VENTILATION & HABITABILITY IN AN OLDER R.A.N. SHIP PROBLEMS & SOLUTIONS

BY

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VENTILATION AND HABITABILITY IN AN OLDER RAN SHIP- PROBLEMS AND SOLUTIONS

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SUMMARY

This paper discusses measures taken during 1978-80 to improve ventilation and habitability in HMAS MELBOURNE at a time when, although a decision on an aircraft carrier replacement programme was pending, it had not been made, and it was obvious that the ship would be in commission beyond 1985. If this goal was to be achieved high priority had to be given to ventilation and habitability improvements; and these had to be achieved within an extremely limited budget. Whilst the problems discussed deal only with one older RAN ship, similar examples may well exist in other ships of this vintage in other navies.

INTRODUCTION

1. HMAS MELBOURNE was one of 16 Light Fleet aircraft carriers built during the Second World War (1939-45). Laid down in April 1943 at Barrow-in-Furness, she was launched in February 1945 and, because of the cessation of hostilities, she was laid-up in reserve in an uncompleted state. She was purchased by the Australian Government in the early 1950's and underwent extensive "modernization" in the U.K., including the fitting of a steam catapult, mirror deck landing aid and improved aircraft arresting systems.

2. Commissioned into the Royal Australian Navy in October 1955, HMAS MELBOURNE has been in continuous service for over 25 years and has steamed over 810,000 sea miles. During this extensive service the ship has had many refits during which, not only were repairs to existing plant and equipments carried out, some new equipments and improved facilities and capabilities have been incorporated in the original hull.

3. In the late 1970's the need for a replacement aircraft carrier became obvious and, for a great many reasons, a government decision was not forthcoming. Moreover, the long lead time necessary for any replacement carrier required HMAS MELBOURNE to remain in service beyond 1985. This, in turn, generated other problems; monies for alterations and additions to structure and plant were necessarily restricted; the ship could not be removed from service for an extended period of time and had to remain within the existing operational cycles (constraints dictated by operational needs); with a complement in excess of 1,300 invidious comparisons were made with habitability standards in ships of more recent construction.

4. In this background, several far-reaching decisions were taken:

Firstly, at a meeting attended by representatives of Navy Office, Garden Island Naval Dockyard and ships officers to discuss the extent of work required to keep the ship operational, the Superintending Naval Architect (SNA) GID decided that, rather than install new air conditioning plant, the existing plant and systems should be examined and their efficiency tested.

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5. At the same time, a decision was taken to form a 'MELBOURNE Habitability Committee". This Committee arose out of papers within Navy Office which acknowledged the pressing need to improve habitability and the lengthy administrative delays which sometimes occurred when processing requests for alterations and additions in the normal manner.

6. A third, and perhaps final, link in the chain of decisions was taken onboard HMAS MELBOURNE itself, by the then Commanding Officer, Commodore D.J. MARTIN, RAN. He observed that there were a large number of ways for the ship to help themselves improve things onboard and in a community as large as MELBOURNE's there were talents which were not fully utilized.

7. These decisions, together with the method of their implementation, formed the basis of a particularly interesting period in the ship's history.

VENTILATION AND CONDITIONING

Description of Fitted Plant

8. HMAS MELBOURNE is fitted with various types of ventilation systems and, whilst some defects were evident in other forced ventilation systems, the main thrust of this paper is towards the air conditioning plant and systems. Five separate plants are fitted:

a. Compartment 6N

Two x 750,000 BTU/hr units
(8 cylinder Yorkaire)

b. Compartment 5M

One x 750,000 BTU/Hr unit
(8 cylinder Yorkaire)

c. Auxiliary Machinery Compartment 8K
Two x 1,500,000 BTU/hr units
(16 cylinder York-Shipley)

9. In basic terms may be described thus: chilled water is produced by the above plants, pumped throughout the ship and led to various cooling cabinets (called chillers or weathermakers) fitted in the air trunking. Across the chiller forced ventilation carries the cooled air to the various compartments.

Trial

10. At the inception, the need for trials to be conducted under actual conditions was realised and to achieve this five dockyard officers joined the ship in Hawaii during March, 1980.

11. The method of approach used by the trials team was:

a. conduct a complete check of each air conditioning system to ensure that it is operating in its designed manner;

b. conduct a similar check on the chilled water system; and

c. with the air conditioning plants operating in their normal mode, measure air flows and temperatures in the form of air conditioning trials to determine heat gain through each cooling coil.

12. A secondary objective of the investigation was to take readings of sufficient parameters of the chilled water plants to enable GID staff to determine whether or not their output could be improved. The ship's staff were given the responsibility of taking these readings for forwarding to the mechanical design office at GID.

13. An additional objective, included after knowledge of conditions in non-air conditioned compartments under tropical conditions, was to record the temperature in as many of these compartments as time would permit.

Trial Results

14. During the trial, irregularities were found in design, system maintenance, operation and documentation. Significantly, the total specified capacity of the plants was 5.25 M BTU/hr; the total coil requirements as fitted was 3.75 M BTU/hr; the total measured at the coils was 3.0 M BTU/hr; and the total required to air condition the remainder of non-air conditioned compartments was 0.5 M BTU/hr - (Ship's indicated plant load was 4.5 M BTU/hr.

15. Many other deficiencies were found and amongst them were:

a. Insufficient annubar flow elements were fitted to the chilled water system to allow monitoring of the chilled water flow.

b. The entire chilled water system required chemical cleaning to remove accumulated sludge.

c. Chilled water main cross-connection transition pieces were 'tee' shaped; 'Y' shapes would improve the total chilled water flow.

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d. A re-arrangement of the chilled water supply to some existing cooling coils would enable additional coils to be fitted in other non-air conditioned compartments.

e. The ship's ventilation party lacked co-ordination and direction.

f. There were no operational or maintenance handbooks and thus the systems, even if their design was better, could not be set up correctly.

g. Insulation of the chilled water main required extensive repair.

h. False and insulated deckheads and decks were required in some instances to reduce local wild heat.

i. Some fans were operating at incorrect speeds and, in several cases, because spare parts were unavailable, fans of incorrect capacity had been installed.

j. Cooling coils required external cleaning and many had been designed such that there was no ready access to permit this.

k. Many ventilation flaps and trunking sections required repair, and in several areas unauthorised trunkings and punkah louvres had depleted the air supply to upstream consumers.

16. Naturally, the very extensive report on these trials covered a great many finer points but, in the main the points listed above form the body of that report. At the time of writing, the majority of these deficiencies have been corrected or are planned to be overcome in the immediate future.

17. It is perhaps the manner in which many of these ventilation and air-conditioning problems were taken in hand that leads to the next section of the paper: The Habitability Committee.

HMAS MELBOURNE Habitability Committee

18. In the life of any ship, ideas and suggestions for alterations and additions (A's and A's) to structure, and modifications (Mods) to plant and systems are forwarded to the appropriate authorities in an endeavour to improve the "as fitted" ship. The very nature of these proposals, in many cases, requires extensive investigation, cost analysis, weight consideration and documentation.

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19. This process, vitally necessary to ensure uniformity of approach, leads to considerable delays in many cases and, in MELBOURNE's case, was recognized as being counter-productive to timely improvements in habitability. Furthermore, the implementation of Mods and A and A's during refits reduced the capacity of the repair agency to undertake defects. Similar effects accrued in the budgetary control of refits.

20. In an endeavour to overcome these difficulties, achieve results quickly and leave a large measure of control within the ship the MELBOURNE Habitability Committee (MHC) was formed. Given an annual budget of $AUST.200,000 of which $50,000 was to be spent on labour (dockyard or contract) the MHC could, within certain constraints, purchase materials and/or goods which would raise the level of habitability.

