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| **AD016301** |
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[illegible] Information

[illegible]

[illegible]

April 1[illegible]

Project Designation NR 171-094

Contract Nonr-[illegible](00)

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DEPARTMENT OF PSYCHOLOGY

UNIVERSITY OF SOUTHERN CALIFORNIA

RESTRICTED

SECURITY INFORMATION

# PREFACE

This report is one of a series based on shipboard observation of electronics personnel aboard ships of the destroyer class. The titles of these reports are given here along with a brief indication of the content of each. Security restrictions do not permit the general circulation of all of these reports but the accompanying list will help the reader place the present report in context.

1. Shipboard Observation of Electronics Personnel:
   A Description of the Research.

   A general presentation of the problem, its background, and the observational techniques which were employed.

2. Shipboard Observation of Electronics Personnel:
   Detailed Descriptions of Observational Techniques.

   A report for the professional worker who desires precise detail regarding the forms and instructions used and the decisions underlying their selection. The summarized data are provided in a classified supplement.

3. Shipboard Observation of Electronics Personnel:
   Implications for the Training of Electronics Personnel.

   Various problems of training are formulated and related to the observational data. (RESTRICTED)

4. Shipboard Observation of Electronics Personnel:
   Shipboard Activities of Electronics Technicians.

   Detailed accounts of the activities of electronics technicians are presented. Topics such as the materials, duties, problems, and future plans of the technicians are discussed. (RESTRICTED)

5. Shipboard Observation of Electronics Personnel:
   Brief Descriptions of Related Electronics Jobs.

   The jobs of the Sonarman, Radarman, and Radioman are briefly described. The areas of overlap between these jobs and the job of the ET are discussed. (RESTRICTED)

6. Shipboard Observation of Electronics Personnel:
   Implications for Certain Operational and Administrative Problems.

   Problems of Shipboard administration, policy, and the operational requirements of the electronics situation are related to the observational data. (RESTRICTED)



RESTRICTED

7. Shipboard Observation of Electronics Personnel: General Conclusions and Recommendations for Further Research.

The objectives of the research are reexamined and general conclusions are drawn. Promising research hypotheses and methods are presented. (RESTRICTED)

## ACKNOWLEDGMENTS

The research reported in this series reflects the contribution of a large number of persons within the Military Establishment. Grateful appreciation for this assistance is extended to the Cruiser Destroyer Force, Pacific; the Training Command, Pacific, and the Underway Training Element of that command; the Training Division and the Research Division, Bureau of Naval Personnel; the Personnel and Training Branch of the Psychological Services Division of the Office of Naval Research; and the Electronics Coordinator's Section of the Office of the Chief of Naval Operations.

## ABSTRACT

This report presents the following information:

1. A brief summary of the duties of five electronics ratings; the activities they perform; the responsibilities they have for various materials; and the materials they use. The five electronics ratings discussed are the electronics technician, sonarman, radarman, radioman, and fire controlman.

2. A detailed description of the duties and activities of each of the electronics ratings in terms of proportions of the men reporting each activity and estimates of the time devoted to each activity during various shipboard conditions; a detailed description of the responsibilities of each of the ratings toward various materials; a description of the maintenance activities of each of the ratings; and a description of the publications, tools, and test equipment used by each rating.

3. A discussion of the relationships among the ratings in terms of their maintenance activities, their duties, their distribution of shipboard time, and a comparison of the materials which they use in connection with their jobs.

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# SHIPBOARD OBSERVATION OF ELECTRONICS PERSONNEL:

# BRIEF DESCRIPTIONS OF RELATED ELECTRONICS JOBS.

## INTRODUCTION

This report contains job descriptions of five major job classifications (electronics technician, sonarman, radarman, radioman, and fire controlman) obtained aboard twenty ships of the destroyer type. Job descriptions which are specific to a single type of ship allow for a comparison between existing job descriptions which are applicable to the Navy as a whole and the particular job done on the type of ship studied. The present report presents job information collected from shipboard electronics personnel. The men in the job report what they do, the materials and tools that they work with, and the relationships that are found between the various rates and ratings.

The data for this report were collected from several sources. A large part of the information came from a job questionnaire which was filled out by all of the men in each of the ratings except fire controlmen.[1] Another source was a check list completed by the lead petty officer of each rating. A third source was a partial analysis of a card sorting task in which the leading petty officer of each rating selected job activity statements which he considered to best describe his job. A description of these sources may be found in Report 2 of this series.

The data are presented in both textual and graphic form, and differences between rates within a rating and between ratings are pointed out. Section I contains brief descriptions based on the detailed descriptions given in Section II.

Section II contains the detailed description of the duties, responsibilities, materials, and maintenance activities of the various ratings and estimates of temporal relationships of the various duties in the normal working day of each rating. The temporal estimates are based on averages of estimates made by the men in each rating and, therefore, should not be taken as exact specifications of the time each man devotes to these duties, since there is a great deal of variability from individual to individual. Differences are reported concerning the proportions of men in each rate of a single rating who report performing the various activities, but these should be taken as

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[1] In the case of fire controlmen, a select sample was used. The sample mainly consisted of the lead fire control technician on each ship. In a few instances, when the fire control technician was not available, the fire controlman who performed the most maintenance was selected. For this reason care should be exercised in generalizing from the information presented concerning this rating.

suggestive information only, especially in the higher rates (second class or above), because of the smallness of the samples in each rate. The information is given largely for the purpose of implying possible differences which may exist between the various rates in each rating. Third class petty officer and seaman samples are more nearly adequate for generalization to larger populations, and more weight may be attached to the activities attributed to them.

Section III contains comparisons between the five electronics ratings in terms of the duties in which they overlap, and the activities which are specific to one or more of the ratings.

# SECTION I

## A SUMMARY OF THE JOBS OF THE VARIOUS ELECTRONICS RATINGS

This section contains a brief description of the duties, activities, and responsibilities of each of the five electronics ratings. It is presented to provide an overview of all of the ratings and serve as an introduction to the more detailed descriptions[2] which are given in Section II. Reference is made to various materials, tools, and test equipment used.

### Electronics Technician

The duties that ETs perform may be divided into two types; electronics and non-electronics. The electronics duties consist of corrective maintenance, preventive maintenance, and keeping records concerning radio receivers and transmitters, radar equipment, sonar equipment, fire-control gear, loran, IFF, radio teletype, and, in general, any type of equipment which contains vacuum tubes. Non-electronics duties refer to deck watches, laundry details, and mess duties. Duties are listed according to the amount of total shipboard time spent on them, with the first named duty requiring the most time. They are performed under all of the shipboard conditions (underway watch, in-port watch, general quarters, etc.). While performing the above duties, ETs have the responsibility for ordering, inventorying, and stowing such materials as spare parts, tools, test equipment, and instruction books. They are also responsible for safeguarding the security of, and inserting published changes in equipment instruction books, maintenance bulletins and other publications.

To assist them in their work, ETs use such publications as Communications Electronic Bulletin, Electron, instruction books (general), NAVShip instruction books for each equipment, the Radar Maintenance Bulletin, and textbooks pertaining to electronics. ETs use such tools as screwdrivers, long-nose pliers, files, wrenches, and soldering guns. They use such test equipment as the oscilloscope, tube tester, voltmeter, ohmmeter, frequency meter, signal generator, and echo box. ETs keep many kinds of records such as failure reports, electronic equipment histories, field change records, and spare parts records. In addition, they prepare work orders and job orders.

In maintenance, ETs diagnose electronic casualties, make major and minor repairs, supervise and train personnel performing preventive and corrective

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[2] The description presented in this section does not include all of the activities which were reported, nor all of the materials that are used by someone within a rating, but only those activities, duties, and responsibilities that have been reported by at least 25 per cent of the men in a rating, or by at least one man on a majority of the ships visited.

maintenance, and superintend maintenance facilities. They perform preventive maintenance and make adjustments on all electronics equipment except sonar. They also operate[3] and calibrate all of the equipment except sonar and teletype. They shift frequencies on radio receivers and transmitters, radar equipment, fire control gear, and IFF. They measure the sensitivity of radio receivers, radar equipment, and IFF, and they measure the selectivity of radio receivers. They do preventive maintenance on and repair almost all kinds of test equipment.

Sonarman

Sonarmen operate sonar gear, perform non-electronic duties, do preventive maintenance, act as phone talkers, keep records, and perform corrective maintenance. These duties are listed in the order of the amount of total shipboard time spent at each. None of these activities is performed during all shipboard conditions, however sonar operating and phone talking are performed under all conditions except import watch. SOs have the responsibility for ordering and inventorying sonar spare parts, and stowing spare parts and tools. They are also responsible for safeguarding the security of, and inserting published changes in equipment instruction books, maintenance bulletins, and other publications.

SOs use such publications as the Sonar Maintenance Bulletin, instruction books (general), NAVShips instruction books for each equipment, USF publications, BUShips manuals, and textbooks pertaining to electronics. Some of the common hand tools used are screwdrivers, long-nose pliers, allen wrenches, soldering guns, and files. They use such test equipment as the tube tester, multimeter, oscilloscope, and signal generator. The records they keep include operating logs; daily, weekly, and monthly equipment check lists; and various maintenance records such as failure reports and repair records. They prepare job and work orders in conjunction with their maintenance.

In their maintenance activities, SOs operate, adjust, calibrate, shift frequencies, and measure selectivity and sensitivity of sonar equipment. They perform preventive maintenance, make minor repairs, diagnose major casualties, and make major repairs on this gear. In addition to this they supervise and train personnel performing preventive and corrective maintenance and superintend sonar maintenance facilities.

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[3] Includes starts, stops, tunes and makes normal operating adjustments. Operation of this type will include both normal operation and the operation involved in testing and repairing the gear.

Radarman

In the order of amount of total shipboard time spent on each activity, radarmen operate radar and radio equipment, perform non-electronic duties, act as phone talkers, plot, keep records, and do preventive maintenance. They operate under all shipboard conditions and plot, perform phone talking activities, and keep records during all conditions except inport watch. RDs file radio messages and dispatches when operating radio, and have the responsibility of safeguarding the security of operation orders, radio messages and dispatches, and some publications. They are responsible for checking the correctness of status boards, radio messages and dispatches, and various publications.

RDs use such publications as USF publications, general signal books, RAD series, JANAP publications, and ACP publications. They also use pencils, the DRT arm, dividers, and the nautical slide rule. The only common hand tool they use is the screwdriver. The only test equipment they use frequently is the echo box. They keep such records as radio logs, CIC logs, equipment logs, daily, weekly, and monthly equipment check lists, and DRT logs.

Radarmen perform operating activities on radio transmitters and receivers, radar equipment, RCM, and IFF gear. They adjust, calibrate and do preventive maintenance on radar equipment, and they supervise and train personnel performing preventive maintenance on this gear. They also prepare job and work orders in conjunction with their maintenance activities.

Radioman

Radiomen operate radio gear, perform non-electronic duties, keep records, do preventive maintenance, and act as phone talkers. These activities are listed in order of the amount of total shipboard time spent on each. Under all shipboard conditions they operate the radio equipment, handle messages, and do preventive maintenance. RMs have the responsibility of filing, distributing, safeguarding the security of, and checking the correctness of radio messages and dispatches.

Radiomen use such publications as JANAP publications, ACP publications, DNC publications, USF publications, instruction books (general), and JANP publications. They use pencils and typewriters. The only tool they use is the screwdriver. They use such test equipment as tube tester, frequency meter, and the dummy antenna. They keep radio logs, radio operator recorder logs, operating logs, and daily, weekly, and monthly equipment check lists.

During maintenance activities they operate, adjust, do preventive maintenance, supervise and train personnel performing preventive maintenance on radio receivers, transmitters, and teletype. They calibrate and shift frequencies of radio transmitters, and receivers, and make minor repairs on radio receivers. In conjunction with their maintenance activities, they prepare job orders.

## Fire Controlman [4]

Fire controlmen perform corrective maintenance, preventive maintenance, operate fire control gear and fire control radar, perform non-electronic duties, keep records, and act as phone talkers. The FCs are responsible for ordering, inventorying, and stowing tools, electronic spare parts, and test equipment. They are also responsible for filing, safeguarding the security of, and inserting published changes in equipment instruction books, maintenance bulletins and other publications.

Fire controlmen use such publications as textbooks pertaining to electronics, instruction books (general), NAVShips instruction books for each equipment, and BUShips manuals. Among the tools they use are screwdrivers, long-nose pliers, allen wrenches, files, hammers, drills, tap and dies, and reamers. They use such test equipment as the analyzer, meggar, oscilloscope, tube tester, voltmeter, echo box, and galvanometer. They keep equipment logs, equipment check lists, repair records, failure reports, and alteration records.

In their maintenance activities they operate, adjust, make minor repairs, calibrate, do preventive maintenance, diagnose major casualties, and make major repairs on fire control gear. In addition they supervise and train personnel performing preventive and corrective maintenance, and superintend maintenance facilities for this gear. They also prepare job and work orders in conjunction with their maintenance work.

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[4] See footnote, page 1

## SECTION II

## DETAILED DESCRIPTION OF THE JOBS OF THE ELECTRONICS RATINGS

The following section discusses the activities of each rating during underway watch, inport watch, battle station, and during those periods when the man is not engaged in any of the foregoing. The maintenance activities, responsibilities for materials, and the types of materials used by each rating are detailed.

Duties and activities are defined and underlined the first time they appear in the text and these definitions apply throughout the job descriptions unless otherwise specified.

The average day of an enlisted man may be divided into periods of underway watch, inport watch, battle station, and periods when he is neither at his battle station nor on watch. These periods are considered separately since it is quite likely that the man will engage in different activities from one period to another.

### Electronics Technician

#### Duties Under Various Shipboard Conditions

Total Time Aboard Ship.[5] ETs report that their total day can be divided into five general types of activities. These are preventive maintenance (cleaning, lubricating, checking, calibrating, and recording meter readings on various pieces of electronic equipment), corrective maintenance (trouble shooting, making major and minor repairs, and making adjustments on the electronic equipment), record keeping (keeping equipment data records, logs, repair records, and spare parts records), non-electronic duties (deck watches, mess duty, and laundry detail), operating activities (the operation of all types of electronic equipment), and a period of time spent off duty. This off-duty time is usually devoted to such personal activities as sleeping, eating, and recreation, and takes up 36% of the total time aboard ship.

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[5] For the purposes of this report, total time is considered to be the sum of the time that individual members of the group report spending under the condition indicated. The details of the procedure for computing "per cent total time" are given in Appendix A.

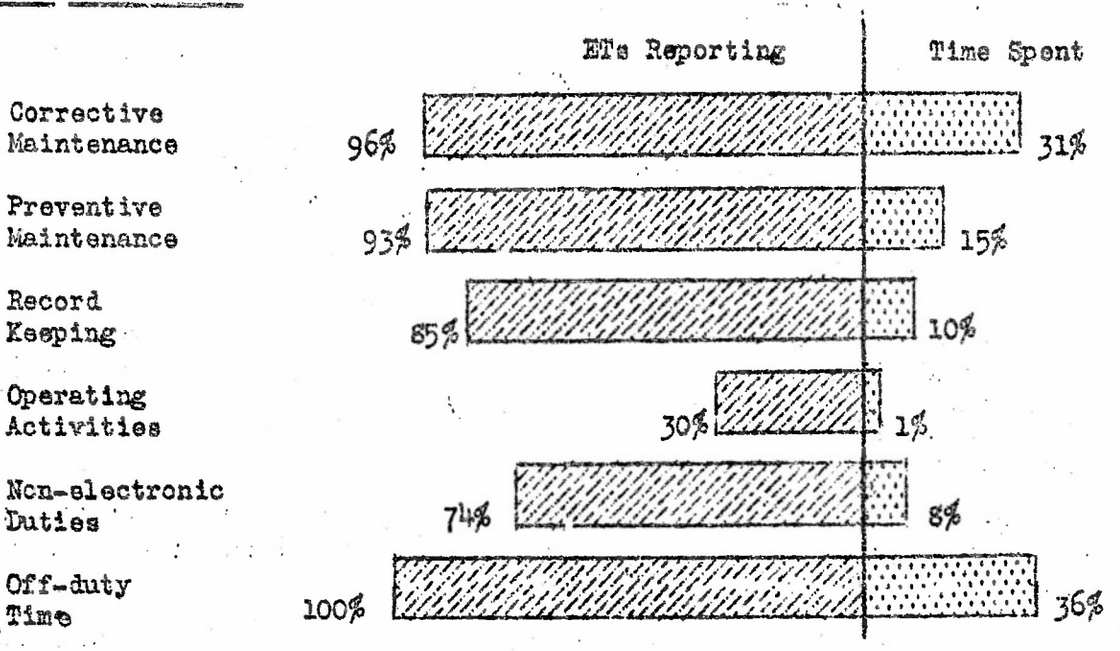



Fig. 1. Shipboard Activities of ETs. Percentage of ETs who perform various activities during their total time aboard ship and the percentage of time they spend at each. (Note: The information shown in this figure is based upon Job Questionnaire, item 41. This questionnaire is fully described in Report No. 2 of this series).

It is apparent from an inspection of Figure 1 that ETs spend almost half of their total time aboard ship performing some type of maintenance activity while a very limited amount of their time is spent operating electronic equipment. ET seaman spend a noticeably larger amount of time (16% of their total time) keeping records than the other rates spend.

Underway Watch. During the periods that ETs are on underway watch, they report the activities of maintenance (both corrective and preventive maintenance in this case), stand-by (the time that ETs are on call or waiting for work assignments), making operating adjustments (checking and tuning equipment and making other adjustments for the purpose of putting the equipment into operation), record keeping, instruction (self-instruction, receiving instruction from others, and instructing others), and miscellaneous activities (which, in this case, includes supervising non-electronic work, cleaning, issuing tools, standing non-electronics watches, movie operator, and messenger). The amount of time and the proportion of men reported for these activities is shown in Figure 2.

Nineteen per cent of the ETs reported that they have no underway watch duties. This includes all of the chief petty officers and a few men of the other rates. The percentages of the lower rated men who report performing maintenance and record keeping (68% and 43%, respectively) during underway watch are considerably greater than the 26% for maintenance and 21% for record keeping reported by the men of higher rates. It is interesting to note

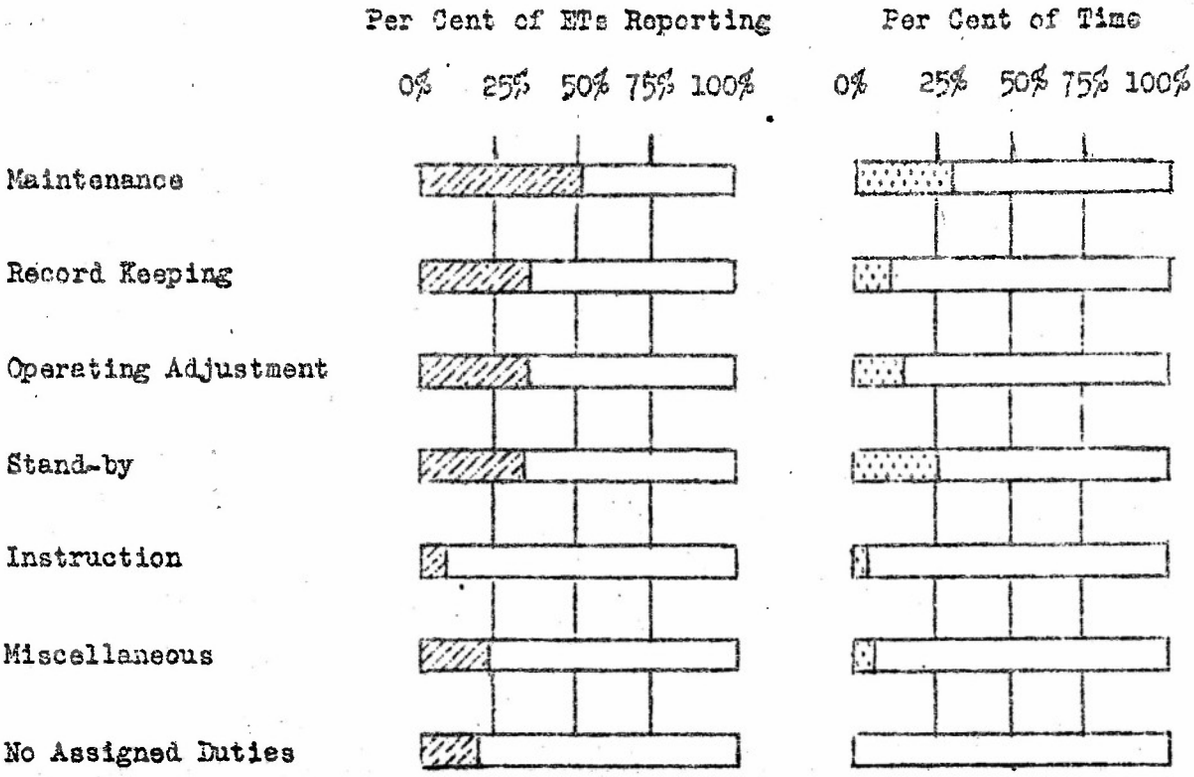



Fig. 2. Underway Watch Duties of ETs. Percentages of ETs who perform various activities during underway watch and the percentage of time spent at each. (Job Questionnaire, item 40)

that although only a third of the ETs report stand-by as an underway watch activity, further analysis shows that those reporting it spend amost two-thirds of their time waiting for a work assignment.

General Quarters. While at their battle stations, ETs perform the following activities: maintenance, stand-by, operating, instruction, record keeping, and miscellaneous activities (which, in this case, include such activities as repair parties, ammunition handling, and gun handling). Figure 3 presents the percentage of ETs who reported each of the above activities and the per cent of time spent on each activity out of the total time that ETs are at their battle stations.

All ETs had definite battle station assignments. A larger percentage (74%) of the higher rated men report doing maintenance during general quarters than the lower rates (59%). Similarly, more higher rated men report that they stand by during general quarters (61% vs. 50%). On the other hand more of the lower rated men (34%) report that they operate electronic equipment under GQ. It is of interest that those who report "operating" during general quarters spend almost all of their battle station time at this activity to the exclusion of all other activities.

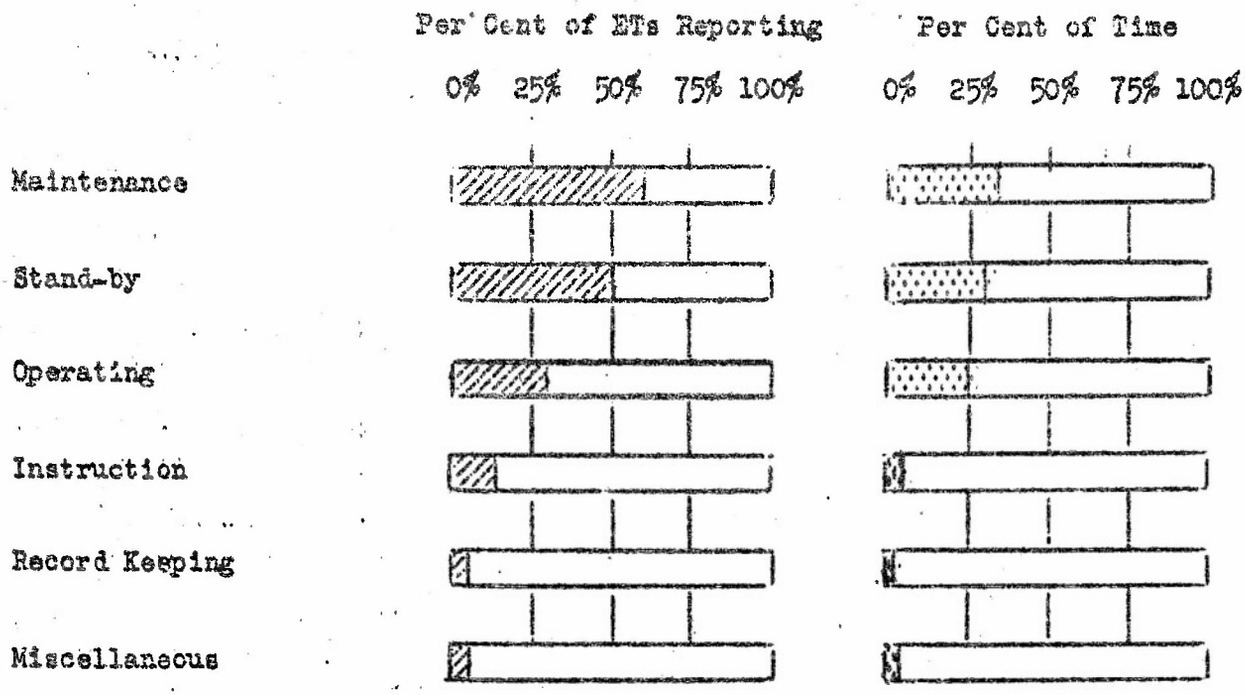



Fig. 3. General Quarters Duties of ETs. Percentage of ETs who perform various activities at battle station and the percentage of time that they spend at each activity. (Jcb Questionnaire, item 36)

Inport Watch. ETs report the following activities for inport watch periods: maintenance, quarterdeck watch (gangway watch, liberty party inspection, boat caller, and deck log keeper), record keeping, spare parts organization (upkeep, stowage, and inventorying of spare parts), and miscellaneous activities (which here include electrician's watch, shore patrol, sentry duty, messenger, switchboard watch, working parties, movie operator, cleaning, study, and supervising). Figure 4 illustrates the relationship between the activities of inport watch. (Fig. 4 on page 11)

Of those responding to a question concerning inport watch activities 24 per cent stated that they have no inport watch duties. A larger percentage of the 3rd and SN group (53%) report maintenance and record keeping (35%) on inport watch than do the higher rated men. It is of interest to note that those who report either maintenance or quarterdeck watches among their duties spend over two-thirds of their total inport watch time on these activities.

