as a function of range or bearing. This information is useful in predicting the performance of an array of hydrophones.

Chart V - Survey Tracks 1955

The survey sites are shown in this chart, together with the actual tracks which the source ship steamed. Several runs extended to ranges greater than 200 nautical miles.

At area Charlie, there was a great deal of fishing activity in the immediate vicinity of the hydrophone site. The underwater noise from the fishing vessels was so great as to eclipse the signals from the CW-source during a large portion of the exercise. The received levels from 3-lb charge of TNT were even obscured, necessitating the use instead of 25-lb charges. The fishing activity, as we shall see in later charts, is especially concentrated along the coast of Iceland, and to a lesser extent south from Jan Mayen Island.

Note that no acoustic work was done in the deep portions of the Norwegian Basin. All sites were in 500 fathoms or less. The principal hydrophone depths at the four survey sites were as follows:

Able - 500 fm.

Baker - 495 fm.

Charlie - 300 fm.

Dog - 240 fm.

Chart VI - 97 cps Transmission Loss

The sound transmission results at sites Able, Baker and Charlie are summarized in this chart. Area Dog has not been included for several reasons: (1) the hydrophone depth (240 fm) is considerably less than that of the other sites; (2) the only long range run conducted was in constant depth water along the ridge between Iceland and the Faeroes; (3) the topographical and oceanographic conditions differ markedly from those of the other areas. The results of the constant depth run showed good transmission out to 40 miles and an abrupt degradation at greater ranges. Losses from 60 to 140 miles averaged 20 db greater than deep water reference levels. Thus, the transmission at Area Dog is not believed to be typical of any area further to the North, i.e., in the region of interest here.

The upper curve is the so-called deep water reference curve, a year-round average of transmission results on bearing 047°T from the experimental array at Eleuthera. Plotted against the logarithm of the range, the losses from a straight line in the range interval of 5 to 200 miles. The curve represents good transmission in a deep ocean area, where bottom limitation does not occur during the cooler months of the year.

It so happens that transmission at Charlie follows the refeence curve out to ranges of about 50 miles. At greater ranges, very little data was obtained.

The lower curve is intended to indicate the worst transmission conditions encountered (excluding Area Dog) at any of the sites. Out to 150 miles, most of the results at Able and Baker are similar and follow this curve closely. From points well out into the Norwegian Basin, 150 to 200 miles from the hydrophones, the transmission at Able improved suddenly and strikingly. The loss at 150 miles, 10 db greater than the reference level, diminished to the reference value at 200 miles. This behavior appears to be directly correlated with a 9°F reduction in the surface temperature along the run. In other words, the colder surface water to the north brings about improved sound transmission. By inference, although no data exists on transmission to hydrophones in the deep basin, good transmission can perhaps be expected in regions of cold surface waters.

In summation, the two curves portrayed are expected to roughly represent the limits of good and poor transmission in the area under consideration.

Chart VII - Ambient Noise Spectra

In this chart are shown composite noise spectra for Areas Able, Baker and Charlie. The higher noise curve reflects the intense fishing activity at Charlie. The results from Able and Baker are similar and comparable to a year-round average spectrum for Eleuthera. Eleuthera is an area remote from heavy shipping.

Since neither Able nor Baker are very remote from fishing areas, it is perhaps surprising that the noise levels are so low. The explanation may lie in the poor transmission at short and medium ranges.

Chart VIII - Cumulative Noise Distributions

In addition to knowing average spectrum levels, it is important to understand how the noise fluctuates, especially at the major frequency of interest. In this chart, distributions of 97 cps noise levels are shown for the two extreme cases of the previous chart. At Charlie, the noise is consistently high and y interfering fishing vessels tribute since the transmission is good. The variation is not appreciable. At the low noise areas - Able and Baker - fewer ships contribute, their individual effect is isolated in time and the fluctuation is considerably greater. The average 97 cps noise level at Eleuthera is shown for comparison, together with the limits of seasonal variation.

The abscissa in this graph may be regarded as the percentage of time the noise exceeds the level indicated.

Chart IX - Prediction of Detection Ranges

From transmission loss and noise measurements it is possible to estimate the submarine detection capabilities of a given system. Also needed are information on the expected radiated sound energy of submarines, the signal-to-noise gain of the array, if an array is contemplated, and the signal processing characteristics of the detecting equipment.

When a submarine snorkels at moderate or high speeds, its spectrum is a complicated mixture of diesel and cavitation noises. Depending on the boat and on the speed, the diesel noise will predominate in some parts of the spectrum and propeller cavitation in others. However, detections of U.S. submarines traveling at normal snorkel speeds are usually made on diesel shaft harmonics in the neighborhood of 100 cps. Measurements of the pressure level at 1 yd. of peak line components have been made for several types of U.S. submarines. The mean value is 64 db above one microbar of pressure with a statistical deviation of about 5 db. This level is a spectrum level, that is, the pressure measured in a frequency band 1 cps wide.

Nuclear submarines under normal operating conditions are noisier than diesel-powered snorkeling submarines. On the other hand, they are on the average 12 db quieter when operating on a patrol creep condition. Since a nuclear boat could transit a broad surveillance area under quiet conditions, it is being realistic to adopt a level of 52 db/µb for the peak line components on which a detection is likely to be made. These lines generally occur at frequencies somewhat above 100 cps, but are not so far removed from this frequency as to negate the use of 97 cps transmission loss data in making predictions.

For snorkel protection in the basin area, a high cross-fix probability is desirable and 40-element Caesar arrays are indicated, with their good bearing discrimination and relatively high array gain. The average gain of operational arrays in the Atlantic SOSUS net is about 10 db and we shall adopt this value here. In the flat portions of the basin, somewhat higher gains may be achieved. The theoretical limit is 16 db. The standard deviation from 10 db is assumed to be negligible compared with the deviation of other factors involved.

An additional consideration is the sensitivity of the signal processing system. For lofar equipment, the probability of detecting an incoming narrow-band signal is the presence of broad-band ambient noise is a function of the signal-to-noise ratio and the visual integration time. This relationship can be expressed in several ways. For a given probability the signal-to-noise ratio is found to increase a given number of db per doubling of the integration time. For example, for an experimental model and for 50% probability, the signal-to-noise ratio increases about 2 db each time the observation period is doubled. Alternatively, for a fixed signal-to-noise ratio, the detection probability increases as the period is increased; after the first five minutes, the probability in a long period is the sum of the probability of shorter periods. More specifically, if the probability of detection in t minutes is p, the probability in 2t minutes is p + (1 - p)p. Observation periods of five to ten minutes are assumed in the present analysis.

Chart X - SONAR Equation

The aforementioned factors, excluding system sensitivity, are combined in a logical way to obtain the signal-to-noise ratio at the input to the lofar processing equipment. If S is the pressure level at 1 yd. of the peak line component radiated by the submarine, then the signal level at the hydrophone is S minus the transmission loss from 1 yd. to the point of reception. Array gain (A) enhances the signal with respect to the noise and hence is an additive factor. Finally, the ambient noise level N is subtracted and the result is the over-all signal-to-noise ratio at the input to the processing system. Each of these quantities must be regarded as representing a distribution of possible values, with a certain mean value and a statistical deviation from the mean. Hence the signal-to-noise ratio at the range in question is also a distribution with a resultant deviation found from the composite distributions. It is thus possible, for each range value, to combine the probability density of the signal-to-noise ratio with the detection threshold characteristics of the lofar equipment. The probability of detecting a submarine at range R is the probability of detecting on the lofar writer a signal S in the presence of noise N multiplied by the probability that S/N will occur and summed over all possible values at that range. If this procedure is repeated at a number of ranges, a probability vs. range curve can be drawn.

Chart XI - Predicted Detection Ranges - Snorkel

This chart shows probability curves for the snorkeling submarine in the basin area. The two top curves bracketing the region labelled "low noise" are computed from the two transmission curves previously shown. Both probability curves assume a median noise level of -29 db micro b, the mean value of Areas Able and Baker. Thus the top curve represents Eleuthera reference transmission and low noise, and the bottom curve of the pair represents the poor transmission limit combined with the low noise figure. The appropriate curve for the deep basin area remote from fishing activity might be expected to lie between these bounds.

Similarly, the lower curves apply to heavily fished, high noise areas. The median noise level at Charlie is assumed, 15 db higher than the low noise level used for the other pair of curves.

Conservatively, one might expect a 50% detection range of 150 miles in an area remote from fishing and 35 miles in an area of concentrated activity.

Chart XII - Predicted detection Ranges - Nuclear

Since the quiet nuclear submarines radiates line components 12 db lower in level than the conventionally-powered snorkeling submarine, the detection ranges shown in this chart are considerably shorter. The 50% ranges are of the order of 50 miles in low noise areas and 10 miles in high noise areas. It should be remarked that nuclear submarines operating under normal conditions at moderate to high speeds radiate more energy than snorkeling submarines, and detection ranges are expected to be correspondingly greater.

Recommendation.

In view of the great number of fishing fleets in the vicinity of Iceland and the banks between the Faeroes and Jan Mayen it is proposed to establish a deep water network South of the G-I-UK Line.

This system will be capable of a 25% detection/classification against a nuclear powered submarine operating in its quitest mode on a continuous unalerted basis.

This will require a fixed system in the area south of the Greenland-Iceland-United Kingdom Line and will provide a depth of detection of 300 nautical miles and a width of 750 nautical miles.

Full use will be made of the coaxial cable multiplex system which will allow all cables to terminate at a common shore terminal in Scotland.

SECRET

TABLE I

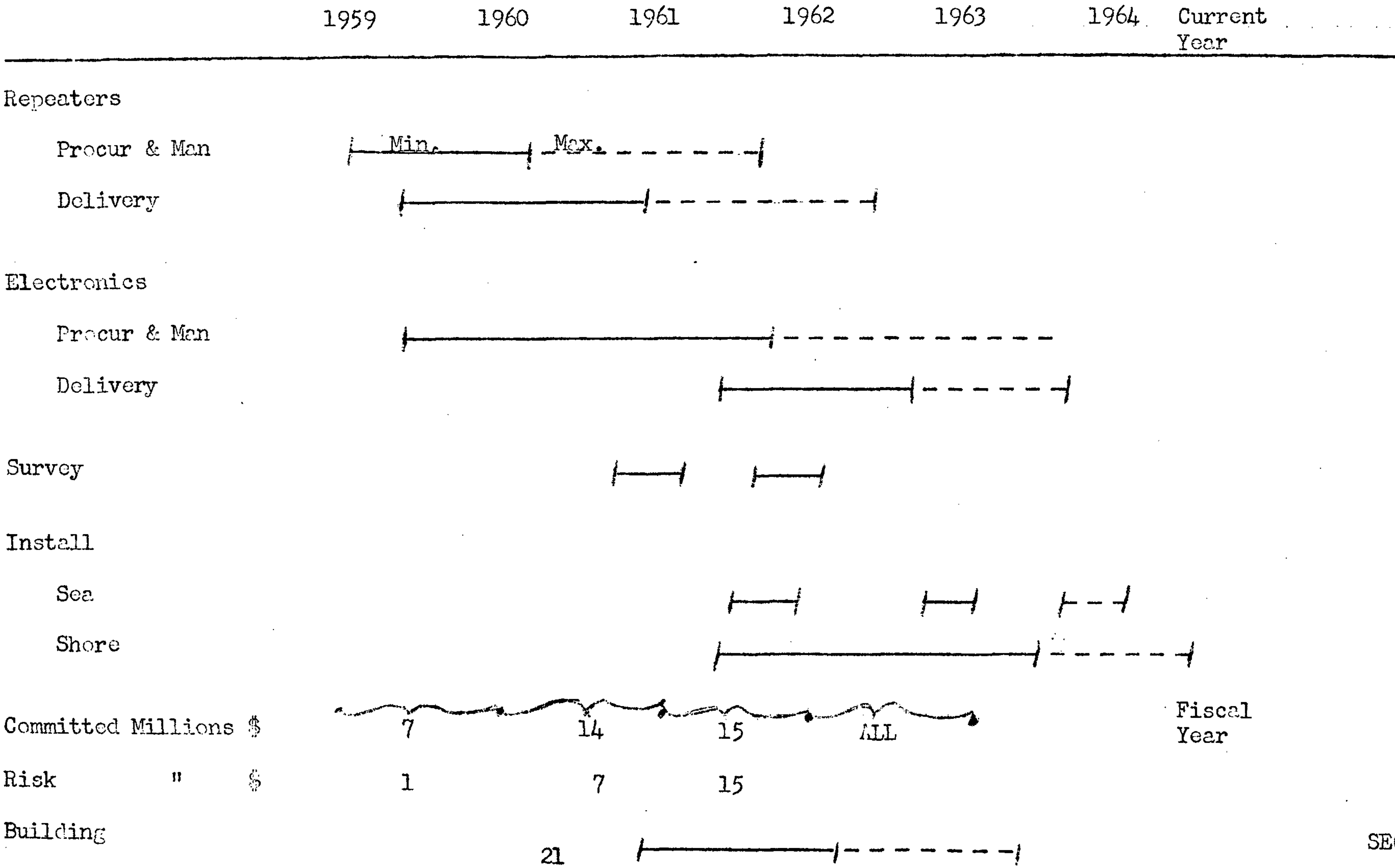
MEDEA COSTS

Millions

	Minimum System	Probable System	Maximum System
No. of Arrays	8	10	13
Miles of Cable	5000	6000	10,000
Repeaters	130	160	260
Sea Costs			
Procure	54	64	94
Install	3	4	5
Shore Terminal			
Procure	16	19	22
Install	2	3	4
Bldg. & Land	5	5	5
TOTALS......	80	95	130

TABLE II

MEDEA INSTALLATION SCHEDULE



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are withheld pursuant to section

sont retenues en vertu de l'article

13(1)(a)

of the Access to Information Act

de la Loi sur l'accès à l'information

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL ERATIONS
WASHINGTON 25, D. C.

OP-714/hgp
Ser 00295P70
26 JUN 1959

SECRET

MEMORANDUM FOR U. S. STUDY GROUP OF ANTI-SUBMARINE DEFENSE OF GREENLAND - ICELAND - UNITED KINGDOM LINE:

Subj: Anti-Submarine Defense of Greenland-Iceland-United Kingdom Line (U)

1. The problem of establishing an effective Greenland-Iceland-U.K. Anti-Submarine detection barrier has been made extremely complex because of the high density of fishing boats in the area under consideration. Over a thousand trawlers operate in the area northeast of Iceland. This fishing boat population includes approximately 350 Russian. Many of the engines used in these small ships have acoustic signatures that are very similar to those employed by Soviet Submarines.

2. The random movements of fishing boats are extremely difficult to record and plot for surface surveillance purposes. Yet an accurate surface plot of these movements is required if the fishing boat signatures are to be effectively eliminated from the total of contacts developed by any underwater surveillance installation. In an area of heavy fishing activity the surveillance capability of any fixed underwater system will either be marginal or will require a surface surveillance effort that far outweighs the basic advantage of the fixed system in reducing mobile force requirements.

3. It is known that our own fishing boats carry good fathometers, Loran and two-way radio. It is understood that in addition to these equipments, some of the European fishermen employ "fish finders" which can serve as limited range sonars. It would appear that a potential surveillance system is already in being in the form of the NATO fishing boats.

4. In view of the above it is recommended that the NATO fishing fleets potential surveillance capability be further explored for the cold war aspects of the anti-submarine defense of the Greenland-Iceland-United Kingdom Line in the area north-west of Iceland.

F. L. ASHWORTH
By direction

APPENDIX X

SECRET

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OPERATIONAL ASPECTS OF MOBILE AND FIXED SYSTEMS

THIS PRESENTATION IS NOT COMPLETE, BECAUSE THE SLIDES WERE NOT AVAILABLE FOR REPRODUCTION. HOWEVER, THE TEXT CONTAINS MUCH PERTINENT INFORMATION.

APPENDIX XI

'ESENTATION OF GIUK GROUP

SECRET

IN OUR CAPACITY AS THE U. S. ASW OPERATIONAL COMMANDER THROUGHOUT THE ATLANTIC COMMAND, ASDEFORLANT HAS HAD OCCASSION TO THOROUGHLY REVIEW AND TEST SOME OF THE ANTISUBMARINE SURVEILLANCE SYSTEMS WHICH ARE APPLICABLE TO THE SOLUTION OF THE SURVEILLANCE PROBLEM IN THE GREENLAND-ICELAND-UNITED KINGDOM AREA. IN PARTICULAR, THE VP/SSK BARRIER PRINCIPLE HAS BEEN TESTED BY SEVERAL BARRIER EXERCISES. ALSO, THE LOFAR EQUIPPED SOSUS SYSTEM HAS BEEN TESTED BY A YEAR OF COORDINATED OPERATIONS WHICH HAVE INCLUDED SEVERAL SOSUS TARGET CONVERSION EXERCISES. THESE SOCEX, AS WE ABBREVIATE THEM, HAVE HAD AS A PRIMARY ~~AIM~~ a/m, THE ASCERTAINING OF THE CAPABILITY OF THE SOSUS, AND THE REQUIREMENTS NECESSARY TO PERMIT THE TACTICAL EMPLOYMENT OF THE DATA GENERATED BY THE SYSTEM.

THE VP/SSK TYPE OF BARRIER HAS PROVED FEASIBLE AND EFFECTIVE IN EACH OF THREE OPERATIONS; NAMELY;

ASDEVEX 1-58
VP/SSK OPERATIONS DURING THE LEBANON PERIOD
LANTBEX 1-59

I WILL REVIEW IN DETAIL THE RESULTS OF ASDEVEX 1-58, SINCE IT WAS THE ONLY ONE OF THE EXERCISES WHICH PROVIDED ENOUGH SPECIFIC CONTROLLED EXAMPLES TO PERMIT THE TABULATION OF ITS EFFECTIVENESS. ASDEVEX 1-58 WAS DESIGNED AS AN EVALUATION EXERCISE TO DETERMINE THE ABILITY OF AN INTEGRATED FORCE OF PATROL A/C AND SUBMARINES TO DETECT, CLASIFY AND REPORT UNIDENTIFIED SUBMARINES COVERTLY TRANSITING THE G-I-UK LINE. THE FORCES INVOLVED WERE AS SHOWN ON THIS SLIDE:

(ON SLIDE #2 FROM ASW SYM. PRES.)

THE BARRIER CONSISTED OF 5 SSKs AND 2 SSNs WITH 24 P2V-7 A/C BEING EMPLOYED TO PROVIDE AIR SURVEILLANCE AND INVESTIGATE FORCES.

(OFF SLIDE #2)

(ON SLIDE #3 [illegible] PRESENTATION)

COORDINATED OPERATIONS FOR THIS EXERCISE COVERED A PERIOD OF 22 DAYS. THE SOUTHERN ICELAND-UNITED KINGDOM BARRIER COVERED A 200 MILE FRONT ACROSS THIS AREA WITH FORCES AS SHOWN DURING THE EARLY PHASE. TWO AIRCRAFT WERE ASSIGNED TO PATROL THE 75 MILE DEEP AIR PATROL ZONE WHENEVER THIS BARRIER WAS EMPLOYED. THE BARRIER WAS TRANSLATED 3 TIMES; FIRST, 50 MILES TO THE SOUTHWEST OF THE INITIAL BARRIER POSITION FOLLOWED BY TWO MOVES TO THE NORTHEAST OF 100 AND 50 MILES RESPECTIVELY. THESE TRANSLATIONS WERE INITIATED BY MESSAGE AND WERE ACCOMPLISHED USING A SPEED OF 2 KNOTS. THE TRANSLATIONS WERE INITIATED TO TEST THE ORDERING PROCEDURES, TO DENY THE TRANSITORS THE OPPORTUNITY TO GAIN INTELLIGENCE OF THE BARRIER POSITION, AND TO INVESTIGATE SONAR CONDITIONS IN THE VARIOUS WATER DEPTHS OF THE AREA. THE 1000 FATHOM CURVE IS SOME 120 MILES SOUTHWEST OF THE ICELAND-FAEROES LINE, WHILE ON THE LINE ITSELF THE WATER DEPTH AVERAGES 250 FATHOMS.

(OFF SLIDE #3)

(ON SLIDE #4 S/M PRESENTATION)

FOLLOWING THE FINAL TRANSLATION, FORCES WERE STATIONED AS SHOWN....WITH THREE AIRCRAFT BEING MAINTAINED ON STATION AT ALL TIMES. THIS BARRIER WAS EMPLOYED DURING THE FINAL FOUR DAYS OF THE EXERCISE. FOUR TRANSITORS WERE EMPLOYED TO TEST THE SOUTHERN BARRIER. THE AVERAGE TRANSIT SOA WAS 6.5 MILES.

(OFF SLIDE #4)

(ON SLIDE #5)

IN THE AREA OF THE DENMARK STRAIT, THIS BARRIER WAS EMPLOYED UNTIL THE FORMATION OF THE PHASE 2 BARRIER THE LAST FOUR DAYS OF THE EXERCISE.

(OFF SLIDE #5)

NORMALLY, WHEN WE MENTION ENVIROMENT IN ASW, WE TREAT IT AS A CULPRIT. THIS WAS NOT THE CASE DURING ASDEVEX; NEAR-PERFECT ENVIRONMENT CONDITIONS EXISTED THROUGHOUT THE EXERCISE. ISOTHERMAL WATER PREVAILED. SEA STATES ONE AND TWO WERE THE HIGHEST. MORE THAN 22 HOURS OF DAYLIGHT PER DAY AND

CLEAR WEATHER AIDED VISUAL SEARCH IMMENSALY. THIS REMARKABLY FAVORABLE SETTING SHOULD BE KEPT CLEARLY IN MIND AS WE EXAMINE THE EXERCISE RESULTS

INSTEAD OF QUALIFYING THE ASW RESULTS WITH MANY EXCUSES AS IS SOMETIMES OUR HABIT; IN THIS CASE WE CAN SAY THAT THE RESULTS WERE SENSATIONALLY GOOD

(ON SLIDE #7)

OVER-ALL THE SURVEILLANCE BARRIER RESULTS LOOKED LIKE THIS. THE BARRIER COMMANDER RECEIVED CONTACT REPORTS ON 43 OF 51 CONTACTED TRANSITS, FOR A PERCENTAGE OF 84%. THESE RESULTS COULD HAVE BEEN EVEN BETTER--FOR ONE TRANSITOR WAS DETECTED BUT INCORRECTLY CLASSIFIED AS ANOTHER SSK, AND FOUR TRANSITS WERE DETECTED BUT REPORTS THEREOF DID NOT GET THROUGH.

AS DIPICTED IN THE SMALLER PIE TO THE RIGHT, THE BARRIER SSNs CHANGED ROLES AND MADE FOUR SPECIAL HIGH SPEED TRANSITS (SOA 16 KNOTS OR BETTER) OF THE SUBAIR BARRIER. IN THIS ADDED ATTRACTION ALL FOUR WERE DETECTED, BUT ONE WAS NOT REPORTED TO THE BARRIER COMMANDER.

(OFF SLIDE 7)

IN A LITTLE MORE DETAIL, LET US LOOK AT THE SSK PERFORMANCE SPECIFICALLY.

(ON SLIDE 8)

HERE WE SEE THAT THE SSKs WERE THE GREATEST CONTRIBUTORS TO THE SUCCESS OF THE BARRIER. SIXTY-FOUR TO SEVENTY-SIX PERCENT OF ALL TRANSITS WERE DETECTED AND SUCCESSFULLY REPORTED BY SSKs ALONE. HOWEVER, WE SEE THAT THEY WERE LOSING ALMOST AS MANY DETECTED TRANSITS THROUGH COMMUNICATIONS TROUBLES AS THEY WERE FAILING TO DETECT IN THE FIRST PLACE. THERE WERE 14 TRANSITS WHICH WERE NOT SUCCESSFULLY DETECTED OR REPORTED TO THE BARRIER COMMANDER--OF THESE, 7 WERE DETECTED BUT THE CONTACT REPORT WAS NOT RECEIVED BY THE BARRIER COMMANDER — 1 TRANSIT WAS DETECTED BUT NOT PROPERLY CLASSIFIED AND 6 TRANSITS WERE NOT DETECTED BY ANY SSK.

(OFF SLIDE 8)

TRANSITS WERE FREQUENTLY DETECTED BY MORE THAN 1 SSK. THIS WAS FORTUNATE, BECAUSE IN SEVERAL CASES OF MULTIPLE DETECTION, ONLY A SINGLE CONTACT REPORT GOT THROUGH TO THE BARRIER COMMANDER.

(ON SLIDE 9)

THIS PICTURE SHOWS THE RELATIVE FREQUENCY OF MULTIPLE DETECTIONS BY SSKs IN THE SOUTHERN AREA WHERE ALL BUT 1 SSK WAS STATIONED. IT IS WORTHY OF NOTE THAT HALF OF THE TRANSITS WERE DETECTED BY MORE THAN ONE SSK.

(OFF SLIDE 9)

THE DETECTION RANGE PERFORMANCE OF THE SSKs IS INTERESTING.

(ON SLIDE 10)

ON THIS BAR GRAPH, WE SHOW THE PERCENTAGE OF TARGET EXPOSURES DETECTED VERSUS THE SHORTEST RANGE TO THE TARGET DURING IT's EXPOSURE. NOTE THE UNIFORMLY EXCELLENT DETECTION PERFORMANCE OF THE BQR-4A BOATS. IN SHARP CONTRAST IS THE FAR WEAKER PERFORMANCE OF THE BQR-2B BOATS. ONE WAY TO DESCRIBE THE COMPARATIVE PERFORMANCE IS TO SAY THAT BQR-4s DETECTED TWO-THIRDS OF ALL TARGETS THAT EXPOSED THEMSELVES WITHIN 30 MILES, WHEREAS BQR-2s DETECTED ONLY ONE-THIRD OF THOSE TARGETS. AVERAGE BQR-4 DETECTION RANGE WAS 28 MILES; THE MAXIMUM WAS 63 MILES. AVERAGE FOR THE BQR-2 WAS 18 MILES: THE MAXIMUM 37 MILES.

(OFF SLIDE 10)

CLASSIFICATION OF SSK TARGETS WAS CONSIDERABLY IMPROVED OVER PREVIOUS EXERCISES DUE TO THE CONTRIBUTION MADE BY THE VECTORED VP.

THE SSKs RECORDED A TOTAL OF 750 CLASSIFIED CONTACT DURING THE EXERCISE. THESE CONSISTED OF AN AVERAGE OF ONE EXERCISE SUBMARINE CONTACT PER SSK PER DAY AND BETWEEN 5 AND 6 NON-EXERCISE CONTACTS PER SSK PER DAY.

THIS NEXT SLIDE SHOWS HOW THE SEAWOLF AND SKATE FARED IN DETECTION.

(ON SLIDE 11)

REMEMBER NOW THAT THE SEAWOLF HAD A 200 MILE FRONT TO COVER AND SKATE HAD ONLY A 75 MILE FRONT, SEAWOLF DETECTED 12 OF 38 TRANSITS OR 32 PERCENT, WHILE SKATE DETECTED 10 OF 13 TRANSITS OR 77 PERCENT. THE SKATE REPORTED ALL DETECTED TRANSITS TO THE BARRIER COMMANDER. REPORTS OF 3 OF THE 12 DETECTIONS BY SEAWOLF DID NOT REACH THE BARRIER COMMANDER DUE TO COMMUNICATION DIFFICULTIES.

THE LOWER PORTION OF THIS SLIDE REFLECTS THE DEGREE OF SUCCESS IN PROVIDING SSNs WITH CONTACT INFORMATION. CONSIDERING NOW ONLY THOSE TRANSITS WHERE AN SSN WAS IN A POSITION TO INTERCEPT AFTER AN SSK DETECTION; THERE WERE 18 OPPORTUNITIES FOR SEAWOLF AND 6 FOR SKATE, A TOTAL OF 24. OF THESE THE TWO SSNs RECEIVED WORD OF ONLY 11---LESS THAN HALF. IT IS NOTABLE THAT OF THE 7 TRANSITORS ON WHICH SEAWOLF RECEIVED CONTACT REPORTS, ALL 7 WERE INTERCEPTED BY HER. THE SSNs DETECTED ALL TRANSITORS THAT EXPOSED THEMSELVES WITHIN 20 MILES, HOWEVER, SSN DETECTION OUTSIDE 20 MILES WERE RARE.