21. Nor were the purchases limited to naval supplies or marine equipments. Where difficulties were being experienced in buying particular items to naval specifications (in many cases designed to outlast a new ship!), suitable commercial equipments could be purchased. This approach acknowledged that some commercial equipments might fail under shock loading or other unusual marine conditions. It also recognised that commercial equipments weighed less, generally occupied less space and were more readily available. In other words, the equipment only had to last 5 to 8 years and did not have to be water-tight to 600 fathoms!

22. The MHC comprised the Commanding Officer, HMAS MELBOURNE (Chairman) with representatives from the Naval Dockyard, Fleet Staff, Navy Office and the Naval Support Command. Although this may seem a cumbersome array of agencies, decisions were taken and implemented with a high degree of co-operation from all parties.

23. Some examples of purchases made are:

a. Galley equipment

b. Carpets and underfelt

c. Carrier Air Conditioning Units (5,760 BTU)

d. Weathermakers (Cooling cabinets)

e. Domestic refrigerators

f. Ice making machines

g. Portable Steam Cleaning Units

h. Furniture

i. A number of 26 inch TV sets

j. Portable Fans

k. Domestic washing machines

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24. Of course, a great many materials were purchased for ship's staff to use in their own attempts at habitability improvements. Dockyard, Fleet Maintenance and personnel from various contractors carried out other work, to drawings and designs provided by GID, and some of the more notable examples are:

a. The extension of the chilled water main and the installation of some weathermakers to extend air conditioning to previously non-air conditions sleeping compartments.

b. Installation of galley equipments.

c. Installation of carpets.

d. Extending the suction and filling lines to the aft trimming tank, thereby increasing the amount of fresh water carried onboard.

25. These various acquisitions and improvements helped habitability tremendously but one important facet remained: the mess areas themselves had shown little or no improvement since the initial design.

The Klan

26. The Commanding Officer, Commodore D.J. MARTIN, RAN, directed that a group be formed onboard to rationalise the proximity of kit lockers to bunks, and suggest methods of improving living conditions generally within the bounds of onboard talents and equipment. This group quickly became known as the Klan.

27. Heading the Klan was a Lieutenant Commander (the Grand Wizard) with every departmental Regulating Chief Petty Officer as the Klansmen (or lesser wizards). They quickly recognised that very few sailors messdecks provided any privacy; nearly all were used as gangways for domestic traffic - and in a ship with over 1300 sailors onboard, someone always wants to go forward or aft, up or down. The non-existence of privacy was a particularly sore point with the sailors.

28. Some messes had made attempts to improve their surroundings but these were few and far between and there was no real co-ordination in their efforts. Invidious comparisons were made with more modern fleet units and, whilst bunk areas were possibly of a similar standard, recreation areas or lounges were viewed with envy.

29. Another fault with MELBOURNE's design was the proximity of bunks to kit lockers. Sailors sleeping in, say, 4C compartment had their kit stowed in 5E. A rather awkward set up particularly under trying working conditions. Bathrooms and Heads were similarly misplaced.

Foot Traffic

30. The first step was to stop traffic through messes.

31. In a ship designed with broadside messing the restriction of through traffic was an important first step, if not a bold one. Education of the entire crew was the key and this was achieved through all forms of media; closed circuit TV; Daily Orders and the ship's newspaper.

32. Signs were posted on all mess doors and on approaches to blocked-off areas. In some cases hatches were closed off and fixed ladders removed, care being taken to leave jacobs ladders and escape hatches rapidly accessible. All escape routes were checked and re-checked before these measures were taken.

33. After some initial teething troubles the system worked. Traffic was forced to use passageways and ladders outside the mess areas, and this resulted in a larger degree of privacy.

Mess Improvements

34. Improvements to messes were much more difficult to achieve because, almost without exception, every mess required a recreation area, not all messes had a domestic refrigerator, there were too few cool water drinking fountains in the ship and, of course, the kit locker problem previously mentioned had to be tackled.

35. Following a presentation on TV each mess was invited to forward a solution to their own mess problem including lists of materials required and any technical qualifications of personnel in that mess (plumbers, carpenters, welafre, sign-writers etc).

36. Most messes responded enthusiastically; submissions were validated, discussed with the various mess committees, altered as necessary, discussed again and forwarded in a report to the CO with Klans' recommendations. The substance of the report was accepted and work began (usually on completion of flying, in off-duty hours or in harbour).

37. The type of improvements undertaken involved the removal of redundant fittings, hoists and the previously mentioned traffic routes. Re-arranging bunks within the mess areas, in some cases from three tier to four tiers, threw up additional deck area. Once some additional space was found the shuffling of kit lockers seemed to fall into place and, although all needs were not fulfilled, many were.

38. A gain in one area ususlly resulted in a loss somewhere else and these had to be rationalised. But substantial gains were made such that each mess had a carpeted recreation area, refrigerator, TV set and some privacy. Perhaps one of the most important features of the whole programme was that the sailors themselves, had been involved and they felt the personal satis-faction of having achieved noticeable improvements to their surroundings.

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39. Configuration control was achieved in two ways: through the various representatives on the MHC who were advised through that Committee of the purchases and alterations to be made; and by defect action from the ship in respect of the general arrangement of the messes. Lists of equipment required frequent amendment and drawings had to be altered.

CONCLUSION

40. Habitability, a major factor in morale, may be defined as anything associated with or affecting the quality of life for the individual. Faced with an unusual problem management provided and implemented workable solutions. In some cases, these solutions did not accord with convention and not all problems were solved but significant improvements were made, and these resulted in a happier, more comfortable ship. This, in turn, improved the operational effectiveness of a major Fleet unit.

Acknowledgment

The author wishes to acknowledge the assistance of Garden Island Dockyard Fleet Staff and the Commanding Officer HMAS MELBOURNE in providing trials reports, documents, letters, information and photographs used in this presentation.