Special Sea Detail. At irregular intervals, (e.g., entering and leaving port, during refueling operations, and while loading ammunition and supplies) men aboard ship are required to devote some time to special duties. ETs report the following activities when on these special sea details: stand-by, maintenance, setting up equipment (which includes setting up radio frequencies, putting equipment into operation, and securing equipment), operating equipment, and supervision (supervising both electronics repair and the setting up of gear). Figure 5 gives the percentages of time and men for each activity. (See page 11)

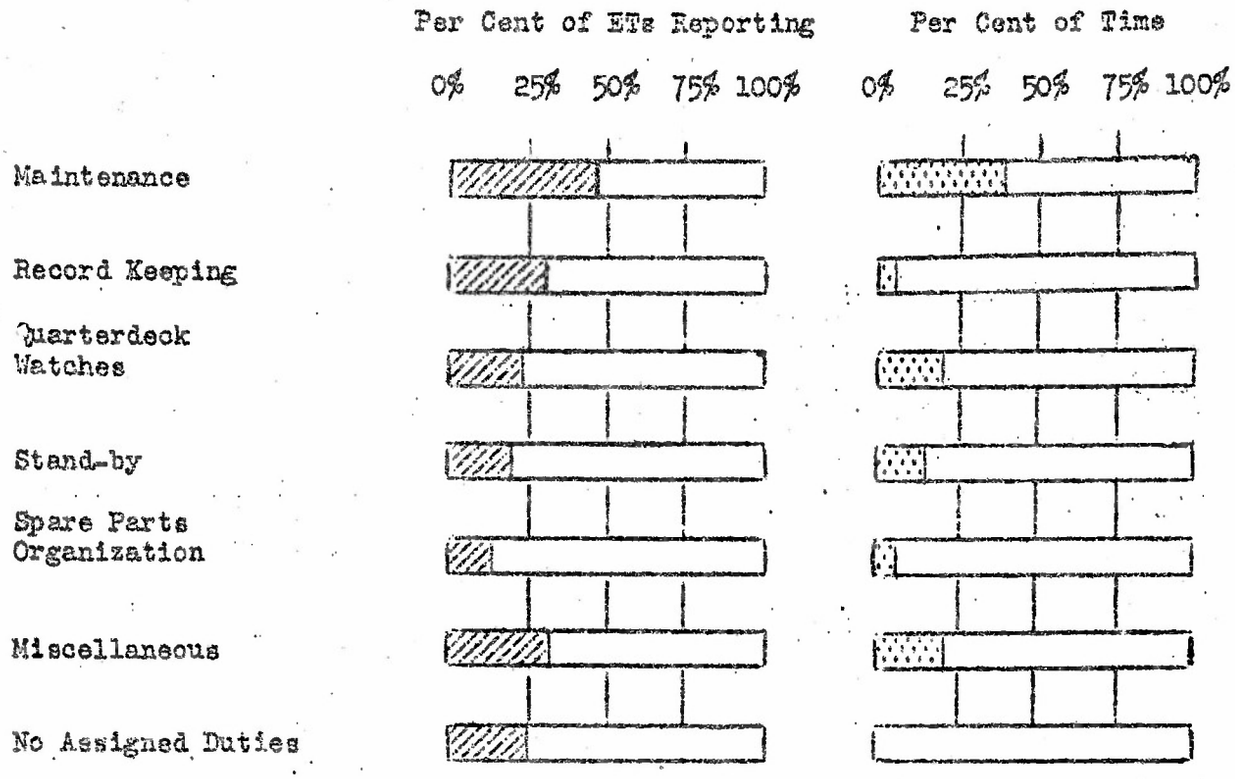



Fig. 4. Import Watch Activities of ETs. Percentage of ETs who perform various activities during import watch and the percentage of time spent at each activity. (Job Questionnaire, item 38)

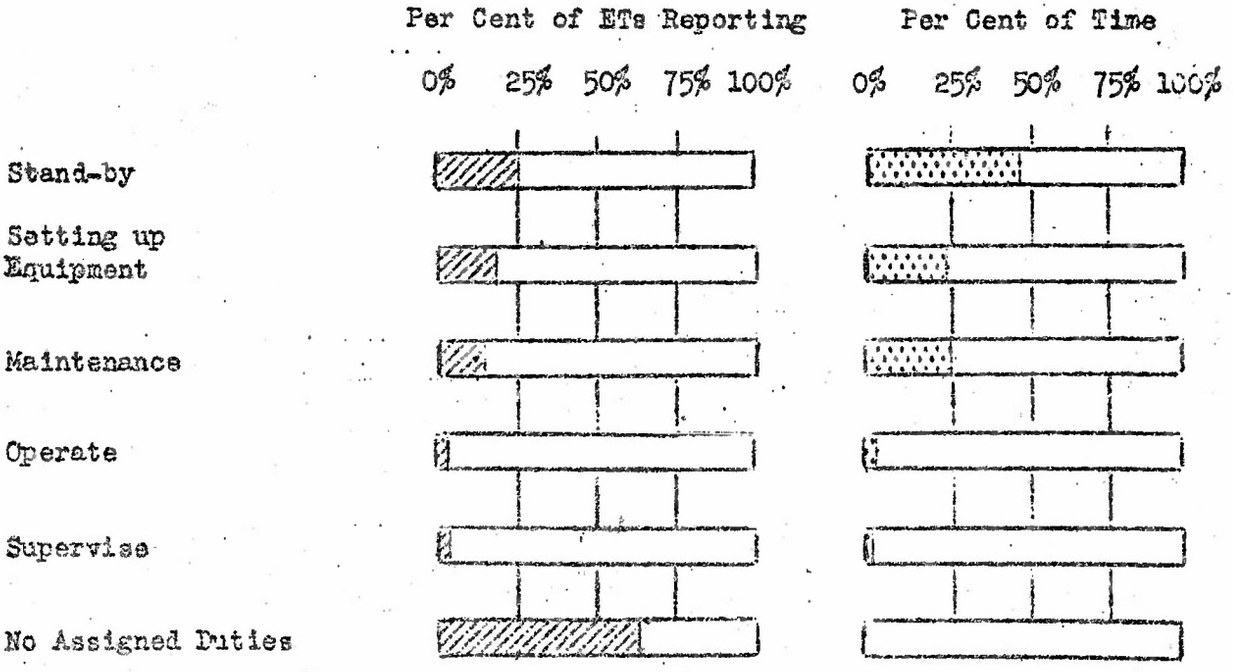



Fig. 5. Special Sea Detail Activities of ETs. Percentage of ETs who perform various activities during special sea details and the per cent of the total special sea detail time spent on each activity. (Job Questionnaire, item 33)

The most obvious feature of Figure 5 is the fact that the majority of the ETs have no special duties assigned to them during special sea detail. Those duties reported are of the same general type as the usual ET duties reported under other shipboard conditions. The small percentage of men who operate equipment spend about two-thirds of their special sea detail time at this activity.

Duties When Not On Watch Or At Battle Station. The activities which ETs report that they perform during working periods when neither on watch nor at battle stations are: maintenance, record keeping, spare parts organization, supervising (which, in this case, refers to the supervision of maintenance facilities, electronics repairs, as well as the setting-up and checking of the equipment), cleaning (which denotes only the upkeep of spaces and the ship in general--not the cleaning of equipment), and miscellaneous activities (instruction and study, operation of electronic gear, movie operator, working parties, and mess duty). ETs estimate that they spend approximately 30 per cent of their work day[6] on watch or at their battle stations. Figure 6 presents the percentage of ETs who perform each of these activities and the per cent of the total work day that they are not on watch or at their battle station which is spent at each of the activities. (See page 13 for Figure 6)

Only seven per cent of the men reported that they have no duties when not on watch or at battle stations. As would be expected, ET/SNs did not report any supervising, and a much larger percentage (48%) of this group reported cleaning than any other rate.

Non-electronic Duties. Included in the descriptions of the activities of ETs during each of the shipboard conditions presented above are certain activities which are non-electronic in nature, i.e., they have nothing to do with the electronic equipment itself but are concerned with the upkeep of the ship in general. It is of interest to consider more closely the kinds of work and the amounts of time associated with these non-electronic activities. As reported earlier, ETs spend eight per cent of their total time aboard ship on non-electronic duties. The non-electronic duties they report are as follows: petty officer duties (guard mail PO, and division PO), working parties (cleaning of ship or work spaces, ammunition loading parties, painting, and chipping paint), gangway watches (including quarterdeck watches and sentry), other watches (such as electrician's watches, switchboard watches, and messenger), mess duty, and miscellaneous activities (movie operator and bridge phone talker). The percentages of men and time for each activity are shown in Figure 7 (see page 13).

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[6] Work day refers to the total time the men are aboard ship other than their off-duty time. For ETs, this would mean that, since 36 per cent of the total time they are aboard ship is off-duty time, the remaining 64% can be considered as a work-day. Thirty per cent of this work-day (about 20% of the total time aboard ship) is spent on watch or battle stations while about 70% of the work day (about 45% of the total time aboard ship) is spent on activities other than those concerned with watch or battle stations.

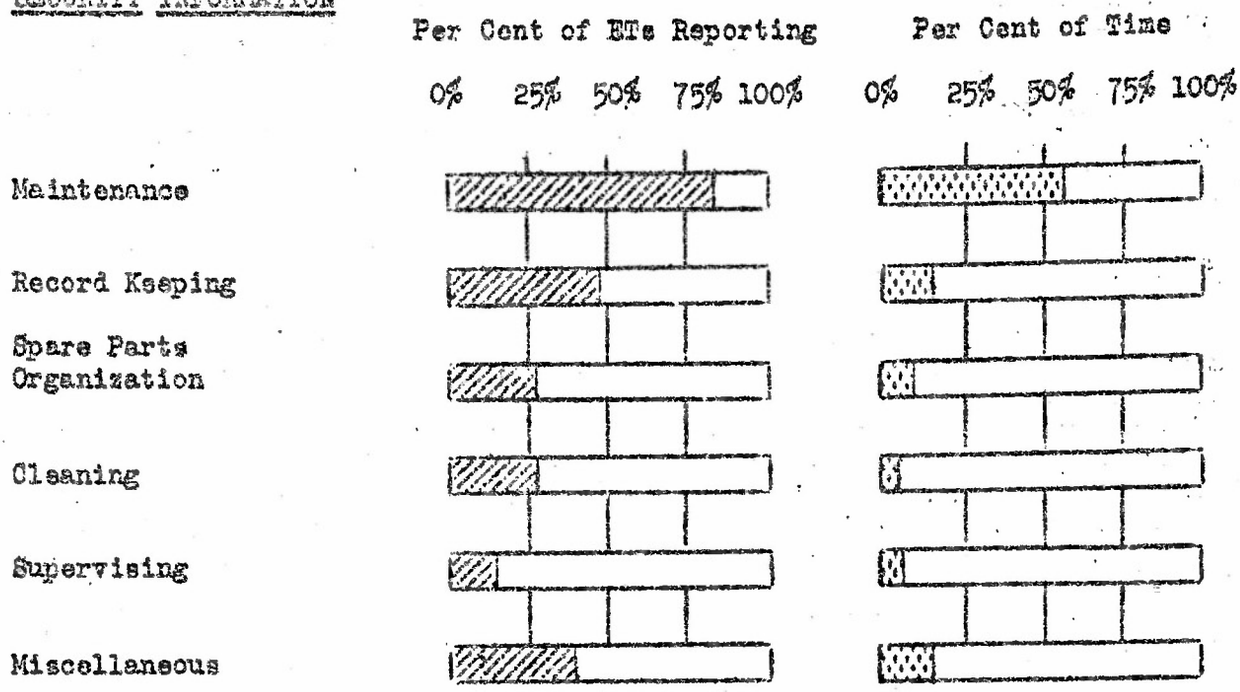



Fig. 6. Activities Performed by ETs When Not on Watch or at Battle Stations. Percentage of ETs who perform various activities during the time that they are not on watch or at their battle stations and the percentage of time spent at each. (Job Questionnaire, item 31)

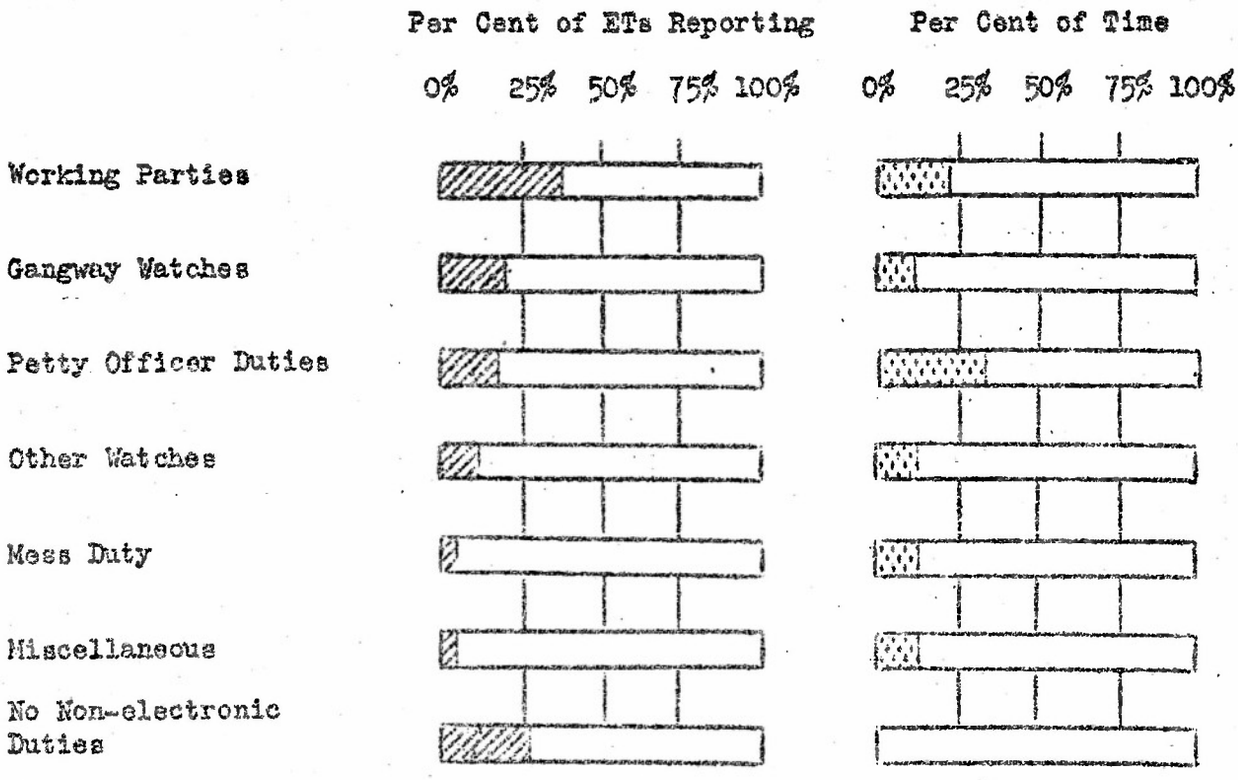



Fig. 7. Non-electronic Duties of ETs. Percentage of ETs who perform various non-electronic activities and the percentage of total non-electronic duty time spent at each. (Job Questionnaire, item 30)

No ET/SNs report doing petty officer duties and only this group reported mess duty, as might be expected. Working parties and "other" watches are reported almost exclusively by the lower rates (ET/3 and ET/SN).

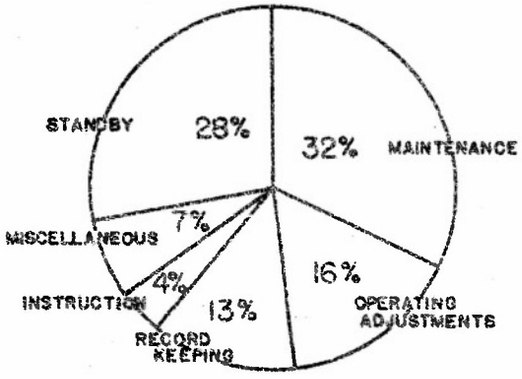
Summary

To sum up the ET duties and their temporal relationships a diagrammatic representation of the division of duties for each shipboard condition is shown in Figure 5. It is apparent from the diagrams that, although each of the shipboard conditions (underway watch, inport watch, etc.) is subsumed under the period of "total time aboard ship," the activities which are attributed to the lesser periods are not exactly equivalent to those in the total situation. This is due to the fact that the respondents, in describing their jobs under the orientation of total time aboard ship, were forced to choose from among eleven designated activities, whereas, in describing their activities under the several shipboard conditions, the men were free to respond without being limited by multiple-choice alternatives.

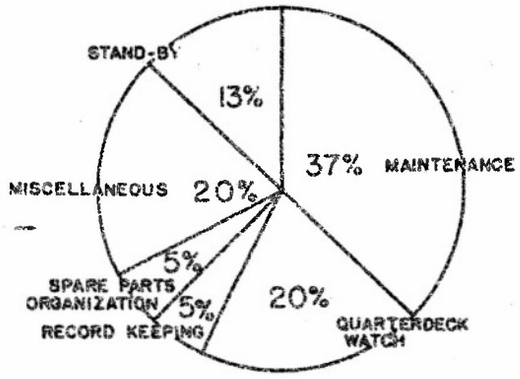
The analysis of the latter condition required that the large assortment of specific activities named by the respondents be categorized into a small number of more general activities which would correspond, as nearly as possible, to the pre-determined categories used for the total shipboard time. However, in order to avoid the loss of information specific to a single shipboard condition the categories of activities were determined primarily by the free responses of the individuals. This was done at the expense of equating the activities reported for the individual shipboard conditions to the predetermined categories used to describe the situation.

However, careful consideration of the categories of activities derived for the various shipboard conditions shows that although they are qualitatively different from those used to describe the total time aboard ship, the two sets of categories are not in conflict. A given activity under a particular shipboard watch condition may not be contained in any single category in the total shipboard diagram but is rather distributed among the various categories. For example, "stand-by," which occurs in all four of the watch conditions, would not be equivalent to (or contained in) any one of the activities given for the total shipboard period, but would be distributed among all of them. An ET would probably spend some time on stand-by while doing maintenance or while operating or performing one of the other activities.

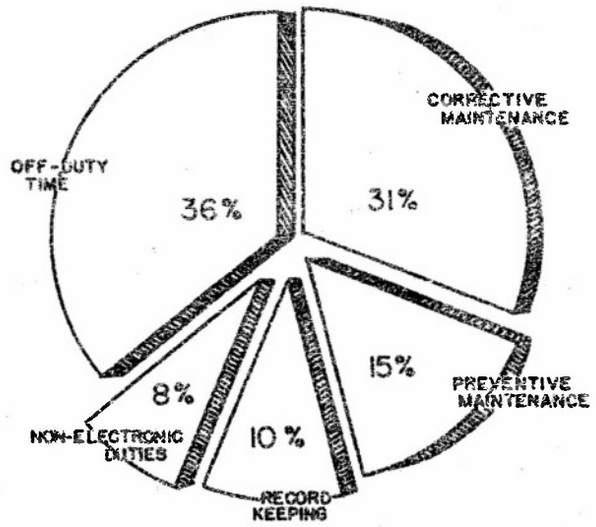
It should be remembered, when comparing the various shipboard conditions with the total time aboard ship, that the activities reported for any one of the watch conditions are the most important for that particular watch but may be only minor activities when considered in terms of the total time the men are aboard ship.



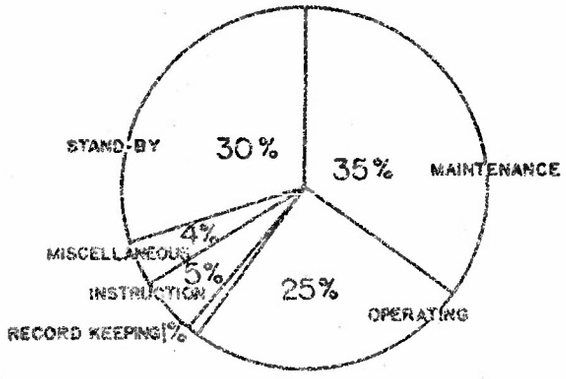

UNDERWAY WATCH



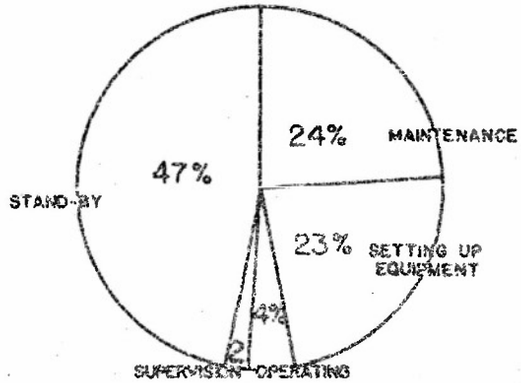

INPORT WATCH




TOTAL TIME ABOARD SHIP




GENERAL QUARTERS




SPECIAL SEA DETAILS

FIG.8. SUMMARY DIAGRAM OF THE ALLOCATION OF ET'S TIME. PERCENTAGE OF TIME THAT ET'S SPEND PERFORMING VARIOUS ACTIVITIES UNDER DIFFERENT SHIPBOARD CONDITIONS.

## Maintenance Activities of Electronics Technicians

Up to this point, the description of the ET's job has been directed toward a development of the various activities which occur under different shipboard conditions and the temporal relationships among these activities. Additional aspects of an ET's job are concerned with the actual materials and supplies that he uses and the responsibilities that he accepts for them. The following sections will discuss some of the aforementioned activities together with the materials and responsibilities in a detailed way.

As shown in Fig. 1, a major portion of the ET's time is devoted to maintenance activities. The following paragraphs will discuss these activities under the headings of preventive maintenance and corrective maintenance. Preventive maintenance in this section includes such activities as cleaning, lubricating, calibrating, tuning, and measuring selectivity and sensitivity of the equipment. Corrective maintenance, here, consists of such activities as making minor and major repairs, diagnosing casualties, making adjustments, and other activities designed to restore inoperative equipment to operating condition.

### Preventive Maintenance

As shown earlier, this activity consumes 15 per cent of the total ET time. The two lower rates (ET/3 and ET/SN) spend a relatively larger proportion of their time thus engaged.

Cleaning. Almost all of the ETs report that they clean and adjust contacts and relays and between 50 and 60 per cent say they are responsible for routine cleaning of gear and test equipment. Thirty-seven per cent of the men say that they clean tools.

Lubrication. Routine lubrication of electronic equipment is performed by 76 per cent of the ETs and a few report that they lubricate tools and test equipment.

Calibration. Eighty per cent of the men report that they calibrate electronic equipment and 38 per cent calibrate test equipment.

Tuning. This is reported by 84 per cent of the ETs and includes shifting frequencies of various equipments as well as other minor adjustments aimed at improving the operation of the gear.

Measurement of Selectivity and Sensitivity. It was found that on 78 per cent of the ships ETs measure the sensitivity of receivers and on 56 per cent of the ships ETs measure selectivity.

## Corrective Maintenance

About one-third (31%) of the total time that ETs are aboard their ship is spent performing corrective maintenance. They spend a greater proportion of time thus engaged than on any other single duty. Some of the corrective maintenance behavior of the electronics technicians are presented below along with the proportions of the ET group who perform each activity. Any distinction between rates in terms of the activity is pointed out.

Minor Repairs. The lower ET rates are more likely to make minor repairs than the higher rates, although almost 90 per cent of the ETs say that they perform such activities as replacing fuses and changing tubes.

Major Repairs. In this case, a greater proportion of the higher rated ETs make major repairs than do the lower rated ETs (95% vs. 72%). Seventy-eight per cent of the men report that they make major repairs to the gear and 51 per cent say that they are responsible for making repairs to test equipment. Only 20 per cent of the men report making repairs to tools.

Field Changes. The higher rated ETs are more likely to make field changes than are the lower rated men. Seventy-four per cent of the men say that they make field changes.

Diagnosis of Casualties. This is reported as being performed by ETs on a large percentage of ships, but it is more likely to be done by the higher rated men. It is interesting to note that chiefs are much more likely to make diagnoses than they are to make major repairs, whereas the lower rated men are as likely to do one as the other.

Maintenance Adjustments. Peak operation of electronic gear requires frequent internal adjustments. About 85% of the ETs report that they make such adjustments as a part of their job.

## Record Keeping

About one hour out of every ten of the ET's time is spent keeping records. The percentage of ETs who report they have the responsibility for the keeping of each type of record is shown in Table 1. Keeping records seems to be a general ET responsibility. The majority of them indicate that they fill out standard navy record forms and failure reports, and they complete periodic check lists. Examination of the records kept by the ETs aboard the ships of this sample revealed that the records were, in many instances, incomplete and did not reflect the current status of the equipment and the repair activities of the technicians. The fact that the ETs report that they spend a tenth of their time keeping records and the fact that the records do not seem to be well kept highlights a problem with regard to record keeping. If the ET's report is correct, then it appears that he will either have to spend more than ten per cent of his time on the records or permit his records to lag behind. The direct observations of the members

of this research group clearly indicate that most of the men had decided in favor of the latter alternative.

Table 1

Records Kept by ETs and the Percentage of ETs Who Keep Each Record (Job Questionnaire - Item 26)

| Records | Percentage of ETs |
|---|---|
| Failure reports | 85 |
| Repair records | 77 |
| Electronic equipment histories | 76 |
| Field change records | 76 |
| Spare parts records | 71 |
| Corrective maintenance records | 68 |
| Standard navy stock cards | 67 |
| Electronic service repair reports | 54 |
| Monthly check lists | 51 |
| Equipment installation records | 48 |
| Weekly check lists | 43 |
| Daily check lists | 43 |
| Resistance test records | 39 |
| Alteration records | 35 |
| Custody records | 27 |
| Equipment logs | 27 |
| Training schedules | 18 |

## Responsibilities for Materials and Supplies

Electronics technicians have certain responsibilities toward the materials they use in their work. The proportion of ETs who report that they have each of these responsibilities is presented in this section.

Maintenance of a Full Allowance of Materials. This refers to the responsibility for ascertaining that the requisite materials and supplies are available, or have been ordered. Table 2 presents the proportion of ETs who report responsibilities of this type. (See page 20 for Table 2)

A greater proportion of the higher rated ETs are responsible for maintaining a full allowance of materials than are the lower rated men.

Table 2

Materials of Which ETs Maintain a Full Allowance and the Percentage of the Group Reporting this Responsibility (Job Questionnaire - Item 23)

| Materials | Percentage of ETs |
|---|---|
| Spare parts | 58 |
| Tools | 35 |
| Equipment instruction books | 29 |
| Test equipment | 23 |

Order. This refers to the responsibility of carrying out the direct operation of ordering materials. Table 3 presents the proportion of ETs who report that they order each of the various materials. There is little difference between rates in terms of the proportion who have this responsibility.

Table 3

Materials Ordered by ETs and the Percentage of the Group Reporting this Responsibility (Job Questionnaire - Item 23)

| Materials | Percentage of ETs |
|---|---|
| Spare parts | 69 |
| Tools | 44 |
| Test equipment | 23 |
| Equipment instruction books | 23 |
| Trouble report forms | 15 |

Inventory. Inventorying includes making a visual check of materials on hand and keeping a running stock inventory. Table 4 shows the materials which are commonly inventoried by electronics technicians. (See page 21 for Table 4)

Storage. The ETs report that they are responsible for the storage of materials listed in Table 5 (see page 21).

In addition to those responsibilities which have been indicated in the preceding tables, the ETs indicated that they were expected to maintain an adequate file of maintenance bulletins, equipment operation forms, and trouble report forms. They also reported that they were required to safeguard

the security of equipment instruction books and maintenance bulletins, and they were responsible for the safekeeping of electronics spare parts, test equipment, and tools.

Forty per cent of the electronics technicians had the responsibility for issuing spare parts. Fewer indicated the distribution of tools (21%) and equipment instruction books (12%). About half of the ETs said that they were responsible for inserting published changes in equipment instruction books and 38% listed the same type of responsibility for maintenance bulletins.

Table 4

Materials Inventoried by ETs and the Percentage of the Group Reporting this Responsibility
(Job Questionnaire - Item 23)

| Materials | Percentage of ETs |
|---|---|
| Spare parts | 82 |
| Tools | 47 |
| Test equipment | 32 |
| Equipment instruction books | 26 |

Table 5

Materials Stored by ETs and the Percentage of the Group Reporting this Responsibility
(Job Questionnaire - Item 23)

| Materials | Percentage of ETs |
|---|---|
| Spare parts | 83 |
| Tools | 50 |
| Test equipment | 42 |
| Equipment instruction books | 31 |
| Maintenance bulletins | 18 |

Checking the Correctness of Material. Table 6 gives the proportion of ETs who report a responsibility for checking the correctness of various materials.

Table 6

Materials Which ETs Check for Correctness and the Percentage of the Group Reporting this Responsibility (Job Questionnaire - Item 23)

| Materials | Percentage of ETs |
|---|---|
| Equipment operation records | 33 |
| Trouble report forms | 33 |
| Equipment instruction books | 23 |
| Maintenance bulletins | 15 |
| Log books | 15 |

## Supervision and Instruction

Supervision and instruction were reported almost exclusively by the higher rated ETs. Most of the people who received this instruction were ETs although instances occurred in which ETs were expected to assist in the training of radarmen in preventive maintenance. Most of the training and supervision was directed toward the proper use of tools and test equipment and interpreting such published information as equipment instruction books and maintenance bulletins. A few ETs trained others in the use of trouble report forms and equipment operation forms.

## Materials ETs Use

This description of the electronics technicians' job will be concluded with lists of the publications, tools, and test equipments that they use in the course of their activities. The lists are arranged according to the percentage of the ET group indicating each item.

Publications. An examination of Table 7 reveals a definite percentage drop between the item "BuShips manuals" and the item "JANAP publications" indicating that the publications which are primarily concerned with maintenance are used to a greater extent than the other publications listed. (See page 23 for Table 7)

Tools. The list of tools presented in Table 8 appears to divide into three sections with division points at "punches" and "reamers." Eight out of ten ETs use the tools which are listed above punches while relatively few ETs use those items listed below reamers. (See page 23 for Table 8)

Table 7

Publications ETs Use and the Percentage of ETs Who Use Each Publication (Job Questionnaire - Item 22)

| Publications | Percentage of ETs |
|---|---|
| Instruction books (general) | 93 |
| Electron | 91 |
| NavShips Instruction books for each equipment | 89 |
| Communications Electronic Maintenance Bulletin | 88 |
| Radar Maintenance Bulletin | 87 |
| Textbooks on electronics(educational publications) | 81 |
| BuShips manuals | 72 |
| Sonar Maintenance Bulletin | 44 |
| JANAP(Joint Army, Navy, Air Force)publications | 24 |
| Radar Bulletin series | 24 |
| JANP(Joint army, Navy)publications | 17 |
| RAD series | 13 |
| USF publications | 11 |

Table 8

Tools ETs Use and the Percentage of ETs Who Use Each Tool (Job Questionnaire - Item 27)

| Tools | Percentage of ETs |
|---|---|
| Screwdriver | 99 |
| Long-nose pliers | 98 |
| Soldering gun | 96 |
| Allen wrenches | 95 |
| Crescent wrenches | 95 |
| Files | 93 |
| End wrenches | 90 |
| Dike pliers | 90 |
| Socket wrenches | 89 |
| Hammer | 88 |
| Drills | 88 |
| Alignment tool | 88 |
| Hacksaw | 80 |
| Handdrill | 80 |
| Punches | 79 |
| Power drill | 67 |
| Strippers | 63 |
| Tap & die | 45 |
| Grinder | 33 |
| Reamers | 22 |
| Drill press | 17 |
| Blow torch | 11 |
| Dividers | 11 |
| Parallel ruler | 10 |

Test Equipment. Table 9 presents a list of the different pieces of test equipment and the percentage of the ET group that indicated the use of each. In contrast to the percentage lists of Tables 7 and 8, no sharp percentage change is noticed in this list.

