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A SURVEY OF COMMUNICATIONS ON HMC SHIPS

PART I: TRIBAL CLASS DESTROYERS Shore

by

W. R. HARPER

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TORONTO, ONTARIO

A SURVEY OF COMMUNICATIONS ON HMC SHIPS
PART I: TRIBAL CLASS DESTROYERS

W.R. Harper

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AUTHOR

W.R. Harper
Applied Experimental
Psychology Section

APPROVED BY

M.G. Whillans, M.D.
Superintendent

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ABSTRACT

At the request of the Director of Naval Communications, a survey of the communications system in use in Tribal class destroyers was carried out on board HMCS Huron during exercises off the Bermuda Islands. A discussion of the present layout of equipment in Radio Office 1 and the Crypto-centre is given and recommendations made for constructing a new message centre and repositioning the equipment. A modified message form is suggested with a slight alteration in message handling procedure.

A SURVEY OF COMMUNICATIONS ON HMC SHIPS
PART I: TRIBAL CLASS DESTROYERS

INTRODUCTION

1. For some time past doubts have been expressed concerning the effectiveness of the communications system on board HMC Ships. Dissatisfaction has been directed mainly towards the message handling procedures and the layout of the equipment. In an attempt to remove the causes for the dissatisfaction it was decided by the Director of Naval Communications (D. N. Com.) that a survey should be made of ships' communications, with special attention given to ships with an immediate operational role. At present the only ships in this category are the Tribal class destroyers. These are being used in the UN Naval Forces in Korean waters. Modifications have been made to fulfil various specific RCN requirements. Also certain changes in electronic detection devices and armament have made it necessary to fit a different type of mast with some corresponding alterations to the adjoining superstructure. Although no two of these destroyers are exactly the same they are of the same general type so that the comments made here on HMCS Huron will apply to the class as a whole.

THE PROBLEM

2. As on all destroyers the basic difficulty is that of finding adequate working space to allow each crew member to perform his allotted task efficiently. This is particularly true in the Communications Department. The equipment is operated by personnel in one branch of communications whilst the clerical and other functions are handled by those in another branch. Since the allotted space is inadequate for their combined tasks a certain degree of friction has developed with a resultant decline in quality of performance. This is aggravated by the layout of the equipment which in many cases has been installed without an adequate evaluation of the methods of its operation.

3. Despite these stringent restrictions an effort was made to find more working space. The terms of reference of this study did not permit any structural alterations below decks nor was any other department in the ship

to be penalised for the sake of providing accommodation for communications facilities.

4. Repositioning the equipment will offer a partial solution to the difficulties described above. Possible solutions are limited by existing structures and by certain basic requirements of construction which must be adhered to. The most important of these is the question of top weight as related to the centre of gravity of the ship. This is determined by a series of finely balanced variables involving such factors as weight and stowage of equipment and fuel, sea and wind state, etc. It is most important, therefore, that this report be read with the understanding that many limiting factors had to be accepted.

METHOD

5. In order to appreciate the situation under working conditions, the Tribal class destroyer HMCS Huron was visited during anti-submarine practices and anti-aircraft exercises conducted off the coast of Bermuda. These exercises were conducted in company with HMCS Portage, HM Submarine Andrew acting as the prey For the A.A. exercises a towed drogue was used. The practice of proceeding to sea each morning and returning to harbour each evening was followed.

During the majority of the exercises the cruiser HMCS Quebec flying the flag of CANFLAGLANT remained in harbour and maintained shore watch to CFH. The ships Huron and Portage maintained a voice circuit to HMCS Quebec and to each other. An additional means of surface communication was provided by flag hoist or lamp. Communication with the submarine while submerged was carried on by a pre-arranged code of hand grenade detonations. In the event of an emergency the submarine and the surface ship could have communicated with one another in Morse code transmitted on the ASDIC apparatus.

PRESENT EQUIPMENT AND LAYOUT OF COMMUNICATIONS DEPARTMENT

6. A detailed description of each piece of equipment and its size and

technical capabilities will not be given here since this is available from other sources (E.E.C.). At present the communications equipment is located in two main offices known as Radio Office 1 and Radio Office 2. Previously on this class of ship there were four radio offices Radio Office 3 is now used for storage purposes and Radio Office 4 has been re-designed to house the Electronic Counter Measure equipment. Radio Office 2 is used to house certain duplicate radio sets which may be operated by remote control from Radio Office 1. The aircraft early warning radar set (291 m.) is also housed here. The room is generally kept locked.

Radio Office 1

7. The communications centre of the ship is the Radio Office 1 (Figs. 1 and 2) situated on the upper deck almost directly below the bridge. This office houses the main transmitting and receiving equipments comprising types PV500, CSR5A, FR12, TDZ, RDZ, TDQ, RCK, and RAK. In addition, certain miscellaneous items are located here, such as the radio teletype equipment (RATT), a stationery locker and the desk and filing racks required for signal distribution and internal message handling. The D/F set used almost exclusively by the navigation officer is also contained in this office as this equipment is regarded as a communications responsibility.

8. The operators on watch receive C/W and record the messages directly, using standard typewriters which are set in wells in the work bench. Metal padded posture type chairs are used.