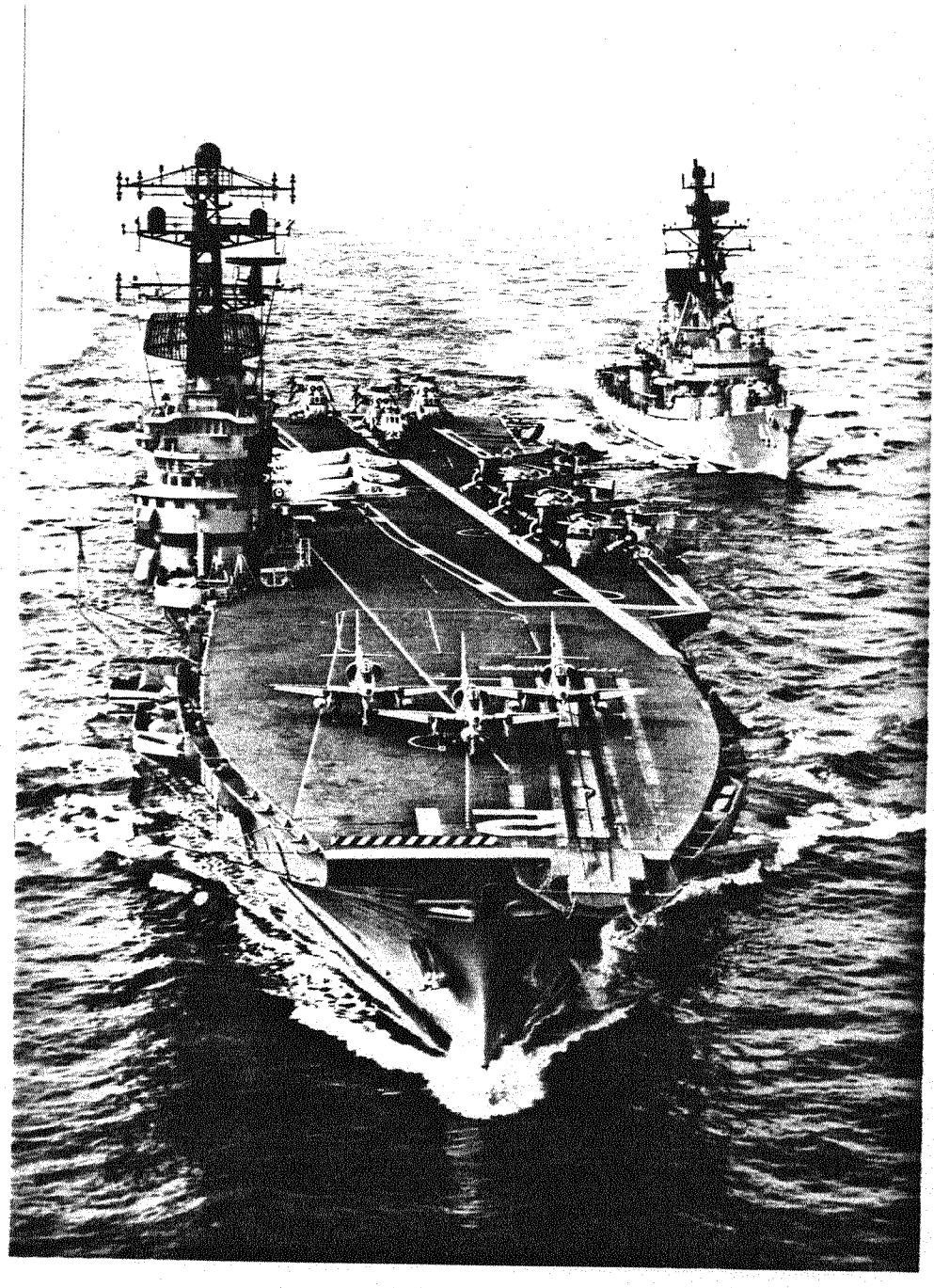
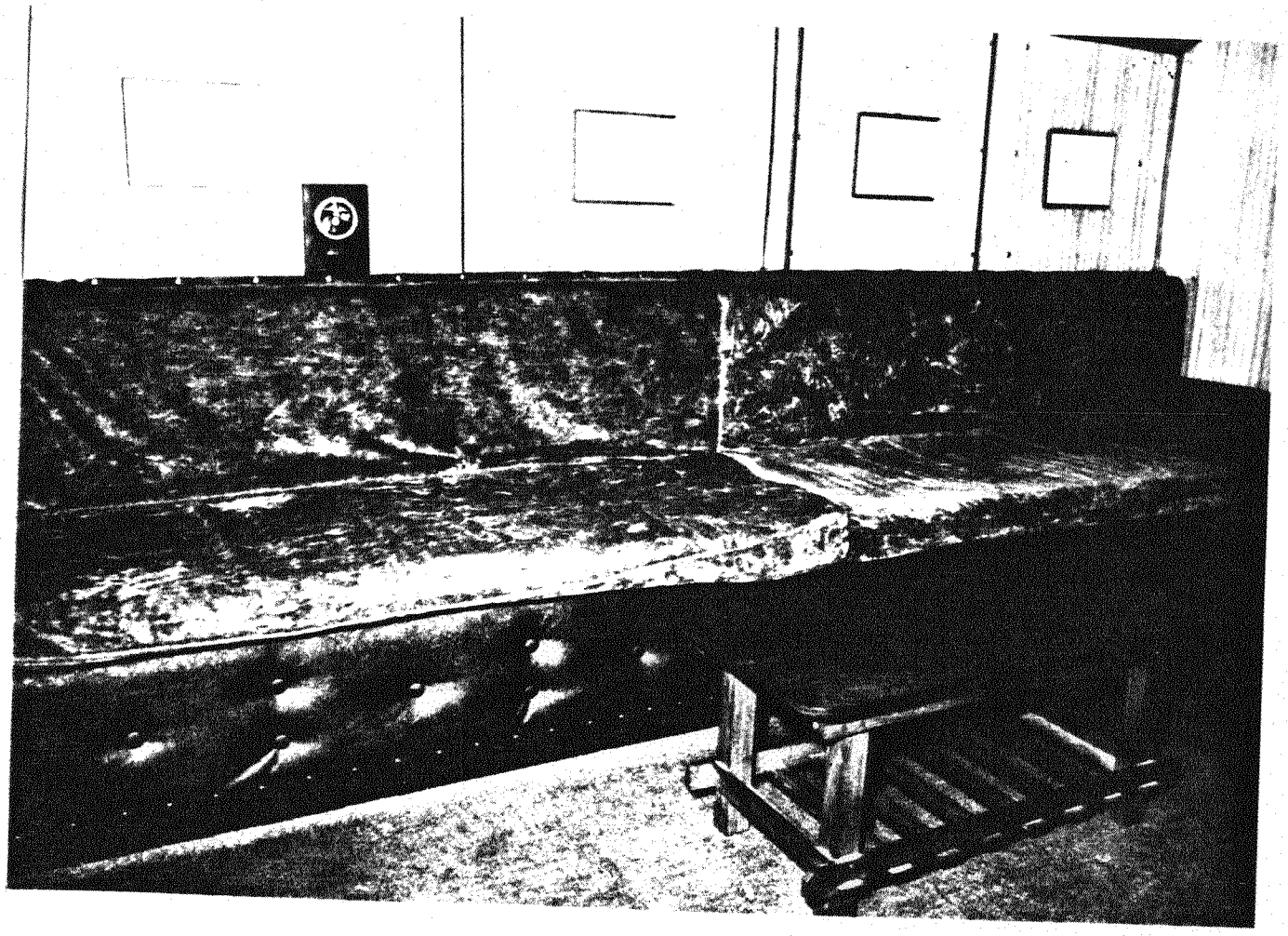
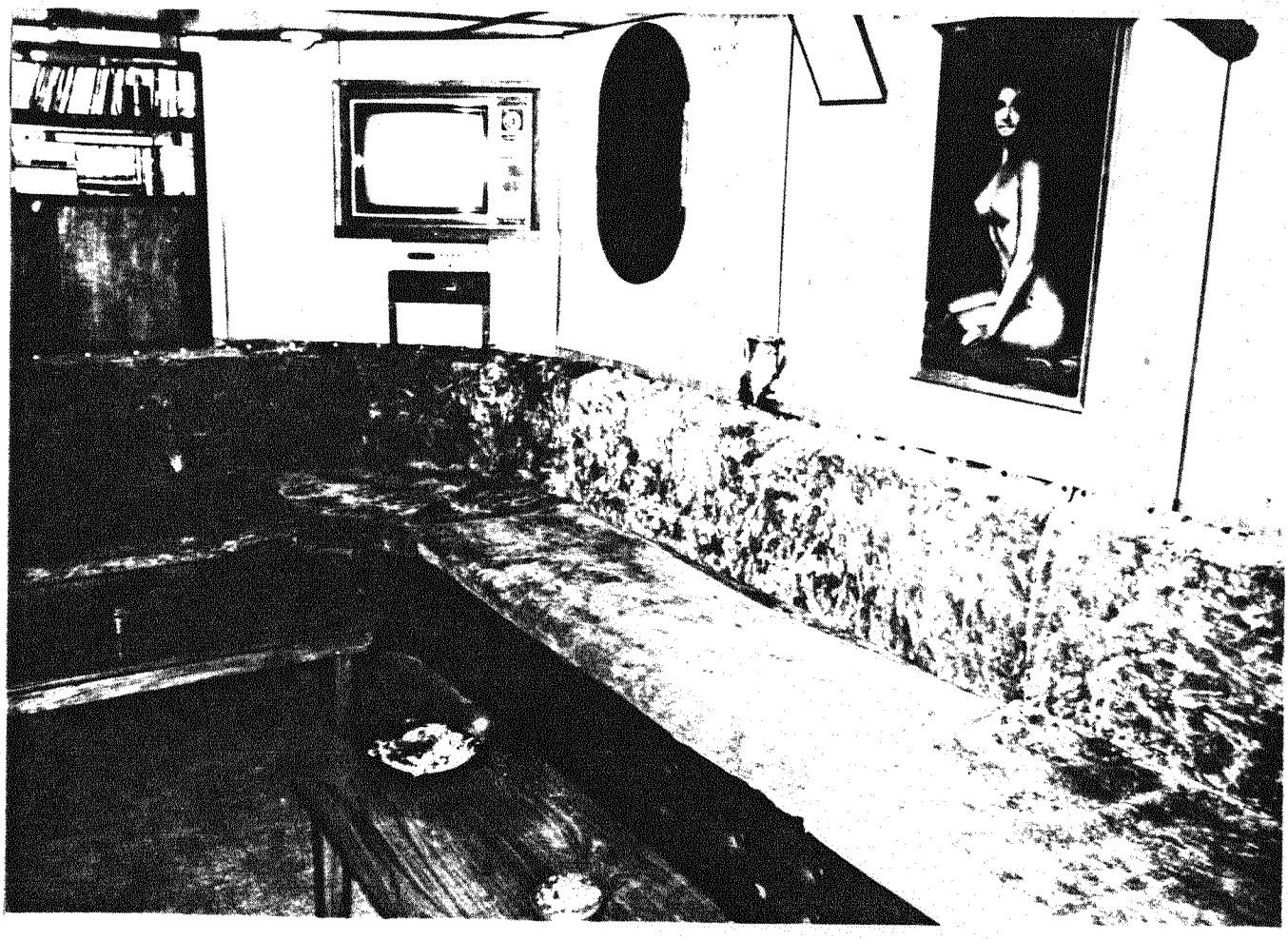