(OFF SLIDE 11)

THE TWO VP SQUADRONS, CONSISTING OF A TOTAL OF 24 AIRCRAFT, PROVIDED OVER 2000 FLIGHTS HOURS DURING THE THREE WEEKS OF THE EXERCISE. AIRCRAFT WERE ON STATION 93 PERCENT OF THE PLANNED EXERCISE TIME; AN AVERAGE OF 3 AIRCRAFT WERE MAINTAINED ON STATION.

VP AIRCRAFT ON AREA SEARCH MADE 10 INDEPENDENT DETECTIONS OF SUBMARINES. OF THESE 6 WERE BY VISUAL, 3 WERE BY RADAR, AND ONE WAS BY SONOBUOY INDICATIONS BY A RELIEVING AIRCRAFT ON AN OLD DATUM. AVERAGE VP DETECTION RANGES ON SNORKELS WAS 8 MILES.

AS A MEASURE OF THE COORDINATION SUCCESS BETWEEN VP AND SSK THERE WERE 133 ATTEMPTED RENDEZVOUS OF WHICH 123 WERE SUCCESSFUL GIVING 93 PERCENT SUCCESS. AFTER RENDEZVOUS AIRCRAFT WERE VECTORED BY AN SSK 102 TIMES WITH THE FOLLOWING RESULTS:

SSKs VECTORED VP AIRCRAFT ON 35 OCCASIONS WHEN THE SSK HELD SONAR CONTACT ON AN EXERCISE TRANSITOR. 20 OF THESE VECTORS—57 PERCENT LED TO DETECTIONS OF THE SUBMARINE BY THE AIRCRAFT. SSKs VECTORED VP AIRCRAFT ON 67 CONTACTS OTHER THAN EXERCISE TRANSITORS. AIRCRAFT WERE ABLE TO IDENTIFY 38 OF THESE—57 PERCENT—AS SURFACE SHIPS. NOTE THAT IN MORE THAN HALF THE OCCASIONS WHERE A PLANE WAS VECTORED, THE PLANE WAS ABLE TO DEFINITELY IDENTIFY THE TARGET EITHER AS A SURFACE SHIP OR SUBMARINE.

SUMMARIZING OUR CONCLUSIONS OF THE EXERCISE:

A. COMMUNICATIONS WERE MARGINAL BUT IMPROVED WITH PRACTICE. LATER EXERCISES HAVE SHOWN FURTHER IMPROVEMENT. SATISFACTORY COMMUNICATIONS IS WITHIN OUR TECHNICAL CAPABILITY AND WITHIN VIEW.

B. VP/SSK OPERATIONS ARE FEASIBLE AND HIGHLY EFFECTIVE FOR DETECTION AND CLASSIFICATION.

C. THE GIUK VP/SSK BARRIER AS CURRENTLY CONVEIVED IS VERY EFFECTIVE IN DETECTING TRANSITING U.S. SUBMARINES DURING GOOD WX. DURING PERIODS OF POOR WEATHER IT MIGHT BE NECESSARY TO DECREASE THE SUBMARINE SPACING AS WELL AS PROVIDE SOME OTHER METHOD OF TARGET INVESTIGATION.

THE ASDEVEX 1-58 RESULTS & CONCLUSIONS WERE CORROBORATED BY OPERATIONS IN THE SAME AREA DURING THE PERIOD 19 JULY TO 1 SEPTEMBER 1958. BRIEFLY THE RESULTS OF THIS EXERCISE WERE AS FOLLOWS:

(ON LEBANON SLIDE)

644 TOTAL CONTACTS
6 OF THESE WERE ON BARRIER SUBS RELIEVING ON STATION
638 NON-SUBS

308 CLASSIFIED VISUALLY BY SUBS
58 CLASSIFIED BY VECTORED A/C
272 CLASSIFIED BY SUB SONAR INFO.

AVERAGE DETECTION RANGE ON 6 SNORKELING BARRIER SUBS = 17.6 MILES
AVERAGE DETECTION RANGE ON TRAWLERS (127 SAMPLES) = 12.7 MILES
AVERAGE DETECTION RANGE ON MERSHIPS (70 SINGLES) = 12.4 MILES.

IN ADDITION TO ABOVE, 5 CONTACTS WERE REPORTED AS POSSIBLE RUSSIAN SUBMARINE. POST EXERCISE EVALUATION OF THESE WERE AS FOLLOWS: 2 POSITIVE, 2 NON-SUB & 1 INSUFFICIENT EVIDENCE. ONE OF THE POSITIVE WAS A VISUAL SIGHTING BY A/C.

WEATHER DURING THE PERIOD OF THIS EXERCISE WAS ALSO GENERALLY GOOD. BOTH THE EAST AND WEST BARRIERS SUFFERED FROM FISH NOISES DURING THE PERIOD OF THIS EXERCISE. AN ADDITIONAL CONCLUSION BASED ON THIS EXERCISE WAS THAT SUBMARINES COULD BE RELIEVED ON STATION WITHOUT DIFFICULTY.

(OFF LEBANON SLIDE)

EXERCISE LANTBEX 1-59 DURING THE PERIOD LATE APRIL TO MID JUNE 1959 FURTHER CORROBORATED THE EFFECTIVENESS AND FEASIBILITY OF THE SSK/VP BARRIER. ANALYSIS OF LANTBEX RESULTS SHOWS THE FOLLOWING PERTINENT FACTS:

IN ADDITION TO THE SURVEILLANCE FOR RUSSIAN SUBMARINES THERE WERE 36 EXERCISE TRANSITS, OF WHICH 31 WERE DETECTED. ALL CONTACT REPORTS WERE RECEIVED BY THE BARRIER COMMANDER.

CONCLUSIONS FROM THIS LATEST EXERCISE INCLUDE:

A. COMMUNICATIONS PROBLEMS STILL EXIST BUT STILL APPEAR CAPABLE OF SOLUTION.

B. SONAR CONDITIONS (DETECTION RANGES) CONTINUED GOOL. TWO OF THE SUBMARINES WERE OF THE OPINION THAT THE BEST RESULTS WERE OBTAINED IN THE SHALLOW WATER AREA.

C. BIOLOGICAL NOISE INTERFERED WITH LISTENING CONDITIONS ON SEVERAL OCCASSIONS.

D. NAVIGATION FACILITIES, PARTICULARLY ON THE NORTH BARRIER, LEFT MUCH TO BE DESIRED.

IN ADDITION TO THE ABOVE CONTACTS, ONE POSITIVE RUSSIAN SUBMARINE WAS DETECTED. INITIAL DETECTION WAS BY SUBMARINE SONAR. CORDINATED VP/SSK TACTICS MAINTAINED CONTACT UNTIL THE RUSSIAN SUBMARINE SURFACED.

IN VIEW OF THE RESULTS TO DATE, COMASDEFORLANT IS OF THE OPINION THAT THE PRIMARY VP/SSK BARRIER PROBLEM REQUIRING A SOLUTION IS AN ALL WEATHER CAPABILITY FOR CONTACT INVESTIGATION. EVEN THIS PROBLEM APPEARS WITHIN PRACTICAL SOLUTION WITH THE PROPOSED ADDITION OF LOFAR/CODAR TO SUBMARINES AND SURFACE CRAFT. THIS ADDITION SHOULD PERMIT THE EMPLOYMENT OF SURFACE CRAFT FOR INVESTIGATIVE PURPOSES. FURTHER, IT SHOULD IMPROVE THE CLASSIFICATION CAPABILITY OF SUBMARINES TO THE POINT WHERE A SUFFICIENTLY HIGH ACCURATE COUNT COULD BE ACCOMPLISHED WITH THE SUBMARINES DOING ALL OF THEIR OWN INVESTIGATING. THE ADDITION OF JEZEBEL EQUIPMENT TO A/C WILL ENHANCE THEIR SEARCH AND LOCALIZATION CAPABILITY.

IN ADDITION TO THE PROVEN CAPABILITY OF THE VP/SSK TYPE BARRIER, OTHER TYPES OF MOBILE BARRIERS, THOUGH NOT YET TESTED, APPEAR ENTIRELY FEASIBLE, FOR EXAMPLE:

A. THE EQUIPPING OF AEW BARRIER SHIPS WITH LOFAR/CODAR AND EXPENDABLE OR ANCHORABLE BUOYS. WE ESTIMATE THAT A HELICOPTER EQUIPPED BARRIER SHIP WITH LOFAR AND A BUOY SYSTEM SHOULD BE ABLE TO COVER A 150-200 MILE SQUARE AGAINST SNORKELING SUBMARINES.

B. AN AIR BARRIER EMPLOYING JULIE/JEZEBEL EQUIPMENT. THIS TYPE OF BARRIER IS SCHEDULED FOR TESTING THE MIDDLE OF THIS SUMMER.

IN ADDITION TO THE ABOVE COMPLETELY MOBILE BARRIERS, ONE OF OUR SUBMARINE SQUADRONS HAS RECENTLY DEMONSTRATED THE FEASIBILITY OF A COORDINATED SOSUS/SUBMARINE BARRIER. THIS BARRIER WAS CONTROLLED BY A MOTHER SHIP IN AN AREA ADJACENT TO THE SUBMARINES. BOTH SOSUS & SUBMARINE DETECTION DATA WAS RELAYED TO THE MOTHER SHIP FOR COORDINATION OF LOCALIZATION EFFORTS. THIS TYPE OF BARRIER PERMITS THE CONVERSION OF A SOSUS LINE OF BEARING AND A SUBMARINE LINE OF BEARING INTO AN ESTIMATED POSITION OF FAIRLY HIGH ACCURACY WHEREAS EITHER UNIT'S DATA BY ITSELF WOULD HAVE RESULTED IN A FAIRLY LARGE SEARCH AREA.

AS I MENTIONED EARLIER, WE HAVE ALSO TESTED THE SOSUS SYSTEM SUFFICIENTLY DURING THE PAST YEAR TO BE CONFIDENT OF ITS POTENTIAL. PRIOR TO TABULATING THE SPECIFIC CAPABILITIES AND LIMITATIONS OF THE SOSUS, I WOULD LIKE TO THOROUGHLY DISCUSS TARGET CLASSIFICATION AS IT APPLIES TO THIS RELATIVELY NEW SYSTEM. THE DATA PROVIDED BY A SOSUS IS MORE ACCURATE AND IN MORE DETAIL THAN HAS EVER EXISTED WITH ANY PREVIOUS SUBMARINE DETECTION EQUIPMENT. TO FULLY BENEFIT FROM THE CAPABILITIES OF LOFAR, IT IS NECESSARY THAT WE TAKE ADVANTAGE OF THIS ACCURATE AND DETAILED INFORMATION THAT THE LOFAR EQUIPMENT PRESENTS.

TO UNDERSTAND THE CLASSIFICATION CAPABILITY OF LOFAR EQUIPMENT, IT IS NECESSARY TO UNDERSTAND WHAT IT DETECTS AND HOW IT IS PRESENTED. FOR REFERENCE PURPOSES DURING THIS DISCUSSION WE WILL LOOK AT A PHOTOGRAPH OF A TYPICAL RUSSIAN SUBMARINE SIGNATURE. (ON R. SLIDE)

THIS LOFARGRAM IS A 3 DIMENSIONAL DIAGRAM OF TIME, FREQUENCY AND RELATIVE SIGNAL STRENGTH. ANY NOISE GENERATING EQUIPMENT ABOARD THE TARGET VESSEL MAY BE DETECTED, IF THE TARGET IS CLOSE ENOUGH, BUT IN GENERAL, LONG RANGE DETECTION IS LIMITED TO THE MAIN PROPULSION EQUIPMENT. FOR CONVENTIAL SUB-MARINES THIS MEANS DIESEL ENGINES AND PROPELLERS AND FOR NUCLEAR SUBMARINES, A TURBINE AND PROPELLERS. WITH A SUFFICIENTLY STRONG SIGNAL WE CAN ASCERTAIN CONSIDERABLE INFORMATION FROM THE LOFARGRAM. WE CAN FOR INSTANCE, AT TIMES, TELL THE NUMBER OF CYLINDERS THE PARTICULAR ENGINE HAS, WHETHER IT IS A TWO CYCLE OR A FOUR CYCLE ENGINE, AND THEREBY DETERMINE THE TYPE OF ENGINE, OR WE MAY BE ABLE TO ASCERTAIN HOW MANY PROPELLERS THERE ARE OR HOW MANY BLADES ARE ON THE PROPELLER. IN CASES OF WEAK SIGNALS WE ARE UNABLE TO DO THIS.

(OFF R. SLIDE)

THE PRIMARY CAPABILITY THAT LOFAR HAS, WHICH IS NOT SHARED BY OTHER SUBMARINE CLASSIFIERS, IS ITS ABILITY TO VERY ACCURATELY MEASURE THE RPM OF THE DETECTED SIGNAL. AS AN EXAMPIE WE WILL LOOK AT A SIGNATURE OF A U.S. SUBMARINE.

(ON U. S. SLIDE)

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THIS SLIGHT SEPARATION IN THESE TWO LINES INDICATES A DIFFERENCE OF 15 RPM IN THE SPEED OF THE SUBMARINES TWO ENGINES. THE SUBMARINE ACTUALLY REPORTED THAT HE WAS OPERATING HIS ENGINES AT THE SAME SPEED. WHAT I AM TRYING TO POINT OUT IS, THAT LOFAR CLASSIFICATION AT A SHORE SITE CONSISTS OF ANALYZING THE PRESENTATION AND DETERMINING FROM THE CHARACTERISTICS PRESENTED, WHAT TYPE OF A SCREW OR ENGINE GENERATED THE SOUND. THE ABILITY TO DO THIS VARIES MORE OR LESS INVERSELY WITH THE AMOUNT OF SIGNATURE DATA PRESENTED. TO DATE WE HAVE NO DEMONSTRATED CAPABILITY TO RECOGNIZE THE DIFFERENCE IN THE SIGNATURE OF A PARTICULAR TYPE ENGINE BECAUSE OF A DIFFERENCE IN THE VEHICLE IN WHICH IT IS INSTALLED. IN OTHER WORDS, THE SIGNATURE OF A FISHING TRAWLER AND A SUBMARINE WITH THE SAME TYPE OF ENGINES AND THE SAME TYPE SCREWS ARE VERY DIFFICULT TO DIFFERENTIATE. THEREFORE, LOFAR BY ITSELF CANNOT POSITIVELY CLASSIFY. SINCE MANY FISHING TRAWLERS ARE DIESEL EQUIPPED, IT IS OBVIOUS THAT, IN AN AREA OF CONCENTRATED FISHING, A PASSIVE SHORE BASED SOSUS SYSTEM IS NOT SUFFICIENT BY ITSELF, HOWEVER, THE ACCURACY WITH WHICH IT CAN MEASURE PROPELLER OR ENGINE RPM CAN BE COUPLED WITH RADAR SURVEILLANCE OR LOFAR EQUIPPED INVESTIGATIVE FORCES TO PROVIDE AN EFFECTIVE DETECTION SYSTEM. IN ADDITION SINCE IT MAINTAINS CONTINUOUS SURVEILLANCE, THE OPERATING MODE OF THE TARGET CAN BE OBSERVED FOR A PERIOD OF TIME AND FROM THIS OBSERVATION MANY CONTACTS CAN BE DISCARDED AS NOT OPERATING IN A MODE THAT WOULD BE USEFUL TO A SUBMARINE.

BASED ON OUR EXPERIENCE TO DATE WE FEEL THAT:

a. THE PRESENT SYSTEM IS CAPABLE OF PROVIDING BEARING INFORMATION WHICH IS SUFFICIENTLY ACCURATE TO BE EMPLOYED FOR TACTICAL PURPOSES. THE ADDITION CODAR OR ARRAY CORROLATORS WILL INCREASE THE ACCURACY OF THE SYSTEM. THEREFORE, NO DIFFICULTY IS ENVISIONED IN THE TACTICAL APPLICATION OF A PASSIVE SYSTEM IN THIS AREA.

b. DETECTION RANGES ARE DEPENDENT ON STATION LOCATION, BACKGROUND NOISE AND AMOUNT OF NOISE GENERATED BY THE TARGET. IT IS IMPRACTICAL TO EXTRAPOLATE THE RESULTS OF OUR DEEP WATER SYSTEM INTO THE AREA UNDER CONSIDERATION EXCEPT TO SAY THAT WE ARE APPROACHING THE PREDICTED RESULTS WITH THE DEEP WATER SYSTEM AND IT IS LOGICAL TO ASSUME THAT WE WOULD REALIZE BUSHIPS PREDICTED RESULTS FOR A SYSTEM IN THIS AREA.

c. AS DISCUSSED PREVIOUSLY UNDER TARGET CLASSIFICATION, WHILE THE SOSUS BY ITSELF CANNOT POSITIVELY CLASSIFY, IT CAN, WHEN COUPLED WITH PROPER PAST INTELLIGENCE, SORT OUT A LARGE NUMBER OF THE TARGETS AS BEING NON-SUBMARINE. FURTHER, IT CAN VERY ACCURATELY MEASURE THE ROTATION SPEED OF THE PROPULSION SYSTEM DETECTED. THIS PERMITS EITHER A DIRECT COMPARISON WITH LOFAR DETECTION BY OTHER VEHICLES OR CORRELATION WITH THE SOA OF TARGETS IN A SUITABLE SURFACE PLOT.

THE PRIMARY LIMITATIONS OF THE SOSUS MAY BE SUMMARIZED AS FOLLOWS: FIRST, SINCE IT IS A PASSIVE SYSTEM, IT IS ENTIRELY DEPENDENT ON THE NOISE OUTPUT OF THE TARGET FOR ITS INFORMATION. FURTHER, BECAUSE OF ITS DEPENDANCE ON NOISE GENERATED BY THE TARGET, THE TARGET CAN ATTEMPT TO COUNTER BOTH DETECTION AND CLASSIFICATION BY OPERATING HIS ENGINES OR PROPELLERS AT A SLOW SPEED FOR REDUCED NOISE OUTPUT OR AT A SPEED WHICH COINCIDES WITH THE SPEED RANGE NORMALLY EMPLOYED BY OTHER VESSELS SUCH AS FISHING TRAWLERS, AND LASTLY, AS DISCUSSED EARLIER, SOSUS BY ITSELF CANNOT POSITIVELY CLASSIFY A CONTACT AND THEREFORE MUST HAVE BACKUP OR INVESTIGATIVE FORCES. IN BROOD TERMS THE SIZE OF THE BACKUP FORCE REQUIRED WOULD VARY IN AN INVERSE ORDER WITH RESPECT TO THE COMPLETENESS OF THE SOSUS COVERAGE BY CROSS BEARINGS.

IN SUMMARY, WE AT ASDEFORLANT FEEL THAT VARIOUS TYPES OF MOBILE SYSTEMS ARE FEASIBLE AND WOULD BE EFFECTIVE. THE ADDITION OF LOFAR - CODAR TO AIRCRAFT AND SUBMARINES SHOULD IMPROVE THE CAPABILITY OF THE VP/SSK BARRIERS OVER THOSE RESULTS TABULATED FOR ASDEVEX 1-58. A MOBILE SYSTEM WOULD PERMIT THE CONDUCT

OF THE SURVEILLANCE IN THE AREA WHICH WOULD EASIEST TO SUPPORT LOGISTICAL. FURTHER, IT WOULD BE CAPABLE OF MOVEMENT TO A NEW AREA IN CASE THE AREA OF INTEREST SHOULD CHANGE. ANY EMPLOYMENT OF A FIXED INSTALLATION MUST INCLUDE A REQUIREMENT FOR BACK-UP OR INVESTIGATIVE FORCES. THEREFORE, CONSIDERATION OF A FIXED SYSTEM, ACTIVE OR PASSIVE, MUST TAKE INTO STRONG CONSIDERATION THE DIFFICULTIES WHICH WILL BE ENCOUNTERED IN SORTING THE SUBMARINE CONTACTS OUT OF THE FISHING TRAWLERS OR OTHER SURFACE TARGETS IN THE PARTICULAR AREA.

SECRET

MOBILE FORCE REQUIREMENTS FOR AN ANTI-SUBMARINE TRANSIT BARRIER SYSTEM IN THE G-I-UK LINE.

The basis for this study is the general directive for the G-I-UK Line Study Group. These are as follows, with slight rewording:

(1) To provide a practical system for dtection, classification, tracking and localization of enemy submarines transiting the Greenland-Iceland-United Kingdom Line, in peace, at the time of an alert and in war.

(2) In time of war this system, when combined with suitable weapons, should provide the means of destroying enemy submarines.

(3) In time of peace the system should provide positive and accurate means ofdetection and classification.

(4) Recommendations are to be made on suitable combinations of presently available forces to achieve the most effective degree of ASW readiness in the event of "War Tomorrow".

(5) Thought should be directed towards fulfilling these requirements in the period 1962-65.

This paper will be concerned with mobile forces only and is directed primarily to item (4) above.

I would like to list some pertinent facts which are familiar in general to all of you and which are basic to our consideration of this problem. In the first place, the oceanographic environment is complex, variable and not well known. Climatic conditions are in general adverse.

There are concentrations of fishing vessels in certain areas of the G-I-UK region and this means that most of the area under consideration is subject to transit by fishing vessels and other merchant vessel types. This is an important factor in consideration of a peacetime detection or suuevillance system and for a condition of alert.

It is assumed that transiting submarines will be snorkel type at present and in the near term, that their endurance submerged, for W and Z class boats, is about 300 miles at 4 knots. This would be of the order of 150 miles for fifty percent of battery reserve.

It is anticipated that in the mid range period the quiet true submarine will constitute a major threat.

I shall consider first the era of the present and near future and will present estimates of dectection and kill capabilities for barriers of two different force levels against a variety of possible enemy transiter tactics.

First, I would like to make some comments about the general nature of the problem.

It is generally agreed, I believe, that an enemy submarine transiting on the surface at night with lights on probably offers the maximum security and speed for the transiter. This is true in part because of the presence of numerous fishing vessels in the area. For peacetime surveillance the classification problem is a major one. Our submarine array sonars do not have the ability to discriminate between surface running submarines and certain types of diesel driven fishing craft.

The transiter has a number of options for surface running. He might transit alone, perhaps on one engine. He might transit part of the way, at least, in company with Russian fishing vessels, or he might transit submerged for a time, then surface with a group of fishing vessels and take on a full battery charge and then proceed out of the area submerged.

Previous concepts of barrier operations have involved the use of VP aircraft to make radar sweeps out over a large area ahead of the SSK line with the purpose in mind of discouraging or preventing enemy submarines from running on the surface, or even more hopefully to discourage them from snorkeling, so that the transiting submarine would be more apt to have to snorkel in the SSK listening zone.

One trouble with this is that we wouldn't know how effective this operation was. In fact, a submarine with good ECM gear would probably have little difficulty determining when it was safe to run on the surface under these conditions.

Further, with this type of operation there is no mechanism for keeping track of the surface contracts obtained and investigated by the VP aircraft. So we are dealing with a system which has no memory capability.

Now I suggest that in order to cope with this problem and operate the barrier in a sound and organized manner that the maintaining of a good surface plot is a necessity. One way this could be done would be with the use of WV-2 type aircraft on station over each segment in the gap.

Let's take a look at a chart of the area (See Chart I).

An aircraft at an altitude of 10 to 12 thousand feet has a radar horizon of around 125 miles so that with WV-2's in each of the large circles shown on the chart each aircraft could provide surveillance of an area 250 miles in diameter.

The WV-2's could provide a surface plot in a number of ways. One would be by maintaining the plots in their own CIC. They have this capability. The other would be to provide Bellhop inputs to a surface plot manned at some surface stations such as DER on station in the straits as shown on the chart or better at some shore station if one were available.

In addition, such a surface plot could accept intelligence from other sources as well, such as VP aircraft, surface ships and barrier submarines. The WV-2, if they were present primarily in an AEW capacity should be able to do this with some additional effort. If then, the location of the native and intenerant surface traffic could be reasonably accurately known, the appearance of some previously unobserved surface contact would immediately be an object of of suspicion and subject to follow-up action, for purposes of classification or attack. We shall consider this matter again later.

First we shall put some additional barrier units into the picture.

I propose to start out with a rather dense barrier and consider then a barrier with a smaller complements of forces.

Represented on the chart by the small orange circles are SSK's in a double line across the entire G-I-UK corridor, on 60 mile spacings.

The circles below the double line represent SSN's which have been put in as back-up for the SSK barrier line.

Now, please pretend when we are talking about a peacetime detection system that these SSN are not there, but that they will be there when we consider the kill capabilities of such a system.

The SSK's have certain detection and kill capabilities of their own which we shall examine. But in addition VP type aircraft are needed in such a barrier system. It will be assumed that they will have a Jezebel and Julie capability, and tentatively that 4 aircraft will be required continuously on station. These are not shown on the chart. They contribute in many ways. One is by coordinatio with the SSK's to be vectored out to investigate or attack contacts obtained by the SSK's.

Another is that they assist in the communication between SSK's and other of the barrier units. They will also make contact with and attack some targets on their own. They would also be useful in connection with investigation of suspicious surface contacts that might be obtained by the WV-2 aircraft which would appear in the surface plot. They also could serve the purpose of discouraging snorkeling in the areas ahead of the SSK line. They could take advantage of the radar flooding in the area under surveillance by the WV-2's.

These barrier lines should translate. In other words, the lines should move back and forth through the area, in order to introduce uncertainty in the mind of the transiter as to the location of these lines, so that it would make it less likely that the enemy could transit these lines submerged.

The barrier has a double-ended problem in that transitors will be departing their northern bases and returning from their deployed areas so that we must be prepared to detect targets traveling in either direction.

The barrier is shown in the chart in the narrowest parts of the straits. However, the best place for placement of the SSK's is a matter of uncertainty and until we know much better how the capabilities of the detection system are effected by the water conditions and the bottom conditions here, we won't know precisely where will be the best place. It may well be that sonar conditions are such that we would need to bring the barrier back into the deeper water or perhaps farther forward into deeper water. We don't know how exactly how these shallow areas may degrade the sonar performance.

Incidentally, I have shown here the thousand fathom curve in the red and the hundred fathom curve in the blue lines. The green on this side of Iceland is a 200 fathom curve. The green dashed line represents the 300 fathom curve.

In the narrowest portion of the straits where force requirements would be least, we have to deal with what are probably less favorable water conditions.

We assume for these SSK's a 30-mile detection radius and assume that if a transiting submarine snorkels within the 30 mile radius, he will be detected and that translation of the barrier lines must be done on some kind of a schedule so that the friendly forces know where they are, that translation will introduce enough uncertainty so that an enemy submarine will transit through the gaps on some snorkel cycle which he has decided will be best for his purpose.

The next chart, II, shows the detection and kill capabilities for some barrier systems. The numbers across the top here indicate the fraction of targets transiting the area which would be detected, as represented by the full length of the bar by the SSK's alone, and the red bars indicate the fraction of targets which would be killed by the SSK's. More specifically, these are the fraction of targets transiting the area which would snorkel within a range and for a long enough period of time so that the SSK's could close and attack. The barrier forces are shown on this side — 3 WV-2's, 3 DER's, the 18 SSK's, and four VP aircraft.

Another barrier in which we have half the complement of submarines.

We get a large variety of detection and kill probabilities for the reason that we have considered a variety of snorkel tactics and listening ranges for the transiters. We assume first a snorkel cycle which represents 8 hours of snorkeling out of a 48 hour cycle at 5 knots, another one hour snorkel period out of a 7.5 hours cycle at 5 knots and an 8 hours snorkel out of a 108 hour cycle at 3 knots and allow for a transiter with different ranges for detecting the sn orkeling of an SSK in the barrier system. We have assumed that the SSK will snorkel one hour out of eight.

For transitor detection ranges of zero to 8 miles, essentially the results are the same. For a detection capability by the transitor against the SSK of 30 miles then the detection probability is somewhat reduced; proceeding downward on the chart we have similar tactics for the transitor for these separate force levels.

Now I want to talk about these numbers somewhat more in detail a little bit later but I would like to disgress for a moment and say something about the classification problem.

These values shown here represent those computed on the basis of a hundred per cent classification capability. Now, of course, we know that the SSK's do not have this capability. Particularly in peacetime classification is a major problem. And if we are to have any confidence in the way in which we can predict how many transitors we should be able to detect, classification will have to be achieved by using all possible means.