Table 9

Test Equipment ETs Use and the Percentage of ETs Who Use Each Piece of Test Equipment (Job Questionnaire - Item 28)

| Test Equipment | Percentage of ETs |
|---|---|
| Oscilloscope | 93 |
| Tube Tester | 93 |
| Voltmeter | 93 |
| Ohmmeter | 93 |
| Meggar | 91 |
| Milliameter | 89 |
| Multimeter | 89 |
| Frequency meter | 88 |
| Volt-ohmmeter | 87 |
| Echo box | 85 |
| Signal generator | 84 |
| Wattmeter | 83 |
| Dummy antenna | 82 |
| Vacuum-tube voltmeter | 82 |
| Audio oscillator | 74 |
| Ammeter | 65 |
| Analyzer | 56 |
| Condenser checker | 56 |
| Range calibrator | 55 |
| Beat-frequency oscillator | 51 |
| Capacity bridge | 50 |
| Signal tracer | 48 |
| Resistance bridge | 41 |
| Wave meter | 40 |
| Micro-ammeter | 39 |
| Radar test set | 35 |
| Signal strength meter | 30 |
| Standing wave indicator | 28 |
| Galvanometer | 17 |
| Rectifier meter | 13 |

## Sonarman

Sonarmen, generally speaking, are responsible for the operation and maintenance of sonar equipment. Their activities will be described in a manner similar to the description of the jobs of electronics technicians.

### Duties Under Various Shipboard Conditions

Total Time Aboard Ship.[7] The sonarman's day can be divided into ten general types of activities. These are sonar operating (which includes operating any sonar equipment), preventive maintenance, record keeping, acting as a talker (manning a sound-powered phone for the purpose of relaying information), corrective maintenance, plotting (which includes such things as making plots for determining the speed, course, range and bearing of contacts), radar operating (which includes operating surface and air search radar), fire control operating (which includes operating fire control radar equipment), non-electronic duties, and off-duty time. Thirty-five per cent of the sonarmen's total time aboard ship is spent off-duty.

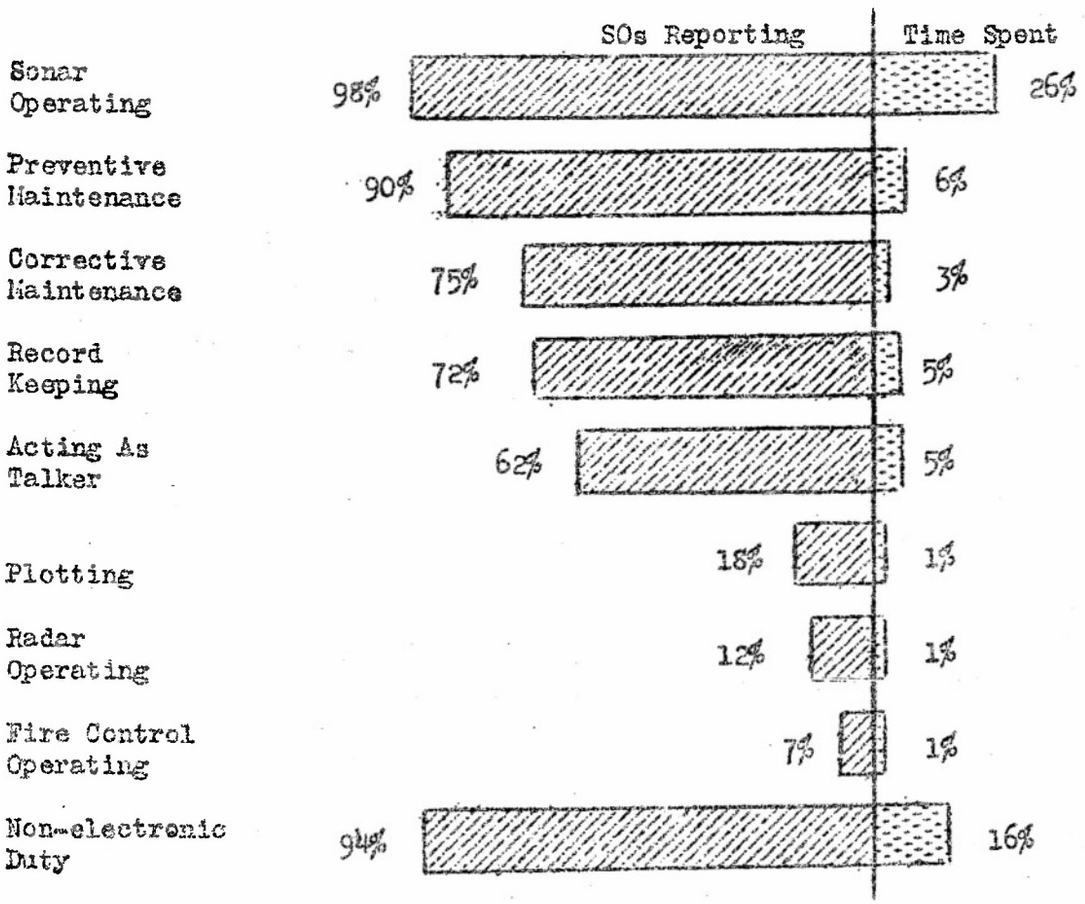



Fig. 9. Shipboard Activities of SO's. Percentage of SOs who perform various activities during their total time aboard ship and the percentage of time they spend at each. (Job Questionnaire, item 41)

[7] See footnote 5, page 7.

As can be seen in Figure 9, sonarmen spend about three times as much time operating as they spend maintaining the sonar equipment. The figure also shows that sonar operating, maintenance, acting as a talker, and record keeping are the major electronic activities of sonarmen.

The two per cent of the men reporting that they do no operating are higher rated men whose sonar activities are confined entirely to a supervisory level. When considering the rates, it was found that a larger proportion of the higher rated men (chiefs, 1st, 2nd) do both preventive and corrective maintenance. Also a larger proportion of the higher rates have non-electronic duties and keep records. Only the lower rates report that they plot.

Underway Watch. The types of activities sonarmen perform during underway watch are operation of sonar equipment, stand-by, supervision, phone talker, record keeping, maintenance, and miscellaneous activities (instruction, study, cleaning, working parties, and non-sonar watches). Figure 10 presents the percentage of sonarmen who reported that they perform each of the activities during underway watch and the percentage of this time that they spend at each activity.

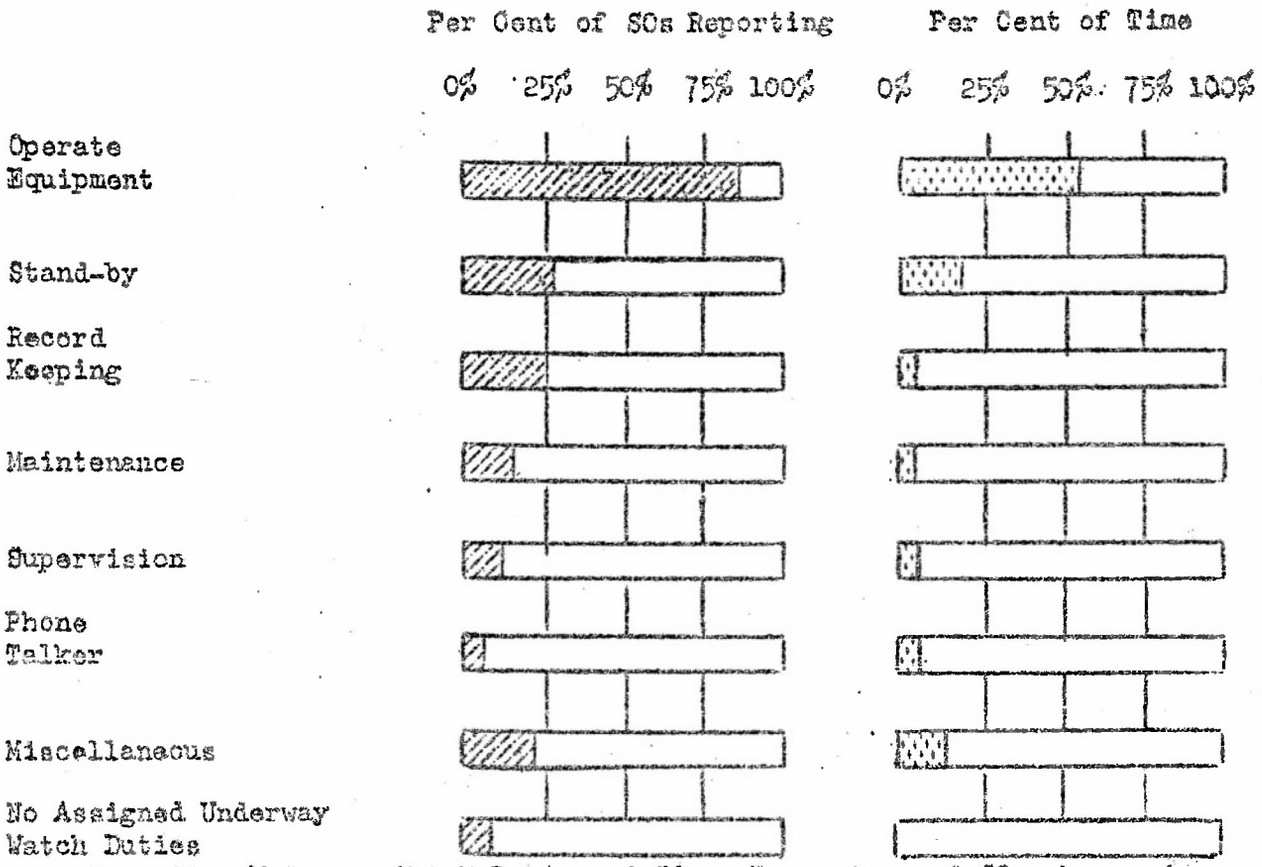



Fig. 10. Underway Watch Duties of SOs. Percentage of SOs who perform various activities during underway watch and the percentage of time spent at each. (Job Questionnaire, item 40).

This figure shows that the men spend approximately 60 per cent of their underway watch time in operating activities and standing by to perform these activities. From further analysis of the data, it is found that 25 per cent of the sonarmen keep records but spend only a small portion of their time in this activity. In contrast to this, only 5 per cent of the men act as talkers but this group spend almost all of their underway watch time at this activity.

The activity of phone talker is found to be confined to seamen, and, as would be expected, supervisory activities are carried on by a larger proportion of the higher rates. Also, maintenance is performed by a larger percentage of higher rated men. The only activity that is common to all of the rates during underway watch is the operation of sonar equipment.

General Quarters. During general quarters, the sonarmen report that they spend their time operating, phone talking, plotting, supervising, assisting the evaluator (assisting the ASW officer, evaluating, coordinating reports, giving firing orders, and making recommendations), and performing miscellaneous activities (giving instruction, studying, keeping records, firing activities, messenger activities, and look-out). The proportion of men who perform these battle station activities and the amount of time they spend doing them is shown in Figure 11.

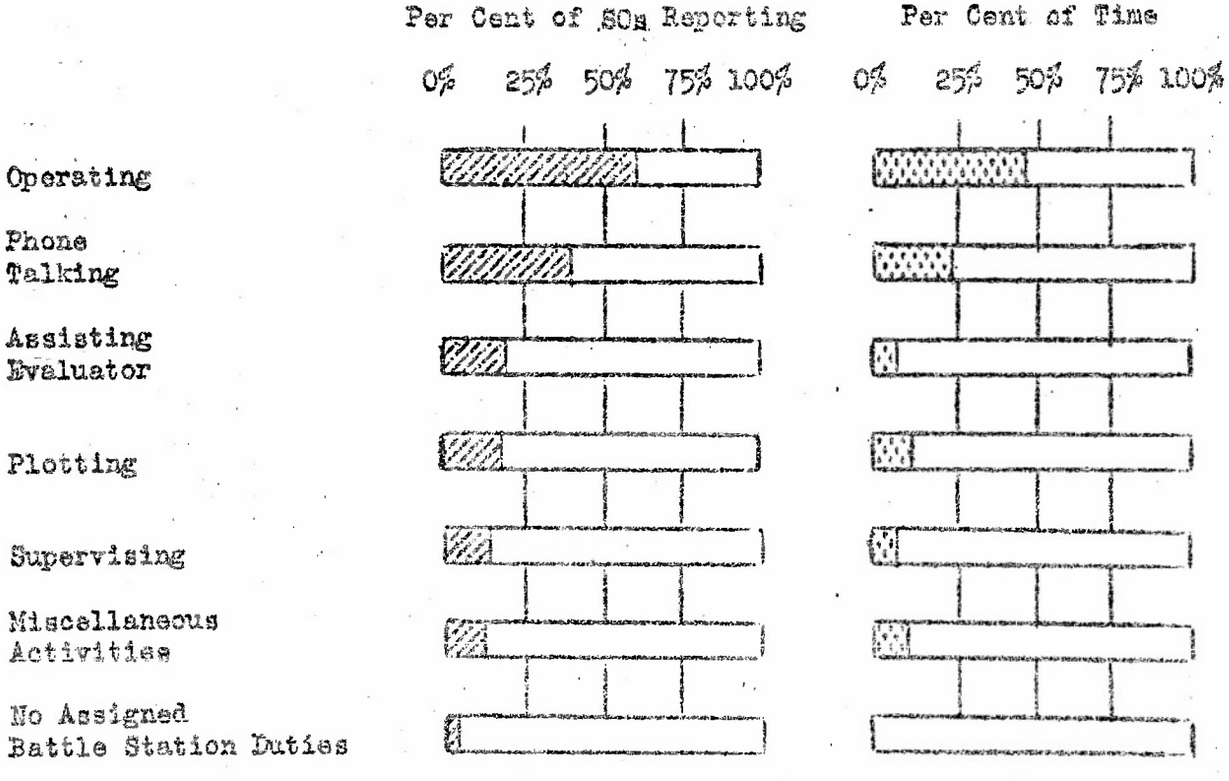



Fig. 11. General Quarters Duties of SOs. Percentage of SOs who perform various activities at battle station and the percentage of time that they spend at each activity. (Job Questionnaire, item 36)

As can be seen in Figure 11, almost all of the sonarman time during general quarters is spent on operating activities.

When comparing the rates, it is found that a larger proportion of the higher rates supervise sonar activities and assist the evaluator. An equal proportion of all the rates except chief perform operating duties, and act as phone talkers. Attack plotting was reported only by the lower three rates and about an equal proportion of these rates reported doing it. Two per cent of the men reported that they did not have battle station duties.

Import Watch. During import watch, sonarmen have petty officer duties, messenger and sentry duties, voice radio watches (listening watch, recording and sending of messages), and miscellaneous activities (record keeping, working parties, signal supervisor, and maintenance). Seven per cent of the group that responded indicated no regularly assigned import watch duties. The data in Figure 12 below, indicates the percentage of sonarmen who perform each of the activities during their import watch and the percentage of time spent at each.

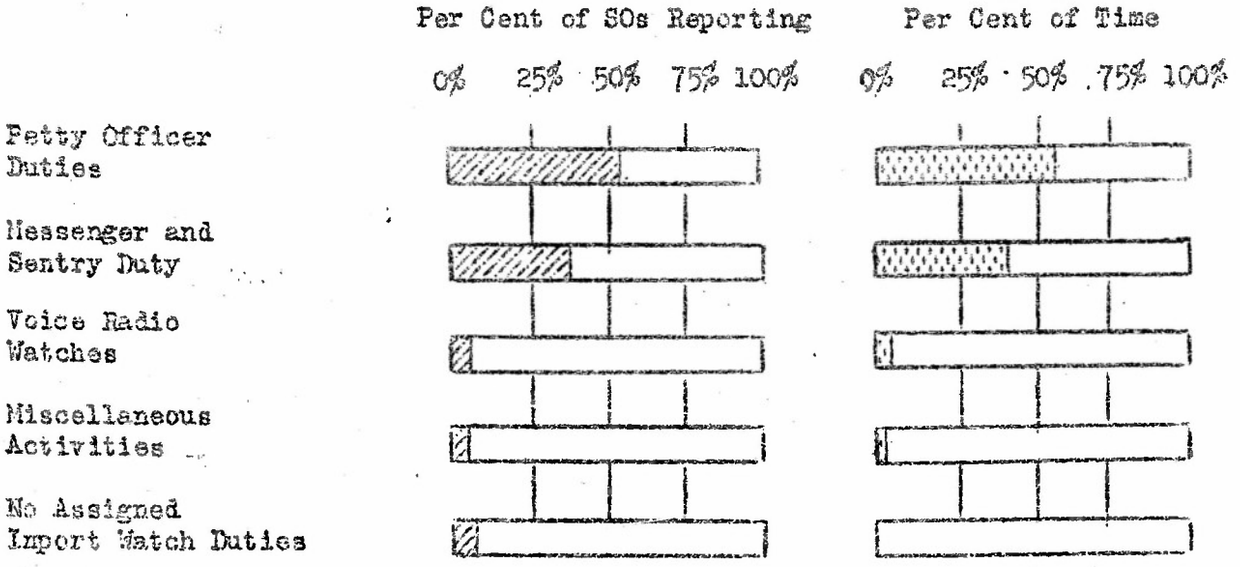



Fig. 12. Import Watch Activities of SOs. Percentage of SOs who perform various activities during import watch and the percentage of time spent at each activity. (Job Questionnaire, Item 38)

Messenger and sentry duty was reported by only seamen. Also only third class petty officers and seamen reported that they maintain equipment and stand voice radio watches while on import watch. Figure 12 shows that 94 per cent of the total import watch time is taken up with petty officer watches and messenger and sentry duty.

Special Sea Detail. Of the sonarmen responding to the question concerning special sea details, 21 per cent reported that they had no special duties at this time. Those reporting that they did have special sea detail duties

listed the activities of operating and checking equipment (applies to all underwater sound equipment except fathometer), operating fathometer, colors (tending the ensign, hoisting and lowering of speed flags, and hoisting and lowering steaming colors), miscellaneous special sea detail duties (bridge messenger, bridge lock-out, engine room telegraph operator, and helmsman), phone talker, stand-by, recording (which refers to recording bearings as well as other kinds of record keeping), and miscellaneous activities (supervising, maintenance, master-at-arms duties, and studying).

Figure 13 illustrates the relationship between the activities.

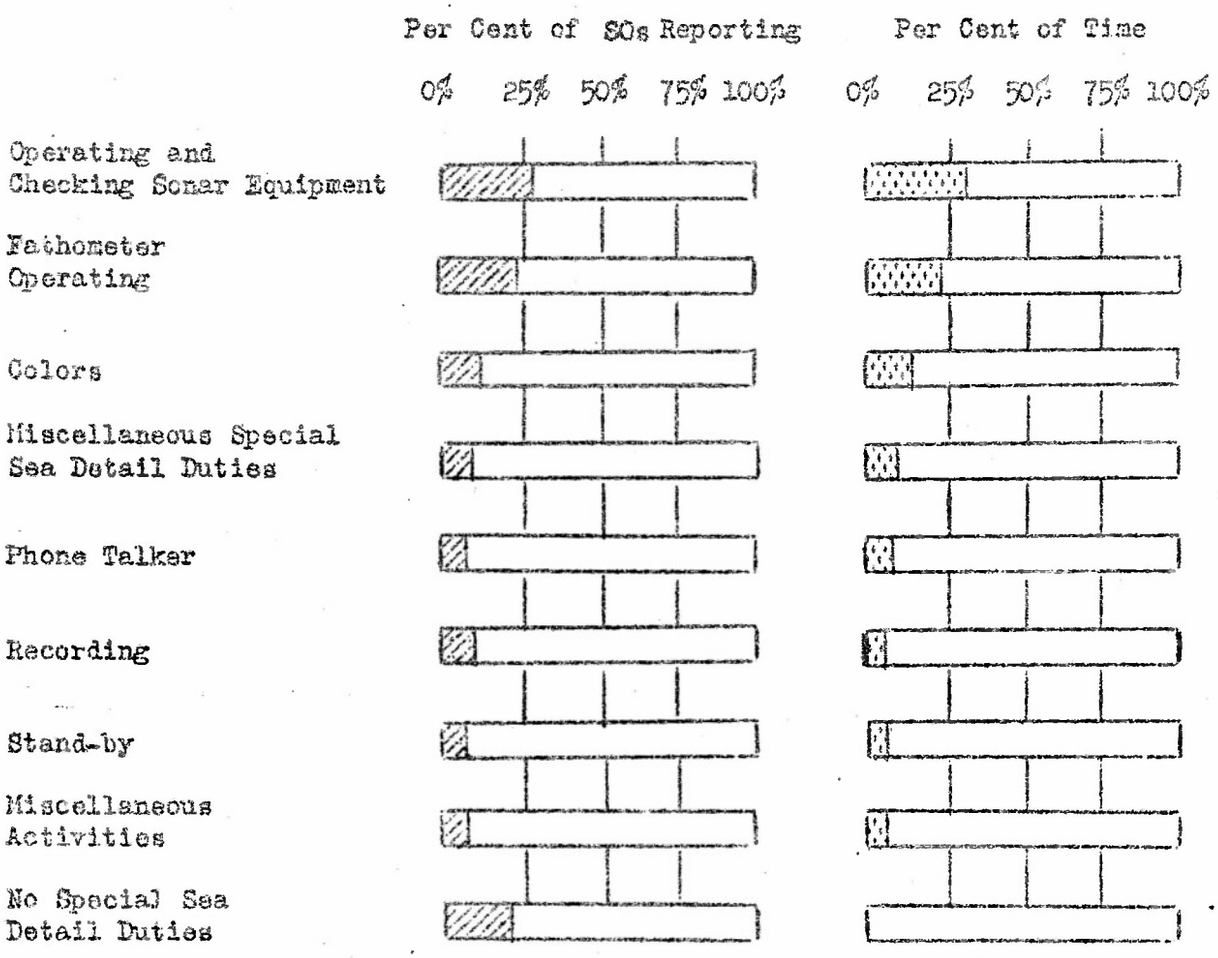



Fig. 13. Special Sea Detail Activities of SOs. Percentage of SOs who perform various activities during special sea details and the percentage of the total special sea detail time spent on each activity. (Job Questionnaire, item 33)

An inspection of the special sea detail information reveals that most sonarmen continue to engage in the activities which they have reported for normal steaming watches. However, an appreciable percentage of the sonarmen (23%) indicate they operate the fathometer under the special sea detail

condition. In addition, some of the lower rated sonarmen indicate that they engage in the activities included in the categories labelled, "colors" and "miscellaneous special sea detail duties" and, in general, devote their entire special sea detail time to these duties.

Duties When Not on Watch or at Battle Station. The activities sonarmen report that they do when not on watch or at their battle stations are upkeep (which includes the activities involved in the cleaning and upkeep of the ship and various spaces), supervision, general duties (which includes general petty officer duties such as guard mail P. O. and working parties such as ammunition handling), maintenance, instruction, record keeping, and miscellaneous activities (equipment operating when not on watch and recreation committee activities).

The data shows that out of the total sonarman's work day, 52 per cent of their time is spent not on watch or at their battle stations, and 22 per cent of the total work day is spent in the upkeep of the ship and spaces. Approximately 70 per cent of the sonarman's work day is taken up by watches, general quarters, and the ships upkeep.

Figure 14 gives the percentage of sonarmen who perform each activity, and the percentage of time they spend on each.

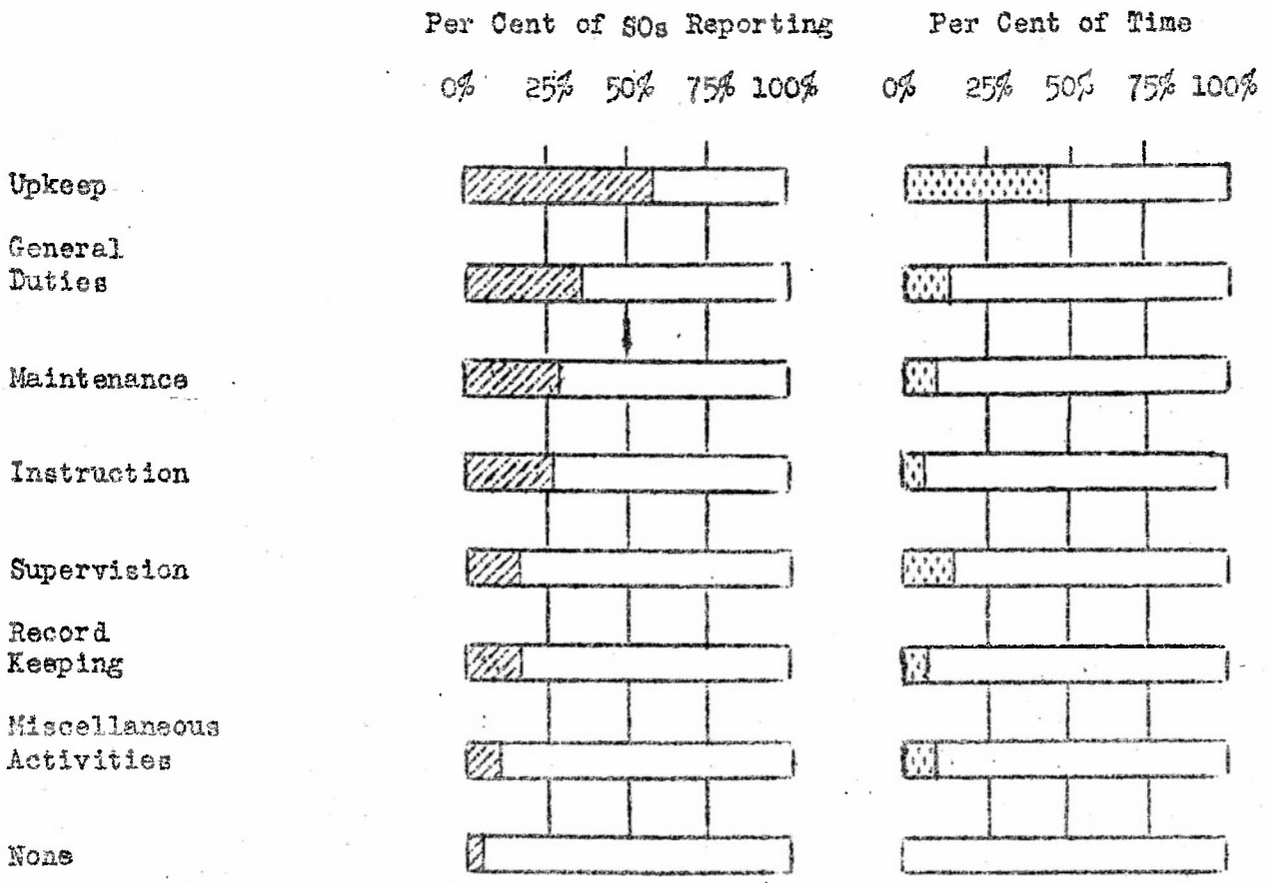



Fig. 14. Activities Performed by SOs When Not on Watch or at Battle Stations. Percentage of SOs who perform various activities during the time that they are not on watch or at their battle stations and the percentage of time they spend at each. (Job Questionnaire, item 31)

Four per cent of the men reported that they had no duties when not on watch or at battle stations. In all instances these men were seamen. A larger proportion (75%) of seamen reported that they perform activities relating to ships upkeep than did rated men (44%).