PLATE 1



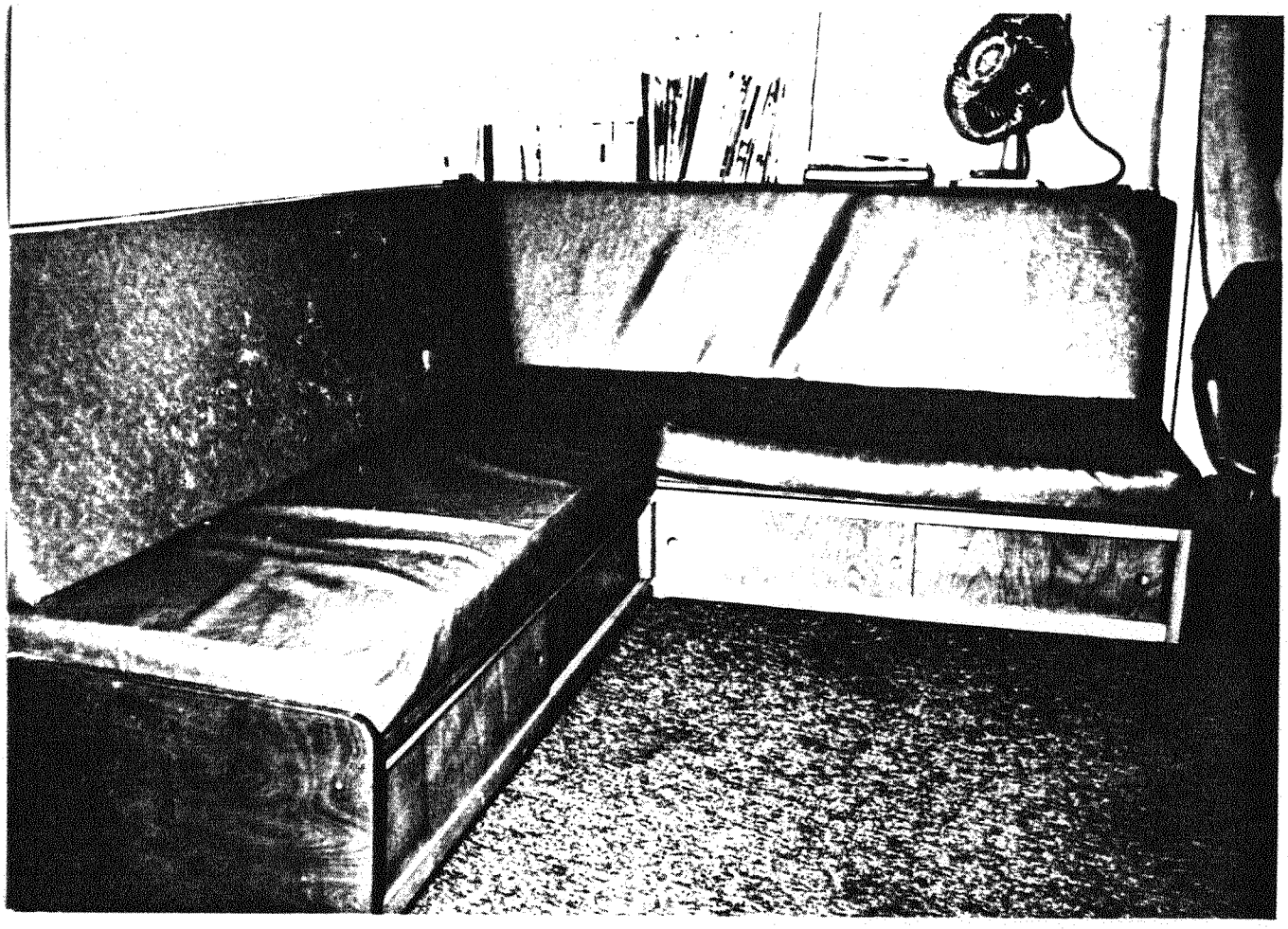
4J CPO/PO MESS

A self help project showing fully pannelled bulkheads and deck hand, carpeted deck. Ample stowage exists under the side bench.