There are several things that could contribute to this. One is the surface plot, if such a plot were maintained. The other is the incorporation into the submarines themselves of increased classification capability, such as LOFAR hydrophones and processing equipment although this would be a capability in the future but is not available now.

Also the use of VP aircraft can contribute substantially to the classification problem by being vectored out on contacts obtained by the SSK's using whatever means they have available, radar and visual, the use of LOFAR/CODAR sonobuoys and explosive echo ranging where applicable. The number of VP aircraft required to do this is difficult to specify because there are so many factors which are involved on which we do not know enough to make an accurate prediction, among which are — the efficiency of a surface plot and communications, the frequency of contacts which are obtained, and the reliability and capabilities of the airborne Jezebel system in this region.

I think we could say that the barest minimum of VP aircraft which would be required would be at least four on-station on the G-I-UK Line.

Now, if we do not have WV-2 aircraft and a surface plot then the commitment of VP aircraft would probably have to be higher because they would have the additional task of having to conduct surveillance over a large area ahead of the SSK line and we suggest without anything more than a guess that perhaps an additional 3 VP aircraft would be required to do that in order to prevent surface running and increase the difficulty of snorkeling undetected.

Now, if we can't put adequate numbers of VP aircraft into this area, then air cover would have to be supplied possibly by antisubmarine carrier groups.

In wartime the classification problem presumably will be somewhat simplified in that surface traffic should be cleared from the area if shooting commence.

Now let's go back to the chart for a minute and look at these numbers. Note that in the 8-48 cycle we get something like a 60 per cent probability of detecting a single transitor. If the transitors detect an SSK snorkeling at 30 miles range, this probability of detection is cut to something like 40 percent. The SSK's would have a chance of killing perhaps 20 percent of the transiters that came through on this cycle.

Note that on the short snorkel cycle the detection capability is very high. This is primarily because the transitor snorkels so often that it is highly likely that he will snorkel within the SSK detection range. The kill probability however, is low for the reason that it is highly likely the transitor has ceased snorkeling before the SSK can close to an attack.

Note that when we have about half the number of SSK we get roughly half of the detection and kill capability that is shown for the first barrier. A 50% weapon effectiveness was assumed for the SSK. This, of course, will vary with the weapons available.

Let's see now shat happens if we consider the kill capability added to the barrier system by the presence of aircraft and SSN back-up.

The kill capability added by the aircraft is shown in green, and for the SSN in the back-up role in blue.

Now, as far as the aircraft are concerned we have assigned to them the targets which were detected by but not taken under attack by the SSK.

The relative percentage of kills obtained by the aircraft and by the SSK's could fluctuate depending on what the policy was about how many targets were assigned to the SSK and how many were taken by the aircraft.

The kill capability of the aircraft has been computed on the assumption that 80 per cent of the cases of call-up and rendezvous between SSK and aircraft will be successful; that the aircraft will be successful 50 per cent of the time in localizing contacts when vectored out, and that a 50 per cent weapon effectiveness applies.

You see these are fairly restrictive in the number of kills that the aircraft can actually achieve. The fifty per cent weapon effectiveness is predicated on homing torpedoes. If atomic depth bombs were used then the kill capability would be considerably increased and the green line would extend out somewhat further.

Notice that the relative effectiveness of the aircraft is much higher when we are dealing with the short snorkel cycle. This is because a much larger number of targets are assigned to the aircraft but also that the aircraft can close and attack in many more cases than the SSK can, because of a greater speed of closing.

Now, consider the kill capability added by the SSN. We did not put the SSN in the detection for peacetime surveillance system because, assuming the same sonar capabilities as SK's, he would contribute no more than a conventional submarine, but we found him to be very effective, maybe too much so, as a back-up for the barrier lines.

We have assumed that he, like the SSK, has a 30-mile detection range, but that on receipt of information from the barrier lines that a target has been detected or the target is on some course through the barrier system, that the SSN can position himself in the track of the transitor within a lane about a 75 mile wide through which the transitor will pass.

Some substantiation for this capability was obtained from ASDEVEX 1-58 when the SEAWOLF was able to close eight out of the nine contacts given to him by the barrier forces.

Here again in the short snorkel cycle the SSN shows up extremely well because the frequency of snorkeling makes it highly likely that the snorkeling will occur in the SSN detection circle. It is much less effective in some of the other cases. On the very long snorkel cycle it is notably less so.

Now, I would like to point out that we have not addressed ourselves to saying what is the appropriate detection probability. This is another subject and deals with the notion of what we would be willing to accept for raid recognition purposes, if in fact the primary purpose of a barrier is to determine when a rai is in progress. But it should be pointed out that even though we have or might have a relatively small detection capability against a single transitor, say 20 or 25 per cent, the probability would be high, of the order of 60 per cent or better, that we could detect as many as five transitors out of 20. These are the kinds of considerations which must be taken into account in thinking of the raid recognition problem. And that if this is our primary purpose, then we can be content with much lower probabilities of detection than we indicated here. However, I want to emphasize that function of an anti-transit system is not confined to a mass movement of submarines.

Now I would like to show one more chart in which we summarized these force requirements.

If you want a barrier which has something like a 60 per cent detection probability (this 60 per cent is a rough average over all the transit tactics which were considered, ranging all the way from 10 to nearly 100 per cent), then the forces suggested here — the 3 WV-2, 3 DER, 19 SSK and 4 VP aircraft — should give that.

This barrier would have roughly a 30 percent kill probability average of the situations considered. For the second barrier, we would get roughly half of the detection capability and something like 20 per cent kill capability.

You can project these numbers downward in roughly the same way. In other words, if we have half of this barrier strength, we are going to get something like 20 per cent detection capability and maybe 10 per cent capability if we cut the number of SSK's, say, from 9 to 5.

This summarizes, then, the area force requirements. If we have to maintain 3 WV-2's on station, allowing them 150 hours per month utilization, something like 15 WV-2 aircraft would be required. The number of SSK's that would have to be committed to the operation depends on how long the barrier has to be manned. If manned for no more than one patrol cycle then 18 SSK's are sufficient but if this has to be carried on continuously over a long period of time, there would have to be appropriate back-up forces for it.

The same thing is true for the SSN. Four VP aircraft continuously on station would require 4 VP squadrons of 12 aircraft each.

The second barrier shown here is similar except with half the number of SSK's involved.

Finally, I would like to point out that there are many complications and factors we have not taken into account.

Among them are the possible enemy transitor tactics that might be adopted in war time. For example, the enemy might elect to send in SSK's of his own to attack the barrier units, and given equal capabilities here, there is no reason to expect anything other than a one to one exchange rate.

We might counter this by putting SSN's in the barrier lines or by increasing the VP aircraft coverage or something of this sort.

Another tactic which has been suggested is that transitors might to in pairs one snorkeling while the other ran quiet. This would make it difficult for an SSN closing at high speed and making some noise in that the quiet transitor would be in a position to attack the SSN which was attacking the snorkeling transitor.

Another possibility is that the enemy might send submarines to feint or spoof certain sections of the barrier line, draw the barrier forces out of position and then send in a number of transitors through the gaps thus created.

We think that this would not be particularly profitable when we have a fairly dense barrier but it might be a very effective tactic when we deal with a thin barrier.

Finally, he might decide to send a large number of transitors through and overwhelm the barrier by brute force and thus in this fashion get a large number of his transitors through.

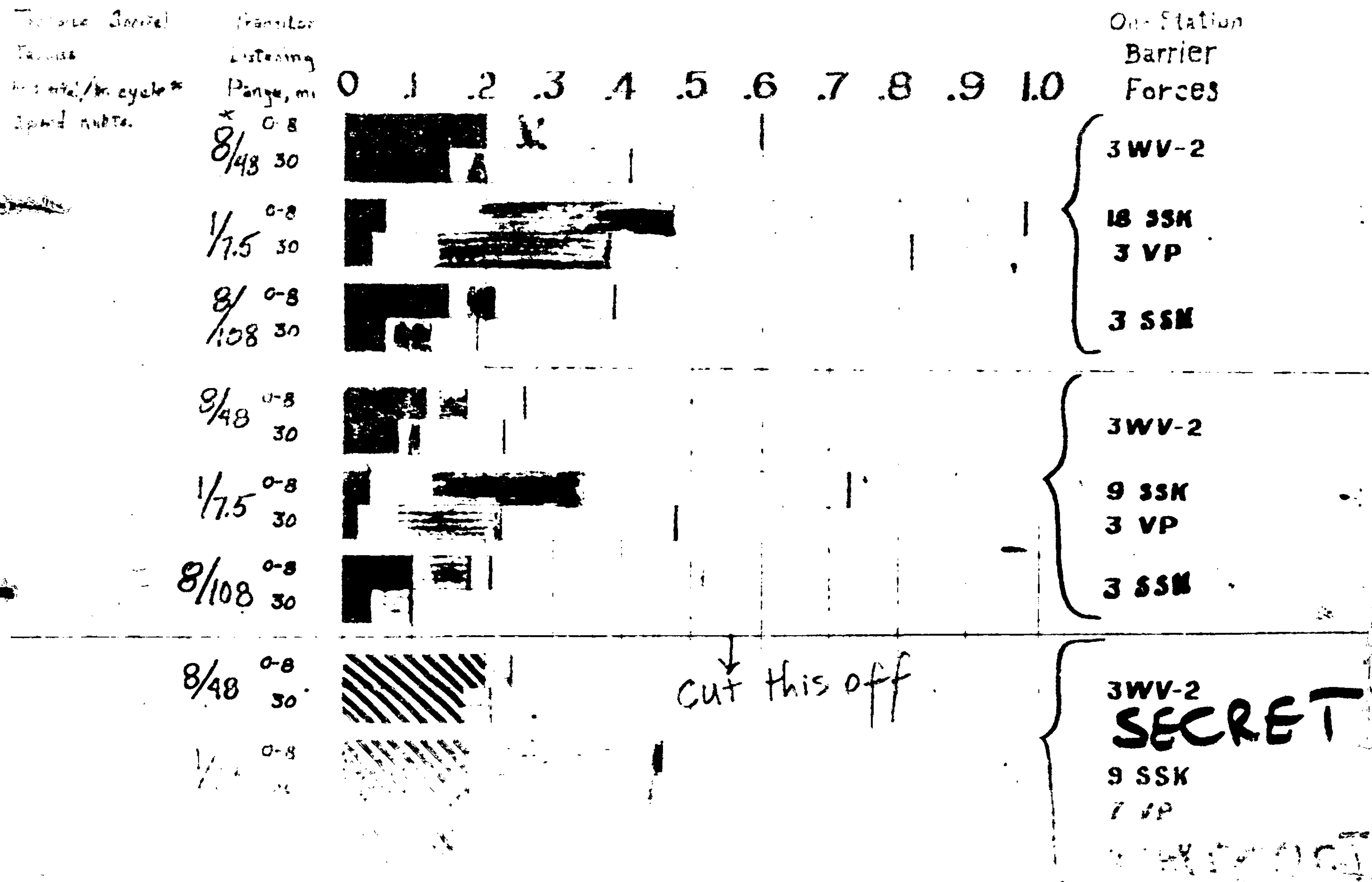
To take into account all of these factors and numerous other ones would require a much more extensive study than we have been able to undertake at this time.

This concludes my remarks, Admiral.

The GIUK Barrier System

SECRET

System Detection and Kill Probability



SECRET

Barrier Force Requirements

On Station Units	Detection	On Station Units	Kill	Area Force Requirements
3 WV-2 18 SSK 3 DER 4 VP	60%	3 WV-2 18 SSK 3 SSN 4 VP	30%	15 WV-2 18-36 SSK 3-6 SSN 4 VP rons (12%) 3-6 DER
3 WV-2 9 SSK 3 DER 3 VP	35%	3 WV-2 9 SSK 3 SSN 4 VP	20%	15 WV-2 9-18 SSK 3-6 SSN 4 VP rons (12%) 3-6 DER

SECRET

Composition of Working Groups

Group I: Long Range (R&D)

CDR J. P. KELLY, USN, Chairman
W/C PAINE, RAF
S/L AGNEW, RCAF
Mr. GOSSAGE, U.K.
Mr. WATSON, U.K.
Mr. PRYCE, U. S.
LCDR DUNTON, USN
LCDR DIEDRICHSEN, USN

Group II: ALERT/WAR TOMORROW (MOBILE)

CAPT McGEOGH, RN, Chairman
CAPT DuBOIS, USN
LCDR JONES, RCN
Mr. VEZEY, U. K.
Mr. LONGARD, Canada
Dr. MASON, U.S.
CDR COCOWITCH, USN
CAPT BONNER, USN
CDR DAHLOFF, USN
CDR SYMES, RN
CDR M. C. KELLY, USN

Group III: PEACE

LCDR ELLIS, RCN, Chairman
W/C BURGESS, RAF
CAPT PRICKETT, USN
Mr. DAWSON, U.K.
Mr. KAVANAGH, Canada
CDR HUEY, USN
F/LT HICKS, RCAF
LCDR MAYNARD, USN
CDR EVERLY, USN

Administrator, Moderator and Coordinator

CAPT F. N. KLEIN, JR., USN

PROJECT ARTEMIS - A. W. PRYCE - ONR

ARTEMIS has the goal of determining the feasibility of ocean surveillance by low frequency active acoustic means. In order to accomplish this, the following action is being taken.

a. Establish means of a major experimental acoustic system capable of extending the present knowledge about reverberation, propagation stability, low frequency target strength and other physical parameters influencing detection at "hundreds of miles."

b. Conduct experiments to assure that the techniques and siting of the experimental system represent the optimum available in the time period.

Installation of the experimental system will permit conduct of experiments to determine detection performance, physical limitations, and techniques of signal transmission, reception, and processing applicable to ocean area surveillance.

The primary scientific problems to be investigated are:

a. Extent of reverberation limiting on detection capability at low frequencies and longranges.

b. The limits imposed by the ocean on receiving array gain.

c. The stability of the ocean as it affects long range acoustic detection. (These are not independent variables).

The program is planned to shed light on the following Naval problems:

a. The feasibility of providing very long range active acoustic detection by both fixed and mobile means.

b. Methods by which the detection capability of passive systems can be increased by an order or magnitude.

Early in the program, a review of available knowledge was made to enable the estimation of "State of the Art" and to propose certain goals for parameters of the experimental equipment discussed previously. After much collaborative effort by the groups involved, the following values were determined as being the most rational:

a. Four hundred cycles/second appears to be the best frequency. Target strength falls off below 1kcc, and is thought to fall sharply below 300 cps. Sea noise decreases with increasing frequency. Equipment difficulties (size, weight, etc.) increase inversely with frequency. Transmission loss appears to increase sharply above 500-600 cps. Although probably not provable mathematically, 400 cps appears to be at about the crossover point of curves of these factors.

b. A transducer of about 1 million watts acoustic output is required to make a significant step forward, and appears rational in that, for efficient designs at 400 cps handling above 30-70 kilowatts, it presents no serious cost disadvantage or other difficulty.

c. It is desired to estend receiver capability to the point that a determination can be made of the limits imposed by the operating medium. A proposed design has been formulated for a receiver with 45 decibel gain. Such an array would be comprised of about 30,000 point hydrophones distributed over a one by two mile vertical surface in the ocean. It appears that in terms of time and money, this may not be feasible and/or practical. A lesser goal of a 1000 point element array has been established for early implementation, with a design such that expansion toward the larger goal can be accomplished if deemed desirable.

d. Early proposals have been made for ocean surveillance using the "forward scatter" effect, known in radar circles as "Flutter". Insufficient evidence exists (in the underwater case) to permit basing an entire program on this phenomena without incurring a serious risk of complete failure. The conclusion was reached that the first experimental conclusion installation should be essentially mono-static but that planning should include means to fully investigate the forward scatter by wide bi-static cases.

Experimental Facility

Plans have been made to install a large experimental system in the Western Atlantic Basin, comprised of the following items.

A. Sound Source

(1) Sound Source I

a. One megawatt acoustic output in beam 12 x 20 degrees.

b. 400 cps center frequency; bandwidth of approximately 100 cps.

c. CW, pulse, noise modulation.

d. Depth of operation: minimum - 200 fms.

e. Site - Bermuda.

f. Installation in May - August 1960.

g. To be supplied with 400 cps power from electronic power amplifiers which are powered from a gas turbine primary plant.

(2) Sound Source II (Proposed)

a. Greater than one megawatt acoustic output, in a beam about $12 \times 360^{\circ}$.

b. 100 cps bandwidth at 400 cps.

c. CW, pulse, noise modulation.

d. Depth of operation - 2000 fathoms.

e. Moveable, operated from ship.

f. No date schedules.

g. Powered from same plant as Source I.

B. Receiver

(1) Initial Receiver.

a. Modular - each module to have 32 or 8 hydrophones arranged to achieve about 30° vertical beam width. To be self orienting.

b. First array will have about 100 modules.

c. To be sited in 500 - 1500 fathoms.

d. Preamplifier in each module.

e. Each module to have output on one pair of wires.

f. These 100 modules to be distributed over an area about 8600 by 8600 ft on a slope.

g. To be sited off Bermuda.

(2) Further Receivers:

a. Dependent upon the results of the above receiver, extend toward 1000 modules.

C. Signal Processing

(1) For 100 module array.

a. Beams less than 1° by 1° over limited aperture.

b. Information available at input in analog form.

c. Beam formation by digital means for some beams.

d. Filtering and averaging probably by photographic — optical methods.

e. Presentation by photographic means.

(2) For larger arrays:

a. Expansion of equipment of 100 module array as practicable.

Concurrent Research and Experimental Programs.

The Concurrent Research and Experimental Program can be divided into two parts; the first aimed at providing information relative to siting of the major experimental installation, and the second to provide information to permit sound design of the equipment and provide early information to permit performance predictions.

A. Information relative to siting.

1. Transmission over paths of interest.
2. Estimates of reverberation in areas of interest.
3. Transmission loss versus source depth.
4. Transmission loss versus receiver depth.
5. Water currents versus depth in areas of interest.
6. Water currents versus time in areas of interest.
7. Bottom topography in areas of interest.
8. Bottom composition in areas of interest.
9. Effect of bottom on transducer efficiency.

B. Information relative to equipment design.

1. Transmission loss.
2. Reverberation levels.
3. Amplitude stability with time.
4. Amplitude stability with space.
5. Phase stability with time.
6. Phase stability with space.
7. Methods of sound production.
8. Methods of providing acoustic compliance at great depths.
9. Methods of signal processing.
10. Distribution of elements in large arrays.

MISCONCEPTIONS ABOUT DESTROYERS

CAPTAIN EMMETT P. BONNER, USN
STAFF, COMMANDER DESTROYER FORCE,
U. S. ATLANTIC FLEET

It seems that almost every one is his own destroyer expert, although he usually defers, in the case of air or submarine matters, to the operators of those forces. Now we in the Destroyer Force have no quarrel with this situation, and do not intend to try to change it, but we would like to highlight some of the more common and dangerous misconceptions about destroyers for the "DO IT YOURSELFERS".

These misconceptions amount to a freezing of destroyer capabilities and tactics at the World War II level, in the face of steadily increasing submarine capabilities.

In all cases in those remarks not specifically noted otherwise, the term "submarine" refers to potential enemy submarines, specifically Soviet submarines, and not to U. S. or Western submarines. I am not comparing the relative ASW merits of U. S. submarines and U. S. destroyers.

Perhaps the most prevalent misconceptions about destroyers is that they must dash about in submarine waters at high speed, maneuvering constantly and radically to avoid being torpedoed. As a result this limits them to active sonar, and concurrent poor performance. In reality, we are changing our tactics. We will stop, leap-frog, or do anything else that will enhance our capabilities.

The misconception that destroyers cannot get good sonar performance at high speeds simply is not true any longer. Working with the Underwater Sound Laboratory, destroyers have found out that sonar domes can be improved, when sufficient effort is applied to the problem, and today we have whole squadrons who get good spoke-free sonar operation at 30 knots. Further improvement in this area appears possible.

The corollary misconception is that passive sonar is not for destroyers. In actuality, the BQR-2B sonar, experimentally installed in a ship of Destroyer Development Group TWO, has shown that this gear can make valuable contributions to initial submarine detection and classification.

Recently this destoryer, the GLENNON, was returning to port from a day's exercises and tests, when the active sonar operator made a sonar contact. As the ship steamed on toward the harbor, the operator classified the target as fish, and the range to the contact opened as it dropped aft in bearing. The active sonar operator glanced over at the unattended BQR-2B display, and saw an unmistakable trace of a submarine in the fish. He notified the bridge, and the ship changed course to close the target. Underwater telephone contact was established, disclosing that the contact was a U. S. submarine on a special mission unknown to anyone in the destroyer at the time.

Further development and tests are underway to install another passive sonar in a destroyer of the Operational Test and Evaluation Force. Also, the SQS-20 combination active and passive sonar, with hydrophone array is now being installed in a radar pickett DER, the Calcaterra.

The surface has obviously just been scratched in providing the tremendous capabilities of passive sonar to destroyers.

Closely related is another common misconception that no noise reduction program for destroyers is justified. It is important to understand the aims and objects of destroyer noise reduction. What we are trying to do is simply to cut down noise that is entering the sonar dome and thus reducing our sonar range. This is a vastly simpler and cheaper aim than that of reducing <u>all</u> noise radiated into the water to prevent detection of the destroyer. Let me emphasize: We are not trying to keep a submarine from detecting the destroyer, but merely to reduce noise entering the sonar dome. This is a much easier and cheaper task.

Generally speaking, the same sonar range improvement can be gained by increasing the source level a given number of decibels,, or by reducing the sonar receiver noise by the same number of db. We are paying about $240,000 per ship to get about 15 db increase in source level in our current RDT modifications to the SQS-4 sonar. By comparison, we can get 20 db noise reduction in our sonar receiver for $60,000. The specific measures taken were hull damping, sonar dome damping, and dome relocation. Again, we are just in the infancy of improving our active and passive sonar performance by a sensible noise reduction program.

Another long-lived misconception is that destroyers must run directly over, or nearly over, a submarine and attack with hedge hogs or depth charges. The destroyer must also outguess and outmaneuver the submarine to prevent him from breaking contact and to get a kill. With submarines of increased capabilities, including homing torpedoes to fire at the destroyer, these tactics are obsolete.

The destroyer must shift immediately to long range kill methods. Several means exist today, and others are imminent. Several years ago, using the now obsolete Mk 35 torpedo with war shot battery, destroyers attained repeated hits on target submarines in the 4000-6000 yard range band. One Mk 35 torpedo hit the target submarine three times before it wrecked its own transducer.

Operations in a destroyer at sea are in progress now with the drone helicopter to deliver Mk 43 (and when available, Mk 44) torpedoes, and a nuclear depth charge capability will also be provided in this way.

USS NORFOLK has begun firing tests of her 10,000 yard ASWC weapon, with excellent initial results. The Mk 37 torpedo is now entering the Destroyer Force, offering a 10,000 yard kill potential. Wire guidance of this torpedo is in the works. The destroyer SARSFIELD, several years ago, conclusively demonstrated the practicability of using wire guidance for destroyer torpedoes. She steamed in circles at high speed without disrupting the wire guidance link to her stern-launched torpedo.

Thus we see that several means of obtaining long range kills of submarines are becoming available to destroyers.

The final misconception I wish to mention is that the destroyer is inherently a poor sonar platform. It is true that the destroyer, until recently, had been permitted to be a poor sonar platform, but this is due more to insufficient effort and emphasis, than to any inherent and insuperable limitation. In the realm of the long range active sonar using bottom bounce and convergence zone modes, such as the SQS-26, we have been told by the Undersea Warfare Committee of the National Academy of Sciences meeting last winter at the Underwater Sound Laboratory, that there was no significant improvement in sonar performance to be expected by lowering the sonar transducer further down in the water, and that this situation prevailed whether the target submarine was in or below the thermal layer. It was stated that there is even some remote and theoretical advantage in having the sonar at keel depth rather than deeper in the water.

Variable depth sonar offers several advantages to destroyers, and, having been evaluated by OPTEVFOR, is now being backfitted in a significant number of destroyers. This sonar gives good long range detection of submarines below the layer, avoids much shipboard noise, and has no stern baffles. This provides the first good look astern that destroyers have had, and will obviously be useful in a destroyer screening astern of a force.

The acoustic detector does not even have to be physically attached to the destroyer. The DESLOC program now just getting underway will provide LOFAR-CODAR capabilities, with JEZEBEL sonobuoys. Tests over a year ago achieved a 35 mile detection of exercise submarines using sonobuoys laid and monitored by the destroyer escort LESTER.

The BIG DASTARD system using moored buoys, laid and monitored by destroyers much as in the Canadian proposal you just heard, is also under active development at sea by Destroyer Development Group TWO. This system is expected to provide destroyers with a transportable, tactical, SOSUS type capability, for use in semi permanent barriers, or at an amphibious objective area, or at any location needed by a theater commander, such as the Persian Gulf or Sea of Japan.

Sonobuoys also offer destroyers a means of using the deep sound channels, as 12,000 foot deep hydrophone arrays, now being tested, become operationally available.

Our file ref....S098-109(CAS).......

CANADA

DEPARTMENT OF NATIONAL DEFENCE

ROYAL CANADIAN AIR FORCE

13/viii

Ottawa, Ontario
9 Jul 59.

Ref Your NSS 1271-8 (STAFF) (Undated)

CHIEF OF NAVAL STAFF

CAN/UK/US Study Group - Argentia

1 In response to your referenced letter received on 30th June 1959, Squadron Leader G.G. Agnew of the Directorate of Maritime Operations has been named to represent the Royal Canadian Air Force at the study group.

(Hugh Campbell)
Air Marshal
Chief of the Air Staff

Referred to ....PA....

JUL

File No .....1271-8.....

Chgd to ....

RCAF G32 (REV. 8-57)

[redacted]

MESSAGE FORM

FILE NJS 1271-8 (STAFF)

NUMBER

FOR COMMCENTRALS USE

"V C" - NO UNCLASSIFIED REPLY OR REFERENCE

PRECEDENCE - ACTION	PRECEDENCE - INFO	DATE - TIME GROUP	MESSAGE INSTRUCTIONS
PRIORITY	DEFERRED	032016Z	

PREFIX: GR

SECURITY CLASSIFICATION: SECRET

ORIGINATOR'S NUMBER

FROM CANAVHED

TO COMBARLANT

CANCOMARLANT

INFO CANAVUS

CANAIRHED

MY 3021472 June PD ADD MR KR KAVANAGH CANAVHED PD

CLEARED TOP SECRET PD

A/ACNS(P)

PAGE OF PAGES	REFERS TO MESSAGE	DRAFTER'S NAME	OFFICE	TEL.
	CLASSIFIED YES ☐ NO ☐	LCDR EM JONES	DNPO	6-8937

FOR OPR'S USE	R	DATE		SYSTEM	OPERATOR	D	DATE	TIME	SYSTEM	OPERATOR	RELEASING OFFICER'S SIGNATURE

CAFC (JSF) (REV 9/58)
CNS 1320 B (REV 9/58)
RCAF 542 (REV 9/58)
7530-21-562-1557

COPY 2

A/Naval Secretary

000218

P 021443Z

PRIORITY
SECRET
"AC" NO UNCLASSIFIED REPLY OR
REFERENCE

FM CANCOMARLANT

TO CANAVHED

CANAIRHED

NSS 1271-8

BT

302147Z (DNPO) RE: CANADIAN REPRESENT-
ATIVES WHO WILL ATTEND STUDY GROUP OF
THE GREENLAND-ICELAND-UK STRAITS AREA.