Crypto-centre

9. The Crypto-centre (Fig. 1) is housed in a compartment originally designed as an oilskin locker. It contains a CCM and a Typex machine, and may communicate with the Radio Office by means of a hatch in the forward bulkhead. The compartment also contains a large generator and starter motor for the CM11 set, a fuse box and a stationery cupboard. There is no storage space for rotors and confidential books during operations. A strong box in Radio Office 1 is used for the safe custody of confidential documents when not in use. The door from the Crypto-centre opens on a main passageway facing the seamen's heads.

Bridge Communications

10. The bridge can receive and transmit by remote control on various voice circuits to other ships or aircraft. In addition, it has communication by several means with other departments such as gunnery, ship's intercom, engine room. There is a voice tube to Radio 1, among other places, which incorporates a message carrier hoist for passing message forms to and from the Captain and Radio Office 1. Visual communications are operated from the signal lamps and flag decks on the port and starboard sides of the bridge.

PERSONNEL

11. It has long been the custom for the men serving in the visual and radio branches of communications to be responsible to one authority but to be given different training. Several years ago it was decided to amalgamate the two branches and combine the training, in an effort to simplify the manning problem. The theory was that each man would then be able to do the work in either branch of communications. Unfortunately, the situation arose where instead of a man attaining maximum efficiency in one branch, he attained a relatively low degree of efficiency in two. This system of training was discarded and the RCN reverted to the original policy.

12. On board ship there is a certain amount of rivalry between the two branches, a rivalry that in itself might be desirable. Unfortunately, on the Tribal class destroyers both branches are forced to work in close and frustrating proximity. The message centre is staffed by visual signallers and is situated in Radio Office 1 along with the radio operators. If the recommendations given in Para. 16 are carried out, the friction resulting from this situation should be materially lessened.

The communications staff consists of the following members:

Executive Officer i/c Communications
Chief Yeoman of Signals

Radio	Visual
1 Petty Officer (Telegraphist)	
2 Leading Seamen	2 Leading Seamen
5 Able Seamen	5 Able Seamen

The watches worked are as follows:

To man radio equipment	Dayman - Petty Officer Per watch - three operators
To man radio message centre	Two Daymen One on watch silent hours
To man Crypto-centre	One per watch (if there is an increase in cypher traffic two per watch will be required)
To man bridge	Two by day (visual signallers)

WORKING CONDITIONS

13. Radio Office 1 is clean and adequately lighted. The floor is covered with ribbed rubber matting. The walls are panelled with insulated plywood. The benches and storage cabinets are of similar construction. The compartment is ventilated by means of forced air. Unfortunately, the Crypto-centre has no means of ventilation unless the door is kept open. For this reason the door of the Crypto-centre is kept open although this is not permissible under present security regulations. A record of temperatures in Radio Office 1 and the Crypto-centre was kept by various watches during the period of the exercises off Guantanamo Bay, Cuba, and the Bermuda Islands. With the outside temperature fluctuating from 65 degrees F. to 70 degrees F. the temperature in the Radio Office and Crypto-centre was approximately 90 degrees F.

ROUTING

14. The routing of outgoing radio messages within the ship generally follows the standard practice of the RCN (Fig. 3A). Under the present layout the message is first drafted by the originating authority and taken to the message centre within Radio Office 1. The operator, who is a visual communicator, types the message on the standard four page NDCS form. After typing, the form is taken by hand, usually by the originator,

to the Captain for approval and signature. The Captain of HMCS Huron has decreed that all outgoing messages must have his approval before transmission. On the bridge it is placed in the message passing bucket for delivery by drop tube to Radio Office 1. If it is for transmission in plain language the operator manning the appropriate circuit transmits the message. The time of despatch (TOD) is noted on the botton of the form and the message is logged in the circuit log. In order that loose message forms may not be mislaid whilst waiting for the message centre rating to handle them, they are held in a spring clip fixed to the set.

15. The signaller in the message centre types out the required internal distribution according to the text on naval message forms. He uses a standard typewriter and carbon paper. Unclassified messages are given an automatic distribution to the bridge log and the wardroom log. The originator receives a copy of the typed message. The message centre retains two sheets of the NDCS form. The reference and originator's copies are destroyed. In the case of messages requiring encryption the message is handed into the coding office via the hatch (Fig. 1). The Crypto-operator logs the encoded message and passes this version to the Radio operator. The P/L version is handed to the message centre for typing. In this case the distribution is limited to the originator and the Bridge log. The routing of incoming radio messages follows the standard practice (Fig. 4A). The message is received in code or P/L on the appropriate circuit by the Radio operator who logs it in the circuit log. P/L messages are passed to the message centre. Rough copies of urgent messages or messages of an operational nature are immediately passed via the message handling bucket in the voice pipe to the Captain. Messages of a routine nature are typed on the standard naval message form for distribution in the same way as for outgoing traffic. Classified messages are passed directly to the Crypto-centre from the Radio operator. They are decoded, logged, and then passed to the message centre for immediate action or for typing and normal distribution. The encrypted copy is filed in the message centre.

16. Messages transmitted by flag hoist are not circulated in this way as they rarely refer to anything beyond immediate actions or manoeuvres. Messages sent by signal lamp occasionally require circulation.