4J CPO/PO MESS

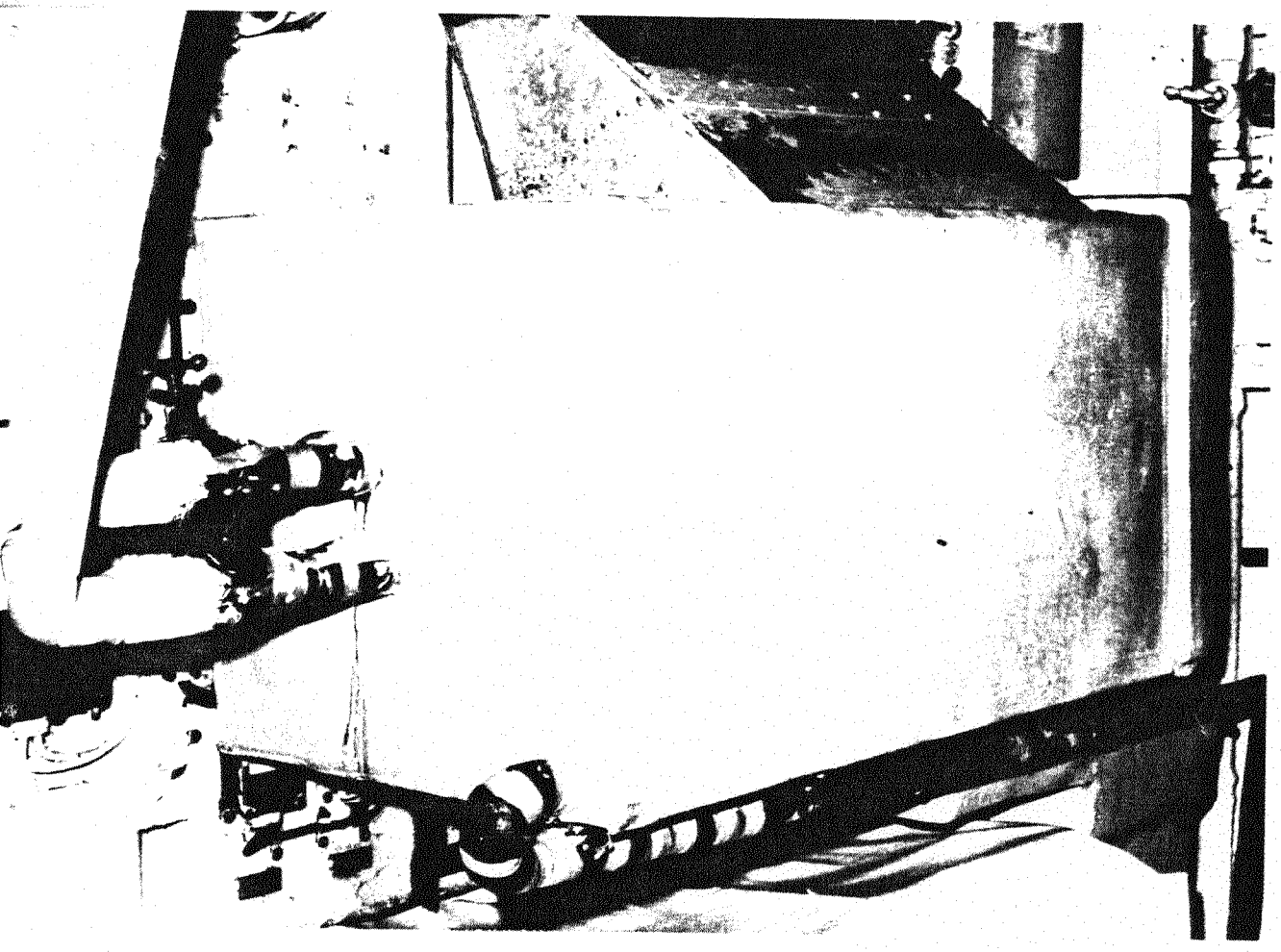
A view of the opposite side showing the built-in TV set and stereo system. Cussions made onboard were covered by the dockyard.



4P POs MESS

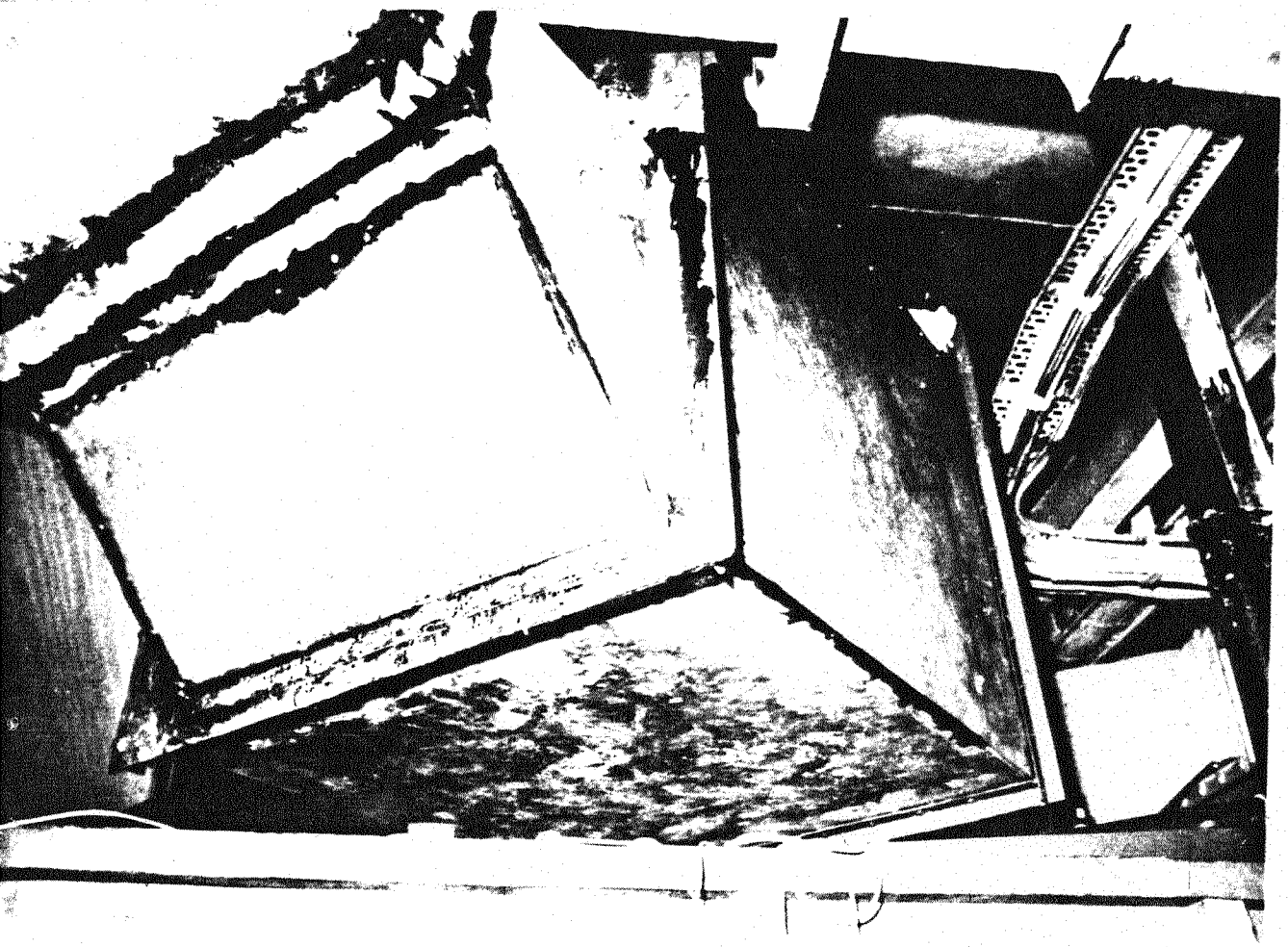
A self help project converted from a junior officer's cabin to provide additional areas for senior sailors.