Non-electronic Duties. Although most of the sonarmen's work is confined to activities related to electronics, part of their time is taken up in performing non-electronic duties. Figure 9 shows that sonarmen spend about 16 per cent of their total time aboard ship on non-electronic activities which include working parties, watches, petty officer duties, supervision, and miscellaneous activities (movie operator, care of athletic equipment, and engine-room telegraph operator).

Five per cent of the sonarmen stated that they had no non-electronic duties. These instances are confined to the low rates. Figure 15 presents the percentage of sonarmen who perform each of the non-electronic duties and the percentage of the time that they spend at each activity out of the total time spent on non-electronic duties.

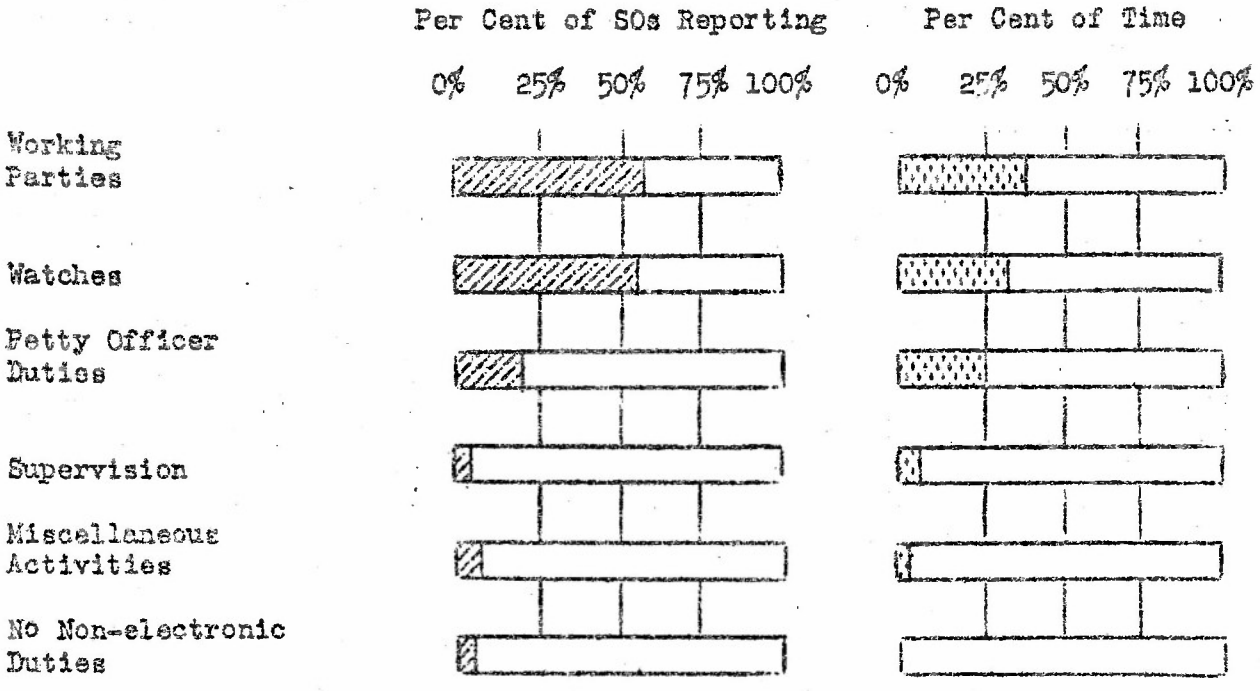



Fig. 15. Non-electronic Duties of SOs. Percentage of SOs who perform various non-electronic activitiesand the percentage of total non-electronic duty time spent at each. (Job Questionnaire, item 30)

As can be seen in the figure, working parties and non-electronic watches are the main non-electronic duties for sonarmen. Working party activities are reported exclusively by the three lowest rates. As would be expected, no seamen reported doing petty officer duties. A much smaller proportion of third class petty officers reported standing non-electronic watches and performing petty officer duties than did other rated sonarmen.

## Summary

In summing up the duties and their temporal relationships for sonarmen during the different periods of shipboard activities, Figure 16 (shown on page 33) is a diagrammatic representation of the division of duties for each of the periods in terms of the relative amounts of time spent on each activity. When considering the five conditions that are presented in the figure, it can be seen that the operation of equipment is the major activity under all shipboard conditions except import watch. It is also shown that a larger proportion of underway watch time is taken up with the operation of sonar equipment than in any of the other conditions. Most of sonar maintenance is accomplished while the ship is underway.

## Maintenance Activities

On a large proportion of the ships, the sonarmen are found to contribute significantly to the maintenance of the equipment they use. On approximately 20 per cent of the ships they perform all the maintenance on sonar equipment. In this section, the kinds and extent of maintenance that the sonarmen do will be discussed.

## Preventive Maintenance

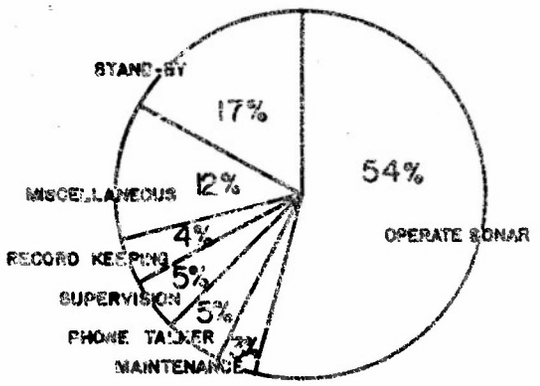
As presented in the description of the ET's job, preventive maintenance includes such activities as cleaning, lubricating, calibrating, tuning, and measuring the selectivity and sensitivity of the equipment. This activity consumes 6 per cent of the sonarmen's total time and is performed by 90 per cent of the group.

Cleaning. Ninety per cent of the sonarmen are responsible for the routine cleaning of their electronic equipment. All of the rates participate in this activity in about equal proportions, although the type of cleaning undertaken may vary among the rates. Thirty-five per cent of the men clean tools, 20 per cent clean test equipment, and 10 per cent of them clean electronic spare parts.

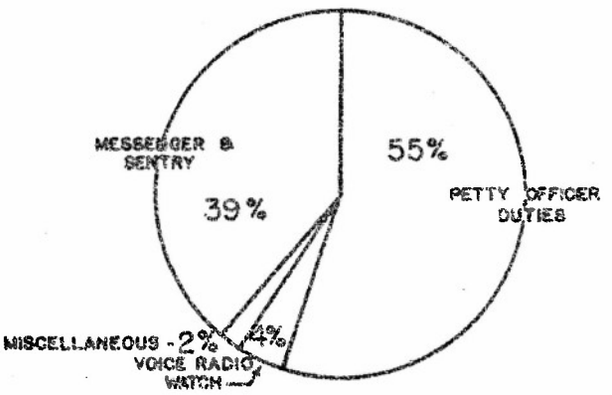
Lubricating. Routine lubrications of equipment are performed by 70 per cent of the sonarmen and a few report that they lubricate tools, test equipment and electronic spare parts. Fifty-seven per cent of the seamen make routine lubrication whereas 83 per cent of the rated men do.

Calibrating. About 65 per cent of the sonarmen are responsible for calibrating electronic equipment and 10 per cent calibrate test equipment. Very few seamen calibrate equipment.

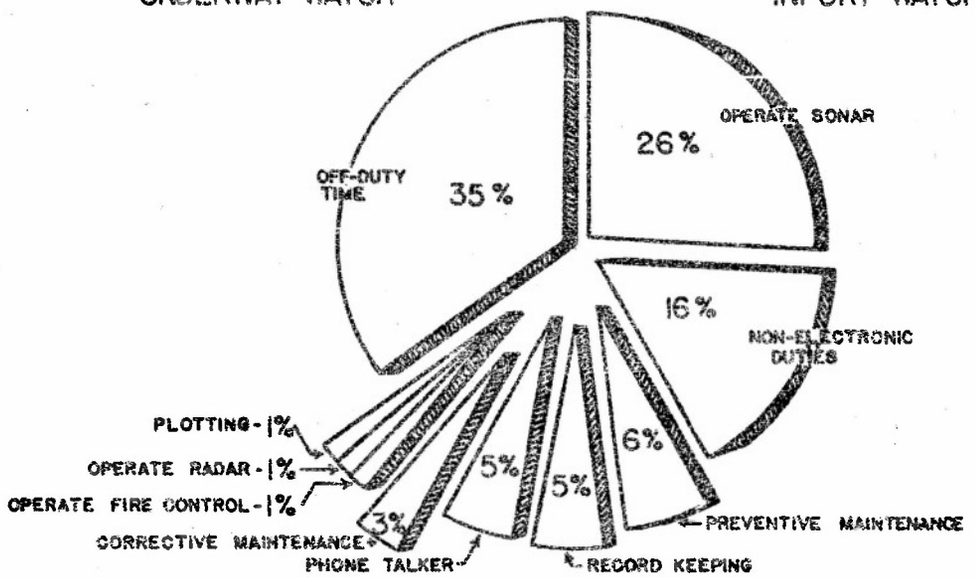
Tuning. This activity is reported by 65 per cent of the sonarmen. Included in this activity is the making of minor adjustments aimed at improving the operation of equipment. A noticeably smaller proportion (51%) of the seaman group report this activity as compared with the other rates (74%).



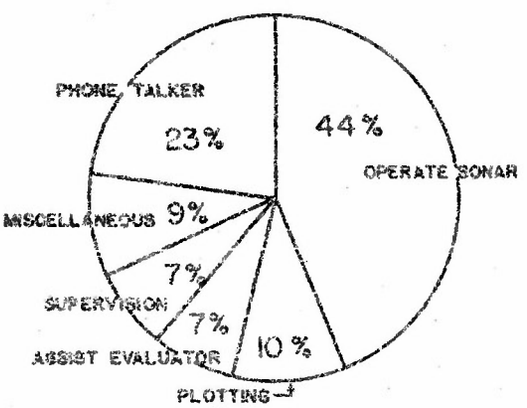

UNDERWAY WATCH



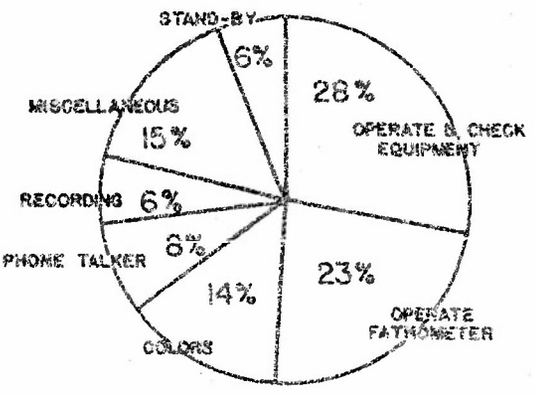

INPORT WATCH




TOTAL TIME ABOARD SHIP




GENERAL QUARTERS




SPECIAL SEA DETAILS

FIG. 16. SUMMARY DIAGRAM OF THE ALLOCATION OF SO'S TIME.

PERCENTAGE OF TIME THAT SO'S SPEND PERFORMING VARIOUS ACTIVITIES UNDER DIFFERENT SHIPBOARD CONDITIONS.

Shifting of frequencies is an activity that is also reported by a smaller proportion of seamen than the higher rates.

Measuring Selectivity and Sensitivity. Sixty-one per cent of the ships report that this activity is done by sonarmen. On practically no ships is this activity performed by seamen.

## Corrective Maintenance

This consists of such activities as making minor repairs, making major repairs, diagnosing casualties, making adjustments, and other activities designed to restore inoperative equipment to operating condition. On the average this activity consumes 3 per cent of the sonarmans total time.

Making Minor Repairs. Seventy-five per cent of the sonarmen report that they replace fuses and change tubes. A larger proportion (94%) of the three higher rates report tube replacements whereas a larger percentage of thirds report replacing fuses.

Making Major Repairs. Thirty-five per cent of the sonarmen report that they make major repairs. Sixty per cent of the three highest rates, 35 per cent of the thirds, and 25 per cent of the seamen do it. Field changes are made by a little more than 24 per cent of the sonarmen, with a much larger proportion (68%) of the higher rates reporting this activity. Only 5 per cent of the sonarmen repair test equipment. Tool repairs are made by 10 per cent of the men.

Diagnose Casualties. This activity is reported as being performed by sonarmen on most of the ships, but it is more likely to be done by the higher rated man. Few seamen are reported to diagnose equipment casualties, and that only a few ships report third class petty officers doing it.

Making Adjustments. Approximately 70 per cent of the sonarmen report that they are responsible for making adjustments to electronic equipment. As is the case with the other maintenance activities, a larger proportion of the higher rated men make adjustments than the lower rates, with the proportion of seamen being the smallest.

## Record Keeping

About five per cent of the total time of sonarmen is spent in keeping records. Table 10 lists the records and shows the relationship between them in terms of the number of men who keep them.

Seventy-two per cent of the sonarmen keep records of some kind. As can be seen in Table 10, all of the sonarmen who keep records, keep operating logs. (See page 36 for Table 10)

Table 10

Records Kept by SOs and the Percentage of SOs Who Keep Each Record (Job Questionnaire - Item 26)

| Records | Percentage of SOs |
|---|---|
| Operating log | 72 |
| Daily equipment check list | 66 |
| Weekly equipment check list | 66 |
| Monthly equipment check list | 65 |
| Equipment logs | 64 |
| Maintenance records | 64 |
| Corrective maintenance records | 51 |
| Repair records | 48 |
| Failure reports | 48 |
| Electronic equipment histories | 44 |
| Training schedules | 43 |
| Meter reading records | 40 |
| Field change records | 39 |
| Equipment installation records | 34 |
| Alteration records | 23 |
| Electronic service repair reports | 22 |
| Resistance test records | 19 |
| Operation schedules and plans | 15 |
| Spare parts records | 15 |
| Custody records | 14 |

## Responsibilities for Materials and Supplies

Sonarmen have certain types of responsibilities toward various materials that they use in their work. This section presents these responsibilities and gives the proportion of sonarmen who report each type.

Maintaining a Full Allowance of Materials. Between ten and twenty per cent of the sonarmen indicated that they were responsible for maintaining a full allowance of equipment instruction books, electronic spare parts, maintenance bulletins, and tools. But, generally speaking, few sonarmen report responsibilities of this type.

Ordering Materials. About a third of the sonarmen indicate that they are responsible for ordering electronic spare parts. Fifteen per cent report a responsibility for ordering equipment instruction books and tools. There is little difference between rates in terms of the percentage who are responsible for ordering materials, except that the proportion of seamen in every case is smaller than the other rates.

Inventorying Materials. A fourth of the sonarmen have the responsibility for inventorying sonar spare parts and fewer report that they inventory equipment instruction books, maintenance bulletins, and tools. This sort of responsibility was reported equally often by all rates.

Storing Materials. Sonarmen are responsible for the storage of the material listed in Table 11. A larger percentage of the men are responsible for storing electronic spare parts and tools than any of the other materials.

Table 11

Materials Stored by SOs and the Percentage of the Group Reporting This Responsibility
(Job Questionnaire - Item 23)

| Materials | Percentage of SOs |
|---|---|
| Electronic spare parts | 31 |
| Tools | 31 |
| Equipment instruction books | 19 |
| Maintenance bulletins | 18 |
| Test equipment | 11 |
| Log books | 11 |

Filing Materials. Table 12 gives the percentage of men who report that they file each of the following. There is no evidence of specialization of filing responsibilities with regard to rate--about the same propertion of all of the rates report this responsibility.

Table 12

Materials Filed by SOs and the Percentage of the Group Reporting This Responsibility
(Job Questionnaire - Item 23)

| Material | Percentage of SOs |
|---|---|
| Equipment instruction books | 28 |
| Maintenance bulletins | 26 |
| Equipment operation records | 21 |
| Log books | 20 |
| Operation orders | 16 |
| Trouble report forms | 14 |
| Radio messages and dispatches | 14 |

Safeguarding the Security of Materials. There are materials aboard ship which are of such a nature that someone has to exercise physical control over them and maintain continuous accountability for them. The written materials in this group frequently contain classified military information and care must be taken to keep this information from falling into unfriendly hands.

When the sonarmen were asked to select from a list of materials those for which they had this type of responsibility they responded as shown in Table 13.

Table 13

Materials Which SOs Safeguard and the Percentage of the Group Reporting This Responsibility (Job Questionnaire - Item 23)

| Materials | Percentage of SOs |
|---|---|
| Equipment instruction books | 63 |
| Maintenance bulletins | 52 |
| Log books | 38 |
| Equipment operation records | 36 |
| Operation orders | 33 |
| Electronic spare parts | 15 |
| Tools | 13 |
| Test equipment | 11 |
| Radio messages & dispatches | 11 |

Inserting Published Changes in Materials. Thirty-eight per cent of the sonarmen reported that they are responsible for inserting published changes in sonar maintenance bulletins. Thirty-four per cent state that they are responsible for inserting such changes in their equipment instruction books.

Checking the Correctness of Materials. Some sonarmen are responsible for checking the correctness of records as well as other materials. Table 14 lists the materials and the percentage of men who report that they have this responsibility.

Table 14

Materials Which SOs Check for Correctness and the Percentage of the Group Reporting this Responsibility (Job Questionnaire - Item 23)

| Materials | Percentage of SOs |
|---|---|
| Log books | 30 |
| Equipment operation records | 27 |
| Trouble report forms | 16 |
| Status boards | 14 |
| Maintenance bulletins | 11 |

A greater proportion (29%) of the higher rated sonarmen have this responsibility than the lower-rated men (9%).

## Supervision and Instruction

Supervision and training are activities that are performed almost entirely by the rated men. Third class petty officers are much less likely to be found training than are the higher rates but they do report a fair amount of these activities.

Supervision. Approximately a fourth of the sonarmen supervise the use of test equipment and equipment instruction books, while about a fifth supervise the use of maintenance bulletins, log books, and tools. The use of equipment operation records is supervised by about a sixth of the men, and a few of the men supervise the use of trouble report forms, operation orders, and status boards.

Instruction. About half of the sonarmen report that they are responsible for instruction related to electronic equipment. Thirty-five per cent of the sonarmen report that they train men in the use of equipment instruction books, and about 30 per cent train men in the use of test equipment and maintenance bulletins. Between 20 and 25 per cent of the sonarmen train men in the use of equipment operation records, log books, and tools. A few sonarmen report that they train men in the use of trouble report forms, operation orders, electronic spare parts, status boards, and radio messages and dispatches.

## Materials Sonarmen Use

This section will describe the kinds of publications, tools, and test equipment that sonarmen use and the percentage of men reporting each.

Publications. The publications which sonarmen use in the course of their jobs are given in Table 15.

Table 15

Publications SOs Use and the Percentage of SOs Who Use Each Publication
(Job Questionnaire - Item 22)

| Publication | Percentage of SOs |
|---|---|
| USF Publications | 84 |
| Sonar Maintenance Bulletin | 81 |
| Instruction books (general) | 81 |
| NAVShips instruction books (for each equipment) | 76 |

Table 15
(continued)

| Publications | Percentage of SOs |
|---|---|
| Textbooks on electronics (educational publications) | 72 |
| BUShips manuals | 67 |
| Electron | 49 |
| General Signal books | 30 |
| CSP (Communication Signal) Publications | 26 |
| Fleet Tactical Instructions | 24 |
| JANAP (Joint Army, Navy, Air Force) Publications | 17 |
| CNO (Chief Naval Operations) Publications | 16 |
| ACP (Army Command) Publications | 15 |
| JANP (Joint Army, Navy) Publications | 12 |

Tools. Table 16 lists the tools that sonarmen use in their job and gives the percentage of men who report that they use each of the tools.

Table 16

Tools SOs Use and the Percentage of SOs Who Use Each Tool

| Tool | Percentage of SOs |
|---|---|
| Screwdrivers | 94 |
| Pencils | 92 |
| Long-nose pliers | 87 |
| Allen wrenches | 75 |
| Crescent wrenches | 75 |
| End wrenches | 74 |
| Files | 67 |
| Soldering gun | 66 |
| Hammer | 59 |
| Dike pliers | 57 |
| Drills | 55 |
| Socket wrenches | 53 |
| Punches | 47 |
| Hacksaw | 46 |
| Hand drill | 44 |

Table 16
(continued)

| Tool | Percentage of SOs |
|---|---|
| Power drill | 43 |
| Alignment tool | 43 |
| Parallel ruler | 35 |
| Typewriter | 33 |
| Strippers | 32 |
| Tap and die | 24 |
| DRT arm | 24 |
| Dividers | 19 |
| Grinder | 16 |
| Nautical slide rule | 10 |

Test Equipment. Table 17 presents the electronic test equipment used by the sonarmen in the course of their normal shipboard jobs.

Table 17

Test Equipment SOs Use and the Percentage of SOs Who Use Each Piece of Test Equipment
(Job Questionnaire - Item 28)

| Test Equipment | Percentage of SOs |
|---|---|
| Tube tester | 72 |
| Volt-ohmmeter | 57 |
| Multimeter | 55 |
| Vacuum-tube voltmeter | 41 |
| Signal generator | 39 |
| Oscilloscope | 32 |
| Beat-frequency oscillator | 30 |
| Ohmmeter | 23 |
| Voltmeter | 22 |
| Frequency meter | 21 |
| Meggar | 17 |
| Ammeter | 15 |
| Milliammeter | 15 |

## Radarmen

The job of the radarmen will described in this section in the same manner as the jobs of electronics technicians and sonarmen were described.

### Duties Under Various Shipboard Conditions[8]

Total Time Aboard Ship. During an average day, a radarman participates in the following activities: radar operating, plotting, acting as phone talker, radio operating, record keeping, preventive maintenance, corrective maintenance, non-electronic duties, and a period of time spent off-duty. Figure 17 shows the percentage of radarmen who perform each of the aforementioned activities as well as the percentage of the total time aboard ship spent on each activity.

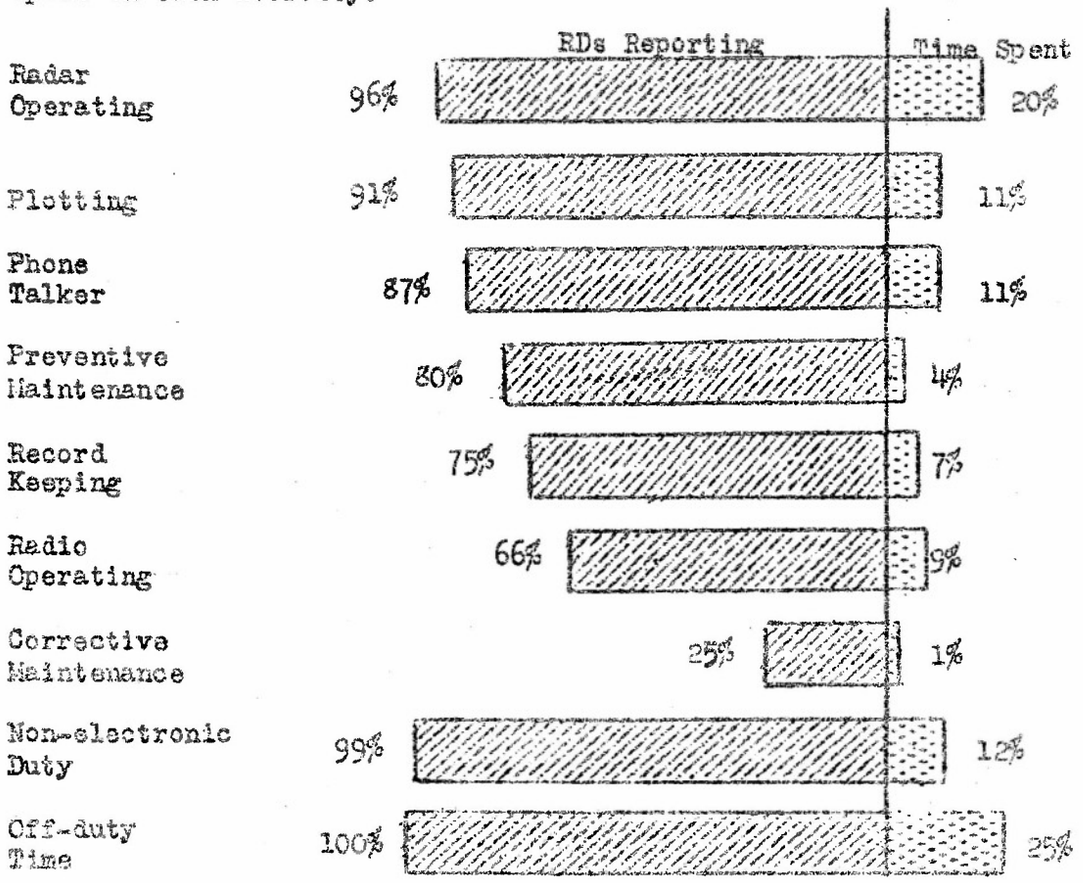



Fig. 17. Shipboard Activities of RDs. Percentage of RDs who perform various activities during their total time aboard ship and the percentage of time they spend at each. (Job Questionnaire, item 41)

[8] See footnote 5, page 7.

More than fifty per cent of the total time that radarmen are aboard ship is spent in an operational activity, i. e., as a radio or radar operator, a plotter, or a phone talker. The remainder of the time is distributed among related activities such as record keeping, and preventive and corrective maintenance, as well as duties of a non-electronic nature. Twenty-five per cent of the radarmen's total shipboard time is spent on personal activities.

There is little difference between the rates as to the percentage who perform radar operating, plotting, or any of the non-electronic duties. However, differences are found between the percentages of various rates who report performing the other activities. Seventy-five per cent of those who do are second or third class petty officers. There is a tendency for more of the rated radarmen to perform on the radar equipment. Seventy-seven per cent of the men who report that they act as talkers during some part of their average day are either RD/3 or RD/SN.

Underway Watch. While on underway watch, radarmen report spending their time performing the following activities: operating radar and radio, plotting, supervising, phone talking, record keeping, and miscellaneous activities (instruction and study, air controller, evaluator, cleaning and maintenance).

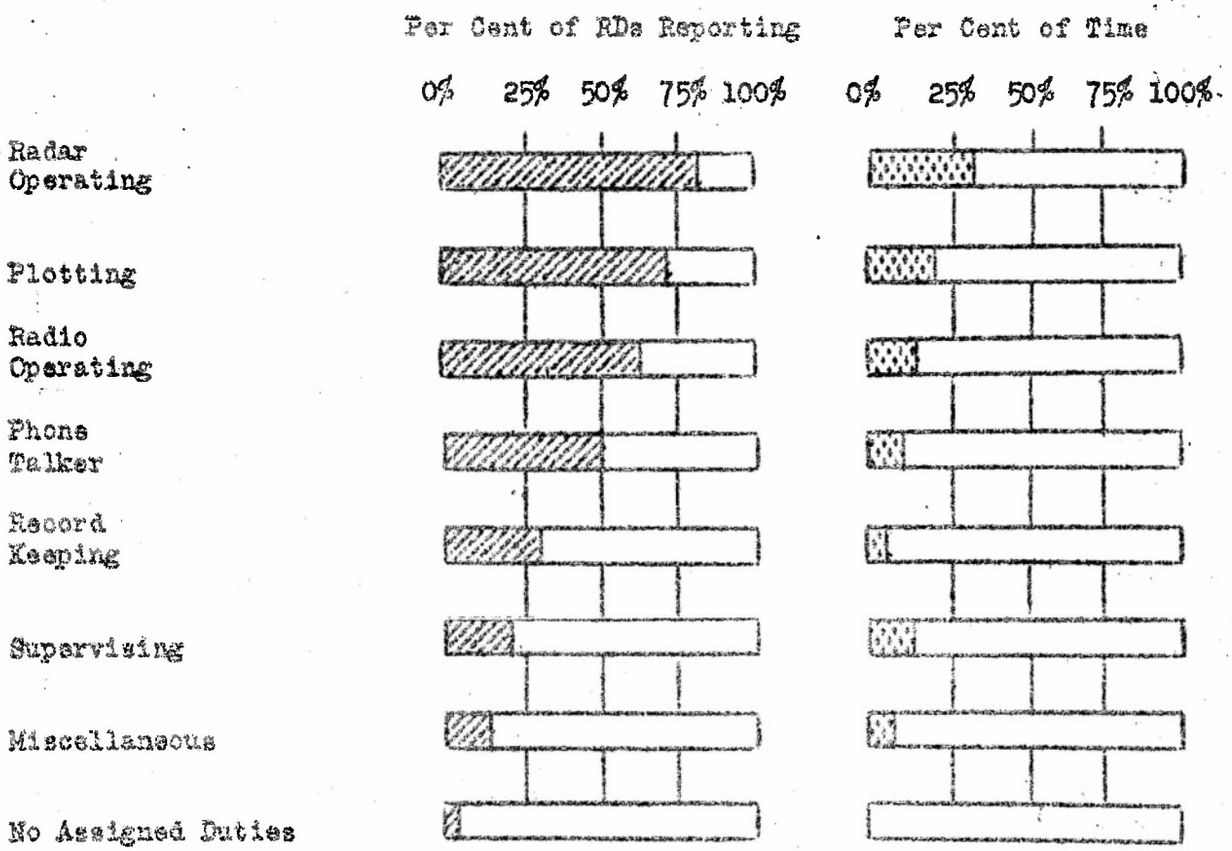



Fig. 18. Underway Watch Duties of RDs. Percentage of RDs who perform various activities during underway watch and the percentage of time spent at each. (Job Questionnaire, item 40)

Three per cent of the radarmen reported that they have no regularly assigned underway watch duties. Figure 18 is based upon the total number of radarmen responding to a question concerning underway watch duties and shows the percentage of RDs reporting each of these activities as well as the total time spent performing each activity while on underway watch.