TRAFFIC

17. In an effort to gauge the amount of signal traffic during the exercises

some figures of incoming and outgoing messages were obtained from the files of Radio Office 1. As these files do not include all the details which would supply this information, the figures are necessarily approximate.

Unclassified Traffic

Fleet broadcast incoming messages	44 per day
Ship-shore (HMCS Quebec) outgoing messages	10 per day
Inter-ship communication incoming messages	20 per day
outgoing messages	14 per day
Operational Voice circuits incoming messages) outgoing messages)	25-30 per day

Classified Traffic

Incoming	12 per week
Outgoing	2 since Jan. 17, 1953

While HMCS Iroquois was on its latest tour of duty in Korean waters, the Commanding Officer made a traffic analysis showing the volume of traffic handled in the Task Element. This totalled 259 incoming classified messages and 144 outgoing per month. From these figures it will be apparent that the traffic figures for the exercises are of limited value in any endeavour to establish link values for the use of equipment.

PROPOSED ALTERATIONS

18. The main difficulty in Radio Office 1 is caused by lack of space which is aggravated by the inclusion of the message centre. Logically this is the proper place for the message centre since all the communications functions should be grouped in one area. Because other departments are equally crowded, it is virtually impossible to reallocate the existing

space in the interest of the message centre. With this in mind it is suggested that a light-weight message centre be constructed inside the base of the mast (Fig. 2). (Here as elsewhere in this report, dimensions can be obtained from the figures which are drawn to scale). This message centre would be positioned at the after-end of the bridge using the deck-head of the existing ECM and Sperry gyro compartments as the deck. The walls could be constructed from sheet aluminum and light-weight aluminum furniture and fittings installed. No structural members need be erected, as sufficient support for the wall and deck-head plates will be given by the mast members. Certain services such as light and heat would need to be installed. A method of receiving and passing messages from the after-end of the bridge would be required. This could be provided simply by installing a light-tight hand-through tube from the message centre to the after-end of the bridge. A method of calling the bridge would be a further requirement, and a simple buzzer or bell signal would fulfil this demand.

19. A most important feature would be a means of passing of messages to and from Radio Office 1. A simple installation such as a message container attached to an endless cord revolving round two pulleys—one in Radio Office 1 and one in the proposed message centre, is a possibility (Fig. 2). This would be contained in a copper or brass voice pipe similar to the existing connection between the bridge and Radio Office 1.

20. The only foreseeable objection to this proposal is the question of topweight. An estimate of the total weight has been made. The weight of the alloy plates required for the bulkheads and deck-head would approximate 1267 lbs. (The total area of 352 square feet of .25 inches thich plate times 3.6 pounds per square foot). The two men would have a total weight of approximately 310 pounds. Allowing 200 pounds for miscellaneous fittings such as furniture and wall files the total should be 1777 pounds.

21. Regardless of the decision to adopt the proposed message centre some re-arrangement within Radio Office 1 is required (Fig. 5). The stationery should be stored in relatively shallow cupboards attached to the port side bulkhead as near the deck-head as possible. This would give additional floor space. The FM12 D/F is not used enough to justify its holding a position in Radio Office 1 since other equipment largely supersedes it. However, the FM12 must be mounted close to the aerial; it would appear that the best solution to the problem of placement is to retain it in Radio Office 1 but to move it from the corner it now occupies. If a wall bracket

was installed on the forward bulkhead in the position previously occupied by the stationery cupboard this would be adequate for stowage. The RATT equipments should be moved from the corner they now occupy to the bench formerly used as a message distributing centre. This would leave the area formerly occupied by the RATT equipments for the P.O. (Tel) to handle messages. The voice pipe from the bridge terminates at this point as would the one from the proposed message centre. The focal point of the activity in Radio Office 1 will be in the starboard aft corner so that the person servicing the voice pipes will be equidistant from the Crypto-centre and the radio sets.

22. The Crypto-centre would benefit by being re-arranged. The entrance is from the much used passageway which gives access to the seamen's heads. The difficulties of enforcing security regulations in such a situation are great, since the door of the Crypto-centre must be kept open for ventilation (Fig. 1). It is suggested, therefore, that the passageway door be sealed and a doorway be constructed in the forward bulkhead between the Crypto-centre and the Radio Office (Fig. 5). This would mean that the only entrance to the Crypto-centre would be through the Radio Office The additional alterations of equipment to improve the conditions in the Crypto-centre would be:

(a) The starter and generator for the CM11 be moved to a position underneath the battery box, which is under the ladder leading to the C.P.O.'s pantry. The starter box be moved up as high as possible on the bulkhead.
(b) The battery box be placed on wall brackets to permit (a) above.
(c) The stationery should be stored in relatively shallow cupboards installed on the after bulkhead as near the deck-head as possible.
(d) A bench is built across the port side (passageway door) of the compartment to accommodate the Typex equipment. The bench on the forward bulkhead be transferred to the after bulkhead. This would accommodate the CCM and in addition will provide a desk area needed for doing book codes. At present there is no such provision.
(e) Small racks should be constructed on the bulkhead above the appropriate cypher machines to hold rotors. In present practice, half full boxes of rotors and loose rotors are left on the bench.

(f) With the removal of the starter motor and generator ample space will become available for the storage of the strong box. The box will then be in the area where it is most used.