PLATE 4



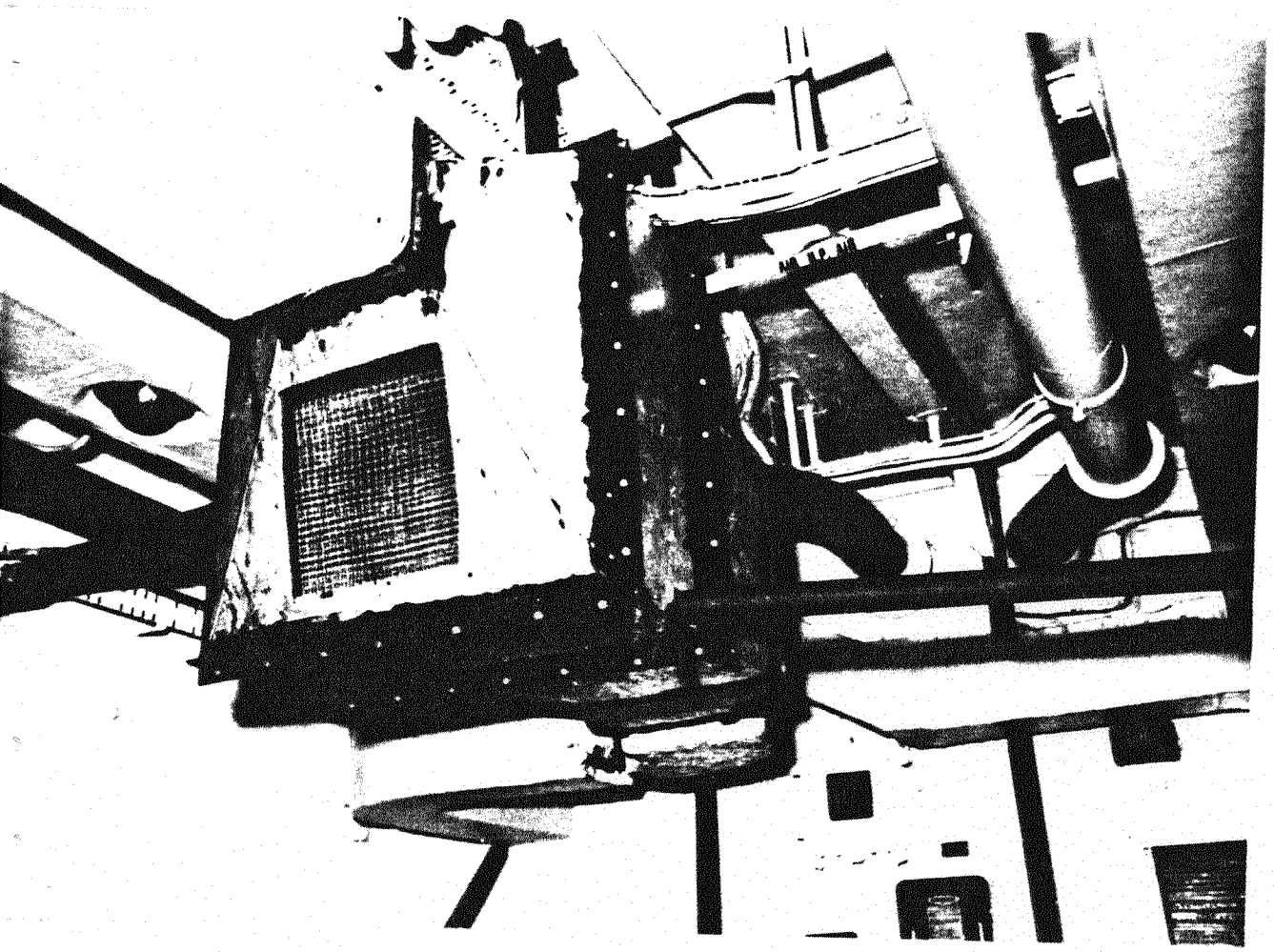
4 R WEATHERMAKERS

Purchased by the MHC, installed by contractors to provide cool air to 5R Section. This unit made a noticeable difference to a previously non-air conditioned area.



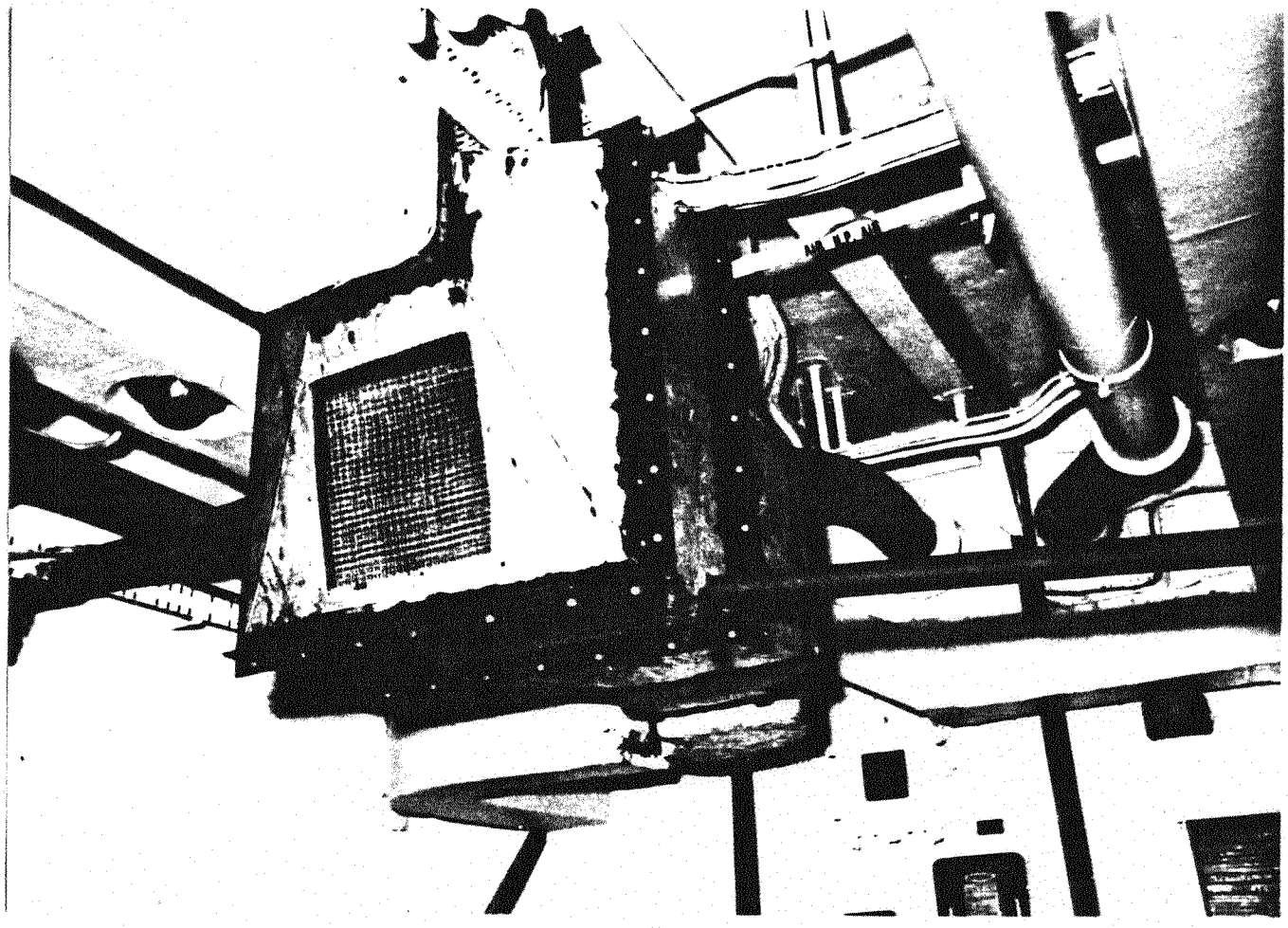
3M PORT MESS WEATHERMAKER

Installed by contractors to provide cool air to a sailor's mess, this unit made a significant improvement for watch-keeping personnel.



2J BRIDGE MESS WEATHERMAKER

Fitted by contractors to provide cool air to the Bridge Mess, this is perhaps the most awkward arrangement - but it works!