Radarmen of the higher rates tend to do much more supervising and record keeping while on underway watch than men of the lower rates. However, larger percentages of the lower rates report spending their time while on underway watch operating radar and acting as phone talkers. About an equal percentage of all rates participate in the other activties.

General Quarters. The following activities are reported by radarmen as taking up all of the time they spend at their battle stations: plotting, operating radar and radio, phone talking, supervising, record keeping, and engaging in miscellaneous activities (evaluator, messenger, RCM operator, and stand-by).

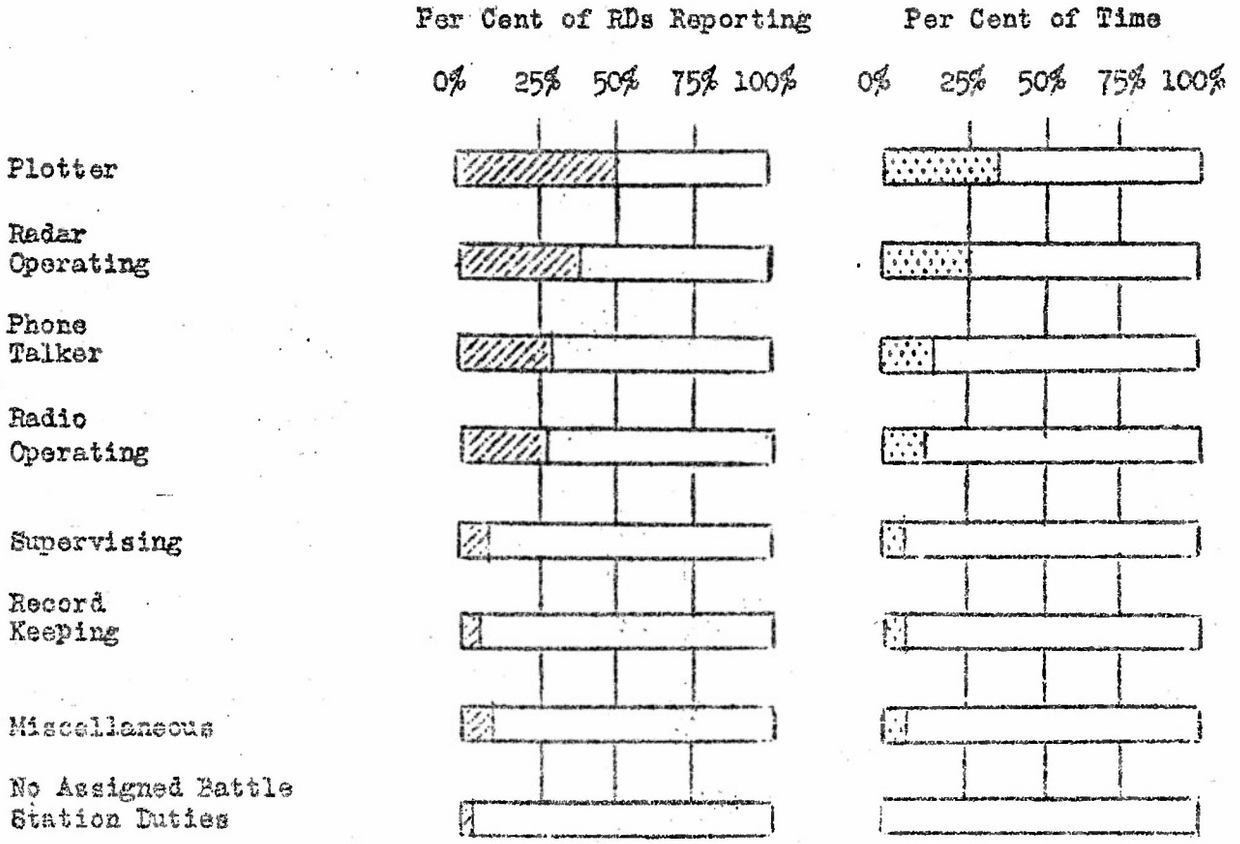



Fig. 19. General Quarters Duties of RDs. Percentage of RDs who perform various activities at battle station and the percentage of time that they spend at each activity. (Job Questionnaire, item 36)

Except for supervising, little difference was found between the rates as to the percentage of each rate reporting each activity. The per cent of the total general quarters time spent on each of the activities and the percentage of radarmen reporting the activity is shown in Figure 19.

Import Watch. Performing the following four activities takes up the total time of radarmen while at import watch: quarterdeck watch, messenger and sentry duties, voice radio watch, and miscellaneous duties (instruction and study, work space cleaning, working parties, keeping records, and supervision).

There is little difference between the rates as to the percentage of the men who participate in the voice radio watch. The duty of messenger or sentry is reported as an activity only by the radar strikers.

A breakdown of the radarmens' import watch time is given in Figure 20.

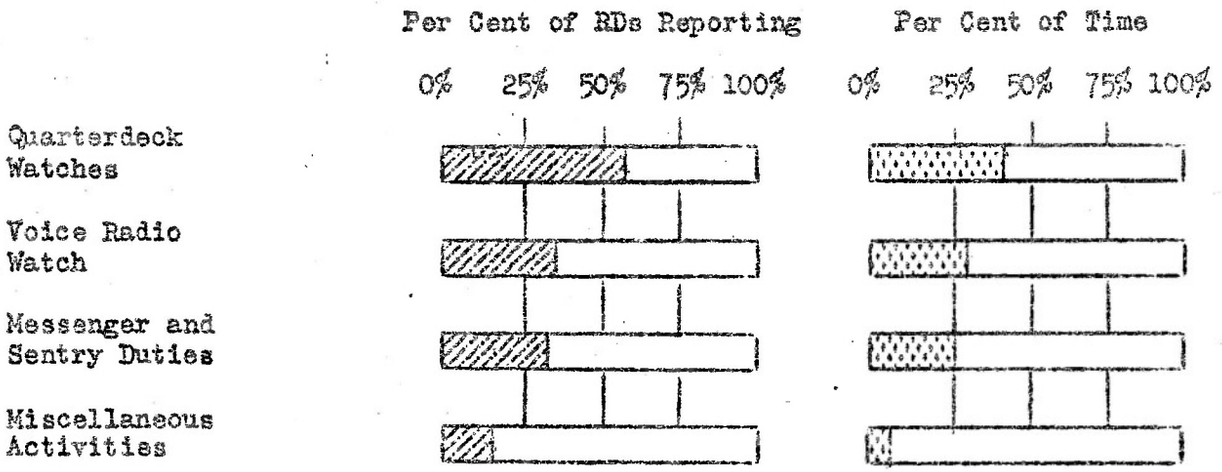



Fig. 20. Import Watch Activities of RDs. Percentage of RDs who perform various activities during import watch and the percentage of time spent at each activity. (Job Questionnaire, item 38)

Special Sea Detail. More than 85 per cent of the radarmen report that they have special sea detail duties. These duties are: radar operating, plotting, acting as a phone talker, supervising, record keeping, radio operating, and engaging in miscellaneous activities (evaluator, stand-by, enunciator, operating the fathometer, lock-out, handling fueling lines, and maintenance).

Supervision is reported only by the upper rates and little difference is found between the rates as to the percentage of those taking part in the other activities.

Figure 21 (page 46) shows the percentage of radarmen who perform each of the activities mentioned above as well as the percentage of the total special sea detail time spent on each activity.

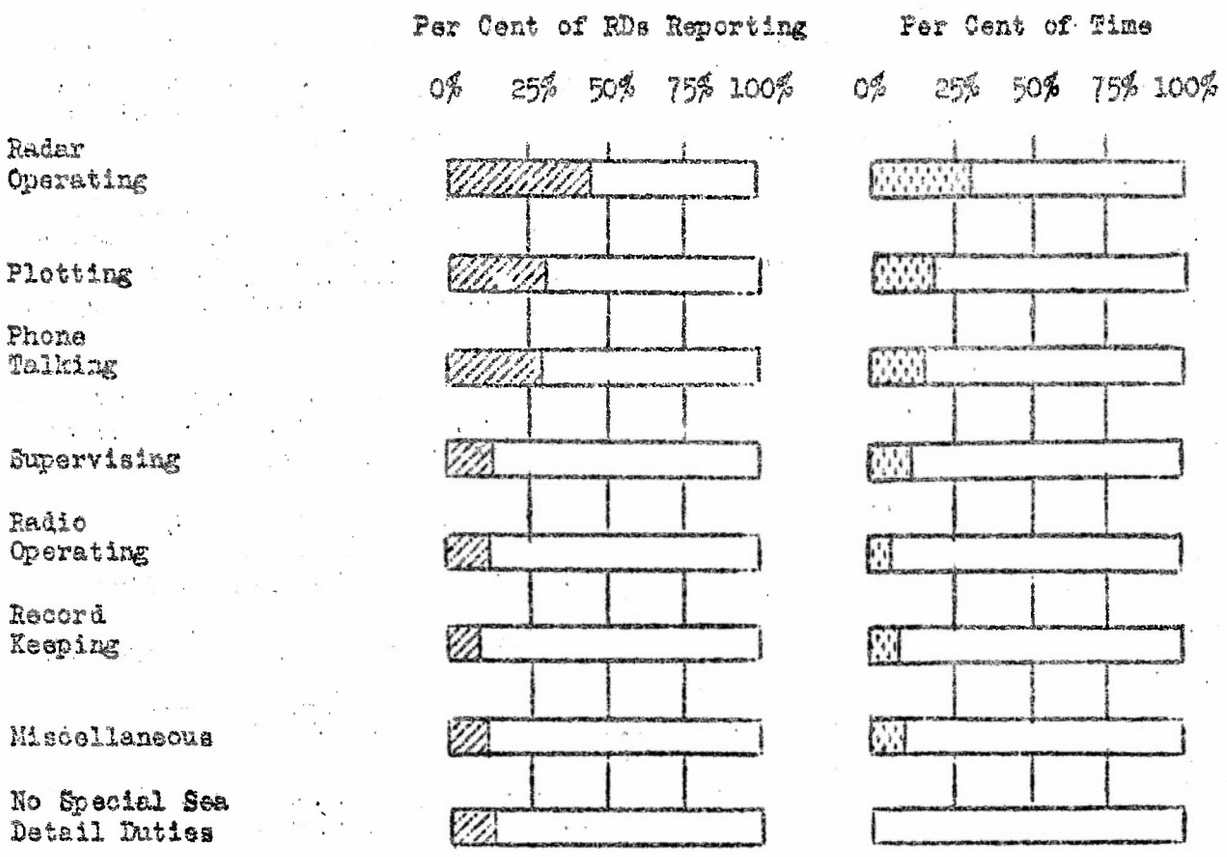



Fig. 21. Special Sea Detail Activities of RDs. Percentage of RDs who perform various activities during special sea details and the per cent of the total special sea detail time spent on each activity. (Job Questionnaire, item 33)

Duties When Not on Watch or Battle Station. The radarmen report that when they are not on watch or at battle stations they engage in the following activities: serving as members of working parties, supervising, instructing, standing watch, keeping records, maintaining the electronic equipment in CIC, and performing miscellaneous activities (radar operating, plotting, and phone talking).

With the exception of the activities of working parties and supervising, little difference is found between the rates of those reporting them. Supervision is restricted almost entirely to the higher rated men while almost all of the men participating in working parties are of the lower rates.

Figure 22 (page 47) presents the percentage of radarmen who perform each of the activities shown and the per cent of the total non-watch, non-battle station time spent on each.

Radarmen spend about 43% of their total work day not on watch or at their battle stations. It is interesting to note that more than two-thirds of the

radarmen report that they participate in working parties when they are not on watch or at their battle stations. In addition, this particular activity takes up more than fifty per cent of this time.

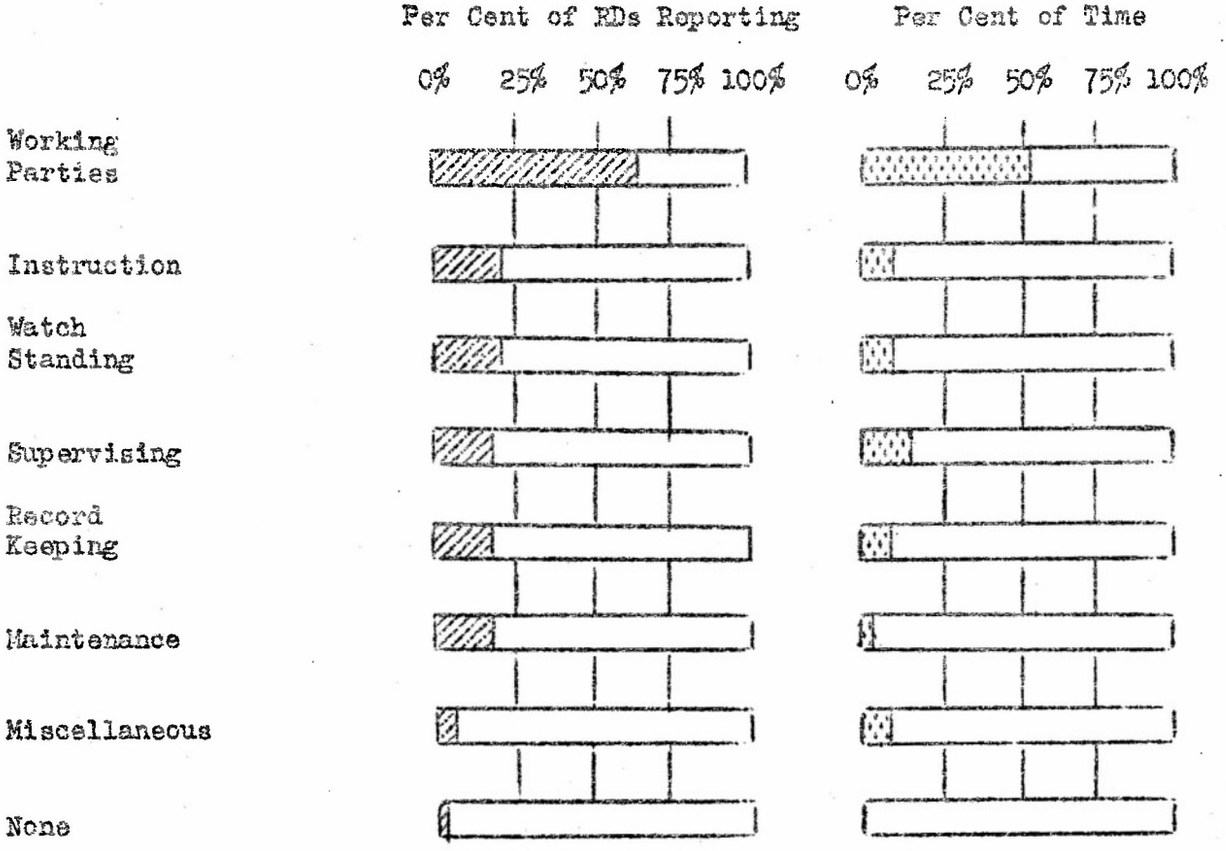



Fig. 22. Activities Performed by RDs When Not on CIC Watch or at Battle Station. Percentage of RDs who perform various activities during the time that they are not on watch or at their battle stations and the percentage of this time that they spend at each activity. (Job Questionnaire, item 31)

Non-electronic Duties. These duties are not associated with electronic equipment. They are concerned with the activities and upkeep of the ship in general. Twelve per cent of the total time that radarmen are aboard ship is spent on non-electronic duties which include the following: working parties, deck watches, petty officers duties, supervising, and miscellaneous activities (movie operator, store keeper, and mess cock).

Petty officer duties and supervising activities are reported only by the rated men while most of the men reporting that they are members of working parties are of the lower rates.

Figure 23 shows the percentage of radarmen who report the activities and the percentage of the total non-electronic duty time spent on each. (Page 48)

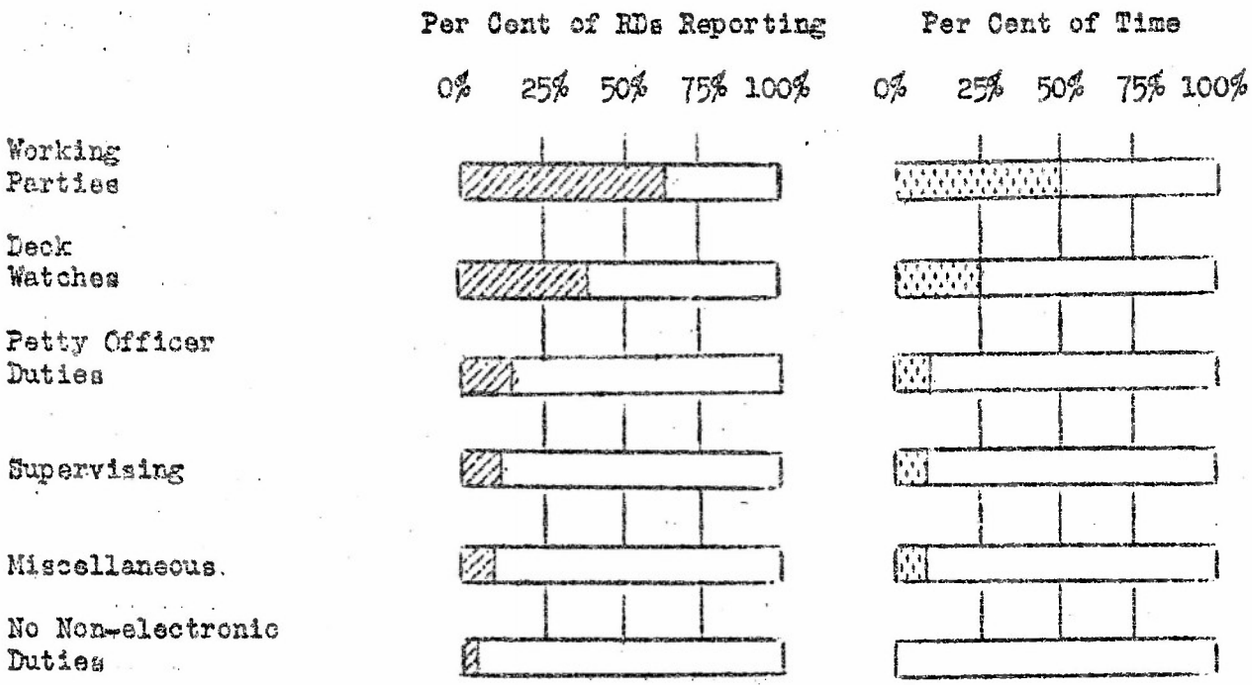


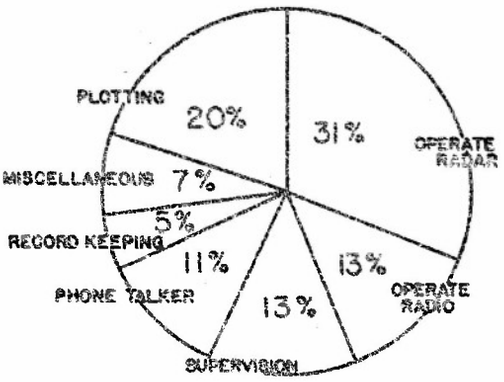

Fig. 23. Non-electronic Duties of RDs. Percentage of RDs who perform various non-electronic activities and the percentage of total non-electronic duty time spent at each. (Job Questionnaire, item 30)

## Summary

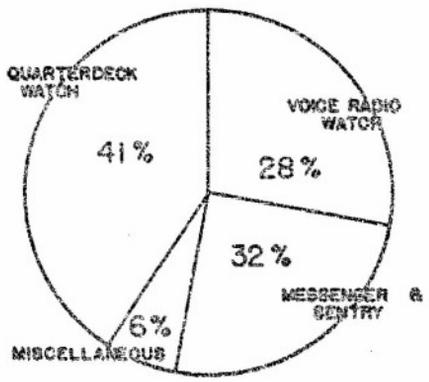
Figure 24 presents breakdowns of the radarmens' shipboard time according to four subdivisions of the total time as well as the total time itself. As can be seen from this figure, the major electronic duties of radarmen are performed under all of the shipboard conditions except import watch. Radio operating is the only activity that is performed by RDs to an appreciable extent under all conditions (including import watch). (Figure 24 is shown on page 49)

## Maintenance Activities

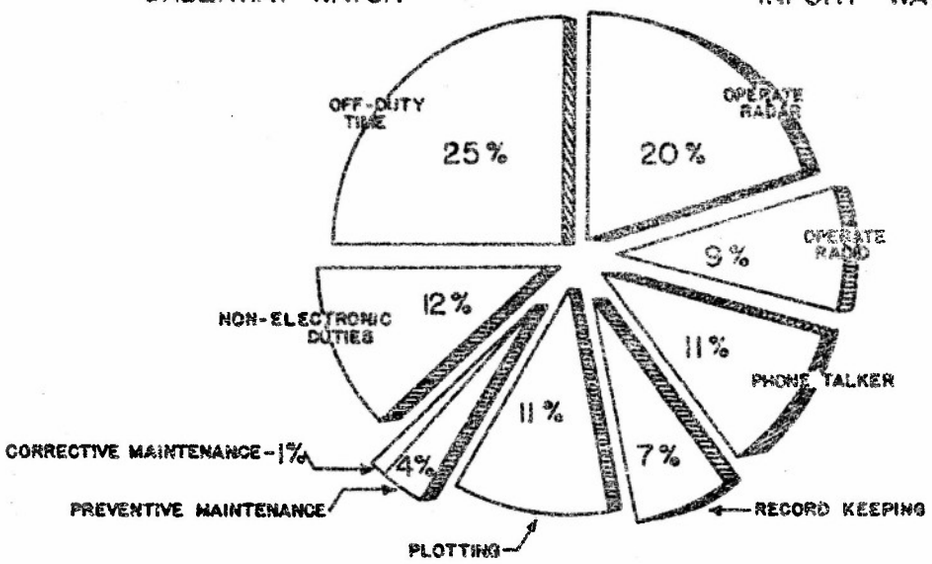
On all of the ships in the sample, the radarmen had some responsibility for the maintenance of the electronic equipment that they used. For the most part, this equipment is physically located in the combat information center and, generally speaking, the maintenance activities of the radarmen were of the routine, low-level type. There is a tendency for the higher rated RDs to spend more time on maintenance than the lower rates spend. A description of the RDs' maintenance activities follows.



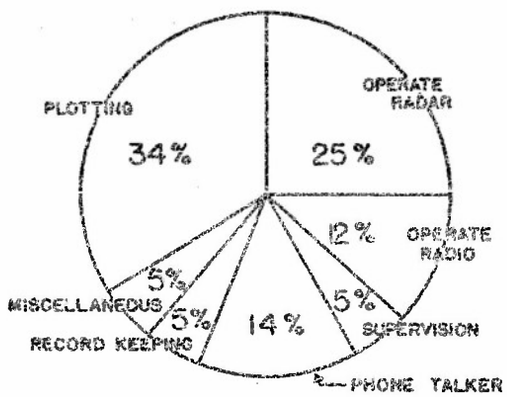

UNDERWAY WATCH



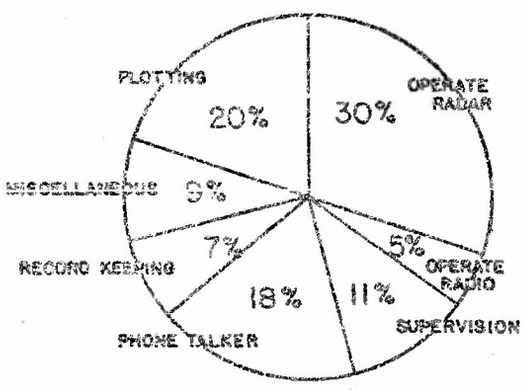

INPORT WATCH




TOTAL TIME ABOARD SHIP




GENERAL QUARTERS




SPECIAL SEA DETAILS

FIG. 24. SUMMARY DIAGRAM OF THE ALLOCATION OF RD'S TIME.
PERCENTAGE OF TIME THAT RD'S SPEND PERFORMING VARIOUS ACTIVITIES UNDER DIFFERENT SHIPBOARD CONDITIONS.

## Preventive Maintenance

These activities are performed by all rates and they take up about 4 per cent of the total time radarmen are aboard ship. However, the RM/SNs report a smaller proportion of men who perform preventive maintenance activities than do any of the other rates.

Cleaning. Eighty per cent of the RDs report that they do routine cleaning of the electronic equipment in CIC. Very few report a responsibility for cleaning tools and test equipment.

Lubricating. A responsibility for performing routine lubrications is reported by 30 per cent of the men--a greater proportion of the higher rated men reporting.

Calibrating. About 75 per cent of the RDs report that they calibrate electronic equipment and a few report that they calibrate electronic test equipment.

Tuning. This activity includes shifting frequencies of electronic equipment as well as other minor adjustments intended to improve it's operation. Eighty-four per cent of the radarmen do this.

## Corrective Maintenance

As a group, the radarmen report that they spend about one per cent of their total time aboard ship making repairs on electronic equipment. For the most part, those who reported this activity were among the higher rated petty officers. Twenty-five per cent of the total group reported that they removed and replaced fuses when it was necessary. Nineteen per cent indicated that they replaced vacuum tubes. (In this connection, the radarmen were asked to indicate whether or not they were required to make such tube substitutions and most of them indicated that they were not required to do so). No radarmen reported making major repairs to electronic equipment.

## Record Keeping

Radarmen spend about seven per cent of their total time keeping records. The records that the men keep as part of their job are listed in Table 18 along with the percentage of the group reporting the same. (Table 18 is shown on page 52)

## Responsibilities for Materials and Supplies

Radarmen have certain responsibilities toward the various materials and supplies with which they work. The following section highlights these responsibilities and shows the percentage of radarmen reporting each.

Table 18

Records Kept by RDs and the Percentage of RDs
Who Keep Each Record
(Job Questionnaire - Item 26)

| Records | Percentage of RDs |
|---|---|
| Radio logs | 87 |
| CIC logs | 75 |
| Radio operator recorder log | 58 |
| Equipment log | 56 |
| Weekly check list (equipment) | 55 |
| Operating log | 54 |
| Monthly check list | 51 |
| Daily check list | 50 |
| DRT log | 50 |
| Tactical Charts | 41 |
| Operation schedule and plans | 34 |
| Training schedule | 29 |
| Strategic chart | 22 |
| Corrective maintenance record | 20 |
| Custody records | 17 |
| Failure report | 10 |

Maintaining a Full Allowance of Materials. A little less than 10 per cent of the radarmen report responsibilities for maintaining a full allowance of various publications and log books. Fewer have this responsibility for operation orders, maintenance bulletins, and tools.

Ordering Materials. The only materials ordered by radarmen are log books, various publications, and tools. Less than 15 per cent of the men report that they have this responsibility.

Inventorying Materials. Fifteen per cent of the men or less inventory various publications, log books, operation orders, and tools.