23. The friction between the two branches of communications personnel will be lessened if the proposed message centre is adopted. To a casual observer, this friction may appear trivial, but most commanding officers regard it as an unnecessary source of discord.

24. Air conditioning should be provided in the Radio Office and Crypto-centre. This is of the utmost importance to any ship which has to serve in the Far East. This installation would dissipate the heat generated by the transmitters which, coupled with lack of ventilation and the outside temperature, makes working conditions uncomfortable.

25. The routing of outgoing and incoming radio messages (Figs. 3B and 4B) in the proposed message centre requires little change.

The present NDCS form is unsatisfactory for shipboard use. An alternative form and method is suggested (Fig. 6). In the present method the rough copy is typed on a message form, signed, transmitted, and then up to five copies are typed for distribution. This necessitates double typing and the destruction of two sheets of the presently used "readiset" NDCS form. A smaller "readiset" form with six interleaved carbons supplied in perforated rolls to be mounted on the back of a typewriter would obviate these inefficiencies. When the message was typed from the originator's rough copy, signed, and transmitted, it would be ready for immediate distribution. The labour of typing would be reduced by 50 per cent and the amount of paper used by approximately 22 per cent.

SUMMARY OF RECOMMENDATIONS

26. To ease the cramped conditions under which the communications personnel work the following recommendations are presented.

Radio Office 1

It is recommended that:

(a) The message centre be transferred to a lightweight structure built inside the base of the mast, with a connection between the bridge and Radio Office 1 so that messages can be passed to and from the message centre.
(b) The stationery cupboards be replaced by several shallow cupboards fitted to the port bulkhead at the deck-head.
(c) The RATT equipments be moved to the forward port corner.
(d) The FM12 be mounted on a wall bracket in the space presently occupied by the stationery cupboard.

Crypto-centre

It is recommended that:

(a) The passageway door be sealed.
(b) A doorway be constructed in the forward bulkhead leading to the Radio Office.
(c) The starter and generator for the CM11 be moved to a position underneath the battery box which is under the ladder leading to the CPO's pantry.
(d) The battery box be mounted on a wall bracket to allow for (c) above.
(e) Benches be constructed along the port side and after bulkhead of the compartment.
(f) Racks be built for the rotors.
(g) The strong box be kept in the Crypto-centre.

Working Conditions

It is recommended that air-conditioning be installed in Radio Office 1 and the Crypto-centre to dissipate the excessive heat in these offices.

Routing

The use of a modified message form is suggested. This should be supplied in "readiset" seven copy rolls, perforated for

easy tear-off. They should be mounted on the rear of a typewriter.

All the recommendations have been discussed with the appropriate Department Head on board HMCS Huron. No objections were raised by the Captain, Chief Engineer, Electrical and Communications Officers to the installation of the proposed changes.

RECOMMENDATIONS FOR FUTURE STUDY

27. The time devoted to this investigation was not sufficient to gather data that would throw light on the inter-relationship of equipments. Furthermore, the exercises were such that data of the kind needed were not produced.

Possibly a study of certain types of ships in the RCN at an earlier stage of development would correct some of the faults which are apparent in Tribal Class destroyers. This refers in particular to

(a) Destroyer escorts now under construction.
(b) HMCS Algonquin type conversions.
(c) HMCS Bonaventure (ex HMS Powerful)
- aircraft carrier.

The order in which these are mentioned has no significance since the priority would be determined by D. N. Com. or other Naval authority.