ACNS(P)
ACNS(A&W)
CNP
DNI
DNPO
SOC
D/SEC/STAFF
DSRA

CANAVHED 302147Z X

TO PROVIDE UNITED PROPOSALS A MEETING OF CANADIAN STUDY GROUP IS SCHEDULED FOR 6 JULY 59 X REQUEST HEADQUARTERS REPRESENTATIVES ARRIVE HALIFAX P.M. 5 JUL 59 X

BT

TOR 022028Z JUL 59

Leaving 1300

R Ø21339Z DROUTINE

ACNS(P)
ACNS(A&W)
CNP
DNI
DNPO
SOC
D/SEC/STAFF
SA/CNS
N COMP

FM CANFLAGLANT

TO RCEPC/CANAVHED

INFO ZEN/NAVRESEARCH DART

BT

UNCLASSIFIED

FOR SA/CNS FROM COMMAND SCIENTIFIC OFFICER X REQUEST APPROVAL VISIT ARGENTIA JUL 8 TO 11 FOR CONFERENCE X TRAVEL VIA RCAF X ESTIMATED EXPENSES UNDER TWENTY-FIVE DOLLARS X INTEND PROCEEDING TWO WEEKS LEAVE ON COMPLETION X

BT TOR 021411Z JUL 59

Lt. Cdr. Jones thanks DSS 3 July

4851 A

DEPARTMENT OF NATIONAL
MESSAGE FORM
FOR CLASSIFIED MESSAGES ONLY

INDICATE DEGREE OF PRIORITY	
OPERATIONAL IMMEDIATE	
PRIORITY	X
ROUTINE	
IF NOT MARKED WILL BE TRANSMITTED DEFERRED	

FOR MESSAGE CENTRE USE ONLY

FACE & NO UNCLASSIFIED REPLY OR REFERENCE

GR

MARK X TO INDICATE SECURITY CLASSIFICATION	
TOPSEC	
SECRET	X
CONFID	
RESTD	

FROM: CANAVHED

ACTION ADDRESSEE/S: COMBARLANT / CANCOMARLANT

INFORMATION ADDRESSEE/S: CANAVUS / CANAIRHED

ORIGINATOR'S NO.

JUN 30 21 17 49 IN

FOLLOWING CANADIAN REPRESENTATIVES WILL ATTEND STUDY GROUP OF THE GREENLAND-ICELAND-UK STRAITS AREA X

GROUP CAPTAIN R.A. GORDON RCAF	CANCOMARLANT
LCDR R.L. ELLIS RCN	CANCOMARLANT
SQUADRON LEADER HEWER RCAF	CANCOMARLANT
MR J.R. LONGARD	CANCOMARLANT
LCDR E.M. JONES RCN	CANAVHED
SQUADRON LEADER G.G. AGNEW RCAF	CANAIRHED

2. ALL REPRESENTATIVES CLEARED TOP SECRET AND WILL ARRIVE ARGENTIA P.M. 7 JUL X

FOR CANCOMARLANT X HEADQUARTERS REPRESENTATIVES WILL ARRIVE HALIFAX LATE P.M. 6 JUL X

E M Jones

F J Bailey

ORIGINATOR	TELEPHONE	DATE - TIME GROUP	FILE NO.
DNPO per LCDR JONES	2-2700	302147Z	NSS. 1271

C.N.S. 1320JC-250M-12-49 (3327)
C.A.F.B. 1617 (4 PARTS) H.Q. 224-21-B-1617.
R.C.A.F. S42

FILE COPY

000221

JCS/mr

H.Q. 1024

NAVAL SERVICE—MINUTE SHEET

FILE No. NSS.1271-8
(STAFF)

REFERRED TO	REMARKS (WITH SIGNATURE, POSITION AND DATE)
~~VCNS~~	30/6

With reference to the proposal that Group Captain Gordon attend as the senior officer of the RCN representatives. I cannot agree to this nomination -- nor to any further loss of our primary responsibility for Maritime Warfare. Surely we can find a suitable RCN officer to attend as senior representative and to this end am willing to nominate a suitable officer from my staff. if necessary

(Jeffry V. Brock)
Commodore, RCN,
Assistant Chief of Naval
Staff (Air & Warfare).

26 Jun 59

SECRET

EMJ:MES

NSS 1271-8
(STAFF)

26 June 1959

CHIEF OF THE AIR STAFF

STUDY GROUP FOR ANTI-SUBMARINE DEFENCE OF THE GREENLAND-ICELAND-UNITED KINGDOM STRAITS AREA

Attached is copy of letter received from the Naval Member, Canadian Joint Staff, Washington concerning Canadian participation in a Study Group for Anti-Submarine Defence of the Greenland-Iceland-United Kingdom Straits Area sponsored by the USN. This group will convene in Argentia, Newfoundland, 8 to 11 July, 1959.

2. In view of the Emergency Defence Planning aspects of this study group, CANCOMARLANT was directed to nominate the Canadian team. Group Captain R.A. Gordon, Deputy Chief of Staff (designate) CANCOMARLANT will be the senior officer of this team and will deliver the Canadian presentation.

3. The attendance of Headquarters personnel is considered advisable in view of the long range ASW planning aspects of the study and its application to Straits around the Canadian Coastline.

4. It is intended that one officer from the Directorate of Naval Plans and Operations will attend. It is requested that I may be informed of any Air Force Headquarters representative that will attend in order that a co-ordinated reply may be made to the USN.

original signed by

(H.G. DeWolf),
Vice-Admiral, RCN,
CHIEF OF THE NAVAL STAFF.

Director of Naval Plans & Ops
JUN 26

SECRET

9/K NS(P)
VCNS

000223

SECRET

EMI/VC

NSS 1271-8 TD-9153
(STAFF)

CHIEF OF THE AIR STAFF

STUDY GROUP FOR ANTI-SUBMARINE DEFENCE OF THE GREENLAND-ICELAND-UNITED KINGDOM STRAITS AREA

Attached is copy of letter received from the Naval Member, CJS Washington concerning Canadian participation in a Study Group for Anti-Submarine Defence of the Greenland-Iceland-United Kingdom Straits Area sponsored by the USN. This group will convene in Argentia, Nfld. 8 to 11 July, 1959.

2. In view of the Emergency Defence Planning aspects of this study group, CANCOMARLANT was directed to nominate the Canadian team. G/C [illegible] Gordon, Deputy Chief of Staff ~~[illegible]~~ (designate) Cancomarlant ~~[illegible], RCN~~ will be the senior officer of this team and will deliver the Canadian presentation.

3. The attendance of Headquarters personnel is considered advisable in view of the long range ASW planning aspects of the study and its application to Straits around the Canadian coastline.

4. It is intended that one officer from the Directorate of Naval Plans and Operations will attend. It is requested that I may be informed of any Air Force Headquarters representative that will attend in order that a coordinated reply may be made to the USN.

VCNS

(H.G. DeWolf)
Vice-Admiral, RCN,
CHIEF OF THE NAVAL STAFF.

Director of Naval Plans & Operations
JUN 23

DNPO

SECRET

MAIN FILE No. S-1221-28 T.D. No. 9153

DEPARTMENT OF NATIONAL DEFENCE

SECRET

TEMPORARY DOCKET

NAVY

28/5

T.D. No. 9153

REFERRED	REMARKS	DATE OF PASS	INITIALS	DATE OF P.A.	INITIALS	DATE OF B.F.	CENTRAL REGISTRY	INSPECTED IN C.R. BY
Staff	WITH PAPERS CR	JUN 2 - 1959						

M 251838Z

DEFERRED
SECRET
"AC" NO UNCLASSIFIED REPLY
OR REFERENCE

CNS
VCNS
ACNS(P)
ACNS(A&W)
DNPO
D/SEC/STAFF

FM CANCOMARLANT

TO CANAVHED

INFO CANAIRHED

BT

MCACS 1271-1 DATED 15 MAY 1959Z X

REQUEST DEPUTY CHIEF OF STAFF (DESIGNATE) BE ASKED TO REPRESENT

THE MARITIME COMMANDER

BT

TOR 252126Z JUN 59

SECRET

Our file ref. NMWS 8100-1

DEPARTMENT OF NATIONAL DEFENCE

CANADIAN JOINT STAFF

9153

CANADA

Reply to:
Naval Member

2450 Massachusetts Ave., N.W.
Washington 8 D.C.
U.S.A.

28 May, 1959

STUDY GROUP FOR ANTI-SUBMARINE DEFENCE OF
THE GREENLAND-ICELAND-UNITED KINGDOM STRAITS AREA

References: (a) NMWS 8100-1 dated 7 January, 1959
(b) NMWS 8100-1 Vol. 3; NMWS 6101-13 dated 13 April, 1959.
(c) MCACS 1271-1 dated 15 May, 1959

Submitted for the information of Naval Headquarters, that an invitation has now been received from the Chief of Naval Operations, for participation by Canadian delegates in the Study Group on the Anti-Submarine Defence of the Greenland - Iceland-United Kingdom area, referred to in the references. The invitation was also extended to the Admiral, British Joint Services Mission, for participation by U.K. delegates.

2. The Chief of Naval Operations advises the composition of the U.S. Navy delegation will be as follows:-

CHAIRMAN

Commander, Barrier Forces, Atlantic
Rear Admiral W.I. Martin

NAVY DEPARTMENT REPRESENTATIVES FROM:

Office of the Chief of Naval Operations
Bureau of Ships
Bureau of Aeronautics
Office of Naval Research

FORCES AFLOAT REPRESENTATIVES FROM:

Commander in Chief U.S. Atlantic Fleet
Commander in Chief Eastern Atlantic and Mediterranean
Commander Antisubmarine Defense Force, U.S. Atlantic Fleet
Commander Naval Air Force, U.S. Atlantic Fleet
Commander Destroyer Force, U.S. Atlantic Fleet
Commander Submarine Force, U.S. Atlantic Fleet

REC'D. IN DUSW
4 June 59

3. For security reasons, it has been decided to limit the membership of the meeting to the United Kingdom, Canada and the United States. The results of this technical conference and that held previously on the defence of the Straits of Gibraltar will later be considered together for implementation.

The Naval Secretary
Attention: ~~DUSW~~ 4/6

DNPO understand LCdr Jones is HQ Rep - request you take nec. action on para 6. D.K. ... for DUSW 4/6

Referred to Staff
JUN
File No. 8127/-8
Chgd to

Copy to: The Canadian Maritime Commander, Atlantic,
Fleet Mail Office,
Halifax, N.S.

CAFA 511 20

SECRET

DIRECTORATE OF NAVAL PLANS AND OPERATIONS
INTERNAL MINUTE SHEET

FILE:

SUBJECT:

		A	I	Initials and Date
D/DNPO	Parker			
PROJECTS	Berry			
	Lambie			
A & P	Feagan			
OPS	Moore			
SC	Moxley			
	Wiggs			
	Green	[illegible]		
STRAT	Grady			
	Jones	1		[illegible] 26/5
BP	Bird			
DNPO		2		
SEC				

Yes you should go - draft a coordinating letter
J 27/5

DNPO
Request decision whether Canada should be represented. GIUK Study Group will possibly meet early in July 1959. Other two files attached are also pertinent to this.
[illegible] 26/5

MAY 22 1959

4. The Chief of Naval Operations suggests that the group's general directive should be as follows:

"To provide practical long term recommendations for detection, classification, tracking, and localization of the enemy submarines transiting the Greeland-Iceland-United Kingdom line, in peace, at the time of an alert and in war.

"In time of war these facilities, when combined with suitable weapons, should provide the means of destroying enemy submarines.

"In time of peace they should provide positive and accurate means of detection and classification.

"When producing these recommendations, thought should be directed towards fulfilling these requirements in the period 1962-1965.

"Concurrently, recommendations are to be made on suitable combination of presently available forces to achieve the most effective degree of ASW readiness in the event of 'war tomorrow.'"

5. Since the Commander Barrier Forces, Atlantic has been appointed Chairman of this study group, the Chief of Naval Operations deems it appropriate to hold the meetings at his Headquarters, Naval Air Station, Argentia, Newfoundland. The meeting is accordingly scheduled in Argentia for 8-11 July, 1959, with the following general agenda:

FIRST DAY

Introduction and Definition of Threat

Canadian Presentation:	Status of systems and equipments applicable to the general directive of the study group - capability, limitation, feasibility and availability of each. Followed by Canadian proposed solution. X.
UK Presentation:	Status of systems and equipments applicable to the general directive of the study group - capability, limitation, feasibility and availability of each. Followed by UK proposed solution.
US Presentation:	Status of systems and equipments applicable to the general directive of the study group-capability, limitation, feasibility and availability of each. Followed by US proposed solution.

SECOND DAY

Discuss and Organization of Working Groups
Working Group Meetings

THIRD DAY

Formulation of Recommendations
Finalize Recommendations

FOURTH DAY

Additional meeting if required.

.........3/

SECRET

6. The Chief of Naval Operations requests that COMBARLANT be informed prior to 1 July, 1959, of name, rank and security certification of representatives. TOP SECRET clearance is required.

COMMODORE

SECRET

SECRET

NSS 1271-8 (DSS)

NAVAL HEADQUARTERS

MEMORANDUM TO: ~~DNPO~~ ACNS(P)

A/S DEFENCE OF STRAITS

References: (a) NMWS 8100-1 Vol. 3, NMWS 6101-13 to Naval Secretary dated 13 April, 1959

(b) DNPO memo this file dated 5 May, 1959

(c) SA/CNS memo this file dated 11 May, 1959

DSS is in agreement with Naval Member, Washington (Reference (a)) that the Canadian team to the Tripartite meeting on the defence of the Greenland-Iceland-UK straits should be strengthened in rank, if not in number, to include a delegate of Commodore or Captain rank, and it is understood unofficially that this is being done. Whether the Canadian representation comes from CANAVHED or from the staff of CANCOMARLANT does not appear to be important at this stage.

2. With reference to para. 3 of Reference (c) it does not seem necessary to bring this subject before the Area Surveys Policy Committee at this time. If, however, as a result of the forthcoming meeting, it appears desirable that the RCN should become involved in planning or survey operations in connection with the GIUK straits, the matter might be considered by the Committee.

(P. W. Nasmyth)
Director of Scientific Services

OTTAWA
22 May, 1959

SECRET

SECRET

FHS/LMH

NSS 1271-8
NSS 1612-10 ABC 21
(SA/CNS)

NAVAL HEADQUARTERS

MEMORANDUM TO DSS 15 May

DEFENCE OF STRAITS

References: (a) Letter CANCOMARLANT to Naval Secretary, MCACS: 1400-1 dated 23 April, 1959. (on file NSS 1612-10 ABC 21)

(b) Minutes of 19th Meeting of Area Surveys Policy Committee, 9 January, 1958, NSS 6101-13.

(c) Memorandum DNPO to DSS, NSS 1271-8 (STAFF) dated 5 May, 1959.

In reference (a) CANCOMARLANT has suggested re-activation of the old Area Survey Team to consider more actively the defence of Belle Isle Strait. I suggest that, in view of the different Headquarters Directorates interested, this might best be considered at a meeting of the old Area Surveys Policy Committee.

2. In Minute 19-3 of reference (b) the Area Surveys Policy Committee agreed not to hold any further meetings, unless one was called, on the grounds that future activities could be handled either by DUSW or DNPO. The Committee, which had been set up by Naval Board, was however not dissolved and might be a useful forum for looking at present problems on the defence of straits.

3. In reference (c) DNPO has made certain suggestions regarding plans for the defence of Canadian straits and also Canadian participation in the Icelandic Straits Study Group. This subject could, I believe, also be tidied up at a meeting of the Area Surveys Policy Committee.

4. Both of the above matters were discussed with officers of CANCOMARLANT 7 May in Halifax and I have a fairly clear picture of their views.

F. H. Sanders

F. H. Sanders,
Scientific Adviser to the
Chief of the Naval Staff.

O T T A W A
11 May, 1959.

cc: ACNS(P)

SECRET

SECRET

MCACS: 1271-1

Referred to ......Staff......
File No.....1271-8......
Chgd to ~~Staff 20-4~~
DSS 6-5

15 May, 1959.

STUDY GROUPS FOR ANTI-SUBMARINE DEFENCE OF STRAITS AREAS

Reference: (a) NMWS 8100-1 Vol. 3
NMWS 6101-13 dated 13 April, 1959 on 1271-8
(b) CANCOMARLANT's 201455Z February, 1959

Information supplied by reference (a) has been noted with interest. It is now intended that the team from this Command be composed of the following, amending reference (b).

Staff Officer Coastal Defence - LCDR Ellis, RCN
Air Operations Officer - Squadron Leader Hewer, RCAF
Command Scientific Officer - Mr. J. R. Longard, DRB

and one senior officer of CANCOMARLANT staff, probably the Chief of Staff or Deputy Chief of Staff, to be named when the date of the meeting is known.

21-5 ~~DUSO~~ Ret 25/5
DNPO
DSS
L Cdr Jones will attend from Canavhed.

Original signed by
G.H. Davidson
for REAR ADMIRAL
MARITIME COMMANDER ATLANTIC

Naval Member of the Canadian Joint Staff
(Washington),
2450 Massachusetts Avenue, N.W.,
Washington 8 D.C., U.S.A.

REFERENCED LETTER PLACED ON ....1271-8........TD F....
AND PASSED TO....STAFF.....

Copy to: The Naval Secretary.
Chief of The Air Staff.

000233

SECRET

EMJ/BL

SECRET

NSS. 1271-8
(STAFF)

MEMORANDUM TO: ~~DNPO~~ ~~DSS~~ Request your comments on these two files
Separate comment is made on
NSS 1612-10 ABC 21
DSS
20 May 59.

A/S DEFENCE OF STRAITS

This problem of A/S defences of focal transit areas is indeed very great with even more implications than the establishment of the DEW line, and an overall cost that could reach the same order of magnitude of one of the radar lines. If we don't get on the ball in this matter right away, (it is already late) the same chaotic condition will exist that existed in the early days of the establishment of the DEW line and the study groups associated with it.

2. I had not seen the previous correspondence on this, but strongly recommend that Canavhed be represented on the Icelandic Straits Study Group by a planner, an operator, and a researcher.

3. This will greatly assist in the preparation of Canadian plans for the defence of Canadian Straits which are now underway by the Arctic Defence Planning Group. Duplication of effort willbe avoided and an excellent insight into the problems involved will be gained. In addition, we must take the initiative concerning submarine defences in the Canadian Arctic to back up our sovereignty claims in this area which are planned but have not yet been made. If we don't, somebody else will and this might seriously jeopardize Canadian plans for Arctic sovereignty claims.

4. The "active consideration" mentioned in DUSW memorandum is a telephone conversation between himself and LCDR Steel in which it was arranged that CANCOMARLANT would send a message recommending that all representation come from East Coast headed by CDR Boggild.

5. The next file down concerning Belle Isle Strait is apropos to this subject. This situation might have been avoided if the Mapping and Charting Plan had been put to its proper use and implemented. There is no general requirements plan and implementation programme for the submarine defence of Canada; hence the Belle Isle Strait situation.

6. The Arctic Defence Planning Group will include Belle Isle Strait in its deliberations.

E.M. Jones
(E.M. Jones)
LIEUTENANT-COMMANDER, RCN

O T T A W A,

5 May, 1959.

SECRET

H.Q. 1024

NA[illegible] SERVICE—M[illegible]NUTE SHEET

FILE No.

REFERRED TO	REMARKS (WITH SIGNATURE, POSITION AND DATE)
D/Sfe. (Staff)	When circulation completed, please return Med 00707/14 (A/S Defence of the Sts. of Gib.) to DOR(N). We require it for an analysis of post-War A/S Exercises
	J S Vajda DOR(N) 27/8/59
~~D [illegible]~~ [illegible] 23/2/60	

FROM: OFFICE OF SENIOR NAVAL LIAISON OFFICER
(U.K. SERVICES LIAISON STAFF), CANADA
THE ROXBOROUGH, 95 LAURIER AVENUE WEST
OTTAWA, CANADA

S E C R E T - DISCREET but CLEARED FOR CANADA

SNLO(UK) #S.31/59

TO: The Naval Secretary,
Department of National Defence,
Naval Service Headquarters,
Ottawa, Ontario.

File: S1-2-18-11F

SECRET

Date: 7th May, 1959.

A/S DEFENCE OF THE STRAIT OF GIBRALTAR

With reference to the A/S Defence of the Strait of Gibraltar, a survey of wartime experience, post war exercises and trials has now been completed and Copy No. 7 of Med. 007071/14 dated 1st January, 1959, is forwarded herewith for retention.

13-5 DNPO Seen 27/5/59 eoh
DUSW Seen ~~[illegible]~~ atw 07/11
DOR(N) JW 18/2/60

R. G. Dreyer

R. G. Dreyer,
Captain, Royal Navy.

REC'D. IN DUSW
29 May 59

SECRET

Referred to Staff
May 11 1959
File No. S 1271-8
Chgd to Staff 20/11/59

000236

BUT CLEARED FOR CANADA

COPY No. 7
Med. 007071/14.

A/S DEFENCE OF THE STRAIT OF GIBRALTAR

Office of the Commander-in-Chief,
Mediterranean.

1st January, 1959.

BUT CLEARED FOR CANADA

RECEIVED
20 MAR 1959
S.M.L.O.
OTTAWA

A/S DEFENCE OF THE STRAIT OF GIBRALTAR

This survey of past experience obtained in the anti-submarine defence of the Strait of Gibrlatar has been split into the following sections:-

Part 1 - Survey of Wartime Results.

Part 2 - An Analysis of Post-War Exercises.

Part 3 - Evaluation of A/S Equipment on Location

Part 4 - Comparison of Results obtained in War, Post-War Exercises and Evaluation Trials.

SECRET/DISCRET

A/S DEFENCE OF THE STRAIT OF GIBRALTAR

PART 1 - SURVEY OF WARTIME RESULTS

INTRODUCTION

During the 1939-45 war Italian submarines transitted the Strait of Gibraltar in both directions in the course of participating in the Battle of the Atlantic.. German U-boats were sent through the strait into the Mediterranean maintaining a sizeable force there. To put this picture into perspective it is convenient to summarize for the period of the war the number of transits involved and the successes achieved by the defences which consisted of ships and aircraft.

TABLE 1 - SUBMARINE TRANSITS OF THE STRAIT, 1940-44

(a) Italian

Number of transits westbound	31	
Number of transits eastbound	13	
Number of detections by defences	0	

(b) German

Number of transits attempted	79	(all eastbound)
Number of transits achieved	62	
Number of transits abandonned	8	(6 were damaged)
Number of detections by defences	16	(9 sunk, 6 damaged and turned back, 1 continued transit)

2. The pattern of events during these war years can be seen to fall into a number of distinct phases which have been well described in Reference 1 from which most of the following information is taken.

SHORT HISTORY OF EVENTS

3. The first phase may be considered to extend from 8th June, 1940 to the end of November, 1941. Initially the immediate defence of the Strait consisted of a small force of A/S trawlers (occasionally destroyers of Force H were available) and a squadron of London flying boats of which on average about six were serviceable at any one time. The latter attempted to maintain patrols up to 150 miles east of Gibraltar. At the end of 1940 the air patrols were reinforced by 3 R.A.F. Swordfish floatplanes and during the same winter, 1940/41, six Naval Swordfish aircraft operated as well. None of the aircraft had A.S.V. capable of detecting U-boats.

4. Transitting submarines made the passage of the narrows at high speed on the surface at night, the outer patrols forcing them to remain submerged until sufficiently close in. During the above period 43 Italian submarines (30 westbound, 13 eastbound) and 14 German U-boats (all eastbound) made the transit and none were detected.

5. In November 1941 the R.A.F. reinforced its squadrons at Gibraltar with 3 Sunderland flying boats and 6 Hudsons while for the period 27th November, 1941 to 26th January, 1942 Swordfish aircraft (from H.M.S. ARK ROYAL) fitted with A.S.V. Mark II were also used. The R.A.F. aircraft either had no radar suitable for night use or if they had no means of illuminating a night contact. However the extension of the R.A.F. patrols forced the U-boats to submerge by day and attempt the Strait passage at night on the surface when the Swordfish were operating.

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6. As a result during the two month period of Swordfish patrols 6 of the 21 U-boats attempting transits were detected, all at night. One U-boat was sunk and the other 5 were damaged and forced to turn back. These results persuaded the U-boat command that the transit was becoming too hazardous, the submarines having no efficient radar-detecting device. The medium U-boat, the type concerned, found its battery heavily strained if forced to submerge for even short distances if caught in adverse underwater currents in the vicinity of the Strait. (Larger U-boats were considered too vulnerable to A/S attack and too valuable for use in the Mediterranean).

7. At the end of 1941, a Type 271 Radar set was erected on Europa Point but this did not result in the interception of any U-boats.

8. Attempts to enter the Mediterranean were resumed in October 1942 and from then until January 1943 15 German U-boats made the passage without detection. In addition an Italian submarine made an undetected transit westbound. These successes would seem attributable to the fact that since October the German U-boats had been equipped with the Metox radar search receiver. Generally, unless continuous aircraft radar was observed, the passage through the narrows was made on the surface.

9. During the earlier part of this period the patrol aircraft consisted of R.A.F. flying boats and Hudsons, which were effective only by day, and one naval Swordfish and one Walrus squadron. However, from the end of 1942 the R.A.F. Wellington aircraft equipped with Leigh Light, A.S.V. and lethal depth charges formed part of the patrol.

10. The U-boats could counter this defence with their search receivers and between April and June 1943 7 more transits were attempted. Five got through undetected but two were sighted by day on the surface by distant air patrols and sunk.

11. Then in September 1943 the Wellingtons with Leigh Lights were fitted with centimetric radar which the U-boats could not detect. Of two attempted transits in September both were detected by these air patrols at night, one being attacked but managing to get through, the other being so damaged as to be forced back. The latter was subsequently damaged again by a day air patrol. As a result of this two U-boats still attempting to get through were recalled, while the intended sailings of three more were cancelled.

12. The next countermove came from the German side with the fitting of the Naxos search receiver which was capable of detecting centimetic radar; this was from October 1943 onwards. In addition the U-boats had now improved underwater endurance which enabled them to make the Strait submerged. As a result between December 1943 and mid-February 1944 7 U-boats made the transit undetected, remaining submerged through the narrows. However there was an intervening period October/November when the Straits patrols were especially strengthened on the basis of intelligence reports and in the course of 5 attempted transits only two got through undetected. One was detected at night and sunk by a Leigh Light Wellington, one was destroyed by the Strait surface patrol after detection by a convoy escort and a third was sunk in the Strait by Leigh Light Wellington and surface vessels.

13. The final phase from mid-February to May 1944 was dominated by the arrival of a U.S.N. Catalina squadron fitted with magnetic airborne detection equipment (M.A.D.). In this period 8 U-boats attempted transits but only 4 got through. Three of the others were detected by M.A.D. aircraft and destroyed as a result of joint action by aircraft and surface ships. The other U-boat gave up the attempt after spending twelve days off the Strait, and returned to base. After this no more U-boats were ordered through the Strait.

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14. During this phase the U-boats planned their passage so as to transit the narrows submerged at night. It was while they were engaged in the submerged daylight approach at shallow depth to avoid the strong westward current below 100 - 150 feet that the M.A.D. aircraft were able to detect them.

Other Planned Transits

15. Post war intelligence has indicated that altogether the Germans ordered 95 U-boats to undertake the passage of the Strait into the Mediterranean. Of these only 79 U-boats actually reached a position of attempting the transit.

16. Of the other 16, 2 were attacked by aircraft soon after leaving their Biscay bases and one of these was sunk and the other so damaged as to force it to return to base. Another U-boat never reached the Strait as it was sunk by a convoy escort when still well to the west. Seven had to return to base with various defects before getting near to the Strait. One on its way to the Strait sank as a result of a collision with another U-boat. And, as already mentioned in paragraph 11, during a period of success by the defences the U-boat command recalled 2 attempting the passage and cancelled the sailings of 3 others.

17. The available records do not indicate whether, and if so how many, Italian submarines ordered through the Strait did not for various reasons reach that area.

Summary of Submarine Transits and Losses

18. The sequence of events recorded above has been tabulated briefly in Table 2. In sum, between June 1940 and May 1944, of the 123 attempted transits (92 Eastbound, 31 Westbound) 106 were successful (75 Eastbound, 31 Westbound). Of the remainder 9 were sunk and 8 submarines abandonned the attempt, 6 of these having suffered damage while the other 2 were forced to give up the attempt in the face of the defences.

ACHIEVEMENTS OF THE DEFENCE

Periods of Success

19. It will be clear from the above record that, as has been well pointed out in Reference 1, there were four distinct periods when the defence became the master of the situation forcing the U-boat command to give up further transit attempts, at least temporarily. The first period, November, 1941 - January 1942, coincided with the introduction of night air patrols having suitable A.S.V. to detect submarines; subsequently the Germans introduced a suitable search receiver to counter this. The second period, September 1943 arose when the night air patrols were fitted with centimetric radar which the U-boats could not detect; later the Germans fitted the Naxos search receiver. In the next period, October-November. 1943, the defence was especially strengthened on the basis of intelligence reports of a number of U-boats intending to make the passage. The final period was February - May 1944 when the M.A.D. aircraft were introduced; the Germans did not develop a counter move to this.