Safeguarding the Security of Materials. In the course of their normal duties, the radarmen are required to handle classified military information. Certain members of the group have been assigned definite responsibilities for seeing that these materials are properly accounted for at all times. Table 19 (page 53) lists the materials which the radarmen safeguard and indicates the percentage of the rader group accepting this responsibility.

Table 19

Materials Which RDs Safeguard and the Percentage of the Group Reporting This Responsibility (Job Questionnaire - Item 23)

| Materials | Percentage of RDs |
|---|---|
| Operation Order | 44 |
| Radio messages and Dispatches | 36 |
| Logbooks | 31 |
| Equipment instruction book | 17 |
| Equipment operation record | 10 |

Checking Correctness of Materials. A number of radarmen indicate that they are required to check the materials listed in Table 20 for errors and to make such corrections as are found to be necessary.

Table 20

Materials Which RDs Check Correctness and the Percentage of the Group Reporting This Responsibility (Job Questionnaire - Item 23)

| Materials | Percentage of RDs |
|---|---|
| Status boards | 31 |
| Logbooks | 31 |
| Radio messages and dispatches | 24 |
| Equipment operation record | 15 |
| Operation order | 13 |

Other Responsibilities. About one out of every five radarmen point out that they are responsible for conducting an inventory of logbooks and operation orders. Most of these men also indicate that they are expected to file operation orders and log books. Almost half of the radarmen state that they file incoming radio messages and dispatches. Twelve per cent reported having a responsibility for distributing radio messages and dispatches.

## Supervision and Instruction

As shown numerous times in previous divisions of this section, the responsibility for supervising and training men in the use of various materials is reported almost entirely by the higher rates.

Supervision. Among the group of higher rated men it is found that about 30 per cent report being responsible for supervising the use of status

boards and log books. Between 10 and 20 per cent also supervise the use of equipment operation records, operation orders, equipment instruction books, and radio messages and dispatches, while only a few report being responsible for the supervision of maintenance and the use of test equipment and tools.

Instruction. Only a few in this group of radarmen report being responsible for the training of men in the use of tools and equipment operation records. A slightly larger percentage (between 10 and 20 per cent) report that they train men in the use of operation orders, equipment instruction books, maintenance bulletins, and radio messeges and dispatches. Thirty-five per cent say that they train men in the use of status boards, various publications, and logbooks while the greatest number (close to forty per cent) report that they are responsible for the training of men in the use of electronic equipment.

Materials RDs Use

In a manner similar to the job descriptions given previously for other classifications, the following portion of this section contains tables which present listings of the publications, tools, and test equipment used by radarmen and the percentages of men who report the use of each of these instruments.

Publications. The job of the radarman requires him to refer to a number of different publications. Each man in this sample was requested to indicate the particular publication that he used while performing his duties aboard ship. These publications are presented in Table 21.

Table 21

Publications RDs Use and the Percentage of RDs Who Use Each Publication (Job Questionnaire - Item 22)

| Publication | Percentage of RDs |
|---|---|
| General Signal Books | 59 |
| USF | 59 |
| RAD Series | 59 |
| JANAP (Joint Army, Navy, Air Force) Publications | 58 |
| ACP (Army Command) Publications | 58 |
| Instruction Books (General) | 50 |
| Communications Signaling Procedure | 48 |
| Fleet Tactical Instruction | 47 |
| JAMP (Joint Army, Navy) Publications | 42 |
| Radar Bulletin Series | 40 |

Table 21
(continued)

| Publications | Percentage of RDs |
|---|---|
| Department Naval Communications | 33 |
| Radar Maintenance Bulletin | 30 |
| NAVShips Instruction Books (Equipment) | 30 |
| CNO (Chief Naval Operations) Publications | 29 |
| Textbooks on Electronics (educational publications) | 23 |
| BuShips Manuals | 21 |
| ONI (Office Naval Intelligence) | 19 |
| Electron | 10 |

Tools. A list of the tools that the radarmen stated that they used in the performance of their shipboard duties is given in Table 22. A brief inspection of the list will substantiate maintenance information presented on the preceding pages. A definite break will be noted between the items "nautical slide rule" and "screwdriver." The most commonly used tools are not of the type used in maintenance but rather are plotting aids.

Table 22

Tools RDs Use and the Percentage of RDs Who Use Each Tool
(Job Questionnaire - Item 27)

| Tool | Percentage of RDs |
|---|---|
| Pencils | 98 |
| DRT Arm | 98 |
| Parallel Ruler | 87 |
| Dividers | 86 |
| Nautical Slide Rule | 77 |
| Screwdrivers | 59 |
| Pliers (long-nose) | 29 |
| Typewriter | 28 |
| Allen Wrench | 25 |
| Hammers | 22 |
| Files | 18 |
| Crescent Wrenches | 18 |
| Drills | 17 |
| End Wrenches | 16 |
| Power Drill | 15 |
| Hand Drill | 14 |
| Hacksaws | 12 |
| Punches | 12 |

Test Equipment. A list of thirty-two pieces of electronic equipment was submitted to all of the radarmen aboard the ships of this sample along with instructions for checking those pieces of equipment which each man used while engaged in his regular shipboard duties. Table 23 presents those items of equipment which were selected by more than ten per cent of the radarmen. With the exception of the echo box, less than a third of the RDs used any of the test equipment to an appreciable extent.

Table 23

Test Equipment RDs Use and the Percentage of RDs Who Use Each Piece of Test Equipment (Job Questionnaire - Item 28)

| Test Equipment | Percentage of RDs |
|---|---|
| Echo Box | 48 |
| Range Calibrator | 29 |
| Tube Tester | 28 |
| Oscilloscope | 20 |
| Frequency Meter | 18 |
| Voltmeter | 15 |
| Ohmmeter | 15 |
| Dummy Antenna | 11 |
| Signal Generator | 11 |

## Radioman

The following section will discuss the job of radioman in the same manner as the previous discussions of the other ratings.

### Duties Under Various Shipboard Conditions

[9]

Total Time Aboard Ship. The total time that a radioman is aboard ship may be divided among the activities of radio operating, record keeping, preventive maintenance, phone talker, corrective maintenance, sonar operating, fire control operating, non-electronic duties, and off-duty time. Figure 25 (page 57) presents the percentage of radiomen who perform each of the activities during the total time they are aboard ship and the percentage of this time they spend at each activity.

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[9] See footnote 5, page 7.

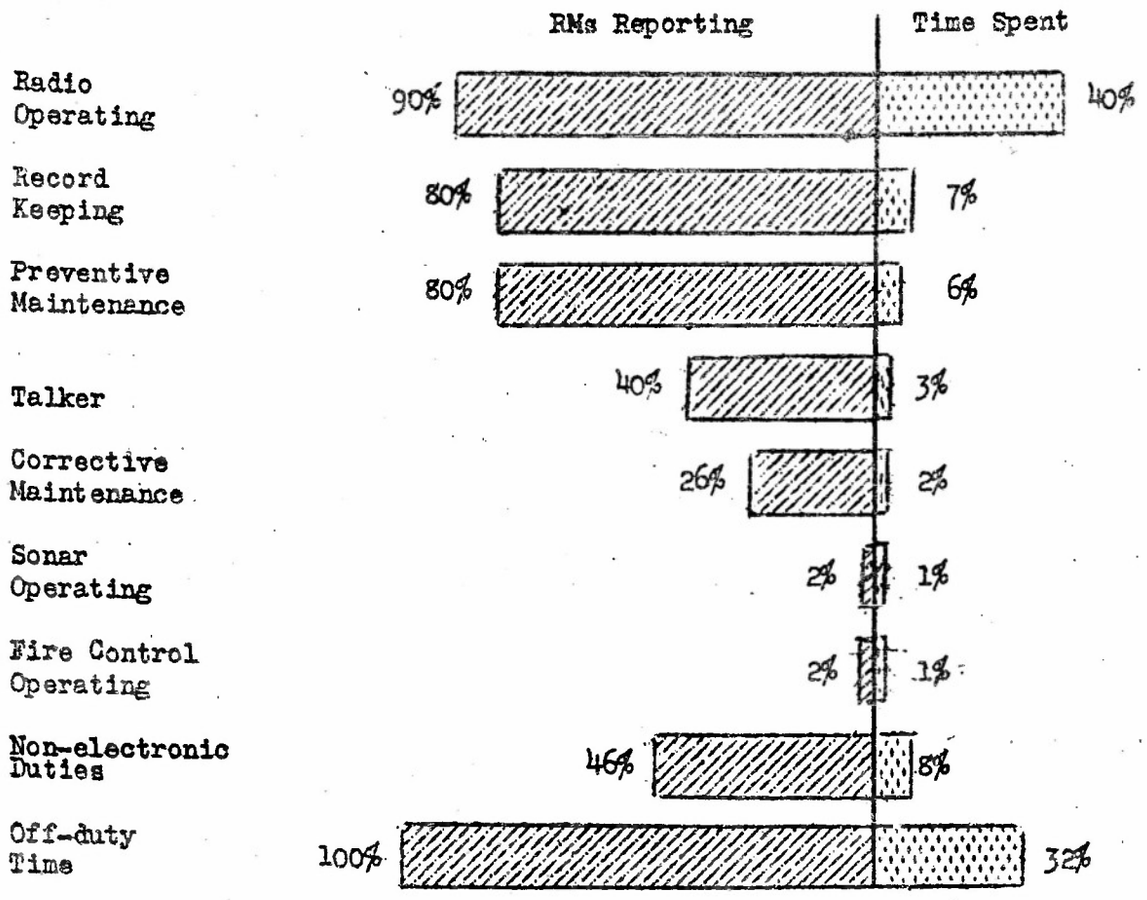



Fig. 25. Shipboard Activities of RMs. Percentage of RMs who perform various activities during their total time aboard ship and the percentage of this time they spend at each. (Job Questionnaire, item 41)

Inspection of Figure 25 reveals that the largest single portion of the total time is devoted to radio operation. A minor amount of the RMs' time is spent in phone talking, corrective maintenace, sonar operating, and fire control operating. The 10 per cent who do not operate radios are RM/3s or RM/SNs. Only the seamen report that they act as phone talkers. The higher rates perform preventive maintenance and record keeping activities in a larger percentage of cases than do the lower rates.

Underway Watch. Radiomen perform the following activities while on underway watch: radio operation, supervision, message handling (filing, routing, checking, and writing messages), messenger, maintenance, instruction, and miscellaneous activities (which, in this case, includes such things as cleaning spaces and correcting publications). The amount of time spent on each of the activities during underway watch is shown in Figure 26, (page 58).

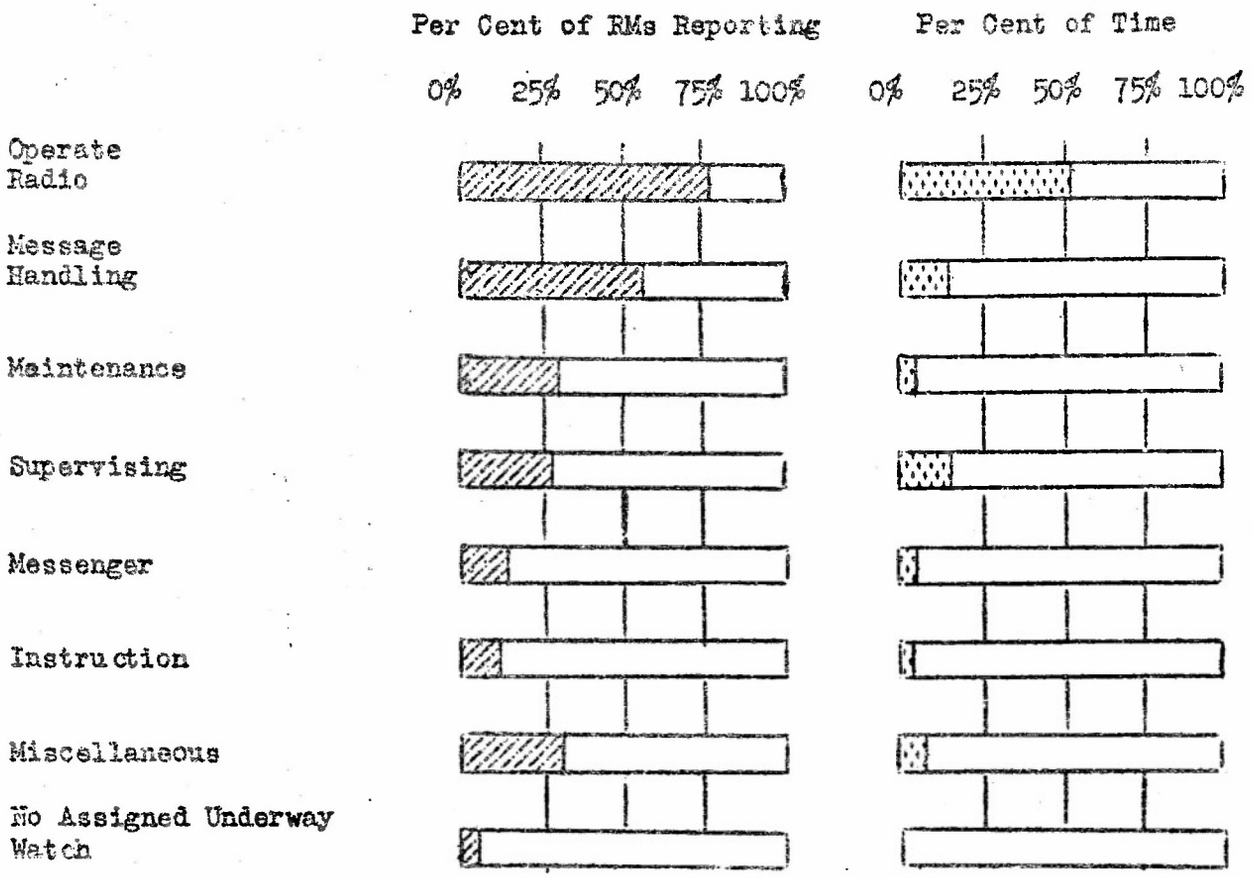



Fig. 26. Underway Watch Duties of RMs. Percentage of RMs who perform various activities during underway watch and the percentage of time spent at each. (Job Questionnaire, item 40)

Four per cent of the radiomen state that they have no underway watches. It was found that more lower rated radiomen reported that they operate radio gear and perform miscellaneous activities cited above. Maintenance, instruction, and supervision are reported most frequently by the higher rates, while messenger duties are reported only by the lower rates.

General Quarters. During the time that radiomen are at their battle stations, they perform the following activities: radio operating, acting as phone talkers, supervising, maintaining radio equipment, routing messages, writing messages, and miscellaneous activities (which here include keeping logs, instruction, and stand-by). Figure 27 illustrates these activities in terms of men and time. (Figure 27 is shown on page 59)

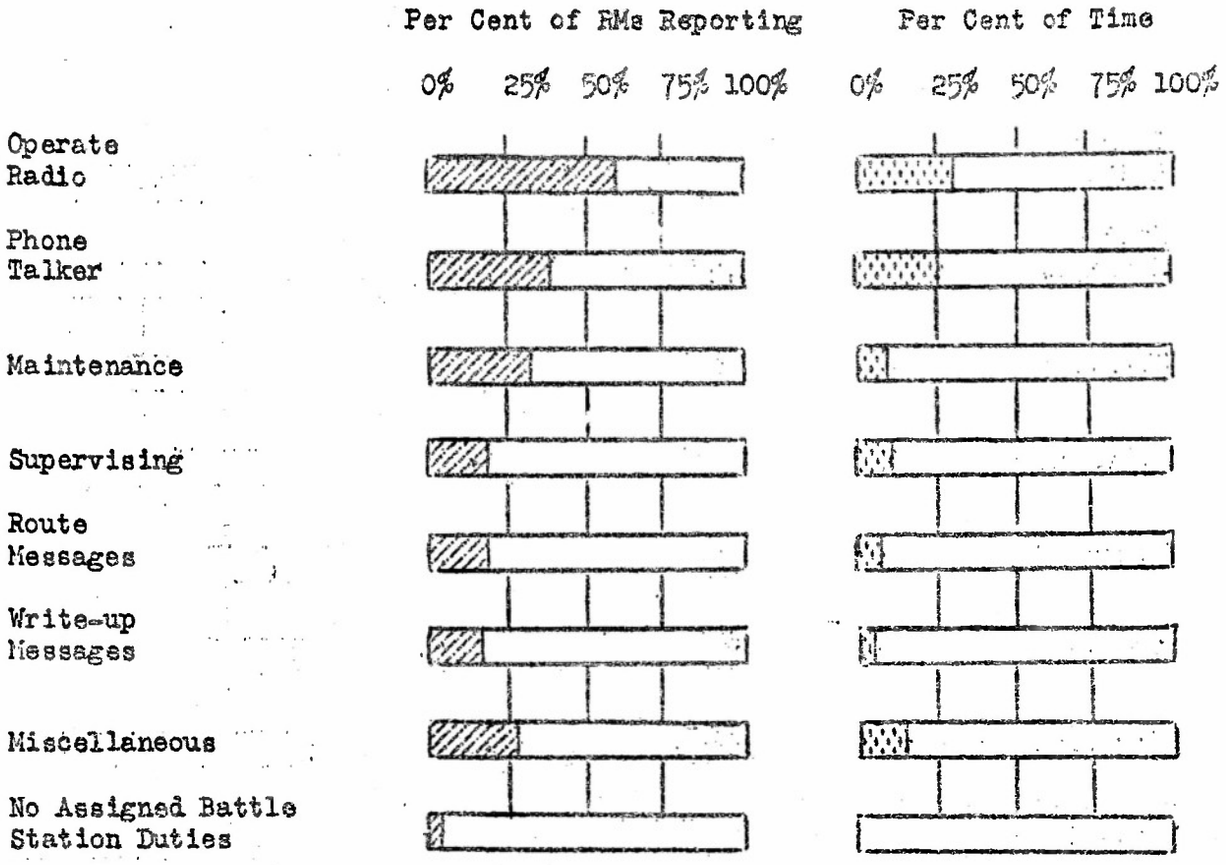



Fig. 27. General Quarters Duties of RMs. Percentage of RMs who perform various activities at battle station and the percentage of this time that they spend at each activity. (Job Questionnaire, item 36)

Except for two seamen, all of the radiomen report that they have definitely assigned battle station duties. There are few inter-rate differences among these duties, although, there is a definite tendency for phone talking to be more characteristic of the lower rates while routing and writing messages, supervision, and maintenance are more likely to be performed by the higher rated men.

Import Watch. Radiomen spend their time during import watch operating radio, handling messages (here includes messenger), supervising, cleaning, maintenance, watches (which in this case, includes petty officer duties as well as quarterdeck watches), and miscellaneous activities (correcting publications, instructing others, and practicing code). Figure 28 (page 60) gives the percentage of men who reported each of these activities, and the percentage of the time spent while on import watch performing each activity.

Seventy-nine per cent of the lower rated radiomen (RM/3, RM/SN) operate radio during import watch and 68% act as messenger and otherwise handle

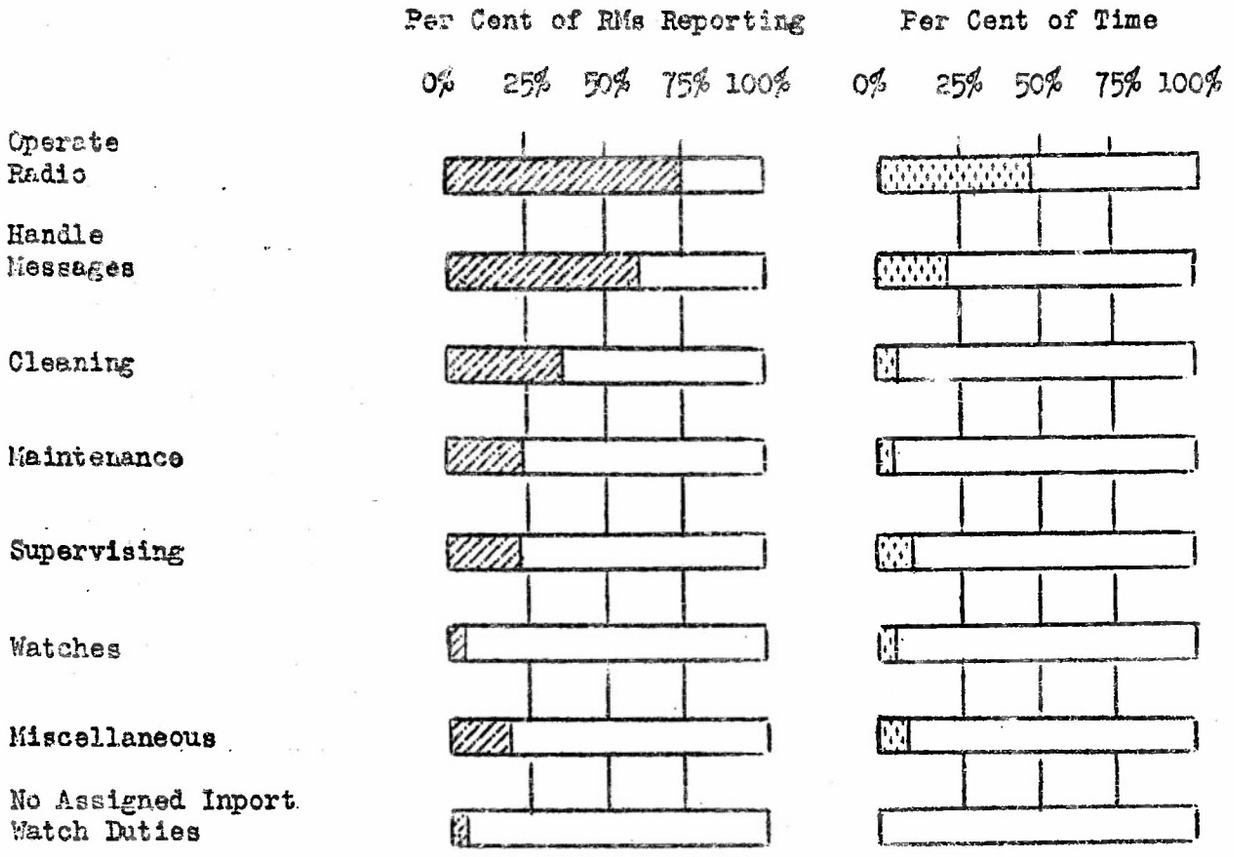



Fig. 28. Inport Watch Activities of RMs. Percentage of RMs who perform various activities during inport watch and the percentage of time spent at each activity. (Job Questionnaire, item 38)

messages. The higher rated radiomen engage in these duties to a lesser extent (47% and 29%, respectively). On the other hand, the higher rates more often report maintenance and supervisory activities. Chiefs report that they spend all of their inport watch time on quarterdeck watches.

Special Sea Detail. In the general case, the radiomen have few special sea detail duties of the type that would require them to leave their regularly assigned duties such as radio operating and message handling. Fifty-five per cent of the radiomen indicated that they had no assigned special sea detail duties but continued with their regular work when the special sea detail is manned. The replies of the remaining forty-five per cent of the radiomen are presented in Figure 29. It will be noted that, with the exception of miscellaneous activities (which consists of handling lines and raising and lowering colors), all of the duties listed are of the routine type. (Figure 29 is shown on page 61)

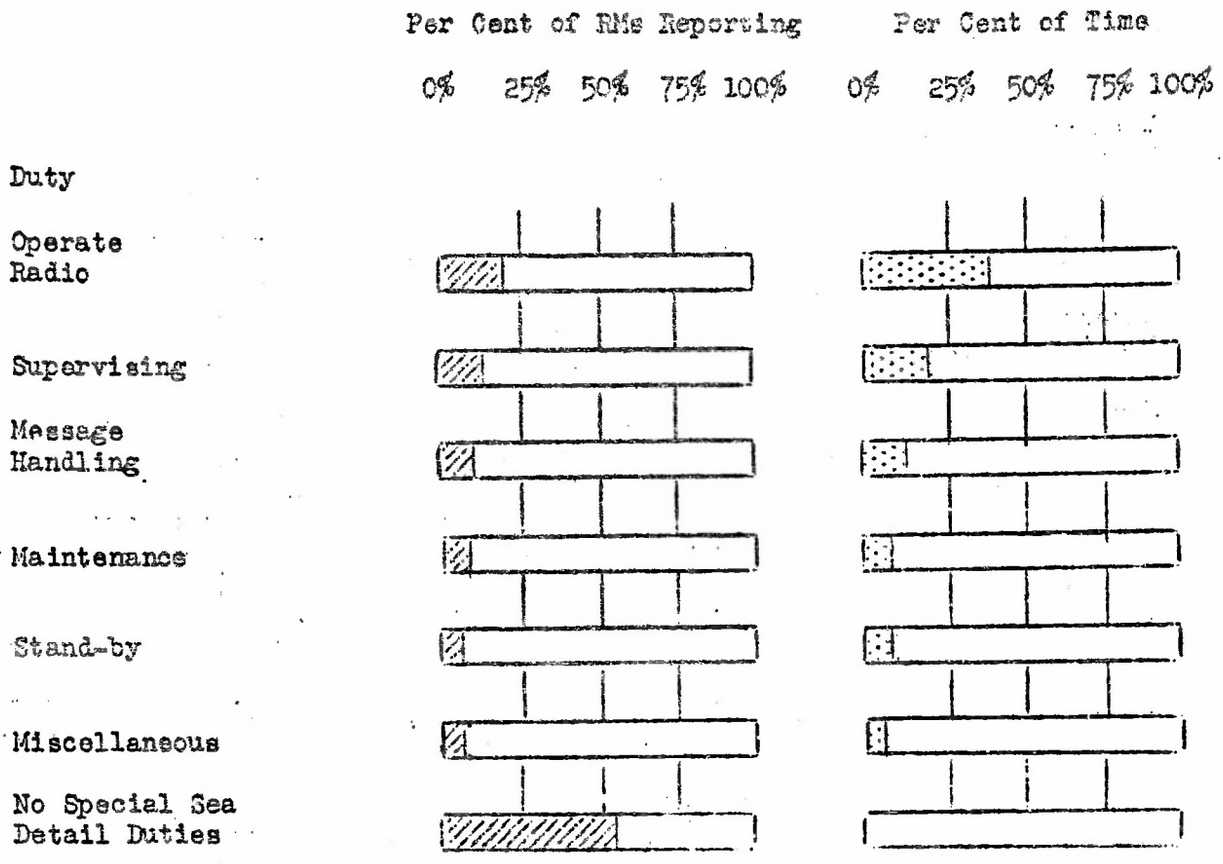



Fig. 29. Special Sea Detail Activities of RMs. Percentage of RMs who perform various activities during special sea details and the percentage of the total special sea detail time spent on each activity. (Job Questionnaire, item 33)

Duties When Not on Watch or at Battle Station. The radiomen report the following activities as being performed during work periods when they are not on watch or at battle stations: working parties, instruction, handling messages, supervising, record keeping, watches (quarterdeck watches or other non-electronic petty officer duties), maintenance, and miscellaneous activities (stand-by, mailman, and messenger). The radiomen estimate that they spend 37 per cent of their work day not on watch or at their battle stations. Figure 30 (page 62) illustrates the relationships between the activities in terms of proportions of men and amounts of time.

Little difference is noted between the rates as to the percentage of each reporting the various non-watch activities, except in the cases of working parties and supervision. As would be expected, the lower rates report almost all of the working party activities, and the higher rates almost all of the supervising.