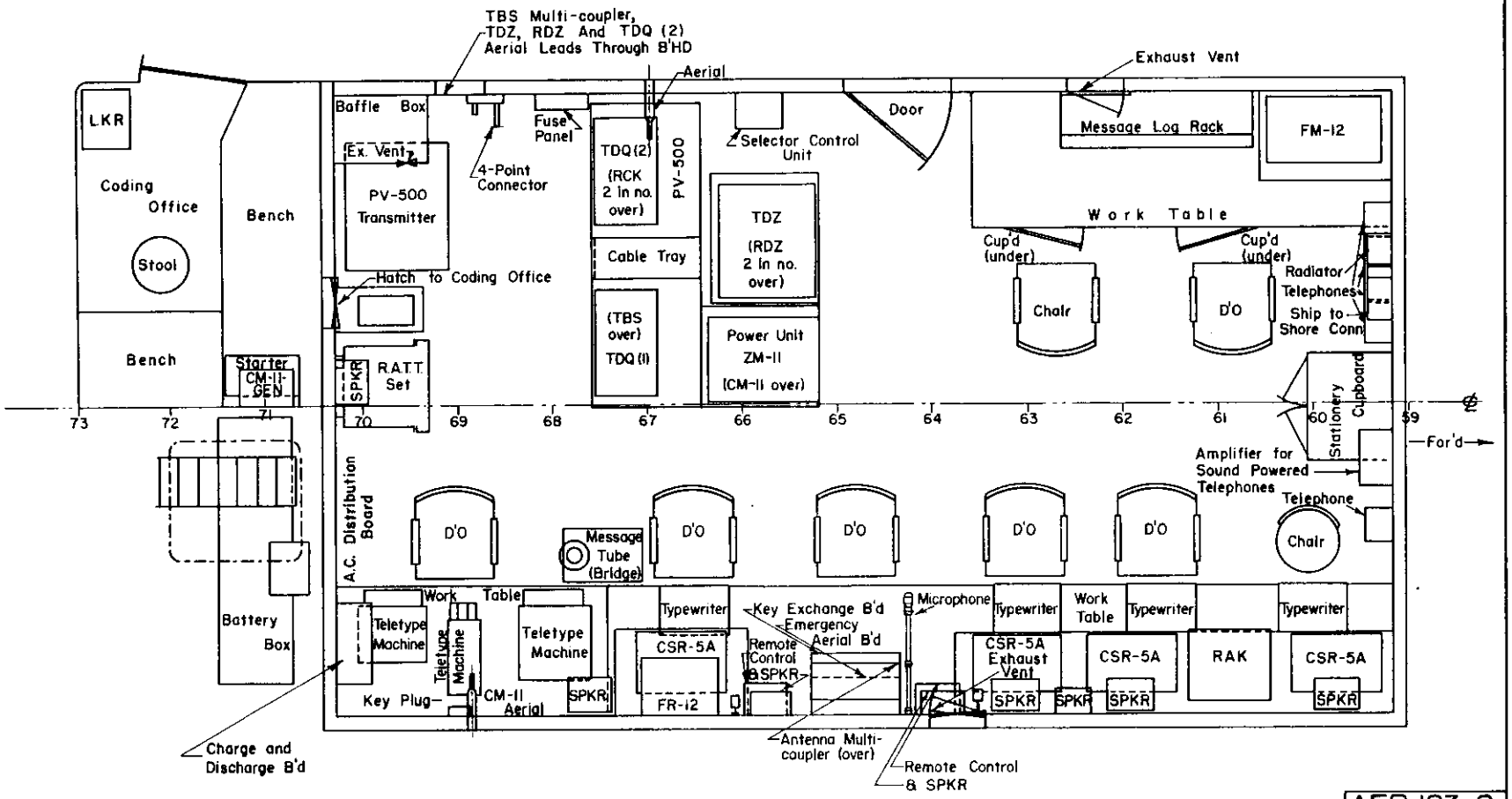
ACKNOWLEDGEMENTS

28. The author wishes to express his thanks to the staff of D. N. Communications for their assistance in arranging the visit to HMCS Huron.

The Captain of HMCS Huron, Cmdr. R. C. Chenoweth, was very kind in proffering hospitality and in making available the services of the Chief Engineer, Lt. -Cmdr. H. D. Minogue, the Electrical Officer, Lt. P. R. Munro, and the Communications Officer, Lt. D. P. Brownlow. Their help was greatly appreciated. The guidance given by Lt. D. O. Campfield was of great value.