Achievements of Different Methods of Detection

20. It is apparent that the records available do not include the number of possible, or confirmed, detections made which did not subsequently lead to a sunk on a damaged submarine. Such will be particularly pertinent to ship asdic detections in that the U-boat experience was that even if contacted by asdic the water conditions were such that contact was often lost before accurate attacks could be made.

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21. Perforce ignoring the possibility of such other detections, we may summarize the results obtained (described above in paragraphs 3 - 13) for the various forms of detection as follows:-

TABLE 3 - CLASSIFICATION OF DETECTIONS

MODE OF DETECTION	AREA OF DETECTION		TOTALS
	APPROACHES	NARROWS	
Aircraft - Visual	2	-	2
Radar	1*	6 *	9
M.A.D.	-	3	3
Total by Aircraft	3*	9*	14
Ships	-	1	1
Indeterminate (Recorded as joint action by ships and aircraft)	-	1	1
Totals	3*	11*	16

* There are in addition two other radar detections the area concerned being uncertain.

For present purposes the narrows have been defined as the area of water between 5° 20' W and 5° 55' W, the approaches being rather indeterminate areas beyond the narrows that were patrolled by aircraft operating from Gibraltar.

22. The various types of aircraft involved have been noted in previous paragraphs but the records to hand do not provide any indication of the overall amount of flying that was undertaken. Aircraft carried out patrols obviously over both narrows and the approaches. In the early stages the distant area searches were carried out only to the east, extending as far as 150 miles from Gibraltar. Later on the patrols were also undertaken in the west approaches, and it was to the west that all the distant air detections took place, that is on submarines that were approaching the narrows. The M.A.D. aircraft were employed normally on day patrol in the west part of the narrows between Camarinal Point and Malabata Point, a leg of 16 miles, particular attention being paid to water deeper than 100 fathoms, the width involved being about 4½ miles. On the occasion of one M.A.D. detection this normal patrol line of two aircraft was supplemented by a second patrol line off Gibraltar as a result of a U-boat being sighted to the westward by aircraft on the previous two days (these visual detections are not included in Table 3, vide paragraph 20).

23. Surface patrols were carried out by A/S trawlers and on occasions by destroyers and it appears that these were undertaken either in or near to the narrows; there is no mention of ships operating further afield. Here again the numbers of ships concerned and their amount of sea time is not recorded.

Damage to and Sinking of Submarines

24. Subsequent to the detections noted above the defence forces either inflicted damage or sank the submarines concerned. The following table classifies these results by the force involved:-

/TABLE 4 ....

TABLE 4 - RESULTS OF ATTACKS BY SHIPS AND AIRCRAFT

FORCES INVOLVED	U-BOATS DAMAGED	U-BOATS SUNK
Aircraft	6	4
Ships	-	3
Indeterminate (Recorded as joint action aircraft-ships)	-	2
Totals	6	9

In the case of the U-boats sunk by joint action, it seems highly likely that the surface units provided the final coup-de-grace. Thus in total it might be said that ultimately aircraft were responsible for preventing 10 transits and ships for 5 transits, after the initial detections had been followed up.

Relative Effectiveness of Ships and Aircraft

25. With no data on the extent to which ships and aircraft were employed in the defence of the Strait it is not possible to put figures to their relative effectiveness in either gaining detections of submarines or inflicting damage on them. In every case except one (or possibly two) aircraft were responsible for first detections which subsequently led to damage or destruction. However this is only to be expected as the aircraft employing visual or radar detection has a much higher search rate than a ship employing asdic detection bearing in mind the probable distribution of forces.

26. On the other hand surface ships gained in importance in the subsequent attack phase, probably being the dominant partner in the achieving of kills.

CONCLUSIONS

27. In the early stages of the war up to November 1941 57 submarines transitted the Strait before any successes were achieved by defences.

28. Subsequently the defences which consisted of aircraft and ship patrols attained a fair degree of control of the Strait during four distinct periods. Three of these can be directly attributed to the introduction of new detection equipment in aircraft, two being radar and the third magnetic airborne detection equipment. After the introduction of metric and later centimetic radar the Germans abandonned further transits until their U-boats were fitted with appropriate search receivers. After the introduction of M.A.D. they attempted no further transits. The other period of success by the defence, an intervening one, arose from the special strengthening of the patrols on the basis of intelligence reports of the approach.

29. Thus from November 1941 to May 1944, out of 66 attempted transits, 17 were prevented by the defences in various ways.

/References ....

References

1. Naval Staff History Second World War: The Defeat of the Enemy Attack on Shipping 1939-45, Volume 1. (Advance Proof Copy, 1952). Historical Section Admiralty.

2. Anti-Submarine Defence of the Straits of Gibraltar: Appendix E Notes on Wartime M.A.D. Achievements. COMEDSOUEAST 29th March 1956.

TABLE 2: SUMMARY OF WARTIME SUBMARINE TRANSITS AND LOSSES

PERIOD	DEVELOPMENTS IN DEFENCE FORCES	NO. OF ATTEMPTED SUBMARINE TRANSITS	NO. OF SUCCESSFUL TRANSITS	DETECTIONS AND FORCE INVOLVED	SUCCESSES OF THE DEFENCE
8 June 1940 - 26th Nov. 1941	A/S Trawlers 6 (Serviceable) London Flying boats 3-9 Swordfish	13 Italian) Eastbound 14 German) 30 Italian Westbound	57	None	None
27th Nov. 1941 - 26th Jan. 1942	Additionally 3 Sunderlands 6 Hudsons for day patrols and Swordfish (ASV Mk.II) for night patrols	21 German Eastbound	14	6 by ASV Swordfish in the narrows at night	1 S/M sunk and 5 S/Ms. damaged and sent back by Swordfish 1 S/M gave up attempt.
Sept. 1942 - Jan. 1943	No A.S.V.II Swordfish Additionally, Walrus Squadron	1 Italian Westbound 15 German Eastbound	16	None	None
April-June 1943	From end of 1942, additionally Wellingtons with Leigh Lights, ASV and depth charges	7 German Eastbound	5	2 by Day Air Patrols in the Approaches	2 S/M sunk by aircraft
Sept. 1943	Wellingtons fitted with cm Radar	2 German Eastbound	1	2 by Wellingtons at night	1 S/M damaged and sent back
23 Oct. 1943 - 2 Nov. 1943	Patrols specially strengthened	5 German Eastbound	2	1 by Wellington at night 1 convoy escort 1 Wellington/surface patrol	1 S/M sunk by aircraft 1 S/M sunk by ships in narrows 1 S/M sunk by aircraft/ship action
Dec 1943 - Mid Feb. 1944		7 German Eastbound	7	None	None
Mid Feb. 1944 - May 1944	Catalina Squadron with M.A.D.	8 German Eastbound	4	3 by M.A.D. aircraft in narrows	2 S/M sunk by ships 1 S/M sunk by aircraft/ship action 1 S/M gave up attempt.

A/S DEFENCE OF THE STRAIT OF GIBRALTAR

PART 2 - AN ANALYSIS OF POST-WAR EXERCISES

INTRODUCTION

There have been six post-war exercises held between 1951 and 1957, involving the defence of the Strait of Gibraltar against transitting submarines. The general features of these exercises and the results obtained are presented briefly in Table 1 while further details are given in Appendix A.

GENERAL DESCRIPTION AND FORCES INVOLVED

2. In the various exercises the submarines have transitted the Strait in both directions to a variety of different plans. They traversed the narrows at depths varying from periscope depth down to 400 ft., while in all cases they found it necessary to snort for some period in the Approaches, on the way in to the Narrows and/or after passing through them. In some cases two or even three submarines were transitting the Strait at about the same time.

3. In some exercises the territorial waters on either side of the Strait were respected while in other exercises they were used. In the former case the width of the channel to be defended is reduced to 1·7 miles at its narrowest while in the latter case the width is about 8 miles

4. The defending forces have varied considerably in makeup and in the way that they were employed. Destroyers/frigates were normally kept to the Narrows operating generally in patrol groups but sometimes singly. Aircraft invariably carried out reconnaissance patrols in the Approaches, the areas varying in extent sometimes stretching as far as 8°W in the west and to 2° 20' W in the east. In addition in some exercises aircraft equipped with M.A.D. were employed as a barrier patrol across the narrows. Helicopters with dipping asdics and M.F.V.s using sonobuoy equipment have also operated in the narrows. On one occasion a submarine was employed in an SSK in an area in the Approaches while in another exercise a submarine was used purely as a passive listening platform.

DETECTIONS ACHIEVED

5. The overall result from all these exercises may be summarised as follows:-

Number of submarine transits	34	
Number of transits detected	19	
Estimated number of "kills"	11	(9 by ships (2 by aircraft

In addition to the "kills" given, a few more detections made by aircraft may have lead to kills but the probability could not be assessed. Somewhat more than half of the transits were made in the eastward direction.

6. Perhaps of more significance is the overall number of detections achieved, some submarines being detected several times by independent forces during a single transit. A submarine having been detected or killed normally continued its transit. However in one or two isolated cases the submarine was hunted to exhaustion, that is its battery was used up; it then had to complete its transit on the surface in an out-of-action status. Apart from such cases it may be said that the different defending forces, for instance the aircraft patrolling the approaches and the ships in the narrows, were given equal opportunities of gaining an initial detection.

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7. Where a combination of forces has been involved in a particular incident, with one force gaining the first contact and bringing in another, any follow-up detection achieved by the latter has been separately noted in Table 1 to differentiate from the initial detections.

8. The form of the initial detection and the location thereof may be summarized for all the exercises as follows:-

TABLE 2 - SUMMARY OF INITIAL DETECTIONS

Location / Mode of Detection	Approaches	Narrows	Total
Aircraft - Visual	14(10)*	1	
Radar	4	-	
E.C.M.	1	-	
M.A.D.	-	5	
Total - Aircraft	19	6	25
Helicopter - Dipping Asdic	-	1	1
Destroyer/Frigate Asdic	2	6	8
M.F.V.s with sonobuoys	-	2	2
Submarines	-	-	0
Shore based E.C.M.	-	1	1
Totals	21	16	37

*Figure in brackets denotes number of transits detected; four submarines were detected twice each by visual means.

For the purpose of simple classification of location the Narrows have been taken arbitrarily to extend between the longitudes of Cape Spartel 5° 55' W and of Gibraltar 5° 20' W. The term Approaches covers all areas outside these narrows which have been used in the exercises. During one exercise a ship carried out E.C.M. searching but no success was achieved.

EXERCISE FACTORS AFFECTING DETECTION

9. Before studying the effectiveness of the various defence forces employed it is necessary to note a number of significant factors which must be borne in mind as having affected the performance of the various types of A/S equipment.

Direction of Transit

10. Of the 34 transits carried out 20 were eastward bound and 14 westbound.

/11. ....

11. The direction of transit could have an influence on the depth at which a submarine is taken through the narrows. The general pattern of currents in the Strait is made up of an eastward-going surface current below which there is a slower westward current. The magnitude of these varies with the time of year and there are superimposed other effects due to wind and tide. Density conditions are also important. There is thus an advantage in undertaking eastward transits at depths generally less than 300 ft. whereas westbound transits gain by using somewhat greater depths.

12. In practice there was no consistency about the depths employed; for instance on westbound transits nearly all submarines spent some time at periscope depth or snorting while at least two went through at periscope depth all the way.

13. The depths of transit could influence the performance of asdic equipment in the narrows and of M.A.D. also used there. This is discussed below.

14. There is also a question of intelligence. On a number of occasions the defence was aware of the direction from which the initial threat was coming; and subsequently in the course of an exercise after obtaining some detections it was possible to estimate which side the submarines lay, when they had to undertake several transits. This influenced the disposition of the air reconnaissance with a bias to the side of the threat. However there is no reason why this should have affected the number of detections made. It could however have an effect on the number of kills obtained. For an aircraft detecting a submarine on the way to the narrows could call up support from ships there, but a detection gained on a submarine at the end of its transit could not be followed up.

The need for Snorting

15. The submarines were all of a conventional type which could not complete a fully submerged transit through the Approaches and the Narrows, and they found it necessary to carry out some periods of snorting. Although snorting was carried out by one or two submarines for short periods in the narrows, the main area for it was in the Approaches. No record is available for the total number of hours spent snorting during these exercises. However a comment given on the exercise MEDFLEX DRAGON was that the submarines spent more time snorting than might have been expected.

16. This of course gave an opportunity for patrol aircraft to detect submarines visually or by radar. Regarding the submarines' opportunity to avoid detection by radar it should be noted that only 7 (20% of the total) of the transits were undertaken by submarines having the appropriate search receivers. On the aspect of visual detection the submarines were criticized in one exercise for not keeping adequate periscope lookout to avoid it.

Weather

17. The weather was commented upon in 5 out of the 6 exercises. In three of them it was reported as being good throughout. Good visibility and calm seas aided aircraft detections either by visual or radar means. In MEDFLEX EPIC the weather ruled out flying operations for less than 15% of the exercise period, but was otherwise satisfactory. In STRAITS ONE the weather deteriorated half way through.

/Asdics Conditions ....

Asdic Conditions

18. It will be noted that the period of the year when five out of the six exercises were carried out was between the beginning of February and the middle of May. This is considered to be much the best time of year from the point of view of asdic conditions in the area, and so ships, defending submarines and M.F.V.s using sonobuoys all benefited. On the other hand transitting submarines might have a slightly better opportunity for picking up surface ships and so to evade them, but they would not gain to the same extent as the ships with active asdic.

19. One exercise, STRAITS TWO, was carried out in August/September, which is a bad period for asdic conditions. This was the only occasion on which helicopters using dipping asdic were employed but this equipment might not suffer to quite the same extent as shipborne asdics.

ACHIEVEMENTS OF THE DIFFERENT FORMS OF A/S DETECTION

Air Patrols over the Approaches

20. From some points of view it is convenient in the present context to classify together the visual and radar detections by aircraft on patrol in the Approach areas. To some extent they are complementary and quite often the aircraft on these patrols relied on visual search in daylight and radar at night but it is not possible to estimate how many flying hours were spent on each.

21. Flying hours are recorded for some exercises as the total number flown and in others for "on task" time only; this difference will not be of significance here. Unfortunately the hours flown in STRAITS ONE and GIBORFLEX are not available so it has been necessary to assume a reasonable utilization of the aircraft available. The following table presents the hours flown and the number of detections made during the various exercises.

TABLE 3 - VISUAL AND RADAR DETECTIONS BY AIRCRAFT

EXERCISE	A/C HOURS FLOWN	NO. OF DETECTIONS	DETECTIONS PER 1000 HOURS	HOURS FLOWN PER DAY	DETECTIONS PER TRANSIT
MEDFLEX ABLE	730	10(8)*	14	91	1.00
GIBORFLEX	((100))	0	0	((50))	0
STRAITS TWO	524	3	6	50	0.50
MEDFLEX DRAGON	426	5(3)*	12	66	0.7
MEDFLEX EPIC	288	1	3	44	0.25
	2068	19(15)*			

*Figure in brackets () indicates number of transits detected where this differs from number of detections.

Thus in total there were 19 detections achieved through about 2100 hours flying, i.e. 1 detection per 110 hours. As will be seen from the above table there is a considerable variation in the frequency of detection, but this is only to be expected.

/22 ....

22. A more valid comparison between exercises is the number of detections made divided by the number of submarine transits compared to the flying intensity, say the hours flown per day. Figure 1 is a plot of the results on this basis. It is seen that three of the five points lie closely to a straight line through the origin. Of the others, one refers to one detection only, and the remaining one to one transit only, and these may therefore be reasonably ignored as being inadequate samples.

23. Due to the particular plan under which transits were undertaken in STRAITS ONE no comparative result from this exercise can be given. The submarines spent considerable periods in the eastern approaches endeavouring to attack a Task Group and on average they operated for about $5\frac{1}{2}$ days each; this is nearly twice as long as required for a normal transit through the particular area concerned. Aircraft therefore did not have their usual opportunity of detecting submarines in transit. It is noted however in Appendix A that aircraft made 6 detections (visual and radar) on the 7 submarines operating, the planned intensity of flying being 72 hours per day.

24. The general trend of the curve is to be expected. The submarines have to snort for more or less a fixed proportion of their time on their way through the approaches in order to have a satisfactory battery condition when transitting the narrows. The greater the frequency at which aircraft cover the approach areas the greater will be the probability of a transitting submarine being detected. The general smoothness of the curve must however be considered fortuitous considering the small number of detections and transits involved and the variation of conditions between exercises; different types of aircraft have different capabilities as regards visual and radar detection of snorts and periscopes. These performance figures which vary with sea state are known and are of course not affected by conditions in the Strait.

25. Making assumptions about aircraft speeds, visual sweep widths, and typical search areas in the appraoches together with a submarine speed and the proportion of the time that must be spent snorting a theoretical detection rate depending on flying intensity may be derived. A note on this is given in Appendix B. If every part of the area is swept at least once per hour, a frequency which it is often assumed would preclude snorting if the submarine wished to take avoiding action on every occasion, then a submarine having to snort for say 4 hours per day would be detected on average 12 times during one transit with the aircraft flying 1030 hours per day. With no evasion on the part of the submarine at lower flying intensities the detection rate would vary in direct proportion with that intensity. This is given as the dashed line in Figure 1. Variations in the numerical figures put to the assumptions would vary the slope of this curve except that the extent of the Approach areas to be swept has little effect. Therefore the closeness of the exercise points to the theoretical curve is not significant and of course some of the detections were made by radar, possibly at night. However the general trend of the field results with increasing flying intensity conforms with the theoretical argument and it would seem safe to predict how the detection rate would be increased with more flying, if only rather roughly.

26. Considering instead the number of different transits detected, as opposed to the total number of detections, it is seen from Table 2 that in total 15 were obtained either visually or by radar against 28 transits undertaken. This corresponds to one transit detected per 140 hours flying.

27. Although there are no grounds here for comparing the two forms of detection it should here be mentioned again that radar accounted for four detections against fourteen visual. The significant point is that only one of the radar detections was achieved against a submarine fitted with an appropriate search receiver. This submarine which was surfaced by night (it had previously been seen snorting by day) was obliged by exercise orders to cross the SSK area in a given time; both these detections may be unrealistic. Therefore against submarines fitted with SH/F D/F and prepared to take avoiding action to preclude radar detection the detection rate achieved in these exercises may be down by perhaps 20 - 25%.

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ECM - Aircraft, Ship or Shore-based

28. There was only one detection by aircraft ECM, and this was on a submarine which transmitted as it was getting close to the narrows. No records are available on the extent to which submarines used their radar nor the amount of time that aircraft kept a watch on such transmissions. It can only be deduced that ECM can offer merely a bonus on detections by aircraft patrolling the approaches.

29. No deductions may be made about shipborne equipment, UA-1, which was used by one ship in one exercise without success.

30. One detection by the Gibraltar search receiver led to a patrol group discovering the submarine in the narrows on the surface showing navigation lights. It is questionable whether the submarine was being too helpful on purpose. One other intercept was obtained during the same exercise. It is considered that such interceptions are not typical of a wartime situation and that should an enemy submarine resort to radar in the vicinity of the Strait the transmissions would be directed away from Gibraltar where the existence of a search receiver might be suspected.

31. The only other point to be made is that the range capabilities of ECM intercept equipment are known and of course are not affected by the location under discussion.

Magnetic Airborne Detection

32. The results obtained from the two exercises in which M.A.D. aircraft were employed on a barrier patrol across the narrows were as follows:-

TABLE 4 - M.A.D. DETECTIONS

EXERCISE	NO. OF S/M TRANSITS	NO. OF DETECTIONS
MEDFLEX ABLE	10	5 (2 detections on same Submarine.)
MEDFLEX DRAGON	7	0 (6 transits while a/c on patrol)

The remarkable difference in M.A.D. achievements can be accounted for by the different conditions prevailing in the two exercises.

33. In MEDFLEX ABLE about 8 aircraft were available to patrol a 1.7 mile barrier; territorial waters were being respected. It appears also that all the submarines transitted the narrows at depths of 120 ft. or less, and the detections were achieved on submarines at depths between periscope depth and 120 ft. Under such conditions it is shewn in Appendix C that, assuming typical submarine speeds and widths of M.A.D. swept paths, a probability of detection per transit of 50% by a single aircraft on patrol is quite a reasonable one.

34. On the other hand in MEDFLEX DRAGON only 4 aircraft were available to carry out a M.A.D. patrol along a 12 mile line between Gibraltar and Ceuta; territorial waters were being used in this exercise. In view of the shortage of aircraft the period of patrols was arranged to cover the most likely times of submarine transit and this was managed on six transits out of seven. The depths of the submarines on crossing the patrol line varied between periscope depth and 400 ft. so that the expected sweep width was not more than 200 yards, with the equipment being fairly new to the aircrews. Under these conditions the probability of detection by a single aircraft on patrol is perhaps 20%,

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so that on average only one detection could have been expected during MEDFLEX DRAGON (see Appendix C).

35. Assuming an attainable sweep of 300 yards, which corresponds to a vertical separation of not more than 600 ft. between aircraft and submarine, it is estimated that to provide a 12 mile barrier with a 50% probability of detection would require 2 aircraft continuously on patrol. In other words a force of perhaps 12 aircraft.

36. M.A.D. also made contact on two occasions with submarines which had been previously detected by other means, one visually and one by aircraft radar. It has been suggested that this could be its more useful role than providing a barrier. However little can be deduced from these results as it is not known on how many occasions such M.A.D. follow-up was attempted.

Destroyer/Frigate Patrols in the Narrows

37. The following table summarizes the detections achieved by ships' asdics during the patrols in the narrows and closely adjacent areas:-

TABLE 5 - ASDIC DETECTIONS

EXERCISE	TOTAL NO. OF SHIPS	NO. OF S/M TRANSITS	NO. OF DETECTIONS
STRAITS ONE	7	6	1
MEDFLEX ABLE	5/2	5/5	4/0
GIBORFLEX	6	1	0
STRAITS TWO	0/3	3/3	0/0
MEDFLEX DRAGON	5	7	2
MEDFLEX EPIC	5	4	1
			8

N.B. Where there are two figures this denotes two phases of an exercise.

38. Exercise reports occasionally recorded the number of ships on patrol at any one time while estimates of this have had to be made in other cases. By so doing it has been estimated that the total period that ships spent steaming during the course of these exercises was 3800 ship hours approximately; it is considered that this figure is not in error by more than 10%. It must be noted that there is a considerable variation in achievement with no apparent correlation between exercises even allowing for the fact that in three of the exercises ships had the simpler task of defending a narrower channel when territorial waters were being respected. However the total number of detections is after all very small and so it is necessary to consider just the overall achievements of the ships. Ships detected six submarines in the narrows - in accordance with the definition of "the Narrows" in this paper - and two others just outside, one 8 miles from the western "limit" and the other 15 miles from the eastern "limit". Thus ships detected by asdic one submarine for about every 450-500 hours spent on patrol. This figure has no absolute significance, depending for instance on the frequency of submarine transits, but it is useful when comparing the performance with other forms of A/S detection against the same submarine "threat".

39. It may be questioned whether this figure of steaming hours per detection is a fair criterion since, although ships occasionally operated singly, they generally patrolled in groups. Ships in consort would some of the time be sweeping the same volume of water and therefore the overall probability of detection in a random sweep in the absence of evasion by the submarine would be lower than if they operated separately. On the other

/hand ....

hand a pair of ships, possibly operating a barrier patrol in the confined water of the Strait has probably more than double the chance of detection of one ship since the submarine has a much more difficult problem of evasion. It is appreciated that ships operate in groups from the advantage gained in the attack phase but this would not seem to offer a penalty as regards the rate of detection per ship patrol hour.

40. However, results do not enable any comparison to be made on the relative effectiveness of ships operating either singly or in groups in the Narrows.

41. It has already been mentioned in a previous section that all but one of the exercises were carried out during a period in the year (of four months) when asdic conditions are good. While the other exercise STRAITS TWO was in August/September, only in Phase III of it were any surface ships employed - and they gained no detections.

42. The actual ranges of detection that were achieved are not available but on one occasion tracking was reported at 2300 yards in the Narrows, a much higher figure than is often the case there. Of the submarine depths involved in these detections at least three were at periscope depth and two more were at 100 ft. or less, one was recorded as, vaguely, deep, while in two cases the depths are not available. These results are inadequate to form a judgement on the performance of hull-mounted asdics as regards depth of target. It may be that depth is not a critical factor during the spring months, whereas with temperature gradients at other times of the year it certainly can be.

43. The conclusion must therefore be drawn that the results obtained of 8 detections from 34 transits cannot be regarded as typical round-the-year averages and may in fact be very optimistic.

44. In STRAITS TWO the ships patrolled out as far as 6° 40' W, while in some other exercises ships did on occasion carry out searches beyond the narrows. However no comparison is possible of the relative value of surface ships in the approaches and in the narrows.

Helicopter Dipping Asdic

45. Only in STRAITS TWO were helicopters employed and just one initial detection was achieved from a search in the Narrows, so no conclusions can be drawn on their use. However it should be noted that this was at a difficult time of year for hull-mounted asdics, and the detection was at a range of 1100 yards on a submarine at 250 ft. During another incident, following an aircraft sighting a helicopter gained contact at 430 yards on a submarine which was then at 200 ft. depth. On no other occasion did a submarine pass within 1000 yards of a helicopter.

M.F.V.s using Sonobuoys

46. M.F.V.s using sonobuoys had varying success as indicated in the following table:-

TABLE 6 - M.F.V. SONOBUOY DETECTIONS

EXERCISE	M.F.V. PATROL	OPPORTUNITIES FOR DETECTING TRANSITS	DETECTIONS MADE
STRAITS TWO	2 BY DAY OFF GIBRALTAR	4(?)	0
MEDFLEX DRAGON	2 BY DAY OFF TARIFA	3	2
MEDFLEX EPIC	2 DAY & NIGHT IN NARROWS	2	0

/47. ....

47. In the report on STRAITS TWO it was noted that the M.F.V.s had considerable classification troubles and it was doubted whether the use of non-directional sonobuoys was a useful supplement to defence of the Strait. However in MEDFLEX DRAGON, again using non-directional sonobuoys M.F.V.s gained two detections out of three transits that took place during their patrol. In MEDFLEX EPIC on the other hand directional sonobuoys were employed but on the two occasions that detections might have been made the submarines were proceeding at a silent speed.

48. No firm judgement can be made with so few results and it can merely be said this type of defence at least showed promise.

A/S Submarines

49. Here again experience is too limited - and somewhat unrealistic - to form any definite opinions on the value of A/S Submarines. In MEDFLEX ABLE the defending submarine operated as a listening post in an area to the N.W. of the narrows prohibited to both sides and gained only one H.E. bearing, and this was but a doubtful contact. In MEDFLEX DRAGON the SSK was given a haven about 50 miles square in the Western Approaches. Conditions were unrealistic in that the transitting submarines had to know of her presence and were obliged either to snort (and cavitate) or to go deep through her area. She gained only two contacts and these were after having been alerted by her co-operating aircraft who had seen snorts. Ranges of these contacts are noted in Appendix A as are the closest distances that the other transitting submarines came to the SSK without being detected.

Differences from Wartime Conditions

50. Mention has already been made of a few situations which were not a realistic simulation of wartime conditions and may therefore have affected the efficacy of various forms of A/S detection. For instance one submarine was detected once when snorting by day and subsequently when on the surface at night when she was obliged by exercise conditions to traverse a particular area in a given time; in the absence of this requirement it is not possible to predict whether she would still have found it necessary to snort and so be detected. On another occasion a submarine was found in the Narrows on the surface burning navigation lights.

51. Exercise reports have also commented on the presence of large numbers of fishing vessels in the area which complicated the task of aircraft radar search and caused the wastage of time in the investigation of large numbers of contacts. In wartime the situation would probably be very different.

52. Comment was made earlier that in some cases "intelligence" was available to the defence of the direction of the probable threat and air patrols, in particular, were planned accordingly - not always successfully timed however. Similar intelligence may sometimes be available in wartime.

53. On the other side the transitting submarines knew of the existence and the approximate whereabouts of an A/S submarine which was opposing them.

54. These are all intangible factors so it is not possible to say to what extent they influenced the results obtained, but it is probably only to a minor extent.