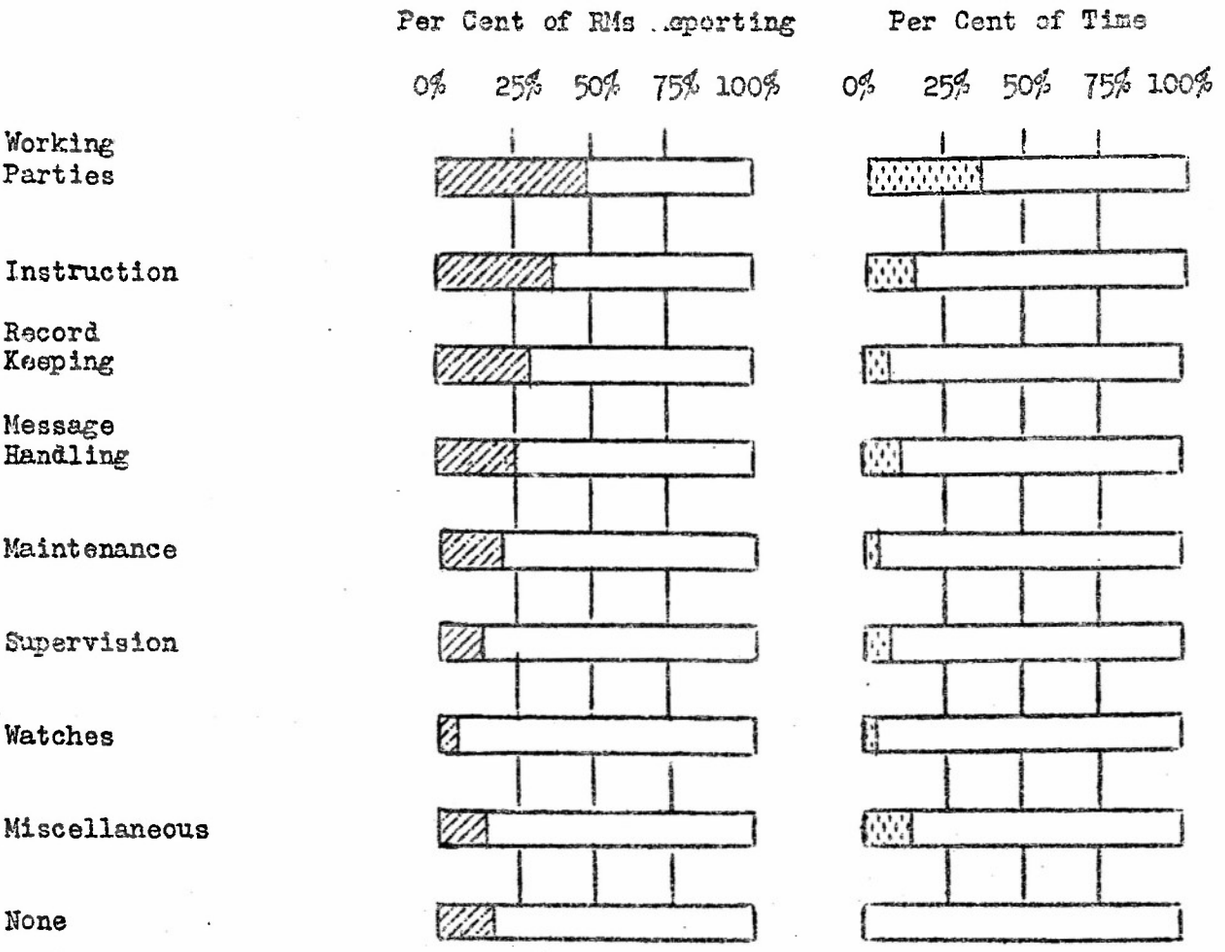



Fig. 30. Activities Performed by RMs When Not on Watch or at Battle Stations. Percentage of RMs who perform various activities during the time that they are not on watch or at their battle stations and the percentage of this time that they spend at each activity. (Job Questionnaire, item 31)

Non-electronic Duties. Radiomen spend eight per cent of the total time they are aboard ship performing non-electronic duties. They report the following activities: working parties, non-electronic watches, supervising, and miscellaneous activities (which include such things as crypto work, mailman, typing for officers, and acting as assistant chaplain). Figure 31 (page 63) presents the percentage of men who report each of the activities and the per cent of total non-electronic duty time which is spent on each activity.

Supervising and petty officer duties are given only by the rated men. Working parties and miscellaneous activities are reported by a relatively larger percentage of the lower rated men.

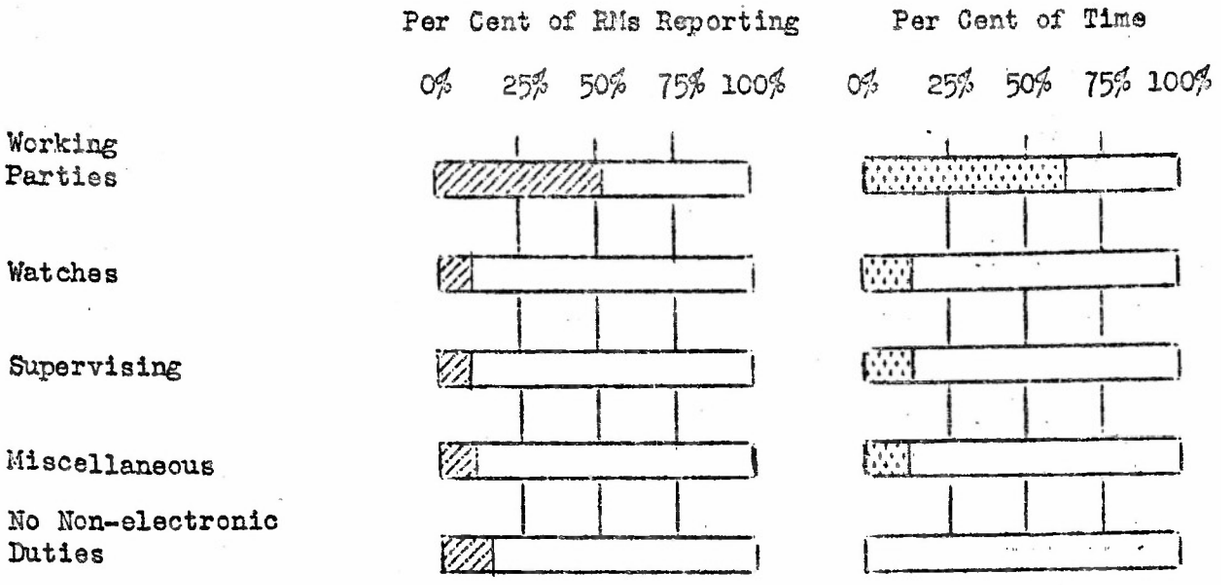



Fig. 31. Non-electronic Duties of RMs. Percentage of RMs who perform various non-electronic activities and the percentage of the total non-electronic duty time spent at each. (Job Questionnaire, item 30)

## Summary

To sum up the radiomens' duties and the temporal relationship of these duties during different shipboard conditions Figure 32 (page 65) presents each of the periods, in terms of the relative amounts of time spent on each activity. From the diagram, it can be seen that radio operating with the supplementary activities of message handling occupy most of the radiomens' time under each shipboard condition.

## Maintenance Activities

The following section will describe the radioman's maintenance activities, his responsibilities for materials and supplies, as well as the materials themselves, in a manner similar to the descriptions of the other ratings.

As shown in the discussion on total time, radiomen spend eight per cent of their time aboard ship on maintenance activities. These activities will be discussed in the succeeding paragraphs under the headings of preventive and corrective maintenance.

## Preventive Maintenance

Six per cent of the radioman's total time is spent on the preventive maintenance of radio receivers, transmitters, and teletype. A larger pro-

portion of the higher rates participate in these activities than do the lower rates.

Cleaning. Eighty per cent of the radiomen say that they are responsible for the routine cleaning of radio equipment. In addition, a few report that they clean test equipment.

Lubricating. The moving parts of radio equipment may require periodic lubrication in order to prevent excess wear or binding. Twenty-six per cent of the radiomen indicate that they have been assigned the responsibility for making such routine lubrications.

Calibrating. Fifty-seven per cent of the men are responsible for calibrating radio equipment, with a much larger proportion of the higher rates reporting it than the lower rates.

## Corrective Maintenance

Although none of the radiomen report making major repairs of any kind, about two per cent of their total shipboard time is devoted to activities of the corrective maintenance type. In the main, these consist of making minor repairs by means of tube or fuse replacements, or by making internal screwdriver type adjustments. Generally speaking, the higher rated men are more likely to attempt such repairs.

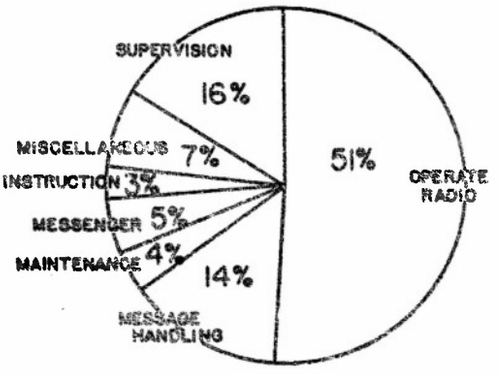
## Record Keeping

Seven per cent of the total time that RMs are aboard ship is devoted to record keeping. A list of the records that radiomen keep is presented in Table 24.

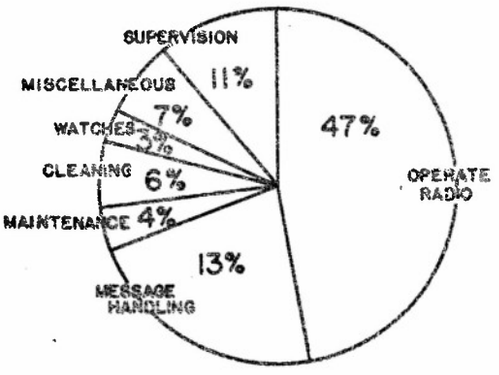
Table 24

Records Kept by RMs and the Percentage of RMs Who Keep Each Record (Job Questionnaire - Item 26)

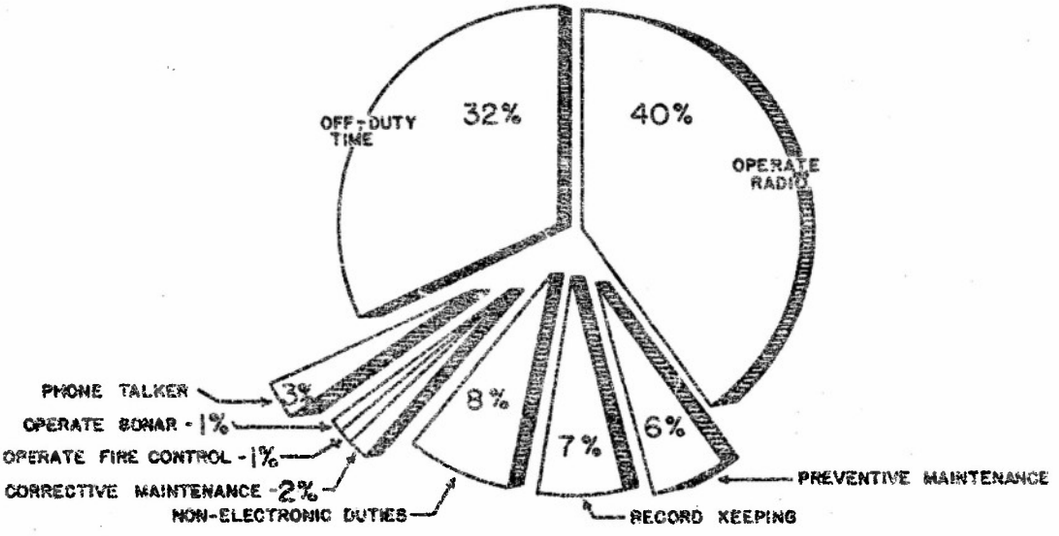
| Records | Percentage of RMs |
|---|---|
| Radio logs | 80 |
| Radio operator recorder log | 63 |
| Weekly equipment check lists | 56 |
| Daily equipment check lists | 54 |
| Monthly equipment check lists | 54 |
| Operating log | 49 |
| Training schedule | 34 |
| Equipment logs | 29 |
| Corrective maintenance records | 29 |
| Operation schedule and plans | 25 |
| Failure report | 24 |
| Custody records | 15 |



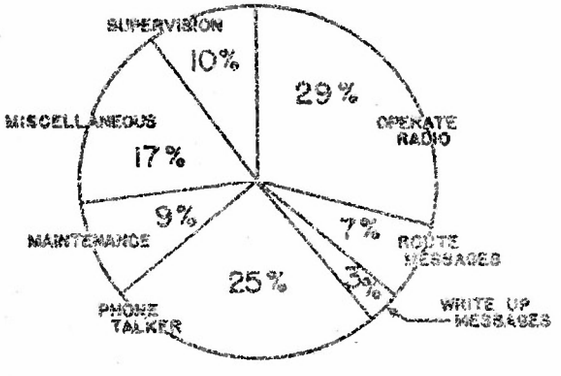

UNDERWAY WATCH



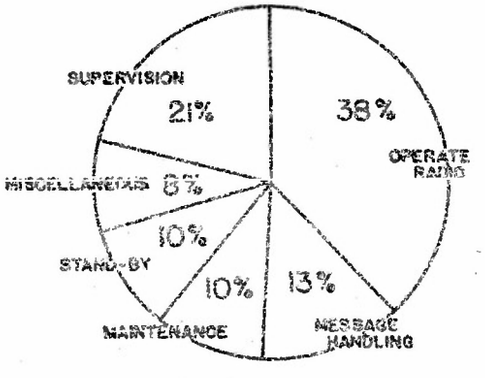

INPORT WATCH




TOTAL TIME ABOARD SHIP




GENERAL QUARTERS




SPECIAL SEA DETAILS

FIG. 32 SUMMARY DIAGRAM OF THE ALLOCATION OF RM'S TIME.

PERCENTAGE OF TIME THAT RM'S SPEND PERFORMING VARIOUS ACTIVITIES UNDER DIFFERENT SHIPBOARD CONDITIONS.

## Responsibilities for Materials and Supplies

Most of the material for which radiomen report a responsibility is in the category of printed material. About half of the RMs indicate that they have been assigned the responsibility for distributing and checking the correctness of radio messages and dispatches, as well as inserting published changes in publications. A similar percentage report that they are responsible for safeguarding the security of radio messages and dispatches and thirty-eight per cent indicate that they have the responsibility for maintaining the security of various publications.

The radiomen have very few responsibilities related to the accounting of job materials. A few men report that they are expected to maintain an adequate supply of blank forms by inventorying existing stocks and ordering replacements as required. Most of the radiomen (75%) are required to file the messages and dispatches in a prescribed manner, and about 20% of the group report that they have this type of responsibility toward log books and operation orders.

## Supervision and Instruction

Between 10 and 20 per cent of the radiomen report that they serve in a supervisory capacity. Thirty-three per cent of the RMs indicate that they instruct others on electronic equipment. Most of the men who report these responsibilities were among the higher rates.

## Materials Radiomen Use

The following tables contain listings of the publications, tools, and test equipment used by the radiomen, and the percentages of men who use them.

Publications. One aspect of a man's job is reflected by the type of publication he uses. A prepared list of publications was submitted to radiomen and they were asked to check those publications which they used in the course of their shipboard activities and the results of that checkoff are presented in Table 25. (Shown on page 68)

Most of the publications that they checked are of the operational type. Three of those indicated are clearly oriented towards maintenance. The relatively small number of maintenance publications checkmarked coupled with the relatively small number of men indicating the use of each is indicative of the minor role that radiomen play in electronics maintenance.

Table 25

Publications RMs Use and the Percentage of RMs Who Use Each Publication
(Job Questionniare - Item 22)

| Publication | Percentage of RMs |
|---|---|
| JANAP (Joint Army, Navy, Air Force) Publications | 99 |
| ACP (Army Command) Publications | 96 |
| DNC (Department Naval) Communications | 95 |
| USF Publications | 79 |
| Instruction Books (General) | 75 |
| JANP (Joint Army, Navy) Publications | 69 |
| CSP (Communications Signaling Procedure) Publications | 59 |
| General Signal Books | 49 |
| Textbooks Pertaining to Electronics (Educational Publications) | 46 |
| NAVShips Instruction Books (for Equipment) | 36 |
| CNO (Chief Naval Operations) Publications | 32 |
| Fleet Tactical Instruction | 14 |
| Communications Electronics Maintenance Bulletin | 12 |

Tools. The tools that radiomen indicate that they use while doing their jobs are given in Table 26. With the exception of pencils and typewriters, which are not ordinarily thought of as tools, it is apparent that these men engage in few of the activities requiring the use of any kind of tool other than the most common hand type such as screwdriver or pliers.

Table 26

Tools RMs Use and the Percentage of RMs Who Use Each Tool
(Job Questionnaire - Item 27)

| Tool | Percentage of RMs |
|---|---|
| Pencils | 97 |
| Typewriter | 97 |
| Screwdriver | 47 |
| Long-nose pliers | 32 |
| Files | 16 |
| Hammer | 15 |
| Drills | 14 |
| Soldering guns | 12 |
| Hand drill | 11 |
| Crescent wrenches | 10 |
| Allen wrenches | 10 |

Test Equipment. Although there is ample evidence that the radiomen spend little time on electronic maintenance and make no major repairs to their gear, certain pieces of electronic test equipment are required in the performance of regularly assigned shipboard tasks. These items are listed in Table 27. The most commonly used equipments are the frequency meter and the dummy antenna which are customarily employed during alignment, calibration, and tuning. With the exception of the tube tester, relatively few radiomen report the use of any of the other types of electronic test equipment.

Table 27

Test Equipment RMs Use and the Percentage of RMs Who Use Each Piece of Test Equipment (Job Questionnaire - Item 28)

| Test Equipment | Percentage of RMs |
|---|---|
| Frequency meter | 86 |
| Dummy antenna | 58 |
| Tube tester | 41 |
| Beat-frequency oscillator | 29 |
| Audio oscillator | 21 |
| Voltmeter | 19 |
| Wattmeter | 18 |
| Milliameter | 14 |
| Ammeter | 14 |
| Ohmmeter | 11 |
| Oscilloscope | 11 |

## Fire Controlman

The description of the fire controlman's job which is presented in this section of the report differs from the preceding job descriptions in two ways. For one thing, the term "maintenance" refers to the maintenance of non-electronic fire control gear (computers, directors, etc.) as well as the electronic parts of sections of fire control equipment (e.g., fire control radar). A second difference, and perhaps a more important one, stems from the fact that the data for the fire control rating were obtained from only one man aboard each ship. These men were chosen on the basis of the amount of electronic maintenance that they performed and, in every case, the fire controlman who participated was reported to be the man who did the most electronic maintenance on the fire control equipment. Because of this select sample, care should be exercised in generalizing the job described to the jobs of fire controlmen in general. Because of the small size of the sample, differences between rates would be difficult to interpret and, therefore, will not be presented.

## Duties Under Various Shipboard Conditions [10]

Total Time Aboard Ship. The fire controlman's daily activities can be grouped into nine general types. These are preventive maintenance, corrective maintenance, record keeping, radar operating, fire control operating, phone talker, plotting, non-electronic duties (includes only those activities which do not refer to fire control gear), and off-duty time.

Figure 33 presents the percentage of fire controlmen who perform each of the various duties during their total time aboard ship and gives the percentage of this time that they spend on each. This figure shows that most of the fire controlmen participate in all these activities, except plotting. It can also be seen that maintenance is the major activity of this group of fire controlmen.

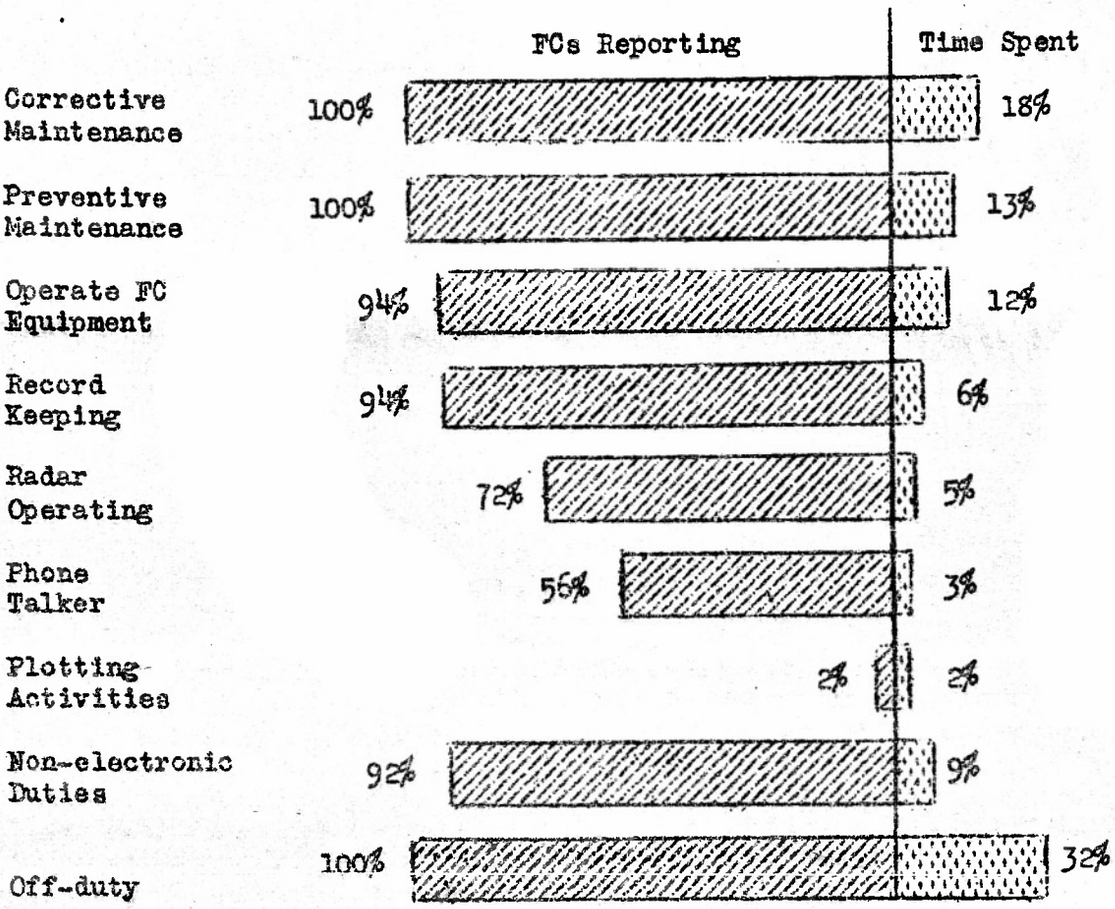



Fig. 33. Shipboard Activities of FCs. Percentage of FCs who perform various activities during their total time aboard ship and the percentage of time they spend at each. (Job Questionnaire, item 41)

[10] See footnote 5, page 7.

Underway Watch. The kinds of activities that fire controlmen are most likely to perform during underway watches are operating, maintenance, general watches and petty officer duties (security watches, master-at-arms, and switchboard watches), supervision, helmsman duties, and phone talker. Fifty per cent of the fire controlmen reported that they have no underway watch duties. Figure 34 shows the percentage of fire controlmen who reported that they perform each of the various duties during underway watch and the percentage of the total underway watch time spent on each duty. As can be seen from this figure, only a small proportion of the men perform any single activity while they are on underway watch. The major activity in terms of time, for those who have underway watch is that of operating equipment. Further analysis of the data shows that although only a few of the men serve as operators during this time they spend almost all of their time at this activity.

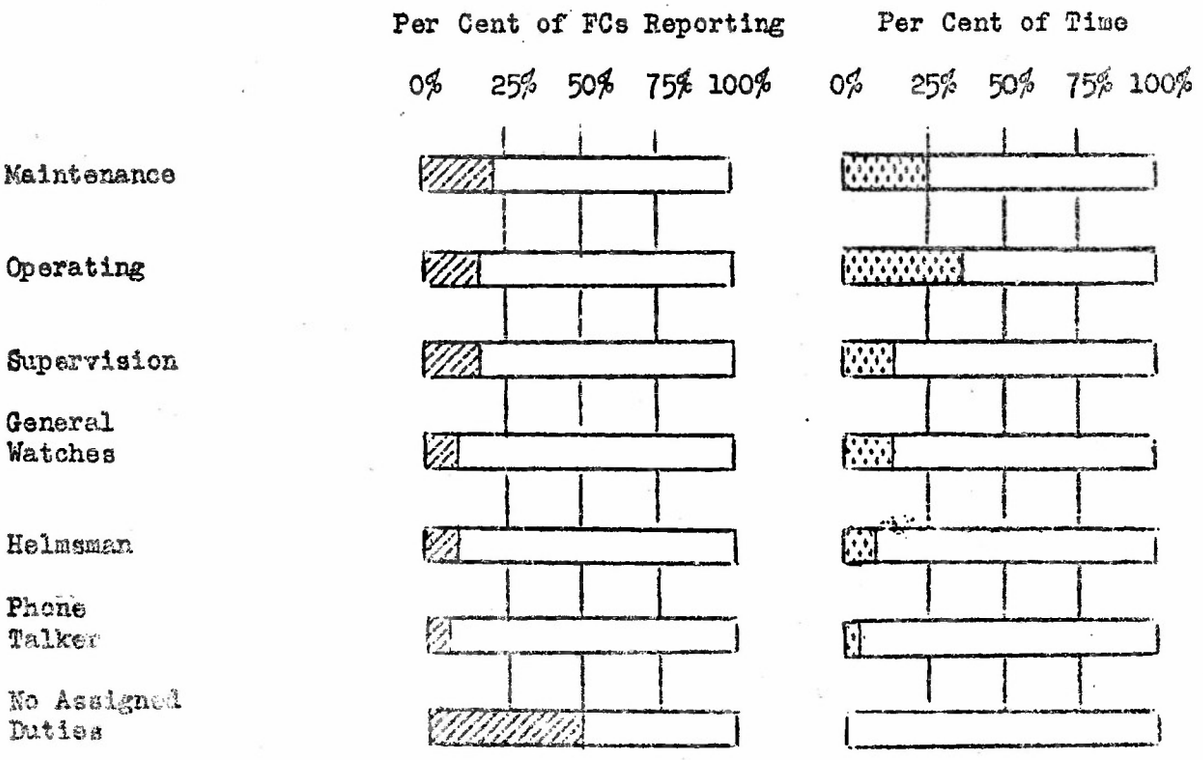



Fig. 34. Underway Watch Duties of FCs. Percentage of FCs who perform various activities during underway watch and the percentage of time spent at each. (Job Questionnaire, item 40)

General Quarters. During these periods fire controlmen spend their time operating radar, operating computer, supervising, performing maintenance (which includes transmission and switchboard checks as well as the previously defined activities), director and bearing operating, and miscellaneous activities (keeping logs and records, plot checking, operating the windbox, and acting as a phone talker).

Figure 35 presents the percentage of fire controlmen who reported each of the above activities and the percentage of time spent on each activity out of the total time that they are at their battle stations.