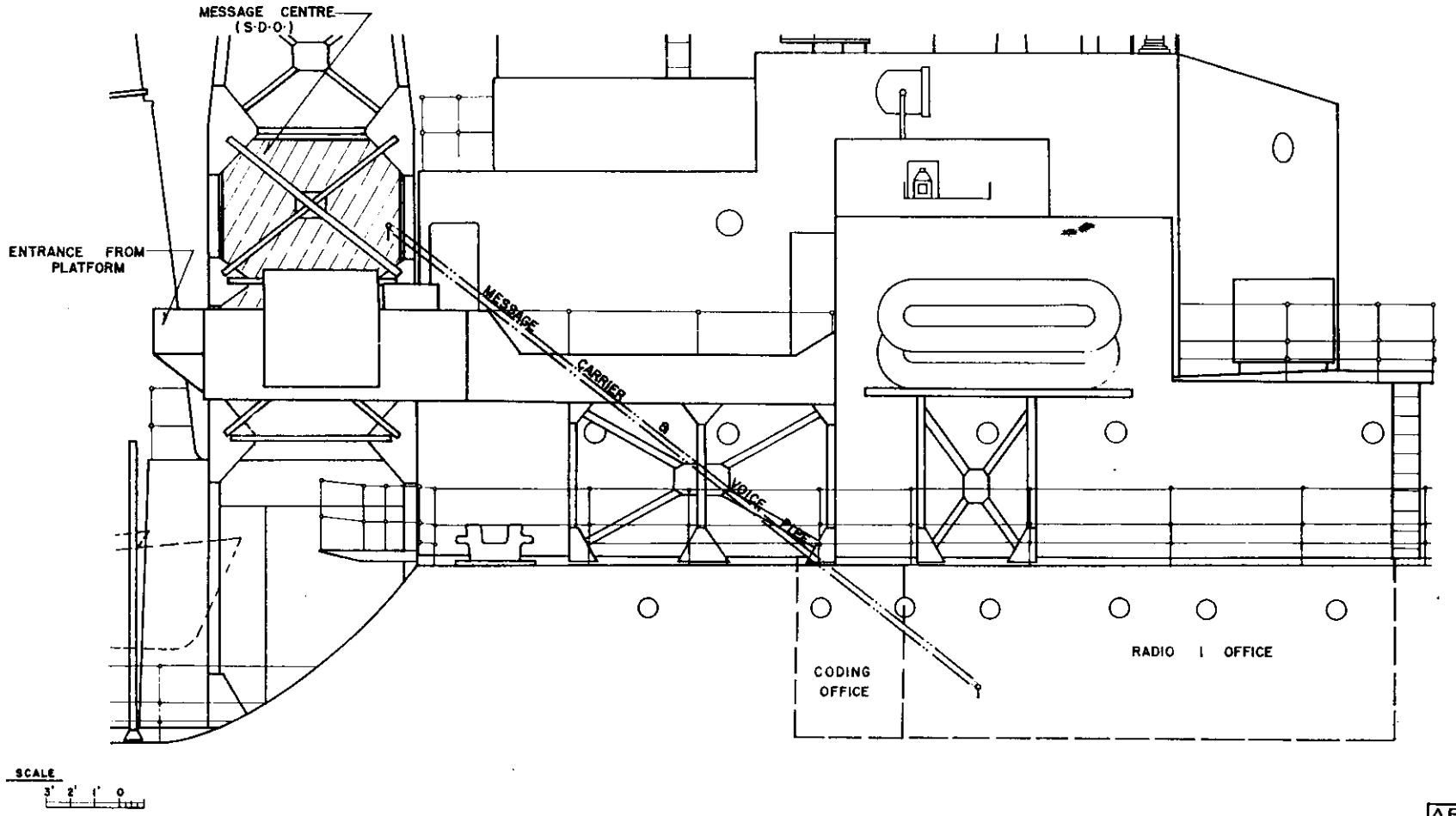
FIG. I — H·M·C·S· HURON

PRESENT LAYOUT OF RADIO I OFFICE & CODING ROOM



AEP-123-2

FIG. 2 — H·M·C·S· HURON
BRIDGE PROFILE SHOWING PROPOSED MESSAGE CENTRE



AEP-124-2

FIG. 3 — H·M·C·S· HURON
FLOW PROCESS CHART OF OUTGOING RADIO MESSAGES