COMPARISON OF DIFFERENT FORMS OF A/S DETECTION

55. The only forms of A/S detection which were employed to a sufficient extent to justify any comparison being made were the reconnaissance air patrols in the approaches, the aircraft M.A.D. barrier patrol across the Narrows, and the ship patrols in the narrows and adjacent waters. It will have been noted

/that the.........

that the intensity of operation of ships and aircraft varied considerably from exercise to exercise, but in the preceding paragraphs some attempt has been made to explain the variation in results achieved and to derive a figure of performance.

Reconnaissance Patrols v M.A.D. Barrier Patrol

56. Using visual, radar and E.C.M. means, reconnaissance patrols in the approaches gained 20 detections - 16 different transits, 4 submarines between detected twice each. This amounted to one detection per 110 hours flying, or one transit detected per 140 hours flying. It was estimated that if the transitting submarines maintained the same proportion of time snorting as shown in these exercises then maintaining an intensity of 60-70 flying hours per day there would be a 50% probability of detecting any transit.

57. On the other hand it was estimated that, assuming a sweep width of 300 yards, an intensity of 50 hours per day by M.A.D. aircraft was needed to provide a 12 mile barrier with a 50% probability of detecting each transit.

58. Thus it appears from a detection point of view aircraft on a M.A.D. barrier patrol are somewhat more effective than aircraft on area searches if both operate at a rate of 50 hours per day.

Reconnaissance Air Patrols v Ships in the Narrows

59. It was seen earlier that there was no apparent correlation between ship activity and number of transits detected so it is only possible to judge the performance of ships in the narrows and nearby over the whole set of exercises. The result was 8 detections or 1 for every 450 - 500 hours on patrol.

60. The fairest comparison is then with the overall performance of aircraft on area search of transit detection per 140 hours. Thus one aircraft on patrol was worth 3 to 4 ships on patrol, purely as regards detection potential. This must be treated only as a rough comparison. It may for instance be objected that ships spent a proportion of their time merely following up contacts gained by aircraft which had no killing capability; no figures are available for this. On the other hand nearly all the ship time was spent during the period of the year when asdic conditions are good.

FOLLOWING-UP OF CONTACTS AND ACHIEVING KILLS

Following-Up of Contacts

61. Table 1 lists the 6 occasions where initial detections gained by one force were followed up by contact being gained by another force. For example there was one incident of ships being successfully homed into an aircraft M.A.D. detection. Incidentally the report on the exercise in question noted that this was the sole occasion out of five opportunities where M.A.D. contact was held long enough for a surface unit to be homed in. Also in Table 1 are those cases where one type of aircraft detection equipment, say M.A.D., took over successfully from an initial detection by other means, say radar, in the same aircraft.

62. The limited number of examples however precludes any deduction except that the wide variety of these "handovers" demonstrates that useful opportunities were taken for co-operation between the forces involved.

/Kills ....

Kills

63. The following table compares the number of occasions on which forces gained initial detections or follow up contacts and the corresponding number of kills achieved:-

TABLE 7 - ESTIMATED NUMBER OF "KILLS"

FORCE INVOLVED	DETECTIONS OR CONTACTS	ESTIMATED NO. OF KILLS
Aircraft	25	2 *
Helicopters	2	0
Ships	11	9
M.F.V.s	2	0
Submarines	2	0

*In MEDFLEX ABLE although aircraft gained 16 detections it was not possible to assess number of kills.

As to be expected these figures shew that the ships were the major factor as regards gaining kills of submarines. Aircraft had to rely only on "depth charges" to gain success; the employment of an airborne homing torpedo could have made a great difference to this picture.

Contacts falsely classified as Submarines

64. In the three largest exercises of those being discussed the number of contacts which were classified at the time as submarine but subsequently analysed as incorrect were catalogued and these are summarized below.

Aircraft	Radar	9
	Visual	1
	M.A.D.	26
	Sonobuoy	5
	E.C.M.	1
Helicopters	Dipping Asdic	4
Ships	Asdic	1
	E.C.M.	(Large no - equipment new to operators).
M.F.V.s	Sonobuoy	2
S/Ms	Sonar	3

This number of incorrect classifications, 50 plus was at least half as many again as the number of correctly classified contacts gained during these three exercises.

65. Most significant above is the M.A.D. figure, the major proportion of which applied to the Narrows. However it was concluded that aircrew and M.H.Q. would quickly learn of any permanent non-subs. encountered on a fixed patrol line.

/SUMMARY ....

SUMMARY

66. Six post war exercises have been carried out involving the A/S defence of the Strait of Gibraltar. During the course of these 35 submarine transits have been made of which 19 were detected and it was estimated that 11 of these would have resulted in kills.

67. These results have been achieved by a wide variety of forces, ships, M.F.V.s, submarines, aircraft and helicopters against conventional (snorting) submarines. No firm conclusions could be drawn regarding the efficacy of A/S submarines, M.F.V.s and helicopters in view of the small number of occasions on which these were employed. The results obtained by aircraft carrying out visual and radar searches in the approaches seem to justify some figure for their effectiveness in the form of probability of detection for a given intensity rate of flying. The achievements of M.A.D. aircraft operating a barrier patrol across the narrows have been shewn to conform to theoretical predictions, within broad limits. The detections achieved by ships can only be accepted at their face value of 8 detections in the course of some 3800 hours steaming (to be compared to 1 aircraft detection per 110 hours flying) but it must be borne in mind that even these results were all achieved in the period of the year known to be the best for asdic conditions.

68. Further conclusions drawn from these trials are deferred to Part 4 of this paper in order that account may also be taken of the results of evaluation trials of various A/S equipments discussed in Part 3.

References

1. Exercise Straits One - Analysis and Report. Commander-in-Chief, Mediterranean No. 1143/Med. 7125/13 dated 11th June, 1951.

2. Operation Order No. 1/51, H.Q. R.A.F. Gibraltar GIB/S.43/13/1/AIR.

3. Exercise Medflex Able - Final Report. Commander-in-Chief, Allied Forces Mediterranean OPS 1712/5/C/IV dated 10th September 1954.

4. Medflex Able Report - Submarine Operations. Commander Submarines Mediterranean dated 29th May 1954.

5. Exercise Straits Two Analysis. Flag Officer Gibraltar/ Air Officer Commanding, Royal Air Force Gibraltar dated 25th October 1955.

6. Summary of Medflex Dragon Serial One. Commander-in-Chief Mediterranean 775/Med. 173/3 dated 29th May 1956.

7. Exercise Medflex Epic - Final Report. Commander-in-Chief, Allied Forces Mediterranean OPS 1712/14/25 dated 6th August 1957.

8. Anti Submarine Defence of the Strait of Gibraltar in the Future. Commander-in-Chief, Mediterranean No. Med. 0064/27 dated 23rd November 1955. (Top Secret).

/TABLE 1 ....

TABLE 1 - SUMMARY OF STRAITS TRA[illegible]T EXERCISES

DATE AND EXERCISE	DEFENDING FORCES	SUBMARINE TRANSITS	NO. OF TRANSITS DETECTED	NO. AND NATURE OF INITIAL DETECTIONS AND LOCATION	NATURE OF FOLLOW-UP CONTACTS	ESTIMATED NO. OF "KILLS"	PARTICULAR FEATURES
26/2 - 4/3/51 STRAITS ONE	6 FFs and 1 Ocean M/S 21 Aircraft	6 (3 Eastbound 3 Westbound)	2	1 Ship Asdic A 1 Gibraltar Search Receiver N (plus 1 intercept) A = Approaches N = Narrows	1 Ship Visual after search receiver. (Sub on surface showing navigation lights)	2 by surface forces	Territorial waters used. Submarines were also carrying out patrols in Eastern Approaches against a transitting Task Force.
26/3 - 2/4/54 MEDFLEX ABLE	5 DEs (Fr) or 2 FFs (Br) 1 S/M (Br) 8 Shackletons 6 P2V-5 MAD 6 P2V-4 6 Lancasters	10 (7 Eastbound 3 Westbound)	7	9 A/C Visual A 1 A/C Radar A 1 A/C ECM A 5 A/C MAD N 4 Ship Asdic (3N) (1A)	1 A/C Visual after A/C ECM 1 Ship Asdic after A/C MAD	3 by surface forces ? by aircraft (not assessable)	Territorial waters respected. Channel only 1.7 miles wide where M.A.D. A/C patrolled Area limited to 7°W to 2°22'W. S/Ms could not choose optimum times of transit M.A.D. barrier patrol
3 - 4/2/55 GIBORFLEX	6 Ships 6 Shackletons	1 (Eastbound)	0	-	-	-	S/M had 24 hr. choice of transit time. Had to snort for 6 hrs. west of 7°W.
26/8 - 5/9/55 STRAITS TWO	3 DDs (Br) in last phase 3 MFVs (sonobuoys) 4 Neptunes (non MAD) 8 Gannets 8 Skyraiders 8 Avengers 5 Whirlwinds (exc. 2 days)	6 (2 Eastbound 4 Westbound)	3	1 A/C Visual N 2 A/S Radar A 1 Helicopter D/A N	1 Helicopter after A/C Visual 1 Ship Asdic after same A/C Visual 1 A/C Sonobuoy after A/C Radar	1 by surface forces (plus 1 possible by A/C)	Territorial waters respected. MFVs daylight only Good visibility and calm sea.
14 - 20/4/56 MEDFLEX DRAGON	2 CHs (Br) and 3 Fr. Ships 3 MFVs (Sonobuoys) 1 S/M (U.S.) 6 Neptunes (U.S.) 4 MAD A/C (Br.) 9 Shackletons (Br.) 5 Harpoons (Port.) 4 Neptunes (Fr.)	7 (5 Eastbound 2 Westbound)	5	4 A/C Visual A 1 A/C Radar A 2 Ship Asdic N 2 MFV Sonobuoy N	1 MAD after A/C Radar 2 S/M after A/C Visual	2 by surface forces 2 by aircraft (probables)	Territorial waters used. MFVs daylight only Asdic conditions very good transitting submarines knew of SSK. M.A.D. barrier patrol.
5 - 12/5/57 MEDFLEX EPIC	4 FFs (Br) & 1 Fr. Ship 2 MFVs (Sonobuoys) Shackletons Neptunes	4 (2 Eastbound 2 Westbound)	2	1 A/C Visual A 1 Ship Asdic N	1 MAD & Sonobuoy after A/C Visual	1 by surface forces	Territorial waters respected MFVs day and night. 2 A/C on task at any time.

SECRET/DISCRET

PART 2 - AN ANALYSIS OF POST-WAR EXERCISES

APPENDIX A - DETAILS OF EXERCISES

(1) STRAITS ONE (Phase D of CFX 51) 26.2.51 - 4.3.51

Defence Forces	:	6 FFs (Br.) (PEACOCK, LOCH SCAVAIG, MERMAID, MAGPIE, LOCH INSH, LOCH ALVIE). 1 Ocean M/S (Br.) (RIFLEMAN) 3 Halifaxes 6 Sunderlands 8 Lancasters 4 Privateers (U.S.)
Employment and Location	:	Surface ships employed as two Task Groups in and near to the Narrows. One TG of 2 FF's was only so employed for last 3 days. Aircraft except Halifaxes, patrolled in various areas between 7° W and Greenwich meridian. Planned that at least 3 A/C on patrol continuously. Halifaxes kept for special sorties. In addition there were 17 DDs which were employed in the A/S protection of a Task Force during its passage through the exercise area.
Submarines transitting	:	6 (AMPHION, TABARD, TALENT, TEREDO, TOKEN, TRUMP). One further S/M, ACHERON, in the exercise did not undertake a transit having been detected when attempting to attack Task Force entering Gibraltar.
Number of transits	:	6 (3 Eastbound, 3 Westbound) The 3 eastbound having started to the west subsequently operated in areas in the eastern approaches against the T.F. The other 3 started in various selected areas in the east, and moving successively into different areas eventually undertook the transit. 2 transits of narrows snorting, 1 on surface with navigation lights burning, 3 unspecified.
Number of transits detected	:	2 (1 Eastbound, 1 Westbound)
Nature of detections	:	1 by ships 15m East of Gibraltar after eastbound transit. 1 by Gibraltar search receiver, and the same sub. was subsequently detected by patrol group in narrows. (S/M was on surface burning navigation lights.)
Assessed kills	:	2 by surface forces
Further comments on detections	:	9 contacts were gained by ships in the remainder of the exercise; some as a result of S/M action. These are ignored in the present analysis.

/6 detections ....

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6 detections (5 visual, 1 probably radar) were made by A/C on S/Ms operating in the area but not at the time in transit. These other detections led to 1 S/M sunk and 2 damaged by A/C, 4 sunk by ships, and 3 sunk by combined action.

False classifications: as Submarine — 11 by ships, 3 by aircraft) in the whole exercise.

Area of Exercise : Area between 7°W and Greenwich meridian. Territorial waters used in the Narrows.

General comments : Due to the combined nature of the exercise there is a certain arbitrariness in the separation of the Straits transit feature and the rest. It is fairly reasonable to include only those ships employed in the local defence of the Narrows. On the other hand A/C were denied their opportunities of detection since the S/Ms never undertook at one time their full passage through the approaches.
Weather was good for radar and visual A/C sightings till 28/2. From 1/3 - 4/3 cloud and rain. Sunderlands grounded for 2 days Asdic conditions were good.

(2) MEDFLEX ABLE Part 1 26.3.54 - 2.4.54

Defence Forces : Phase 1 (26 - 29.3.54)
5 DEs (Fr.)(BERBERE, KABYLE, SOUDANAIS, BAMBARA, MALGACHE)
6 P2V-5 (MAD)(U.S.)
6 P2V-4 (U.S.)
8 Shackletons (Br.)
6 Lancasters (Fr.)

Phase 2 (30.3.54-2.4.54)
2 DDEs (Br.) (WHIRLWIND, ROEBUCK)
1 S/M (Br.) (TALENT)
Air effort as in Phase 1

Employment and Location : Patrol aircraft searched areas out to 60 miles westward and 150 miles eastward.
P2V-5s and Shackletons employed on MAD barrier patrol.
No particular areas allotted to ships. Given freedom of action to follow up A/C contacts.
S/M as listening platform to N.W. of Narrows.

Submarines transitting: Phase 1 2 (Fr.) (ANDROMEDE, ARTEMIS) and 1 U.S. (TIRANTE) (U.S. has SH/F D/F)
Phase 2 3 'T' Class (Br.) (TUDOR, TOKEN, TEREDO) and 1 'S' Class (Br.) (SENTINEL)

Number of transits : Phase 1 5(3 Eastbound, 2 Westbound)
Phase 2 5(4 Eastbound, 1 Westbound)
All at or about P.D. in Narrows, except one.

/Transits detected ....

Transits detected :	Phase 1. 4 (plus 1 possible fleeting contact by patrol group. Phase 2. 3.
Nature of detections :	5 MAD detections in the narrows; 2 on same sub. by different A/C. In one case patrol group successfully homed in. Some disagreement about depths of detection; final report gives 1 at P.D., 1 snorting, 1 at 120 ft., and 1 detected twice (½ hr. interval) 80 ft. 9 A/C visual in approaches (8 in west, 1 in east). 2 transits were observed twice each. 1 A/C radar in approaches (east) 1 A/C ECM in approaches (in west) followed up by visual. 4 ship asdic (3 in narrows, 1 in approaches to west). All in Phase 1.
Assessed kills :	3 by surface forces. not possible to assess for A/C.
False classifications as submarine :	8 by A/C MAD 1 by A/C Visual 2 by A/C radar 1 by ship asdic 1 by ship ECM
Further comments on detections :	MAD gained 3 other contacts on S/Ms in non-exercise status. 2 A/C radar and 1 A/C visual were also on S/Ms in non-exercise status. SSK had one HE bearing but this is only a doubtful contact.
Area of Exercise :	Territorial waters avoided. Area lay between 7°W and 2°22' W; the small area of the western approaches into SACLANT's area was thoroughly covered by air patrols making snorting impossible without detection. 3 S/Ms having to make return transits so betrayed their presence.
General Comments :	MAD patrol simplified as channel was only 1.7 miles wide. Reconnaissance air patrols consisted of 90 sorties - 730 hrs. on task. Areas small in west, inadequately covered by 2 A/C in east. Many good air contacts were lost before SAU could get to the area. Only one MAD held long enough for SAU to take over. Heavy merchant traffic prevented S/Ms being detected at night when snorting or surfaced. S/Ms not able to choose time of transit to take best advantage of hydrographic conditions. Weather conditions good aiding A/C radar and visual detections. Good time of year for sonar conditions.

/(3) GIBORFLEX ....

(3) GIBORFLEX 3.2.55 - 4.2.55.

Defence forces	:	6 Ships 6 Shackletons
Employment of forces	:	Ships in 3 patrol groups of 2.
Submarines transitting	:	1
Number of transits	:	1 (Eastbound) At 280 ft. in Narrows.
Transits detected	:	0
General comments	:	S/M obliged to snort for at least 6 hours west of 7° W and had 24 hours choice of transit time.

(4) STRAITS TWO Phases I and III 26.8.55 - 5.9.55.

Defences Forces	:	Phase I 26.8.55-31.8.55: 3 MFVs with non-directional sonobuoys 4 Neptunes (non-MAD) 8 Gannets 8 (4?) Skyraiders 8 (4?) Avengers 5 Whirlwinds (excl. 28-29.8.55) Phase III (31.8.55-5.9.55): 3 DD's (AGINCOURT, BARROSA, CORUNNA. Remainder as in Phase I
Employment and Location	:	2 MFVs patrolled by day off Gibraltar. Naval A/C operated area searches by day, the Neptunes by night. Whirlwinds to investigate datums to 60 miles, and carry out searches in the Narrows at times favourable to submarine transit. DD's as one group to the west of narrows, patrolling as far as 6° 40'W.
Submarines transitting	:	2 (TRUNCHEON, TUDOR). TUDOR had no SH/FD/F. TRUNCHEON could detect AN/APS31, not APS20.
Number of transits	:	Phase I 3 (1 Eastbound, 2 Westbound). Phase III 3 (1 Eastbound, 2 Westbound). 2 Westbound deep through narrows. 2 Westbound, deep(day)/snort (night) 1 Eastbound 300' in narrows 1 Eastbound snort
Transits defected	:	Phase I 1 (Eastbound) III 2 (1 Eastbound, 1 Westbound)
Nature of detections	:	1 by helicopter dipping asdic on S/M eastbound at 250 ft. off Gibraltar (Range 1100 yds.) 1 A/C Visual on snort off Tarifa, Westbound followed by helicopter d/asdic (S/M at 200 ft., range 430 yds.) and surface ship asdic. 1 A/C radar on snort (TRUNCHEON eastbound could not detect APS20) followed by sonobuoy tracking in western approaches. 1 A/C radar in western approaches on snort of S/M eastbound, followed by visual.
Assessed kills	:	1 by ships Possibly 1 by aircraft.
False classifications as S/M.	:	7 disappearing radar contacts. 5 sonobuoy (A/C) 4 helicopter dipping asdic 1 A/C ECM 2 MFV sonobuoy Large number of ship ECM due to confusion with AN/APS 20 transmissions.

/Further comments ....

Further comments on detections: 1 A/C SH/F D/F intercept incorrectly classified as non-sub. MFVs with non directional sonobuoys had considerable classification difficulties.

Area of Exercise : Between 36° 50' N and 35° 30' N and between 3° W and 8°W. Territorial waters were respected.

General comments : Neptunes and Skyraiders 10 cm radar picked up large number of contacts (sometimes 200 on screen) requiring investigation.
Air density by night half that by day.
Hours flown:- Fixedwing(day) 331 (119 sorties)
Fixedwing (night) 193 (19 sorties)
Helicopters 82 (38 sorties)
Weather was good and generally in favour of A/S forces. Good visibility and calm sea.
Bad time of year for sonar conditions.
Sonobuoys can be misleading in the Strait due to drift from their markers.
Intelligence suggested that two S/ms were to the east at beginning of Phase I.

(5) MEDFLEX DRAGON Serial 1 14. 4.56 - 20.4.56

Defence Forces : 2 CHs (Br.) (CHAPLET, CHIEFTAIN)
3 French ships (BERBERE, TOUAREG, SENEGALAIS).
1 SSK (U.S.) (CROAKER)
3 MFVs with sonobuoys
6 Neptunes (U.S.)
4 R.A.F. MAD equipped A/C (3 Neptunes, 1 Shackleton).
9 Shackletons
5 Harpoons (Port)
4 Neptunes (Fr.)
SH/F D/F at Gibraltar

Employment and Location : Ships: for 2 days 2 to the west of narrows, 1 in narrows and 2 at about 4°W. After this all in the vicinity of Gibraltar. At least 4 on patrol at any time.
MFVs maintained 2 on patrol by day off Tarifa.
SSK in haven about 50 miles square west of 6° W.

/MAD aircraft ....

		MAD aircraft patrolled 12 mile line Gibraltar to Ceuta normally covering period 3 hrs. either side of low water. One on at a time. Air patrols over the approaches. U.S. A/C in west out to 60 miles, remainder in east out to 150 miles.
Submarines transitting	:	1 (Fr.) (ROLAND MORILLOT) and 2 (Br.) (TURPIN, SENESCHAL) Only TURPIN equipped with SH/F D/F.
Number of transits	:	7 (5 Eastbound, 2 Westbound) Eastbound 3 Deep in narrows, 1 snort/100', 1 snort/P.D. Westbound 1 Deep in narrows, 1 deep/snort.
Transits detected	:	5 (4 Eastbound, 1 Westbound)
Nature of detections	:	4 A/C visual on snorts; 1 in eastern approaches, S/M westbound, 1 in western approaches and another in eastern approaches on same S/M eastbound., 1 in western approaches, S/M eastbound. 1 A/C radar on S/M surfaced at night, on same S/M eastbound transit as visual detection just above. (2 A/C visuals lead to SSK contacts) 2 ship asdic in narrows, 1 S/M eastbound 1 westbound. 2 MFV sonobuoys in narrows, 1 eastbound, 1 westbound **transit.**
Assessed kills	:	2 by surface forces 2 probables by aircraft
False classifications as Submarine	:	3 by SSK 18 by A/C MAD (16 in Narrows, 2 in Approaches.)
Other comments on detections	:	When TURPIN was detected snorting by day and again surfaced by night she was having to obey exercise orders and not stay over 6 hrs. in the SSK area. SSK contacts were at:- 2 miles, S/M snorting at 4 knots and 12 miles, S/M snorting at 8 knots. SSK missed detections at:- 7 miles, S/M at 250', 5 knots. 8½ miles, S/M at 240', 5 knots 1 mile, S/M at 250', 3 knots 20 miles, S/M on surface, 12½ knots. An additional A/C detection was unrealistic as S/M was purposely snorting to read W/T message and knew of A/C's presence.

/Area of Exercise ....

Area of exercise	:	Territorial waters were used. TURPIN made one passage of the narrows inside territorial waters and on other occasions used them for approaches or withdrawals.
General comments	:	MFVs had only 3 opportunities for detection; non-directional sonobuoys. MAD A/C had 6 chances for detection; probability of detection with a A/C on patrol unlikely to be higher than 20% MAD A/C operated 100 hrs. Flew at 100 ft. by day, 300 ft. by night. Transits through the line were at depths of P.D., 100 ft., 240 ft., 300 ft., 375 ft. and 400 ft. respectively. No SH/F D/F contacts by A/C, ships or Gibraltar. Just before the end of exercise the 5 surface units were put on an endless chain patrol of Gibraltar, but the French S/M passed underneath undetected. SSK unrealistic as other S/M had to know of its presence and had either to snort or go deep through its area. Air searches. 160 hrs. in west, 266 hrs. in the East. S/Ms spent more time snorting than might have been expected. TURPIN 86 hours out of 160 hours. R. MORRILOT 65 hrs. Defence was aware all S/Ms starting from the west. Weather was generally good; asdic conditions as good as possible in the area; one tracking reported at 2300 yards in the narrows.

(6) <u>MEDFLEX EPIC</u> 5.5.57 - 12.5.57.

Defence Forces	:	5 FFs (Br.) (TORQUAY, WHIRLWIND, WIZARD, WAKEFUL) 1 French ship 2 MFVs (Br.) Shackletons (Br.) Neptunes (U.S.)
Employment and Location	:	Surface ships with four on patrol at one time were used singly in the narrows. MFVs used directional sonobuoys patrolled day and night in the narrows. Air patrols maintained both east and west of the narrows with one aircraft on patrol in each area all the time.
Submarines transitting	:	1 French S/M and 1 (Br.) 'T' Class.

/Number of transits ....

Number of transits :	4 (2 Eastbound, 2 Westbound) 3 at least spent some time at P.D.
Transits detected :	2 (both westbound)
Nature of detections :	1 A/C visual on periscope to the west, contact held by MAD and sonobuoys. Surface unit had fleeting contact. 1 ship asdic contact (held on and off $9\frac{1}{2}$ hrs.)
Assessed kills :	1 by ships
Other comments on detections :	Ship picked up radar transmissions which may have been a S/M on an eastbound transit.
Area of exercise :	Territorial waters avoided.
General comments :	Ships picked up a large number of non-sub. asdic contacts in the Narrows. On the 2 occasions on which MFVs might have made detections, S/Ms were proceeding at a silent speed. 24 hrs. were lost (in each area) from flying operations due to weather conditions.

PART 2 - AN ANALYSIS OF POST-WAR EXERCISES

APPENDIX B - THEORETICAL AIR RECONNAISSANCE OF THE APPROACHES

Typical areas of search over the approaches are shown in the sketch, Figure 2. These are simplified as (a) a sector of a circle in the west of 100 miles radius and (b) a roughly rectangular area in the east, stretching to say 150 miles from the narrows. In this case the areas concerned are approximately

West approaches	12,000 sq. miles
East approaches	14,000 sq. miles
Total area	26,000 sq. miles

2. With a typical visual sweep width against a snort of 4 miles, and assuming an equivalent performance is maintained at night by radar (an underestimate) the rate of sweeping with a 150 knot aircraft is 600 square miles per hour. To cover the above area once each hour would require a force of 43 aircraft continuously on patrol, i.e. 1030 flying hours per day.

3. The time taken for a submarine to traverse the area at a ground speed of 4 knots would be 70 hrs. Assuming that the submarine would need to snort for 4 hrs. every 24 hrs., this means that 12 hrs. would be spent snorting during the transit.

4. If the frequency of search of once per hour over every part of the sea precludes a submarine from taking evading action every time if he is to complete the snorting programme, it could be assumed that such a coverage would on average detect the submarine twelve times in the course of one transit. If at lower frequencies of air coverage the submarine does not evade, then the frequency of detection would be reduced in direct proportion to the intensity rate of flying. This is represented by the dashed line in Figure 1.

5. Variation of submarine speed, proportion of its time spent snorting and the sweep width attained by the aircraft will alter the slope of this curve. However it is not affected by reducing the two areas of search in proportion, say for instance to 50 miles in the west and 75 miles in the east.

6. The search shape suggested for the area of search to the west is the most economic of the possible choices there as regards the amount of flying to maintain the 1 hour coverage rate against the time taken for the submarines to transit it or the time spent snorting and the opportunities for detection. However, this area is less economical than the "rectangular" area in the east which perforce must be adopted there for geographical reasons. Thus, if the submarines maintained the same proportion of their time snorting whether approaching or withdrawing from the narrows, the advantage to the air patrols would lie in their operating entirely in the east providing they did not depend on the backing up of ships in the vicinity of the narrows against submarines making the eastbound transit.

PART 2 - AN ANALYSIS OF POST-WAR EXERCISES

APPENDIX C - THEORETICAL NOTE ON MAD PATROLS

The following table presents the MAD sweep widths of a P2V-5 aircraft in straight and level flight for various vertical separations between submarine and aircraft:-

VERTICAL SEPARATION	SWEEP WIDTH
200 ft.	1260 ft.
400	1140
600	850
800	50

These figures have been taken from NWP Anti-Submarine Operations (U.S. C.N.O; October, 1957). It is presumed that these apply to an average sized de-permed submarine; it is known that continuous degaussing would reduce the slant detection range by about 20%. Range is also reduced somewhat for a submarine on a W-E or E-W heading, and the above figures are presumably averages over all headings.

2. It is considered likely that submarines entering the Mediterranean through the Strait will transit the narrows at a depth of 300 ft. or less. The practical heights for aircraft MAD patrol appear to be 100 ft. by day and 300 ft. by night.