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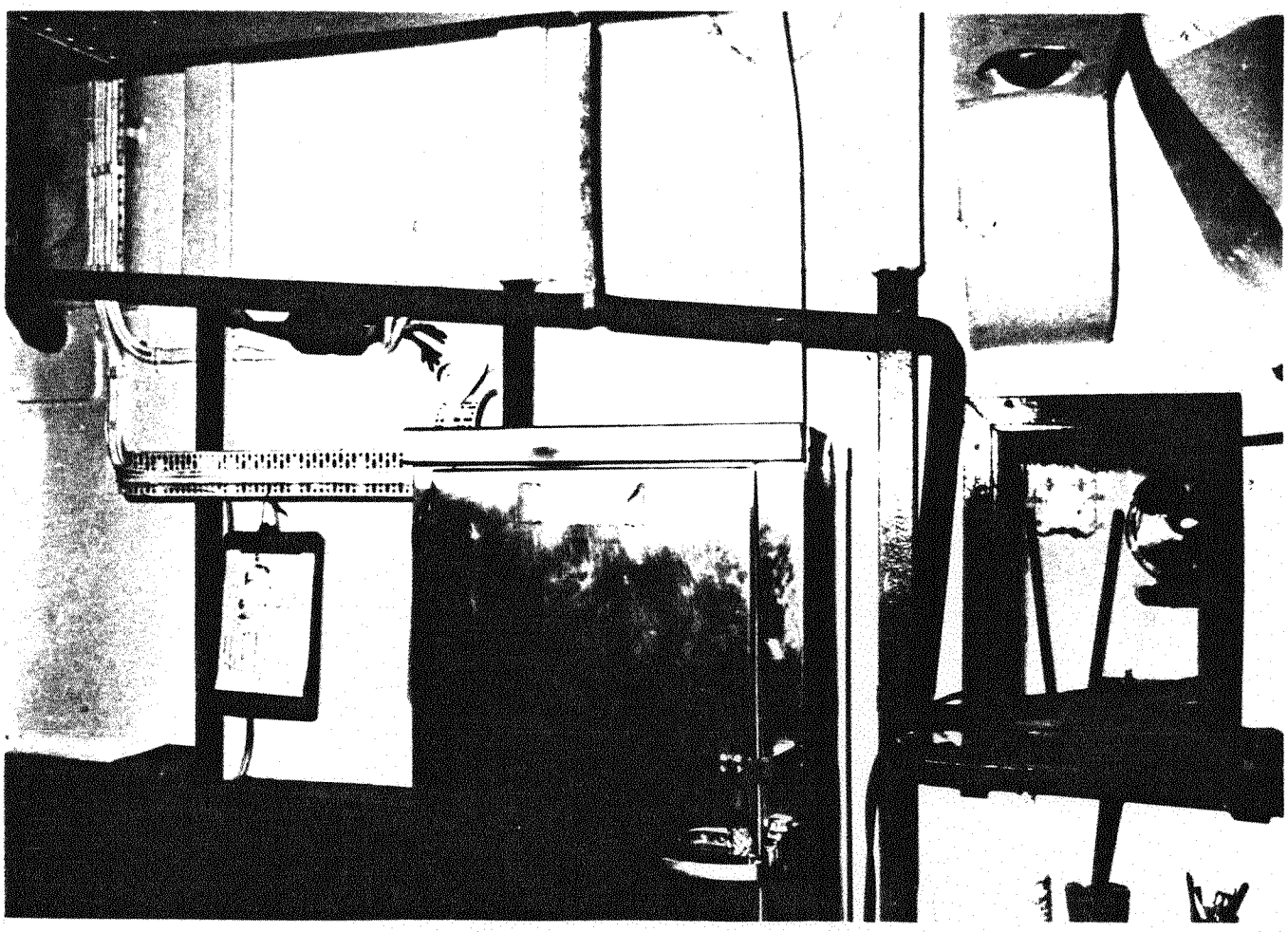
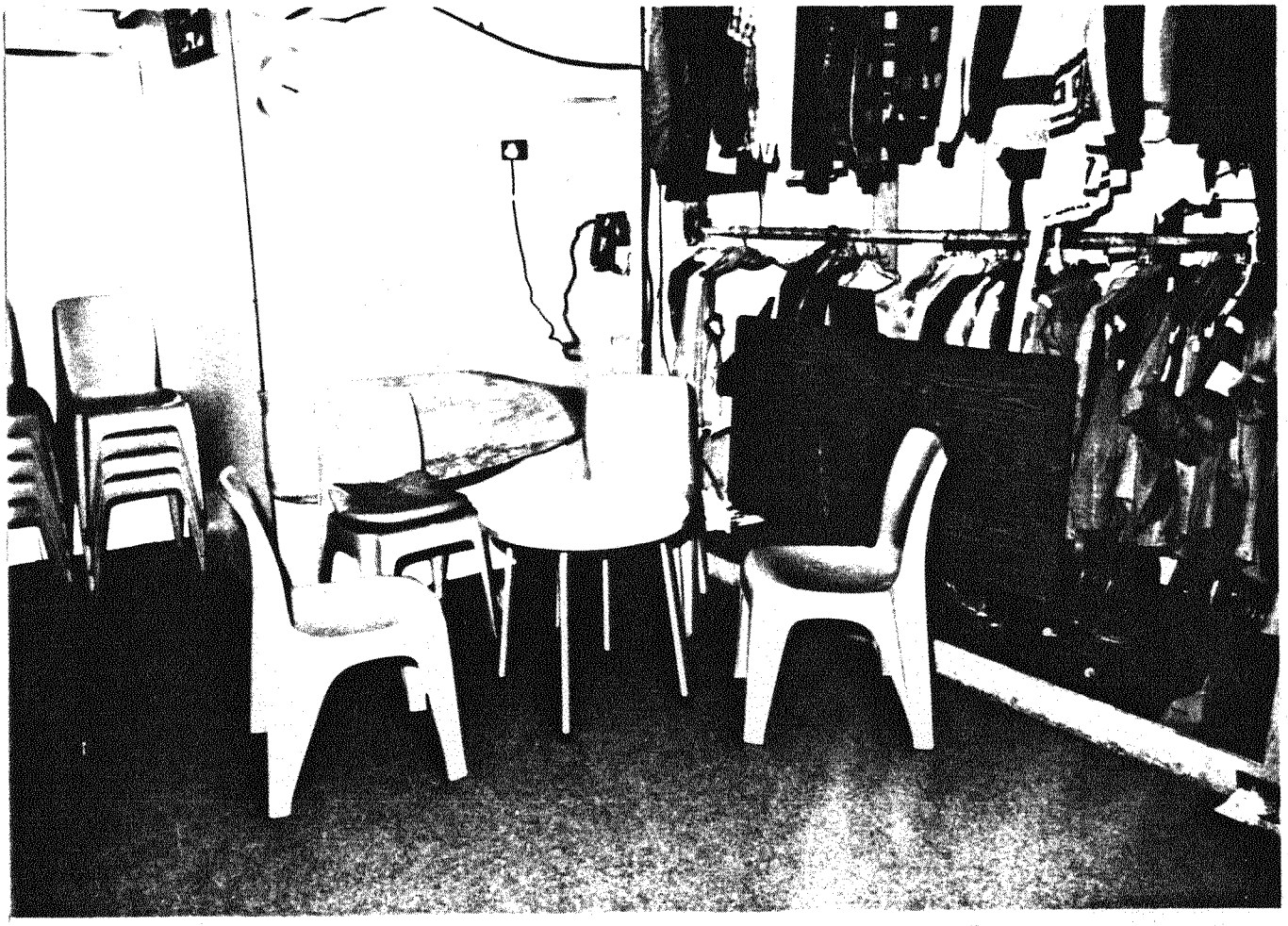