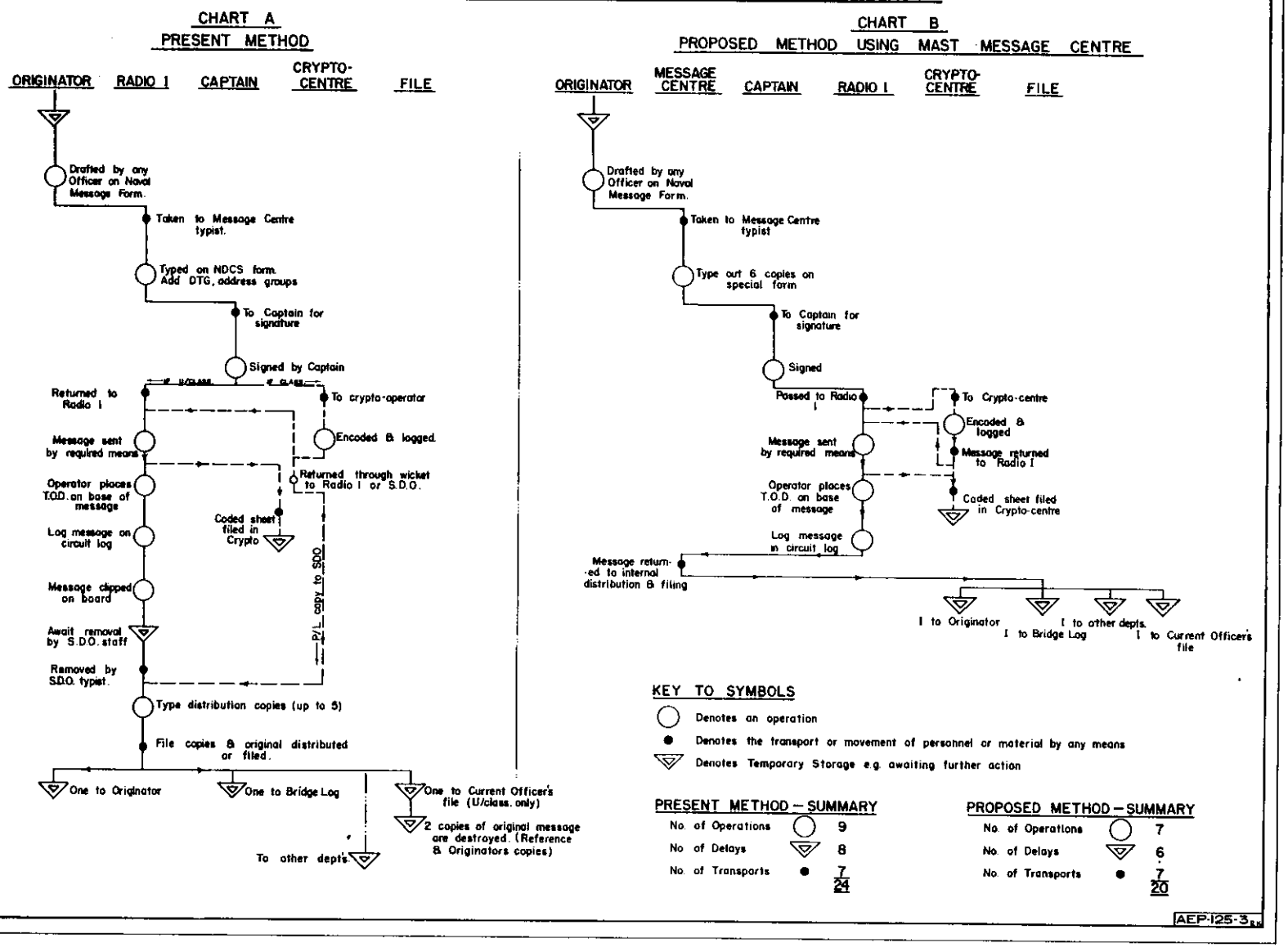
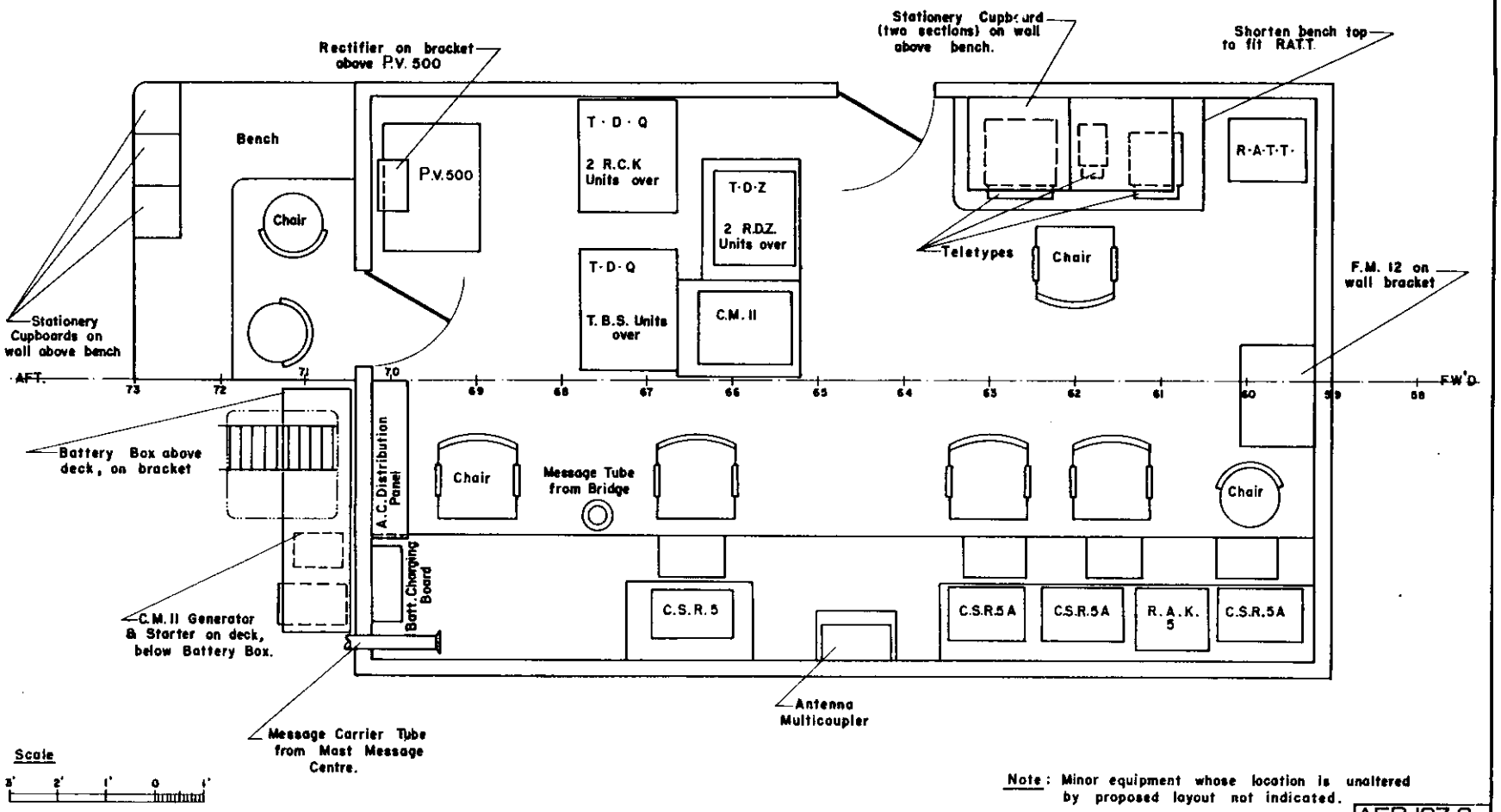


FIG. 5 — H·M·C·S· HURON
PROPOSED LAYOUT OF RADIO I OFFICE & CODING ROOM



Note: Minor equipment whose location is unaltered by proposed layout not indicated.