3. To derive the following figures it has been assumed that the average MAD swept path for a barrier patrol be taken as 300 yards. A 180 knot aircraft flying the 12 mile Gibraltar-Ceuta line will have to alter course every 5 minutes (figure of 4.8 minutes was quoted for MEDFLEX ABLE). Against a 5 knot submarine crossing a patrol line flown by a single aircraft the probability of detection is about 30%. To achieve a 50% probability of detection it would be necessary to maintain two aircraft continuously on patrol.

4. In MEDFLEX DRAGON it was considered that the aircraft were only achieving a swept path of perhaps 200 yards - in the light of trials held just previously (see Part 3). The probability of detection for a single aircraft patrol was about 20% against a 5 knot submarine.

5. With the same swept path, a single aircraft flying a 1.7 mile long barrier will have a 50% probability of detection.

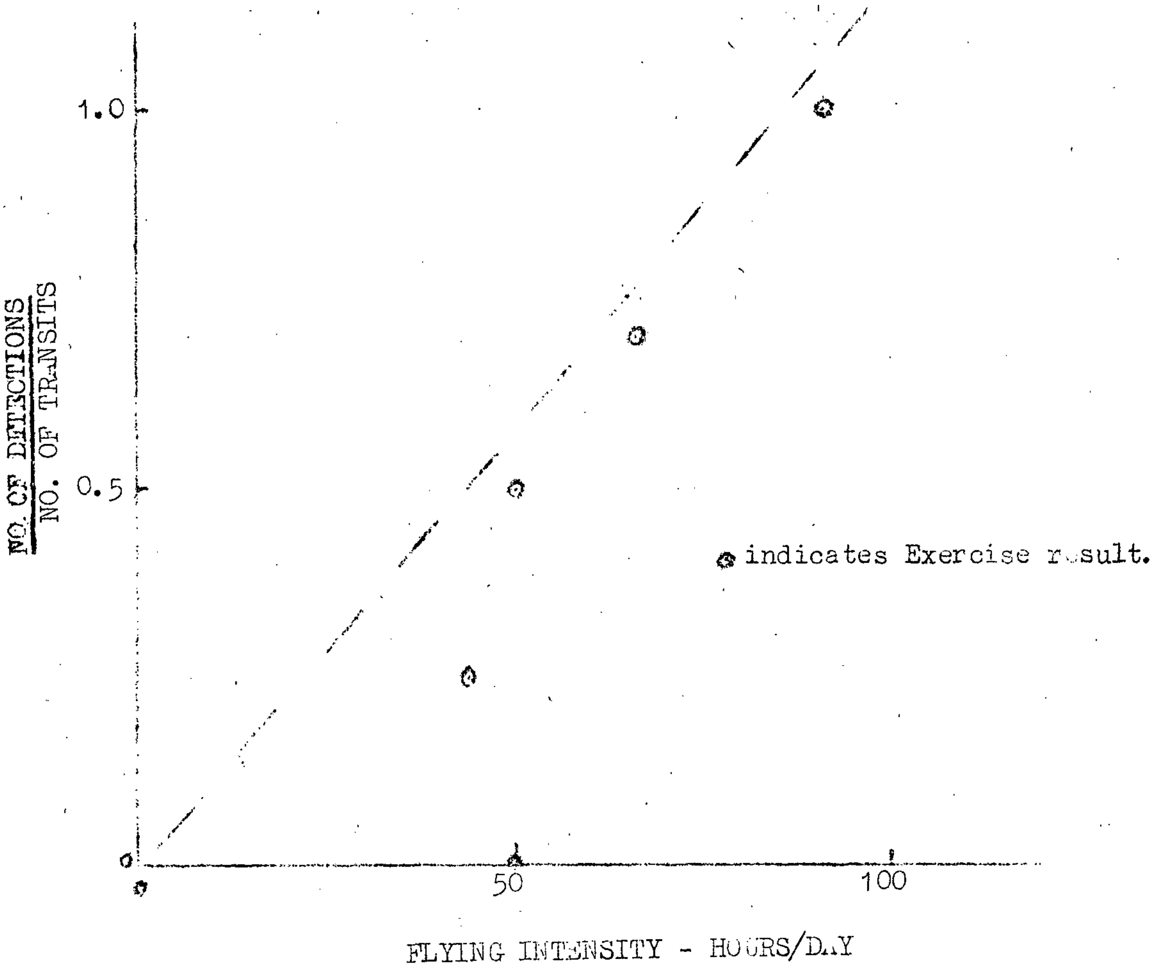

FIGURE 1. NUMBER OF VISUAL-PLUS-RADAR DETECTIONS BY AIRCRAFT PER SUBMARINE TRANSIT PLOTTED AGAINST FLYING INTENSITY OVER THE APPROACHES.

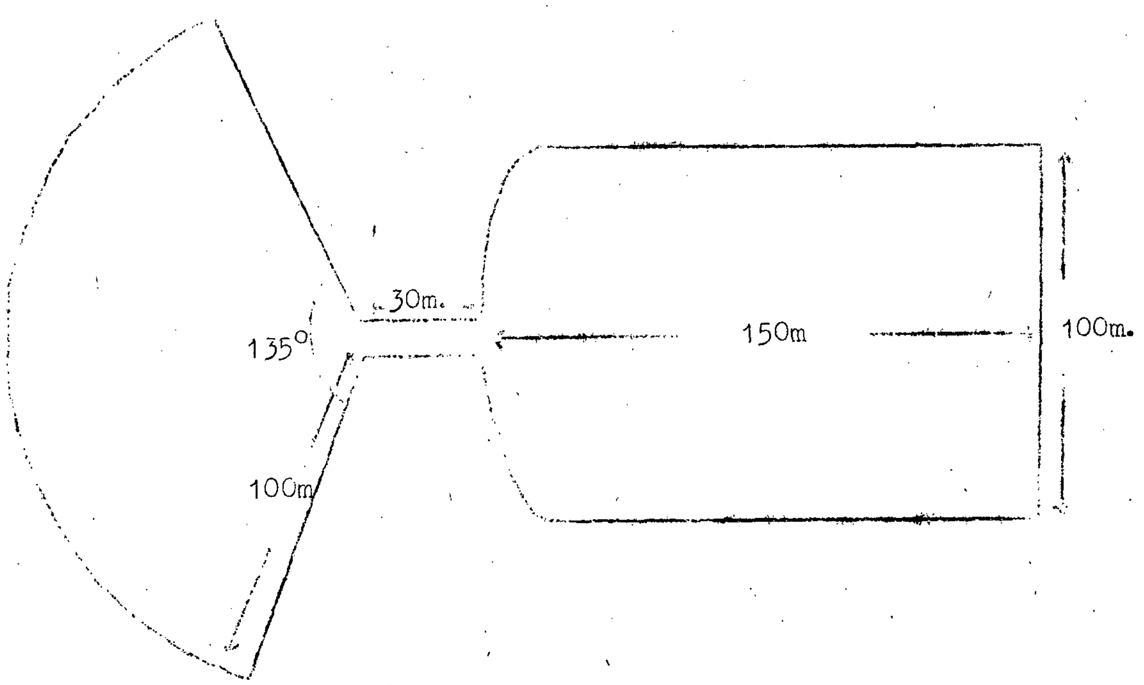

FIGURE 2 - SIMPLIFIED VERSION OF TYPICAL AIR SEARCH AREAS IN THE STRAIT APPROACHES.

A/S DEFENCE OF THE STRAIT OF GIBRALTAR

PART 3 - EVALUATION OF A/S EQUIPMENT ON LOCATION

INTRODUCTION

A number of different types of submarine detection equipment have been the object of a few brief trials in the region of the Strait. These have been carried out under controlled conditions in an attempt to evaluate the performance of these equipments; such is particularly important in the case of asdics due to the difficult water conditions in the area whereby the performance may be severly reduced compared to average results obtained elsewhere.

2. The following special trials have been undertaken:-

TABLE 1 - EVALUATION TRIALS OF A/S EQUIPMENT

TYPE OF EQUIPMENT	DATE OF TRIAL
1. Submarine Asdic Type 169	10th September 1955.
2. Ship Asdic Type 177X	1st & 24th October 1955.
3. Variable Depth Asdic (Type 192 and cast 1X)	29th August & 1st September 1958.
4. Helicopter Dipping Asdic AN/AQS 4A	28th-29th August 1955.
5. M.A.D.	8th December 1955 & 1st February 1956.

The conditions under which the trials were conducted and the results obtained are presented briefly in the following Sections.

SUBMARINE ASDIC TYPE 169

3. On 10th September 1955, H.M. Submarine TRUNCHEON employed her Asdic Type 169 against H.M. Submarine TUDOR, when both submarines were submerged in the narrows.

4. Two runs were carried out on transitting courses at a speed of $4\frac{1}{2}$ knots, the mean position being about 8 miles S.S.W. of Europa Point. Both submarines started at periscope depth, gradually opening range. Then TUDOR went to 150 ft. depth and TRUNCHEON went down to 320 ft. and up again to 80 ft. still opening range.

5. Bathythermograph records showed:-

(a) Very marked negative gradient from 40 ft. to 60 ft.
(b) A medium negative gradient from 60 ft. to 100 ft.
(c) A slight negative gradient from 100 ft. to 320 ft.

/6. ....

6. Asdic Ranges obtained in the Narrows. On the first run when opening from 600 yards, contact was lost at 2,200 yards when TRUNCHEON was at 170 ft. and TUDOR at 150 ft. On the second run contact was held throughout from 1,000 yards to 3,000 yards when the trial was stopped with TRUNCHEON at 80 ft. still in contact with TUDOR at 120 ft. With both submarines between 30 ft. and 60 ft. very poor results were obtained even at short ranges. However once both submarines were below the very marked negative gradient sonar conditions showed considerable improvement and no difficulty was then experienced in holding the target.

SHIP ASDIC TYPE 177X

7. H.M.S. UNDAUNTED fitted with Asdic Type 177X carried out echo-ranging trials against a submarine target in an area south of Europa Point on 1st October 1955 and again on 24th October 1955.

Asdic Ranges obtained in the Narrows

8. On the morning of 1st October 1955, although the bathythermograph showed a deep isothermal layer and there was an extremely calm sea echoes were intermittent and much fading occurred. Contact was lost on the first opening run at 2,800 yards. In a closing run intermittent echoes were gained at 6,000 yards, 5,000 yards and 4,000 yards but in each case contact could only be held for a short while before the echoes faded.

9. In the afternoon with a negative surface gradient asdic conditions were similar echoes appearing for short periods at ranges of 5000 yards and 7000 yards when opening from the target, and at 7,500 yards and from 6,700 yards in to 5,000 yards when closing.

10. On 24th October 1955 similar runs gave similar results although both bathythermograph dips on this day showed an isothermal surface layer. Quite good contact could be held to 2,500 yards but beyond this range contact was intermittent and subject to severe fading.

11. The ranges at which echoes appeared and disappeared were quite random on both days;at any time firm contact might be made at a range at which no echoes had appeared half an hour earlier. This would seem to indicate water conditions that were extremely variable probably both in time and space.

12. Conclusion. It was concluded that under the prevailing conditions echoes from a submarine beyond about 2,500 yards were too uncertain and intermittent for a definite classification of the target to be made.

VARIABLE DEPTH ASDICS TYPES 192 AND CAST 1X

13. During a programme of comparative trials between H.M.S. BROCKLESBY fitted with Asdic Type 192 VDA and H.M.C.S. CRUSADER with CAST 1X V.D.S. operations on 29th August and 1st September 1958 were conducted in and near the Narrows. The submarine concerned was H.M. Submarine TALLY HO.

Asdic Results obtained in the Narrows

14. On 29th August runs were carried out in the Narrows roughly between a position 10 miles S.W. of Europa Point and 5 miles S.E. of it. The ships operated generally at 10 knots on a parallel course to the submarine (at 4-5 knots) turning in on a number of occasions to close it, asdic teams being informed of the relative position of the submarine by visual or radar observation of its marker.

/15. ....

15. Frequently taken bathythermograms showed considerable variations in temperature patterns, but could generally be described as indicating a steep negative gradient from the surface down to 50-100 ft., (sometimes to 200 ft.) below which the negative gradient was reduced to become quite small at 300 ft. The temperature difference between the surface and 300 ft. was generally 10° - 12° F.

16. The maximum detection ranges obtained on 7 runs with the two equipments are given in the following table:-

TABLE 2 - RANGES OF DETECTION BY TYPE 192 AND CAST 1X IN THE NARROWS

S/M DEPTH (FT.)	BODY DEPTH (FT.)		MAXIMUM RANGE (YDS.)	
	TYPE 192	CAST 1X	TYPE 192	CAST 1X
300	310	220	2400	1300
300	300	-	No contact	Not operating
300	300	-	No contact	Not operating
300	300	?	2800	No contact
P.D.	180	100	No contact	No contact
180	180	180	4000	No contact
90	180	90	No contact	No contact

It is however considered that CRUSADER may have had less opportunity than BROCKLESBY to get close in.

17. Conclusions

(a) Type 192 showed more promise in these waters than CAST 1X

(b) Bearing in mind that the results were under alerted conditions and contacts often faded rapidly so that they may have passed unnoticed in unalerted conditions, the most that Type 192 can offer is a possible range of a few thousand yards (2 or 3 say) on a submarine at 200-300 ft. but this could not be relied on.

(c) At shallow depths the submarine would remain undetected in these water conditions.

Asdic Results obtained in adjacent areas

18. On 1st September 1958 similar trials were conducted in an area between a position S.E. of Europa Point and the submarine exercise areas some 15 miles N.E. of Europa Point, i.e. off the eastern end of the narrows. The following ranges of detection were obtained:-

TABLE 3 - RANGES OF DETECTION BY TYPE 192 AND CAST 1X CLOSE TO THE NARROWS

S/M DEPTH (FT.)	BODY DEPTH (FT.)		MAXIMUM RANGE (YDS.)	
	TYPE 192	CAST 1X	TYPE 192	CAST 1X
300	260	235	5200	5500
300	260	260	5800	1900
300	-	235	Not operating	2000
300	260	260	5400	2200
300	-	260	Not operating	3800
300	200	260	3000	2600
300	-	235	Not operating	5000
300	200	260	3000	8400
300	?	?	No contact	3000
300	200	260	No contact at 6800 yds.	7000

These contacts could often be held over considerable changes of range.

19. It is seen immediately that moving a short distance away from the narrows resulted in improved ranges of detection and more reliable contacts with less frequent fading. However, the number of runs completed was very small and any average range of detection would have to be treated with caution.

20. It is useful to compare these results with those obtained slightly further away, viz in the submarine exercise areas centred some 12 and 20 miles N.E. of Gibraltar. With the submarine at 300 ft. and under alerted conditions the average detection range by Type 192 was 10,000 yds. over 16 runs; on 2 of these no contact was made and the range taken as zero for purposes of averaging. CAST 1X had an average range of 9800 yds. for 20 runs, 5 of them being misses. In semi-alerted conditions CAST 1X achieved a marked superiority over Type 192.

21. On the occasion that the submarine remained at 120 ft., in a marked negative gradient, neither VDA could gain contact.

22. It may be noted that the bathythermograms were not all that dissimilar from those from the narrows, with quite steep gradients down from the surface; this demonstrates yet again the significance of other factors, density, currents, etc.

23. Conclusions

(a) At short distances away from the narrows the ranges of detection of VDA equipment rose to the order of 10,000 yards. On a submarine at 300 ft., and such detections were much more reliable than those in the Narrows.

(b) However, under these negative gradient conditions even away from the Narrows a submarine at shallow depths would probably escape detection.

HELICOPTER DIPPING ASDIC AN/AQS 4A

24. During Phase II of STRAITS TWO helicopters of 845 Squadron carried out trials with Dipping Asdic Type AN/AQS 4A against H.M.Submarine TUDOR.

25. Asdic Results near the Narrows. On 28th August 1955 trials took place in an area some 10 to 15 miles off the eastern end of the Narrows. The following results were obtained using the standard (60 ft.) cable:-

TABLE 4 - HDA (STANDARD CABLE) - BOW ASPECT DETECTION RANGES

S/M DEPTH (FT.)	DETECTION RANGES (YDS.)
32	1000, 850 ; one "no contact"
80	600 ; two "no contacts"
250	800, 1100 ; one "no contact"

26. Asdic Results in the Narrows. On 29th August trials took place in an area just south of Europa Point. Results with standard cable were as follows:-

/TABLE 5 ....

TABLE 5 - HDA (STANDARD CABLE) - BEAM ASPECT DETECTION RANGES

S/M DEPTH (FT.)	DETECTION RANGES
CONTROL ROOM DEPTH. H.R.C.	
32	750-1000, 500-800 ; one "no contact" from 1000 to 4000
80	400-750 , 500-650, 700-850
250	1200-1400, out to 1200 (3 times); one "no contact" at 3000-4000.

This table shows the range brackets over which contact was held.

27. On both occasions there were strong negative temperature gradients with 15°- 20° F drop between the surface and 200ft.

28. A few results were obtained using the long (150 ft.) cable but no conclusions could be drawn.

29. For purposes of comparison it may be noted that in the subsequent exercise helicopters gained two submarine contacts, at 430 yds. and at 1100 yds. On no other occasion did a helicopter dip closer than 1000 yards to a submarine. Classification was found to be difficult; out of 7 detections, 5 were classified as submarine but in fact only 2 of these were so.

30. Conclusions.

(a) There appears to be no significant difference between the ranges of detection obtained in the two areas. However, it must be expected that bow aspect detection ranges in the narrows may be somewhat less than the average above, while beam aspect ranges out of the Narrows may be somewhat greater.

(b) The trials report tentatively concluded that at all states of tide and current with varying temperature and density patterns, detections could be made out to 800 yards and sometimes to 1000 yards. This would not appear unduly optimistic in view of the severe temperature gradients obtaining at the time of the test.

MAGNETIC AIRBORNE DETECTION

31. Two brief trials of MAD equipment have been carried out in the Narrows. The first on 8th December, 1955 involved Neptune (R.A.F.) aircraft tracking H.M. Submarine THERMOPYLAE which proceeded through the Strait on a course of 255° at 6 knots at a depth of 80 ft. The aircraft tracked at various heights, in ideal weather.

32. MAD Swept Path. The swept path for a 500 ft. vertical separation of aircraft and submarine was 600 ft. wide. The maximum practicable separation for satisfactory tracking was 700 ft. when the swept path had virtually zero width.

33. The second trial on 1st February, 1956 was against H.M. Submarine AUROCHS. The submarine transitted the Strait from 6° W to 5° 10' W at 5 knots at a depth of 80 ft., 180 ft. or250 ft. The MAD aircraft flew at 100 ft. and again the weather was good. The results obtained confirmed the conclusions of the THERMOPYLAE trials above.

/34 ....

34. These results were obtained with the latest AN/ASQ 8 equipment but this had only just been installed and the aircrews were not worked up in its use. In fact the swept widths obtained were somewhat less than the figures given in "Anti-Submarine Operations" NWP 24 for this equipment fitted in a P2V-5 aircraft (quoted in Appendix C to Part 2 above). However those figures are presumably averages for all headings whereas it is known that the detection range is reduced somewhat for a submarine on a W or E heading as opposed to N or S. In this connection these figures are presumably appropriate to a depermed submarine. It is considered that continuous degaussing would reduce the slant detection range by about 20%.

35. There would seem no reason to doubt that the results obtained elsewhere could equally well apply to this location. In this connection the view is held that although there are a number of permanent non-subs. in the area both aircrews and A. H. Q. would quickly learn those encountered on a fixed patrol.

36. Apparently a brief trial of MAD in the Straits was carried out during the war. A submarine made passages at 50 ft., 100 ft. or 150 ft. through a Catalina patrol and a blimp patrol. When the submarine speed was in the 2-5 knot range the Catalinas detected 11 out of 12 transits; but with the speed in the 5-8 knot range they were not so successful. The blimp patrol detected 13 out of 14 transits.

CONCLUSIONS

Asdic Equipment

37. It has been seen that several different types of asdic equipment have been tested in the Strait but such evaluation trials have been very short, never longer than two days and the number of runs have been very limited. The results already presented above may be summarized briefly as follows:-

TABLE 6 - SUMMARY OF LIMITED ASDIC TRIALS

TYPE OF ASDIC	PERFORMANCE ATTAINED
Submarine Type 169	Contact at 2000-3000 yds., when both A/S Sub. and target Sub. below a severe negative temperature gradient. Results very poor when both in marked surface gradient.
Ship Type 177X	Good contact up to 2500 yds. Submarine depth not specified.
Type 192 VDA	Possible contact at 2000-3000 yds., but unreliable, against submarine at 200-300 ft. Unlikely to detect submarine at shallow depths in temperature gradient.
Helicopter Type AN/AQS 4A	Detection at 800 yds., possibly 1000 yds. Submarine depth not specified.

/These results ....

These results must be accepted with caution. They have all been obtained in the August - October period of the year when it is known that negative temperature gradients are often severe and therefore crippling to horizontal-looking asdics. Useful as these results are as indications it is quite impossible to predict any round-the-year averages, say, for these equipments without many more trials figures, for water conditions are quite different at other periods of the year.

38. It is also apparent from the above summary that depth of the target is very critical and much more information is required for different depths.

39. Bottom-mounted Asdic. The trial with Type 192 VDA was conducted at a slow ship speed in an area south of Europa Point with the object of simulating as far as possible a bottom mounted asdic facing south across the eastern end of the Narrows. The results may therefore be considered as indicative of the performance to be expected from such equipment.

40. Other hull-mounted Asdics. There is a general lack of information on the performance to be expected in this area of the presently fitted hull-mounted asdics.

Magnetic Airborne Detection.

41. Apart from the existence of a number of non-submarine targets in the area the exact whereabouts of which could be determined the location does not influence the performance of MAD. The results in the form of swept path against submarines on a W or E heading attained elsewhere should be equally appropriate in the Narrows.

References.

1. Report on Trial to determine Sonar Ranges in Strait of Gibraltar below 100 feet. H.M.S. TRUNCHEON reference 4/97/Y of 12th September 1955.

2. Sea Trials of Type 177X Asdic in H.M. Ships UNDAUNTED and BROCKLESBY carried out in the Atlantic during Autumn 1955. UDE Establishment Report No. 165.

3. Comparison Trials of Variable Depth Sonars CAST 1X and Type 192X. UDE Establishment Report No. 188 September 1958.

4. Helicopter Dipping Asdic: Operational Progress Report No. 4 (HDR 4) 845 Squadron 12th September 1955.

5. MAD in the A/S Defence of the Strait of Gibraltar. Commander-in-Chief, Mediterranean No. 738/Med.214/1 22nd May 1956.

6. Anti-Submarine Defence of the Strait of Gibraltar: Appendix E Notes on Wartime MAD Achievements COMEDSOUEAST 29th March 1956.

7. Anti-Submarine Operations NWP 24. U.S. Chief of Naval Operations 22nd October 1957.

/PART 4 ....

A/S DEFENCE OF THE STRAIT OF GIBRALTAR

PART 4 - COMPARISON OF RESULTS OBTAINED IN WAR, POST-WAR EXERCISES AND EVALUATION TRIALS

INTRODUCTION

The previous sections have been devoted to separate phases of experience with the problem namely wartime results, post-war exercises involving combinations of forces and the evaluation of certain particular items of A/S equipment. Although perforce very limited a few comparisons may be drawn between the results achieved.

RESULTS FROM WAR AND POST-WAR EXERCISES

2. Types of force involved. The post-war exercises have been undertaken with various forces that could be assembled for the task and were not necessarily representative of what would be available for defence in any future war. While some new forms of defence were employed, namely helicopters with dipping asdic, MFVs with sonobuoys and submarines, the main task fell as in the 1939-45 war on asdic-fitted ships and patrol aircraft using either radar/visual or MAD as the means of detection. Although some more modern versions of equipment were in use in the exercises their performance would not have been markedly different from that in wartime.

3. A comparison of initial detections gained by these particular means is presented in the following table:-

TABLE 1 - COMPARISON OF RESULTS OF SIMILAR MEANS OF DETECTION IN WAR AND IN POST-WAR EXERCISES

MODE OF DETECTION	NO. OF DETECTIONS	
	WAR	POST-WAR EXERCISES*
Aircraft - Visual	2	15
Radar	9	4
MAD	3	5
Total	14	24
Ships' Asdic	1	8
Joint action Ship/A/C	1	-

*Successive detections on same transit of Submarine are excluded

4. It has been pointed out earlier (Part 1) that no record is available of the numbers of ships and aircraft and their time on task spent during the war so it is not possible to make an exact comparison of achievements with those gained in the post-war exercises. However it is to be noted that in both phases aircraft obtained the majority of initial detections.

5. Considering just the visual/radar area searches most detections during the war were gained by radar (at night) in the Narrows. Two reasons may be adduced for this; first, at least during the early part of the war the enemy submarines having limited underwater endurance adopted a policy of a submerged approach followed by a transit of the Narrows on the surface at night, and secondly a proportion of the patrol aircraft had only a short endurance and could only be employed in the Narrows.

/6. ....

6. In contradistinction to this the majority of air detections during post-war exercises were gained visually on submarines in the Approaches. Here the submarines having longer underwater endurance often adopted the policy, as employed during the latter stages of the war, of a snorting approach followed by a submerged transit of the Narrows. Consequently the aircraft were employed on deep area patrols.

7. The following table lists the successes in attack of aircraft and ships in war and post-war exercises:-

TABLE 2 - COMPARISON OF SUCCESSES IN ATTACK IN WAR AND POST-WAR EXERCISES

FORM OF ATTACK	NO. OF SUBMARINES	
	SUNK IN WAR	ESTIMATED "KILLS" IN EXERCISES
Aircraft	4 (6 damaged)	2*
Ships	3	9
Joint Attack	2	-

*MEDFLEX ABLE results excluded, where there were 16 A/C detections.

Results of both "eras" show the greater importance gained by ships in the attack phase; aircraft lacked the means to ensure high probability of kill after gaining detection.

DETECTIONS IN WAR AND IN EXERCISES AND THE TRIALS PERFORMANCE OF EQUIPMENT

Airborne Equipment

8. It was seen in Part 3 that brief evaluation trials of MAD were carried out in the Strait. A somewhat lower performance (lower slant range of detection) was achieved compared to that normally to be expected but an explanation was offered for this. In the two exercises involving MAD the number of transits detected accorded reasonably well with the estimated probabilities of detection based on the aircraft patrol frequency assuming the standard detection range. (Part 2, paragraphs 33-34).

9. Visual and radar ranges of detection from any particular type of aircraft are known from experience in other waters and these are equally applicable in the area of Strait. The overall numbers of detections gained in exercises can only offer circumstantial evidence that these are of the appropriate magnitude. (Part 2, paragraph 25)

Asdic Equipment

10. The paucity of submarine detections by ships' asdic in war and in exercises suggests a low range of detection obtaining in the area of the Narrows. This is a well-known feature to be expected from the nature of the water conditions there. The degradation of performance both in range and reliability of detection of asdics generally when employed in this area is confirmed by the few trials that have been carried out with recently developed equipment, either in ships, submarines or helicopters (Part 3).

/11. ....

11. There is however a complete lack of data on the ranges of detection that can be achieved against a submarine target in the Narrows with the asdic equipments currently installed. Such information is needed for different periods in the year - owing to varying water conditions - before any estimate could be attempted of the detection capability of a given force. Equally useful would be similar knowledge of performance in areas outside the confines of the Narrows.

CONCLUSIONS

12. If the forces available to defend the Strait against the present day type of snorting submarine were to be of similar type and similarly equipped to those used in exercises then the employment of aircraft would be of paramount importance for detection purposes. With the performance of airborne equipment known the flying intensities required to provide a given probability of detection either by visual/radar area searches in the Approaches or by an MAD barrier across the Narrows have been discussed in Part 2.

13. There is a need for performance data on an all-round-the-year basis of currently-fitted asdic equipment operating both in the Narrows and outside of these. It is not known whether the gain in performance, i.e. range and reliability, by employing ships outside the Narrows would more than offset the disadvantage of a wider channel to be covered.

14. The main role for surface ships has been to provide back-up support for aircraft and to provide the main "killing" power. If aircraft were equipped with a weapon of greater killing potential then the need for ships would be partly offset.

than depth charges

1st January, 1959.