2J BRIDGE MESS

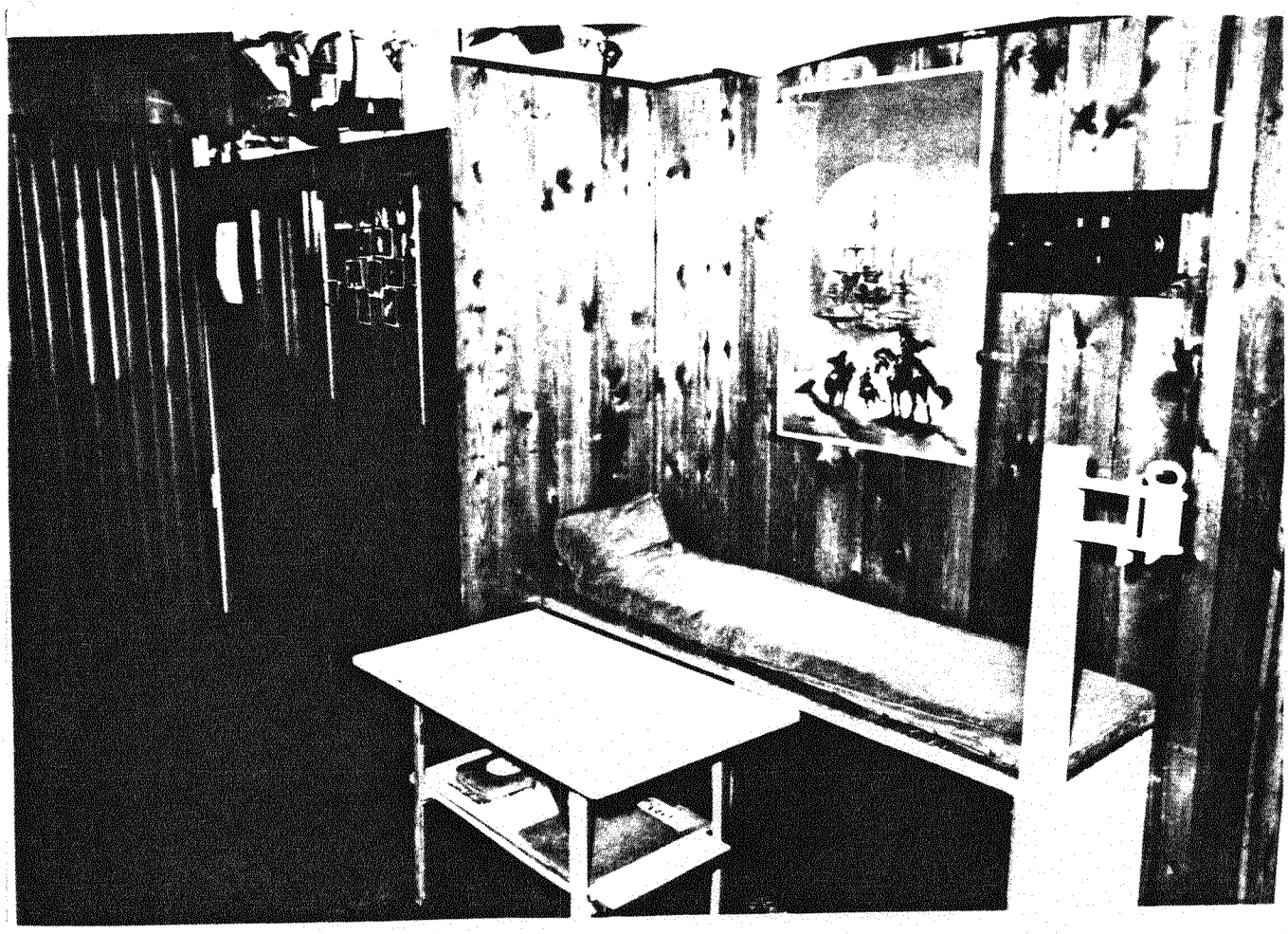
Note the awkward drain arrangement from the weathermaker : for every gain there is a loss.



4N ELECTRICAL MESS

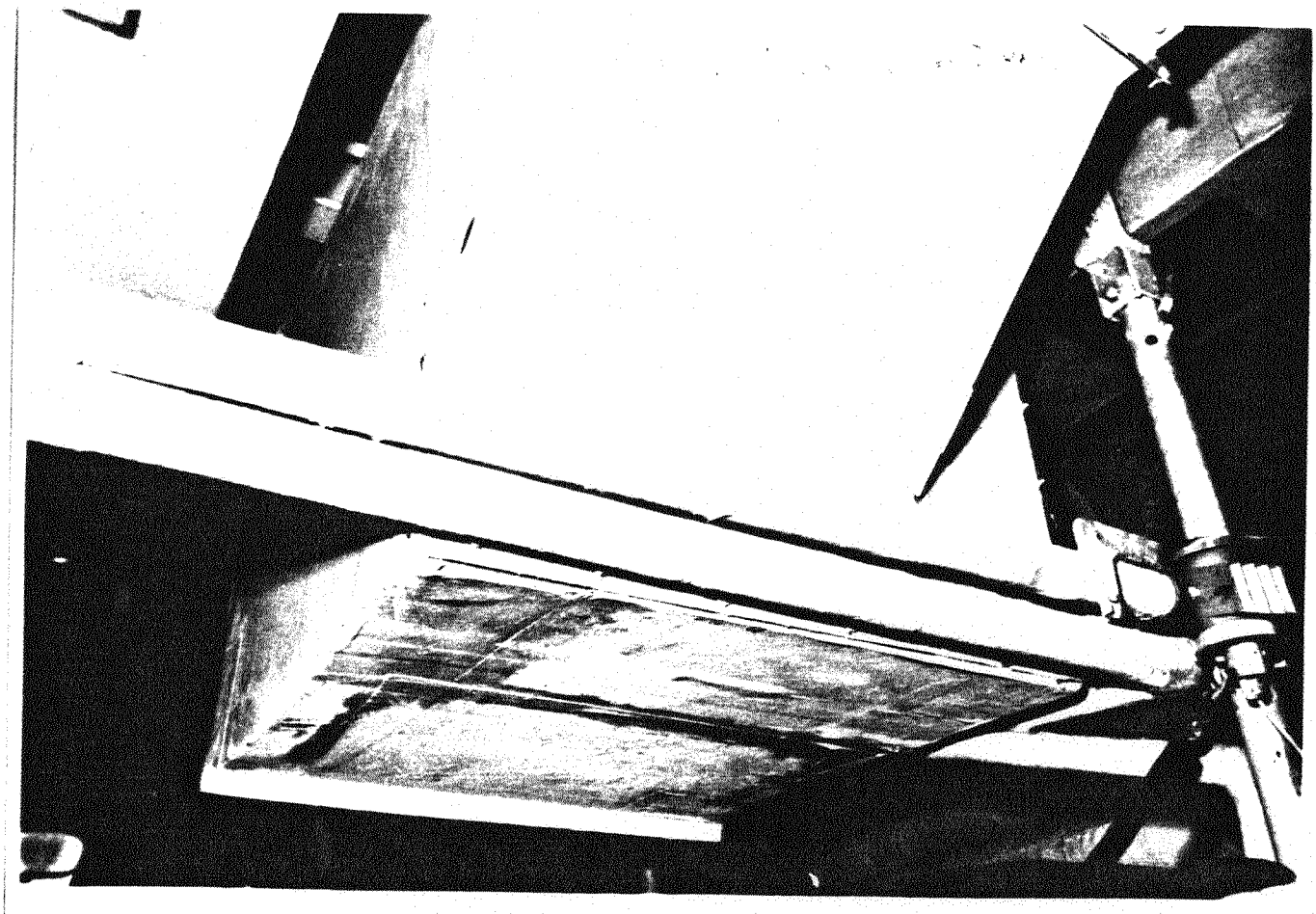
A panelled recreation area, carpeted deck and additional hanging space all by self help.

PLATE 9



3D PORT MESS

Panelling, concertina door, carpet and built-in stereo - all self help in a mess that used to be a main passageway.



3D PORT MESS WEATHERMAKER

Installed by contract to provide cool air to a sleeping compartment which was previously non-air conditioned.