AEP-127-2

NAVAL MESSAGE

PRIORITY		FOR MESSAGE CENTRE USE ONLY
OPERATIONAL IMMEDIATE		
PRIORITY		GR.
ROUTINE		FROM
DEFERRED		ACTION ADDRESSEE/S

INFORMATION ADDRESSEE/S

ORIGINATOR	DATE-TIME GROUP	FILE NO.
	Z	

JE

FIG. 6 – Proposed Form to Replace NDCS Message Form. AEP-128-1

FIG. 4 — H·M·C·S· HURON

FLOW PROCESS CHART OF INCOMING RADIO MESSAGES

CHART A

PRESENT METHOD

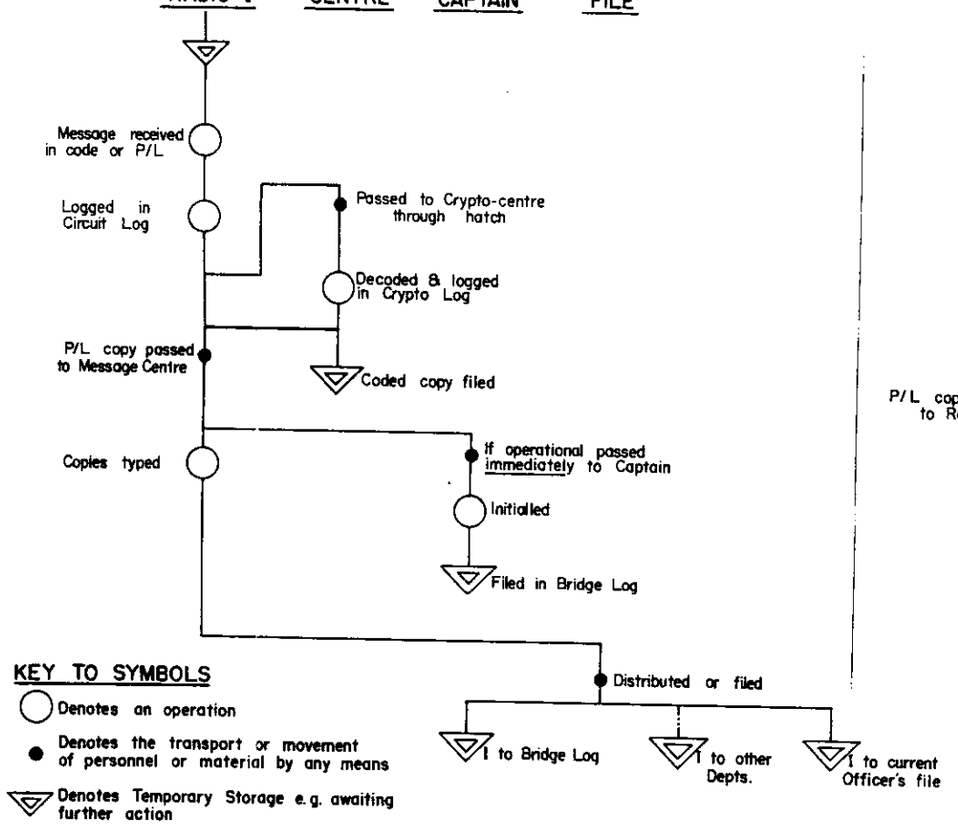
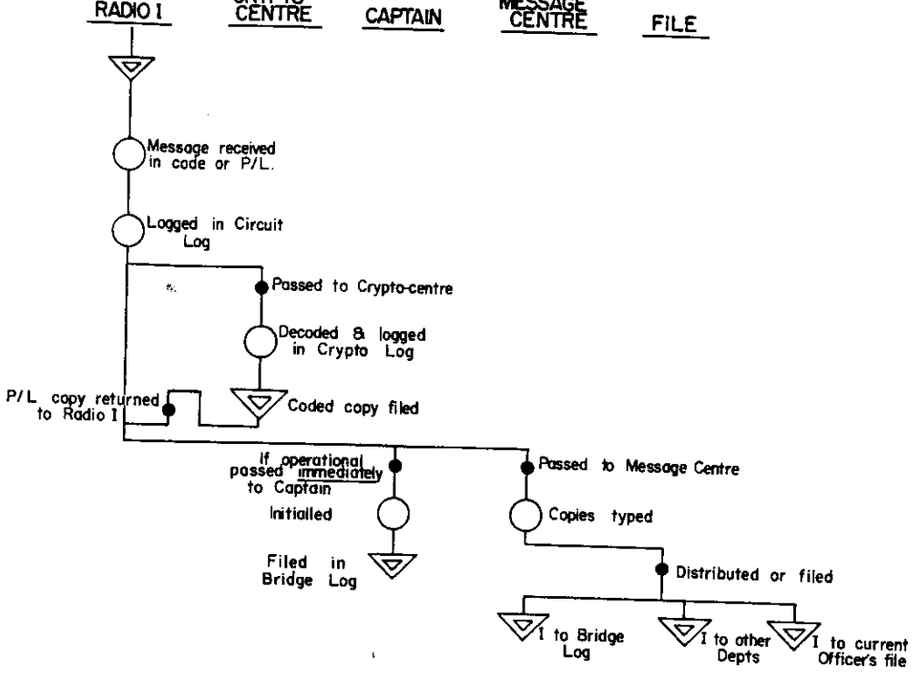


CHART B

PROPOSED METHOD USING MAST MESSAGE CENTRE



KEY TO SYMBOLS

- ○ Denotes an operation
- ● Denotes the transport or movement of personnel or material by any means
- ▽ Denotes Temporary Storage e.g. awaiting further action

PRESENT METHOD — SUMMARY

No. of Operations	○	5
No. of Delays	▽	6
No. of Transports	●	4
		15

PROPOSED METHOD — SUMMARY

No. of Operations	○	5
No. of Delays	▽	6
No. of Transports	●	5
		16

AEP-126-3