DEPARTMENT OF NATIONAL DEFENCE

SECRET

MINUTE SHEET NSS 1271-8 (STAFF)

Referred To	REMARKS To be signed in full showing Appointment, Telephone Number & Date

~~ACNS(A&W)~~
DNPO
ACNS(P)
SA/CNS
VCNS

Fan-bloody-tastic,

A/S DEFENCE OF STRAITS

Reference (a) NMWS 8100-1, NMWS 6101-13
Dated 13 April, 1959.

The study groups on A/S Defence of Straits are off to a vigorous start (reference (a)). Their findings could be of good value to Canada if plans were called for, for defence of Canadian Straits - Cabot, Belle Isle, Hudson etc.

2. CANCOMARLANT was requested and has designated the following officers as his representatives for the Icelandic Straits Study Group;

LCdr (TAS) J.M. Steel, RCN.
S/Ldr T.W. Hewer, RCAF.

3. Para 8 of the above reference is under active consideration.

4. The brief outline by NMCJS(W) at reference (a) on the first Gibraltar meeting is interesting.

R W Timbrell

(R.W. TIMBRELL)
Captain, RCN.
DIRECTOR OF UNDERSEA WARFARE

Ottawa, Ontario.
28 April, 1959.

DND.317

SECRET

SECRET

Our file ref. NMWS 8100-1 Vol. 3
NMWS 6101-13

DEPARTMENT OF NATIONAL DEFENCE

CANADIAN JOINT STAFF

CANADA

Reply to:
Naval Member

2450 Massachusetts Ave., N.W.
Washington 8 D.C.
U.S.A.

13 April, 1959

STUDY GROUPS FOR ANTI-SUBMARINE DEFENCE
OF STRAITS AREAS

Reference: (a) NMWS 8100-1 Vol. 3 dated 7 January, 1959

Submitted for the information of Naval Headquarters is a summary of information learned concerning the first meeting of the UK-US- Study Group on the defence of the straits of Gibraltar, held during February, 1959, together with comments as to its relation to the proposed study group on the defence of the Greenland, Iceland, U.K. Straits Area (GIUK).

2. The official report of the meeting has not yet been received by the USN, and presumably a copy will be available to Naval Headquarters, through the SNLO, UK, when it is finished. The USN report of the meeting cannot be made available but relevant sections were discussed.

20-4 DUSW DNPO

3. The final USN representation at Gibraltar was much larger than indicated in paragraph 2 of reference (a), and was as follows:-

CNO - 1 Commander (Op 91)
- 1 Scientist (Op 91)
- 1 Lieutenant Commander (Op 31)

BUSHIPS - 1 Commander (Code 689)

ONR - 2 Scientists

CINCLANTFLT - 1 Captain

COMOCEANSYSTEMS - 1 Lieutenant Commander

Referred to Staff
APR 17 1959
File No. 8127-8
Chgd to

4. It was apparent from the record of the U.S. presentations that the USN team went to the meeting with a completely prepared plan. This was backed-up with good hydrographic and oceanographic data available from the survey of the area carried out by the U.S. during 1958.

5. The study was made on the basis of defences which could be made available with equipment presently under development. The impression was gained that most of the proposals were made by the U.S. delegation, but confirmation of this must await the official report. The U.S. proposals for a defence system may be summarized as follows:-

(a) A system of SOSUS arrays in the Atlantic and Mediterranean approaches giving a detection probability of 75% out to about 200 miles.

REC'D. IN DUSW
20 April 59

Naval Secretary
Attention: DUSW

Copy to: Maritime Commander Atlantic, Halifax

........2/

CAFA 511

000283

SECRET

These arrays would be connected to a central station in Gibraltar using coaxial cable. Estimated cost of SOSUS system $24 million.

(b) A double line colossus barrier to back-up the SOSUS arrays. The colossus barrier employs bottomed upward looking echo sounders operating on frequencies from 26 to 60 kcs, 20 per mile. Cost of colossus barrier $75,000.00 per mile. Nominal estimate - 50 mile barrier. = $3,750,000

(c) Back-up in the Straits area of loops and other magnetic detection devices.

(d) Order of forces mentioned:-

(i) 16 long range maritime aircraft

(ii) 40 short range maritime aircraft

(iii) 4 ships

(iv) 4 SSK's

6. The following probability factors were used:-

(i) Detection probability - 75%

(ii) Kill probability - 45%

It was decided that the next meeting would be held within six months, or after the first meeting of the GIUK Study Group.

7. It was stated that the U.S. will be holding their first national meeting shortly, in preparation for the GIUK meeting. The Chairman for this Study Group will be Rear Admiral Martin, USN, Commander Barrier Force, Atlantic. He will be OTC in a major exercise during May and June, so the earliest time which the GIUK Study Group can meet will be July, 1959.

8. Undoubtedly, the USN will come to the GIUK meeting with some very firm proposals. It is submitted that after the official report of the Gibraltar meeting has been studied, consideration might be given to possibly strengthening the Canadian team for the GIUK meeting.

COMMODORE

MESSAGE FORM

FILE NSS 1271-8 (STAFF)

NUMBER

FOR COMMCEN/SIGNALS USE

"A[redacted] - NO UNCLASSIFIED REPLY OR REFERENCE"

PRECEDENCE - ACTION	PRECEDENCE - INFO	DATE - TIME GROUP	MESSAGE INSTRUCTIONS
ROUTINE	DEFERRED	261942	

PREFIX: GR

SECURITY CLASSIFICATION: SECRET

ORIGINATOR'S NUMBER

FROM CANAVHED

TO CANAIRHED
CANCOMARLANT

INFO CANAVUS

CANCOMARLANT 201455Z X

CONCUR NOMINATION LCDR JM STEEL X REQUEST CANAIRHED REPLY RE S/L HEWER X

CONCURRENCE DNPO

ACNS(A&W)

PAGE	OF	PAGES	REFERS TO MESSAGE	DRAFTER'S NAME	OFFICE	TEL.
			CLASSIFIED YES ☐ NO ☐	RING D/DUSW	3636 "A"	6-7171

FOR OPR'S USE	R	DATE	TIME	SYSTEM	OPERATOR	D	DATE	TIME	SYSTEM	OPERATOR

RELEASING OFFICER'S SIGNATURE

CNS 1320JC (REV. 54)

COPY 2

St 2/3 PA
2/8/59

R 201455Z

ROUTINE
SECRET
"AC" NO UNCLASSIFIED REPLY OR
REFERENCE

ACNS(A&W)
CNP
SOC
D/SEC/STAFF
SA/CNS

FM CANCOMARLANT

TO CANAVHED

CANAIRHED

INFO CANAVUS

BT

NSS 1271-8 (STAFF) DATED 3 FEB 59.

INFORMATION HAS BEEN OBTAINED THAT AS A RESULT OF THE EXPERIENCE OF THE STUDY GROUPS OF THE STRAIT OF GIBRALTER, AN RCAF AS WELL AS AN RCN OFFICER SHOULD ATTEND THE ICELANDIC STRAITS STUDY X THEREFORE RECOMMEND THAT CANCOMARLANT BE REPRESENTED BY LCDR J M STEEL O- 69693 AND SQUADRON LDR T W HEWER 19917

BT TOR 201755Z/FEB/59

REC'D. IN DUSW
25 Feb 59

DUSW
Request you draft reply pse
Message des [illegible]
J 23/2

2436

000286

DRS/MM

SECRET

NSS 1271-8 (Staff)

PA [illegible] 16/2

(ROYAL CANADIAN NAVY)

3 February 1959.

PROPOSED STUDY GROUP FOR ANTI-SUBMARINE
DEFENSE OF STRAITS AREAS

Reference (a): NMWS 8100-1 Vol.3 dated 7 January 1959.

Enclosure (A): NMWS 8100-1 Vol.3 dated 7 January 1959.
(Copy to CANCOMARLANT and CANFLAGLANT).
(B): NSS 1271-8 (Staff) dated 14 October 1958.
(Copy to CANCOMARLANT and CANFLAGLANT).

As indicated in Enclosure (B) it is not intended to provide RCN members to the Tripartite Study Group on the Straits of Gibraltar; however, it is intended to provide a member for the Study Group dealing with the Anti-Submarine defense of the Icelandic Straits.

2. It is requested that CANCOMARLANT nominate an officer as a member for the Icelandic Straits Study Group and inform CANAVHED and CANAVUS, by message, the name of the officer selected.

NAVAL SECRETARY

Maritime Commander Atlantic.

Flag Officer Atlantic Coast.

Naval Member of the Canadian Joint Staff (Washington).

Copy to: Chief of the Air Staff.

To FMO
For Despatch
Date FEB - 4 1959
Initials AR

For Concurrences - See 1 down.

REC'D. IN DUSW
4 Feb. 1959

SECRET

000287

DRS/MM

SECRET

NSS 1271-8 (Staff)

(ROYAL CANADIAN NAVY)

26 January 1959.

PROPOSED STUDY GROUP FOR ANTI-SUBMARINE DEFENSE OF STRAITS AREAS

Reference (a): NMWS 8100-1 Vol.3 dated 7 January 1959.

Enclosure (A): NMWS 8100-1 Vol.3 dated 7 January 1959.
(Copy to CANCOMARLANT and CANFLAGLANT).

(B): NSS 1271-8 (Staff) dated 14 October 1958.
(Copy to CANCOMARLANT and CANFLAGLANT).

As indicated in Enclosure (B) it is not intended to provide RCN members to the Tripartite Study Group on the Straits of Gibraltar; however, it is intended to provide a member for the Study Group dealing with the Anti-Submarine defense of the Icelandic Straits.

2. It is requested that CANCOMARLANT nominate an officer as a member for the Icelandic Straits Study Group and inform CANAVHED and CANAVUS, by message, the name of the officer selected.

NAVAL SECRETARY

DUSW
JAN 27 1959

Maritime Commander Atlantic.

Flag Officer Atlantic Coast.

Naval Member of the Canadian Joint Staff (Washington).

For Concurrence: DNPO 28/1

SECRET

2217

000288

DEPARTMENT OF NATIONAL DEFENCE

SECRET

MINUTE SHEET

NSS 1271-8 (STAFF)

Referred

REMARKS

To be signed in full showing Appointment, Telephone Number & Date

PROPOSED STUDY GROUP
A/S DEFENCE OF ICELANDIC STRAITS

DNPO

The Straits of Gibraltar were considered to be too remote to warrant sparing an RCN officer to assist in Study of their A/S Defence. However, the Icelandic Straits are of more direct concern to the RCN and it is, therefore, recommended that effort be made to provide RCN representation in the Group which CNO proposes should study their A/S defence.

2. It is recommended that COMARLANT be invited to nominate a member for this study group.

R W Timbrell

(R.W. TIMBRELL)
Captain, RCN.
DIRECTOR OF UNDERSEA WARFARE

DUSW.

Ottawa, Ontario.
19 January, 1959.

Suggest you draft message to Marlant asking him to nominate officer info CanavUS

J 22/1

SECRET

DND.317

000289

SECRET

DEPARTMENT OF NATIONAL DEFENCE

CANADIAN JOINT STAFF

CANADA

Our file ref. NMWS 8100-1 Vol. 3

Reply to:
Naval Member

2450 Massachusetts Ave., N.W.
Washington 8 D.C.
U.S.A.

7 January, 1959

PROPOSED STUDY GROUP FOR ANTI-SUBMARINE DEFENSE OF STRAITS AREAS

Reference: (a) NSS 1271-8 (Staff) dated 14 October, 1958

Submitted for the consideration of Naval Headquarters that, in addition to the study group referred to in reference (a), the Chief of Naval Operations proposes that a second study group be formed to study measures for controlling the passage of enemy submarines into the Atlantic via the Icelandic Straits. The proposal by the Chief of Naval Operations is quoted as follows:

" There is an urgent need to study measures for controlling the passage of enemy submarines into the Atlantic Ocean. The principal areas in which controls must be exercised are the Straits of Gibraltar and the Icelandic Straits. Each of these should be studied, and implementing priorities established based on consideration of the overall importance of each area to the control of the Soviet submarine threat.

In order to complete the study of the overall problem, as set forth above, the Chief of Naval Operations proposes that a second group composed of US-UK and Canadian representatives be set up to study the anti-submarine defense of the Icelandic Straits. This group should have a general directive, similar to that of the Gibraltar group, to provide practical long term recommendations for controlling the passage of enemy submarines through the Icelandic Straits in the light of weapons likely to be available. It is further proposed that the chairman of this group be a U.S. naval officer of flag rank and that the group convene in the United States, preferably in the Washington, D.C. or Norfolk, Virginia areas. Since CINCLANT has primary interest in ASW problems in his capacity as SACLANT, the Chief of Naval Operations will request CINCLANT to recommend implementing action.

A similar invitation to participate in the Icelandic Straits study group has been forwarded to British authorities."

2. Discussions with CNO authorities concerned revealed little further information. The first meeting of the Gibraltar Study Group is tentatively scheduled for 10 and 11 February. USN representation is not firm, but it appears likely that it may be limited to one Commander from the Undersea Warfare Division of CNO, and possibly one Commander from the Bureau of Ships. It is thought that few further details concerning the Icelandic Straits Study Group will be learned until CINCLANT has recommended the implementing action.

REC'D. IN DUSW
13 Jan. 1959

The Naval Secretary

13 Attention: DUSW

Referred to .... Staff
JAN 12 1959
File No. S1271-8
Chgd to....

CAFA 511

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3. It is considered that the RCN should participate in the Icelandic Straits study. Canadian representation could be from CANCOMARLANT'S Staff, CANAVUS or CANAVHED, depending on the locale and timing of the meetings, and the detailed composition of the USN group proposed by CINCLANT. In the meantime it is recommended that Canadian participation in this study group be approved, so that the USN may be advised as soon as possible.

COMMODORE

SECRET

NSS 1271-8
(STAFF)

ROYAL CANADIAN NAVY

14 October, 1958.

PROPOSED TRIPARTITE STUDY GROUP
A/S DEFENCE OF THE STRAITS OF GIBRALTAR

Reference: (a) MII/614/8/58, dated 11 August, 1958.

The Royal Canadian Navy feels that there is much merit to Admiralty's proposal for a group to study the A/S defence of the Straits of Gibraltar. Furthermore, it is conceivable that some aspects of the problem may be applicable to the A/S defence of narrow waters adjacent to North America.

2. It is noted that preliminary studies are being started, and a meeting of the Group might take place towards the end of the year. It would not be practical to provide a suitable RCN officer, or officers, to assist with the study, for some time to come, in view of the Royal Canadian Navy's present commitments. It is regretted, therefore, that the Royal Canadian Navy can only agree in principle with the formation of a Tripartite Study Group, but cannot support the proposal actively.

15/10

DEPUTY NAVAL SECRETARY

NAVAL SECRETARY.

Director Staff Naval Plans & Operations

SENIOR NAVAL LIAISON OFFICER (UK).

Copies to: CHAIRMAN, CHIEFS OF STAFF.

R 118 NAVAL MEMBER OF THE CANADIAN JOINT STAFF (WASHINGTON).

R 119 NAVAL MEMBER OF THE CANADIAN JOINT STAFF (LONDON). - Redraft

For Despatch
Date 15/10 58
QK

Enclosure

A/VCNS 15/4

ACNS(A)

SECRET

000292

SECRET

CRF:MES

NSS 1271-8
(STAFF)

ROYAL CANADIAN NAVY

3 October, 1958.

PROPOSED TRIPARTITE STUDY GROUP
A/S DEFENCE OF THE STRAITS OF GIBRALTAR

Reference: (a) MII/614/8/58, dated 11 August, 1958.

The Royal Canadian Navy feels that there is much merit to Admiralty's proposal for a group to study the A/S defence of the Straits of Gibraltar. Furthermore, it is conceivable that some aspects of the problem may be applicable to the A/S defence of narrow waters adjacent to North America.

2. It is noted that preliminary studies are being started, and a meeting of the Group might take place towards the end of the year. It would not be practical to provide a suitable RCN officer, or officers, to assist with the study, for some time to come, in view of the Royal Canadian Navy's present commitments. It is regretted, therefore, that the Royal Canadian Navy can only agree in principle with the formation of a Tripartite Study Group, but cannot support the proposal actively. ~~Admiralty may wish to proceed with the study on this basis, and, if this is decided upon, might further consider regarding the Group as a subsidiary of the NATO ASW Committee being formed by SACLANT. The proposed Study Group would then be charged with forwarding progress and final reports to the latter.~~

NAVAL SECRETARY.

SENIOR NAVAL LIAISON OFFICER (UK).

Copies to: CHAIRMAN, CHIEFS OF STAFF.

NAVAL MEMBER OF THE CANADIAN JOINT STAFF (WASHINGTON).

NAVAL MEMBER OF THE CANADIAN JOINT STAFF (LONDON).

ACNS(O)

Concur

~~DUSW~~ for concurrenc

Enclosure

A/A DNPO

H.Q. 1024

NAVAL SERVICE—MINUTE SHEET

FILE No. NSS 1271-8

REFERRED TO	REMARKS (WITH SIGNATURE, POSITION AND DATE)
DNPO	Ref: NSS 1271-8 dated 23 Sept '58. The above does not agree with VCNS memo dated 16 Sept (3 folios down) 2. I cannot agree with minute II. R. Rimbull [illegible] 26-IX-58 [illegible] 30/9
D/DNPO	See DUSW & redraft. [illegible] 29/9

000294

PA

PHG/VC

SECRET

NSS 1271-8
(STAFF)

MEMORANDUM TO: ~~ACNS(P)~~
VCNS
~~CNS~~ 15/X
ASLon.

PROPOSED TRIPARTITE STUDY GROUP,

A/S DEFENCE OF THE STRAITS OF GIBRALTAR

The Flag Officer Gibraltar has generated a requirement for a Study Group to be formed on a Canada-US-UK basis to investigate and solve the problem of A/S defence of the Straits of Gibraltar. SNLO has forwarded Admiralty's proposal asking if the RCN wishes to join the study.

2. Because we have problems of defending narrow waters against the submarine, it is considered that the RCN should take part in the study. However we are already involved in the Tripartite ASW Group and the WEU-SACLANT groups. Therefore it is proposed that CANAVBRIT provide an RCN representative to the proposed Study Group and the Study Group report its findings to SACLANT's ASW committee.

3. The committees established by different authorities to work on ASW problems are as follows. Under the Combined Policy Committee there is the US-UK-Canada Tripartite Research and Development Organization of which the RCN is active in Technical Sub-Group "G" on Undersea Warfare. It is considered that Admiralty's proposed Study Group will have to go outside the technical aspects of the A/S defence of Gibraltar Straits problem into tactics and force requirements. Therefore it is recommended that the problem can best be monitored by SACLANT's new ASW committee, established at a time to take advantage of the birth of the Western European Union ASW Committee. Both committees are scheduled to meet in Italy next month. DUSW will be the RCN representative.

4. It is not expected that the UK will resist the interjection of NATO into the proposed Study Group.

this most in accord with VCNS minute
16/9 -

(J.A. Charles)
Captain, RCN,
DIRECTOR OF NAVAL PLANS AND OPERATIONS.

OTTAWA,
23 September, 1958.

II

Although another subject, the results of staffing this paper indicate that the section responsible for ASW Systems Planning should report to ACNS(P), despite the natural interest of DUSW.

(J.A. Charles)
Captain, RCN,
DIRECTOR OF NAVAL PLANS AND OPERATIONS.

SECRET

SECRET

PHG/VC

NSS 1271-8
(STAFF)

ROYAL CANADIAN NAVY

23 September, 1958.

PROPOSED TRIPARTITE STUDY GROUP.

A/S DEFENCE OF THE STRAITS OF GIBRALTAR

Reference (a) MII/614/8/58, dated 11 August, 1958.

The Royal Canadian Navy supports Admiralty's proposal for a Canada-US-UK group to study the A/S defence of the Straits of Gibraltar. It is conceivable that some aspects of the problem may be applicable to the A/S defence of narrow waters adjacent to North America, for example, Hudson Strait.

2. Although research will probably be involved, it is not considered that the proposed Study Group should become a panel of the Technical Sub-Group "G" on Undersea Warfare of the US-UK-Canada Tripartite Research and Development Organization, because tactics and force requirements to be studied by the proposed group are outside the technical field in which the tripartite organization operates. However to assure continuity in the A/S field on an allied level it is suggested that the proposed Study Group be regarded as a subsidiary of the NATO ASW committee being established by SACLANT. The proposed Study Group would then be charged with forwarding progress and final reports to the latter. In this regard it is suggested that SACLANT should be requested to comment on the general directive to the proposed Study Group. The RCN has no objection to the general directive and its definitions as contained in reference (a), paragraphs 3 and 4.

3. As it is intended that the RCN representative to the proposed Study Group be nominated by CANAVBRIT, it is requested that CANAVBRIT be kept informed of arrangements, terms of reference etc. generated by Admiralty in establishing the proposed Study Group.

Director of Naval Plans & Operations
SEP

NAVAL SECRETARY.

SENIOR NAVAL LIAISON OFFICER (UK).

Copies to: CHAIRMAN, CHIEFS OF STAFF.

NAVAL MEMBER OF THE CANADIAN JOINT STAFF (WASHINGTON).

NAVAL MEMBER OF THE CANADIAN JOINT STAFF (LONDON).

DUSW for concurrence

A/A DNPO

000296

DEPARTMENT OF NATIONAL DEFENCE

MINUTE SHEET

Referred To	REMARKS To be signed in full showing Appointment, Telephone Number & Date
DHP.o.	for draft reply pse [illegible]

DND.317

H.Q. 1024

NAVAL SERVICE—MINUTE SHEET

FILE No. NS 1271-8
(SA/CNS)

REFERRED TO	REMARKS (WITH SIGNATURE, POSITION AND DATE)
A/VCNS	Discussed with ACNS(P). It is my fear that the RCN and DRB are getting so involved in international committees and study groups on AS Warfare that we are in danger of being swamped. I suggest we ask CANAVBRIT to keep an eye on the Straits of Gibralter study but that we do not participate in the actual study. F.H. Sanders F. H. Sanders, SA/CNS
16/9/58	
ACNS(P)	I agree with SA/CNS. We seem to be getting too involved in distant theatres. Please have a reply drafted along these lines for CNS. to see 16/9 VCNS.

DEPARTMENT OF NATIONAL DEFENCE

MINUTE SHEET

Referred To	REMARKS To be signed in full showing Appointment, Telephone Number & Date
VCNS.	Considering that we have a similar problem in the HUDSON STRAITS, it would seem that participation in this Study Group might be of future benefit to us. [signature] 5/9 ACNS(P)
SA/CNS See Minute attached. [signature] SA/CNS 15.9	Your comments please before passing to VCNS. [signature] A/VCNS 8/ix

DND. 317

FROM: OFFICE OF SENIOR NAVAL LIAISON OFFICER
(U.K. SERVICES LIAISON STAFF), CANADA
THE ROXBOROUGH, 95 LAURIER AVENUE WEST
OTTAWA, CANADA

SECRET
SNLO(UK) # S119/58

TO: The Naval Secretary,
Department of National Defence,
Naval Headquarters,
Ottawa, Ontario.

SECRET

File: S1-2-18-11F

Date: 22nd August, 1958.

Enclosed are two copies of Admiralty letter MII/614/8/58 of 11th August, 1958, concerning the establishment of a Study Group to consider the problem of providing an adequate A/S defence of the Straits of Gibraltar.

2. It is requested that I may be informed whether the Royal Canadian Navy agree to join this Study Group so that I may inform the Admiralty.

27/8 DUSW
A/CNS (~~A&W~~)
ACNS (P)

R. G. Dreyer.

R.G. Dreyer,
Captain, Royal Navy.

SECRET

Referred to Staff
AUG 26 1958
File No. S1271-8
Chgd to ....

Pmr

000300

Any further communication
should be addressed tto-
The Secretary of the Admiralty
London, S.W.1

quoting MII/614/8/58

Whitehall 0900
Extension 601

ADMIRALTY S.W.1

11th August, 1958.

SECRET

United Kingdom Naval Liaison Officer, Ottawa, Canada
copies to: Admiral, British Joint Services Mission
Commander-in-Chief, Mediterranean
Flag Officer, Gibraltar.

A proposal by the Commander-in-Chief, Mediterranean that a Study Group should be set up to consider the problem of providing an adequate A/S defence of the Straits of Gibraltar has been approved.

2. Both the United Kingdom and the United States have undertaken various investigations in the Gibraltar Straits area, but as far as is known, these investigations have not been co-ordinated. If real progress in controlling the transit of enemy submarines through the Straits is to be made, priority must be given to the development of suitable detection devices, and the efforts of those who have a direct interest in the problem must be closely co-ordinated. With this in mind it is proposed, subject to the agreement of the American and Canadian Authorities and the Air Ministry to set up a CAN/U.K./U.S. Study Group of the following composition:-

The Flag Officer, Gibraltar (Chairman)
The Air Officer Commanding Gibraltar
Representative of D.O.R. and/or D.P.R. Admiralty
The Scientific Adviser to the Commander-in-Chief Mediterranean
The Scientific Adviser to the Air Officer Commanding-in-Chief Coastal Command
Appropriate United States Navy representation
Appropriate Canadian representation
A full time working member who would be the Mediterranean Fleet T.A.S. Officer

3. The following has been proposed as a suggested general directive to the Group :-

"to provide practical long term recommendations for controlling the passage of enemy submarines through the Gibraltar Straits in peace, at the time of an alert and in war in the light of new ships, aircraft and weapons likely to become available. Additionally and subsequently, recommendations are to be made on suitable combinations of CINCAFMED's presently assigned forces to achieve the most effective degree of control in the event of "war tomorrow". When producing these recommendations, the unconventional use of existing detecting devices to provide better detection capabilities than the orthodox ship/aircraft/submarine barrier must be constantly borne in mind. The possible siting of shore-based detection devices in Spanish territory or Alboran Island should not be excluded.

4. The expression "control" in the above paragraph can be interpreted as :-

(a) Peacetime. The initial detection of enemy submarines transitting the Straights under any conditions and the tracking of these submarines for a distance and time which would, in war, enable them to be attacked by the weapon systems available.

SECRET

../2...

SECRET

(b) Wartime The detection and tracking of enemy submarines as above, together with the means of killing them.

5. I am to request that the Canadian Authorities be approached inviting them to join this Study Group. Preliminary Studies are being started and it is thought unlikely that a meeting of the Group itself will be required much before the end of this year.

BY COMMAND OF THEIR LORDSHIPS

(Sgd.) A.A. PRITCHARD.

SECRET

SECRET FILE No. S- 1271-8

DEPARTMENT OF NATIONAL DEFENCE

NAVY

ANTI-SUBMARINE COMMITTEE

/S DEFENCE OF STRAITS OF ~~GIBRALTAR~~ STUDY GROUP

CAN/UK/US

FOR CROSS REFERENCES SEE INSIDE COVER

ROUTING				P.A. & B.F. ENTRIES				REGISTRY ONLY	
REFERRED	REMARKS	DATE OF PASS	INITIALS	DATE OF P.A.	INITIALS	DATE OF B.F.	CANCEL B.F.	DATE RECEIVED	IN-SPECTED
Staff	WITH PAPERS CR AUG 27 1958			16-10-58				OCT 16 1958	
Staff	WITH PAPERS CR JAN 12 1959			19-2-59				FEB 18 1959	

CROSS REFERENCES

FILE No.	SUBJECT
Call VCNS	

SECRET FILE No. S- 1271-8

DEPARTMENT OF NATIONAL DEFENCE

ANTI-SUBMARINE COMMITTEE

A/S DEFENCE OF STRAITS OF STUDY GROUP

CAN/UK/US

FOR CROSS REFERENCES SEE INSIDE COVER

ROUTING				P.A. & B.F. ENTRIES				REGISTRY ONLY	
REFERRED	REMARKS	DATE OF PASS	INITIALS	DATE OF P.A.	INITIALS	DATE OF B.F.	CANCEL B.F.	DATE RECEIVED	IN-SPECTED
STAFF	... FEB 23 195.			9.3.59				MAR 3 - 1959	
1 ...	APR 30 1959								
DSS		6.5.59	[illegible]						
DNPC		22-5-59	[illegible]						
DUSW		20/8/59	[illegible]						
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DEPARTMENT OF NATIONAL DEFENCE

Anti Submarine Committees

A/S DEFENCE OF STRAITS ~~OF GIBRALTAR, STUDY~~

~~GROUP CAN/UK/US~~

CAN/UK/US. Study Group

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			11/3/60	CnL		MAR	[illegible]	L