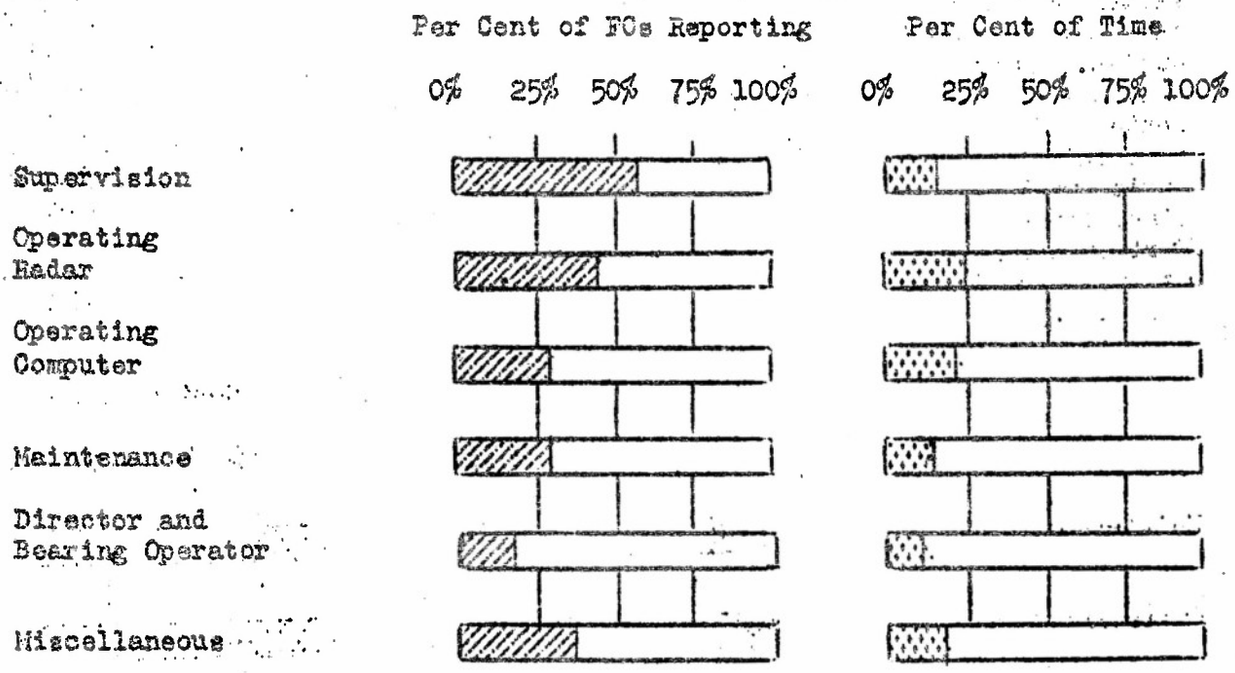



Fig. 35. General Quarters Duties of FCs. Percentage of FCs who perform various activities at battle station and the percentage of time that they spend at each activity. (Job Questionnaire, item 36)

Import Watch. Most of the fire controlmen spend all of their import watch time standing ship watches (includes petty officer duties). A few men report that they supervise others and maintain fire control equipment under import watch conditions. Figure 36 gives the percentage of fire controlmen who reported each of the above activities and the percentage of time spent on each activity. (Figure 36 is shown on page 73)

Special Sea Detail. Eighty-three per cent of the fire controlmen reported that they have special sea details. The duties they perform during these periods are supervising, securing mooring lines, acting as phone talker, and miscellaneous activities (such as switchboard operating). Figure 37 presents the percentage of fire controlmen who reported each of the above activities and the percentage of time spent on each activity out of the total time that they are on special sea details. From this figure it can be seen that most of this group's time is taken up in supervisory activities. Further analysis of the data shows that all the men who supervise or act as talkers during this period, spend all of their time so engaged. (Figure 37 is shown on page 73)

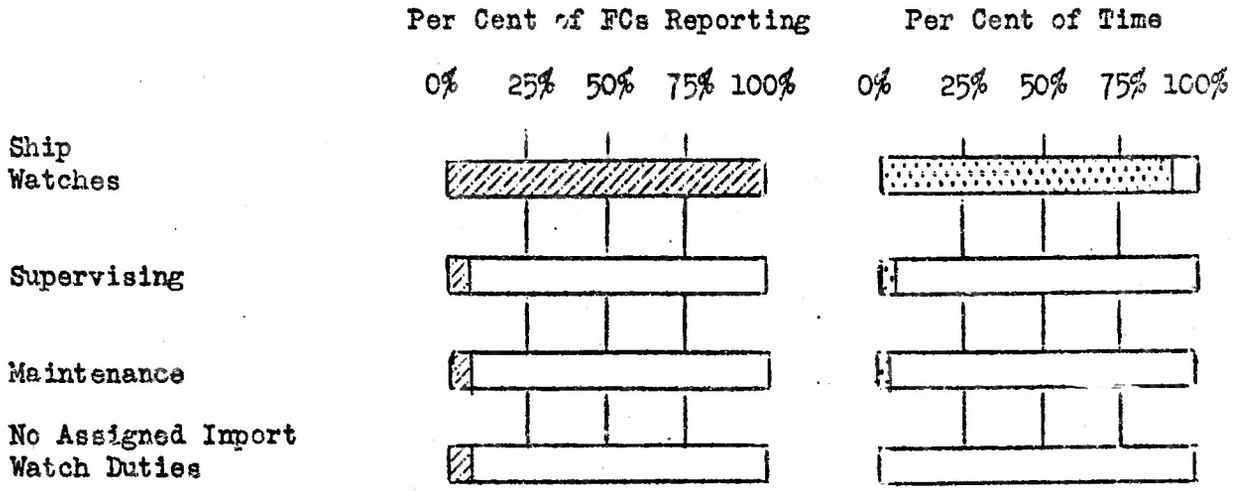



Fig. 36. Inport Watch Activities of FCs. Percentage of FCs who perform various activities during inport watch and the percentage of time spent at each activity. (Job Questionnaire, item 38)

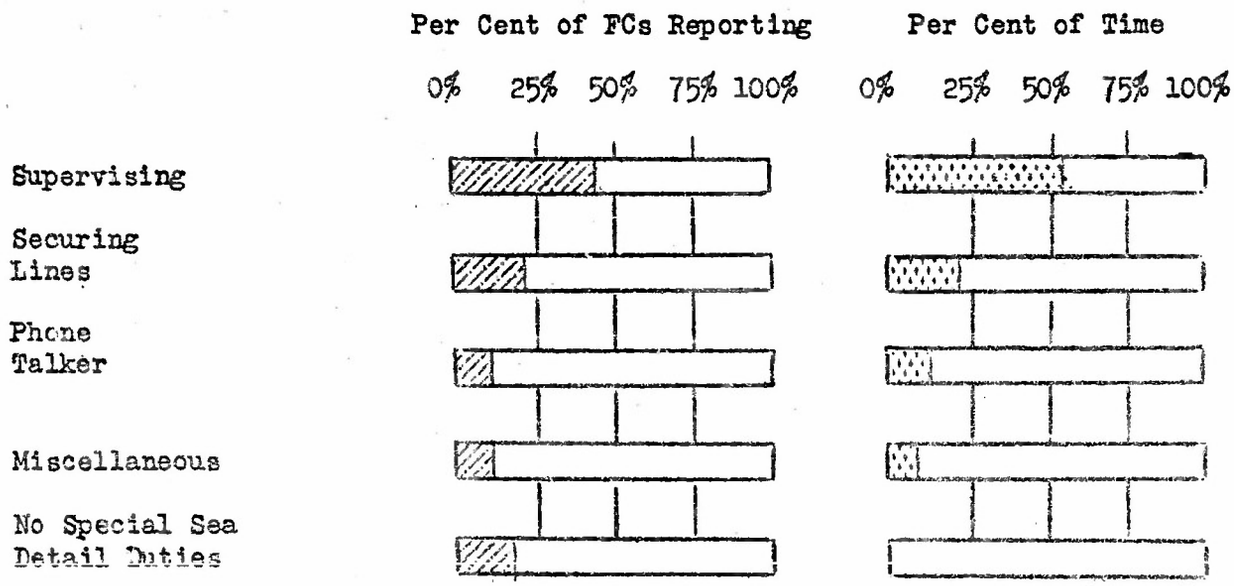



Fig. 37. Special Sea Detail Activities of FCs. Percentage of FCs who perform various activities during special sea details and the per cent of the total special sea detail time spent on each activity. (Job Questionnaire, item 33)

Duties When Not on Watch or at Battle Station. Fire controlmens' non-watch, non-battle-station duties are shown in Figure 38 (page 74). All of the fire controlmen reported that they had duties when they were not on watch or at battle stations. Examination of Figure 38 reveals that most of the men take advantage of this time to perform the necessary maintenance of

fire control equipment.

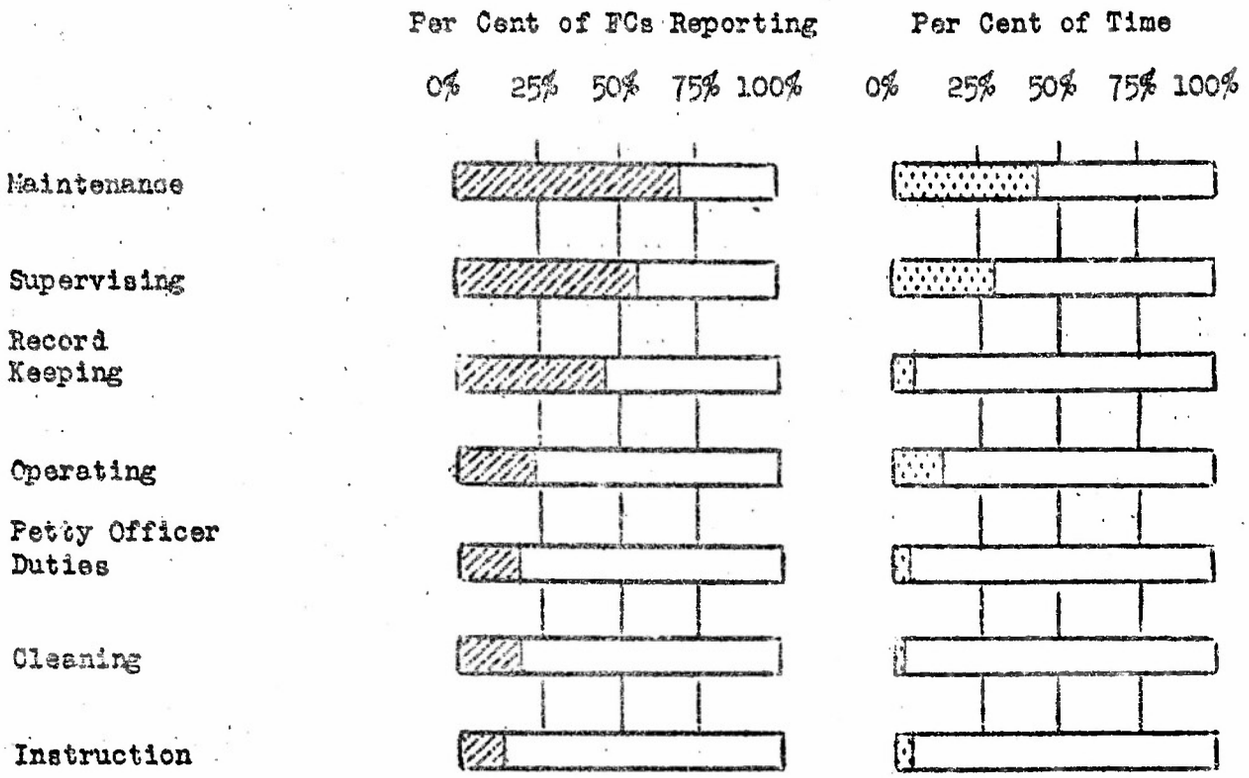
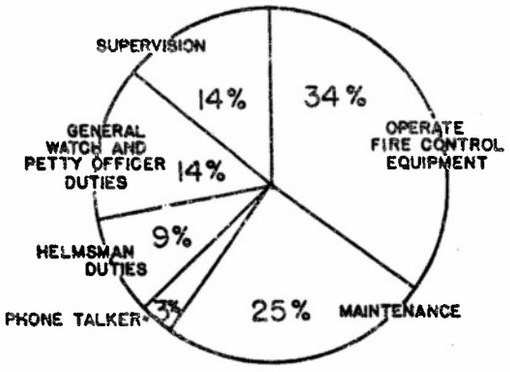



Fig. 38. Activities Performed by FCs When Not on Watch or at Battle Station. Percentage of FCs who perform various activities during the time that they are not on watch or at their battle stations and the percentage of this time that they spend at each activity. (Job Questionnair , item 31)

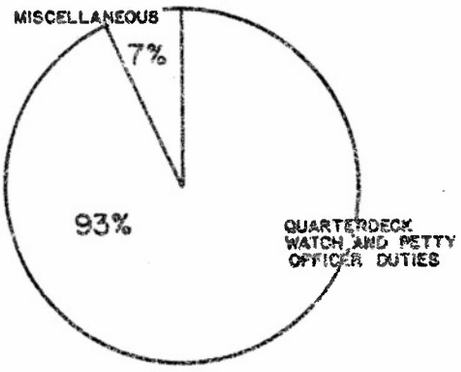
Non-electronic Duties. In addition to those duties directly associated with the technical specialty of the fire controlmen in this group, they report some duties which are not directly associated with that specialty or with electronics in general. All of the duties reported under this heading by the members of this group fell into the general class of petty officer duties or general supervisory activities. No duties were reported which were inconsistent with the fire controlman's specialty or his rate.

Summary

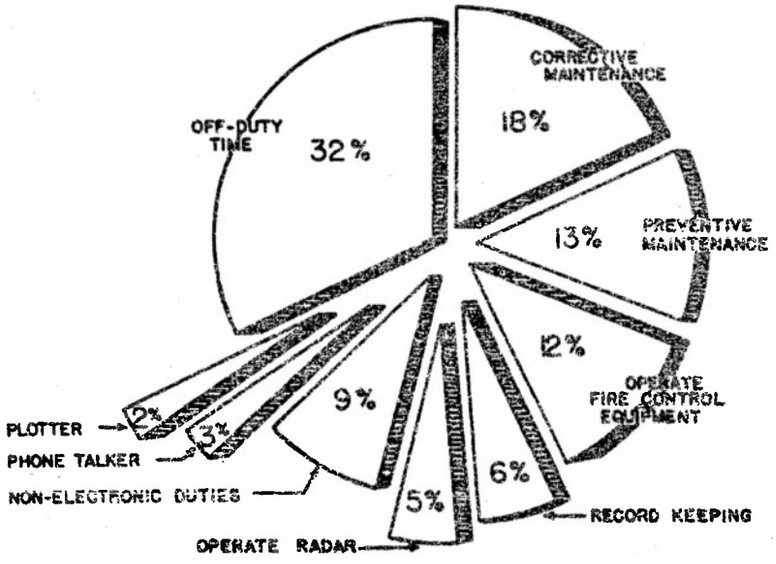
A select sample of fire controlmen indicated the way that they apportioned their time under the four shipboard conditions in terms of the total time that they spent aboard ship. Figure 39 (page 75) diagrammatically presents their responses. These men were originally selected for the sample because they spent more time maintaining the electronic fire control equipment than other members of their groups. Inspection of the diagram



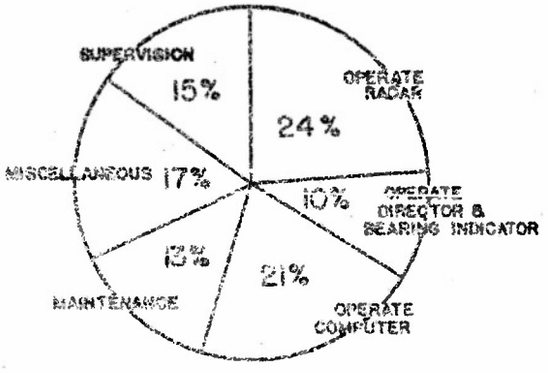

UNDERWAY WATCH



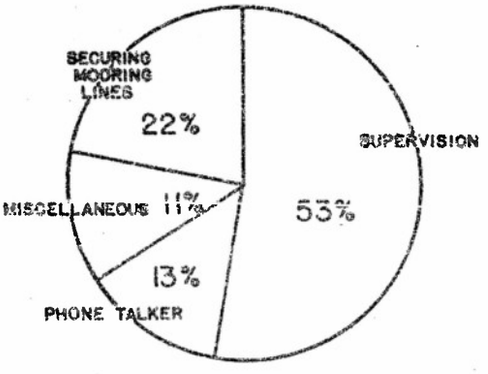

INPORT WATCH




TOTAL TIME ABOARD SHIP




GENERAL QUARTERS




SPECIAL SEA DETAILS

FIG. 39. SUMMARY DIAGRAM OF THE ALLOCATION OF FC'S TIME.

PERCENTAGE OF TIME THAT FC'S SPEND PERFORMING VARIOUS ACTIVITIES UNDER DIFFERENT SHIPBOARD CONDITIONS.

substantiates the fact that they spend a greater fraction of their total time engaging in maintenance activity than in any other single kind of activity. It appears that they accomplish the bulk of their maintenance while the ship is underway and the men are not at general quarters or the special sea detail has not been manned. The balance of their time is largely spent operating fire control equipment or serving in some supervisory capacity.

## Maintenance Activities

The amount of fire control radar maintenance performed by fire controlmen varies from ship to ship, and it depends upon the availability of adequately trained men. As is shown in Figure 39, maintenance activities performed on all types of equipment, takes up a little over 30 per cent of the fire controlmens' time aboard ship. In this section the kinds of maintenance will be discussed and the percentage of men reporting each activity will be pointed out.

## Preventive Maintenance

As was pointed out in the discussions of the other ratings, "preventive maintenance" includes such activities as cleaning, lubricating, calibrating, tuning, and measuring selectivity and sensitivity of electronic equipment. Such activities consume about 13 per cent of the fire controlmens' total time and are performed by almost all of the men.

## Corrective Maintenance

This takes up 18 per cent of the fire controlmens' total time.

Making Minor Repairs. Almost all of the fire controlmen report that they make minor repairs. Ninety-five per cent of them state that they replace fuses and tubes and 90 per cent of them say that they clean and adjust contacts and relays.

Making Major Repairs. A little over 60 per cent of the fire controlmen report that they make major electronic repairs. Thirty-four per cent of them make field changes and a few repair test equipment.

Making Adjustments. Ninety-five per cent of the fire controlmen report that they are responsible for making adjustments to electronic equipment.

Record Keeping. This group of fire controlmen reported that they spent six per cent of their total time keeping records. Ninety-five per cent reported that they keep records of some kind. Table 28 (page 78) lists the records kept by fire controlmen and gives the percentage of men that keep each of the records. As can be seen from this table most of the records kept by this group concerned maintenance activities.

Table 28

Records Kept by FCs and the Percentage of FCs
Who Keep Each Record
(Job Questionnaire - Item 26)

| Records | Percentage of FCs |
|---|---|
| Equipment logs | 94 |
| Daily check lists | 94 |
| Weekly check lists | 94 |
| Monthly check lists | 83 |
| Operating logs | 83 |
| Repair records | 72 |
| Corrective maintenance records | 72 |
| Failure reports | 67 |
| Spare parts records | 56 |
| Resistance test records | 50 |
| Equipment installation records | 50 |
| Standard navy stock cards | 50 |
| Alteration records | 44 |
| Custody records | 44 |
| Electronics equipment history | 39 |
| Electronics service repair reports | 28 |
| Training schedules | 28 |
| Field change records | 28 |
| Operations schedules and plans | 11 |

## Responsibilities for Materials and Supplies

The materials for which the fire controlmen are responsible and the nature of the responsibility that they have for each of the materials are given in Table 29 (page 79). Raw frequencies are employed because of the small number of men in the sample.

An examination of Table 29 shows that fire controlmen feel most responsible for those materials which are directly related to the maintenance and operation of fire control equipment--equipment instruction books and tools. There also seems to be a general understanding of the need for safeguarding the security of these materials.

Table 29

Frequencies With Which FCs (N=18) Indicated
Responsibilities for Certain Materials
(Job Questionnaire - Item 23)

| Materials | Order | Inventory | Store(Stow) | Maintain Full Allowance of | Distribute | Safeguard Security of | File | Insert Published Changes in | Check Correctness of |
|---|---|---|---|---|---|---|---|---|---|
| Electronic Spare Parts | 7 | 7 | 4 | 4 | 0 | 1 | 0 | 0 | 1 |
| Trouble Report Forms | 0 | 1 | 0 | 1 | 2 | 1 | 2 | 0 | 2 |
| Equipment Operation Records | 1 | 2 | 1 | 0 | 1 | 6 | 4 | 2 | 6 |
| Operation Orders | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 1 |
| Test Equipment | 7 | 5 | 4 | 4 | 0 | 1 | 0 | 0 | 2 |
| Equipment Instruction Books | 6 | 2 | 6 | 4 | 4 | 9 | 5 | 8 | 2 |
| Maintenance Bulletins | 2 | 1 | 2 | 4 | 2 | 6 | 7 | 3 | 1 |
| Log Books | 3 | 1 | 3 | 2 | 0 | 7 | 4 | 2 | 8 |
| Tools | 10 | 11 | 8 | 9 | 4 | 3 | 0 | 0 | 0 |

## Supervision

Between 50 and 60 per cent of the fire controlmen supervise the use of test equipment, log books, and tools. Between 40 and 50 per cent supervise the use of equipment instruction books, maintenance bulletins, and other publications. About 30 per cent of the men report that they supervise the use of electronic spare parts, and equipment operation records, and a few report that they supervise the use of trouble report forms, and operation orders.

## Instruction

Ninety per cent of the fire controlmen report that they are responsible for giving instruction of some type. Between 60 and 70 per cent of them train men in the use of test equipment and tools, and between 40 and 50 per cent of them report that they train men in the use of log books, equipment instruction books, and maintenance bulletins.

## Materials Fire Controlmen Use

This section will be devoted to the kinds of publications, tools, and test equipment fire controlmen use in their job. The following tables show the proportion of FCs who use each of the materials.

Table 30

Publications FCs Use and the Percentage of FCs Who Use Each Publication (Job Questionnaire - Item 22)

| Publication | Percentage of FCs |
|---|---|
| Instruction Books (general) | 83 |
| Textbooks on electronics (educational publications) | 78 |
| NAVShips Instruction Books | 67 |
| BUShips Manuals | 50 |
| Radar Maintenance Bulletin | 39 |
| Electron | 28 |
| U&F Publication | 28 |
| Sonar Maintenance Bulletin | 22 |
| CNO (Chief Naval Operations) Publications | 22 |
| ONI (Office Naval Intelligence) Publications | 17 |
| Fleet Tactical Instructions | 11 |
| JANP (Joint Army, Navy) Publications | 11 |
| Radar Bulletin Series | 11 |
| Communications Electronics Maintenance Bulletin | 11 |

Table 31

Tools FCs Use and the Percentage of FCs Who Use Each Tool (Job Questionnaire - Item 27)

| Tool | Percentage of FCs |
|---|---|
| Screwdriver | 100 |
| Long-nose pliers | 100 |
| Files | 100 |
| End wrenches | 100 |
| Allen wrenches | 100 |
| Hammers | 100 |
| Drills | 100 |
| Crescent wrenches | 100 |
| Socket wrenches | 100 |
| Tap and Die | 94 |
| Pencils | 94 |
| Power drill | 89 |
| Hacksaw | 89 |
| Hand drill | 89 |

Table 31
(continued)

| Tool | Percentage of FCs |
|---|---|
| Reamers | 89 |
| Dike pliers | 83 |
| Punches | 83 |
| Strippers | 78 |
| Alignment tools | 78 |
| Soldering gun | 72 |
| Dividers | 61 |
| Grinder | 44 |
| Typewriter | 28 |
| Blow torch | 28 |
| Parallel ruler | 22 |
| Lathe | 11 |
| Nautical slide rule | 11 |

Table 32

Test Equipment FCs Use and the Percentage of FCs Who Use Each Piece of Test Equipment
(Job Questionnaire - Item 28)

| Test Equipment | Percentage of FCs |
|---|---|
| Analyzer | 100 |
| Meggar | 100 |
| Ohmmeter | 100 |
| Tube tester | 94 |
| Voltmeter | 94 |
| Oscilloscope | 89 |
| Volt-ohmmeter | 89 |
| Milliammeter | 56 |
| Galvanometer | 56 |
| Echo box | 50 |
| Dummy antenna | 33 |
| Multimeter | 33 |
| Frequency meter | 28 |
| Micrometer | 28 |
| Condenser checker | 28 |
| Resistance bridge | 22 |
| Signal generator | 17 |
| Vacuum-tube voltmeter | 17 |

Table 32
(continued)

| Test Equipment | Percentage of FCs |
|---|---|
| Wattmeter | 17 |
| Ammeter | 17 |
| Signal strength meter | 11 |
| Capacity bridge | 11 |
| Audio oscillator | 11 |

# SECTION III

## INTERRELATIONSHIPS OF ELECTRONICS RATINGS

### Introduction

This section will present comparative information derived from the job descriptions presented in the earlier sections of this report. The various jobs will be compared from six different points of view: in terms of the activity statements employed in the card sort technique;[11] with regard to the distribution of the total time spent aboard ship by each of the ratings; with reference to the records kept in connection with each of the jobs; in terms of the publications used by the various ratings; with respect to the tools employed in the conduct of the separate job categories; and, finally, in terms of the electronic test equipments which each of the ratings indicate that they use.

This section is included in an effort to facilitate an overview of the jobs of the ET, SO, RD, RM, and FC ratings. Such an overview highlights those aspects which are common to two or more of the jobs and those which are unique to a single rating. This cross-comparison reveals the extent to which the jobs under consideration are related and the extent to which they differ from each other. Such job-family information is the basis for current personnel procedures.

The information upon which the job descriptions are based is derived from descriptive techniques emphasizing the job actually performed rather than the job that the man thought that he ought to do, was expected to do, or might have done under special circumstances. Because of this, a comparison of the various jobs based upon this information establishes the nature and extent of the overlap that occurs among the various jobs as they are actually performed aboard ship.

Since the descriptions were drawn up from data collected on ships of the destroyer class, they present the jobs only as done on ships of this type. They also provide a basis for the comparison of the jobs done on destroyers with descriptions of the same jobs performed on ships of other classes.

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[11] A complete description of this technique is contained in Report No. 2 of this series.

## Comparison of Maintenance Activities

One of the techniques employed in the derivation of the present job descriptions was called the card sort technique. It consisted of members of the sample group sorting a large number of 3 X 5 index cards which bore statements descriptive of observable behavior related to electronic maintenance. Whenever a man encountered a statement which described an activity which he performed as a part of his regular shipboard job, he set that statement aside. Thus, when he had sorted through the entire deck of cards, he had segregated those which applied to his job from the ones which did not. Theoretically, this procedure yields a very detailed and comprehensive job description. The deck of cards used in the present investigation, however, was limited to electronic maintenance activities. As a result, these data bear on only this aspect of the jobs being described.

Representatives of each of the five electronics ratings sorted the cards and the results of these sortings are summarized in Table 33. The activities are grouped according to the number of ratings reporting that the activity is a significant feature of their jobs. No activity is included in the list unless half of the men in at least two ratings indicated that they customarily engage in that activity.

Valuable insights regarding the various jobs can be obtained throughout this section of the report if the pattern of the underlines is considered before any attempt is made to identify the different ratings.

Similarities between jobs become evident at the "three ratings" stage of Table 33. If the patterns formed by the underlines are examined, it becomes apparent that the jobs listed in the first, second, and fifth columns have a great deal more in common with each other than with those jobs presented in columns three and four. This analysis is independent of the job title given in the heading of each column. However, when this information is checked against a knowledge of these particular ratings and when the five jobs are compared, the jobs of the electronics technicians, the sonarmen, and the fire control technicians are found to be very similar (maintenance-wise) to each other although differing rather definitely from the jobs of the radarmen or the radiomen.

Table 33

A Summary of the Electronic Maintenance Activities
Performed by Electronics Ratings

| ACTIVITY | ET % | SO % | RD % | RM % | FC % |
|---|---|---|---|---|---|
| Five ratings | | | | | |
| Instruct personnel in safety precautions | 55* | 65 | 86 | 85 | 88 |
| Clean interior of equipment | 79 | 81 | 76 | 80 | 75 |
| Clean exterior of electronics gear | 59 | 89 | 76 | 80 | 50 |

Table 33
(continued)

| ACTIVITY | ET | SO | RD | RM | FC |
|---|---|---|---|---|---|
| Four ratings | | | | | |
| Supervise preventive maintenance activities | 59 | 42 | 95 | 70 | 81 |
| Obtain information from operators on how gear broke down | 77 | 54 | 52 | 40 | 69 |
| Three ratings | | | | | |
| Lubricate bearings | 73 | 60 | 00 | 15 | 94 |
| Lubricate gears | 61 | 58 | 33 | 20 | 75 |
| Replace indicator lamps | 86 | 65 | 24 | 20 | 88 |
| Read schematic diagrams | 100 | 70 | 14 | 05 | 88 |
| Use voltmeter | 95 | 63 | 05 | 05 | 88 |
| Check circuit continuity | 100 | 53 | 00 | 00 | 88 |
| Replace fixed fuses | 95 | 63 | 19 | 25 | 81 |
| Replace fixed resistor | 95 | 51 | 05 | 00 | 88 |
| Inspect tube pins for burning or corrosion | 61 | 51 | 19 | 15 | 62 |
| Inspect fuses and resistor clips for pitting or burning | 71 | 51 | 19 | 15 | 62 |
| Determine value of component from color coding | 95 | 58 | 10 | 05 | 56 |
| Fill out failure report | 91 | 51 | 05 | 05 | 62 |
| Review records for possible cause of failure | 73 | 53 | 10 | 05 | 75 |
| Visually inspect tubes for gas | 95 | 54 | 24 | 05 | 50 |
| Visually inspect tubes for open filament | 91 | 63 | 24 | 05 | 69 |
| Replace rectifier tubes | 98 | 60 | 10 | 10 | 81 |
| Two ratings | | | | | |
| Adjust cathode ray tube positioning adjustments | 73 | 56 | 05 | 00 | 31 |
| Use shorting bar | 95 | 63 | 48 | 35 | 19 |
| Adjust antenna coupling | 82 | 00 | 05 | 50 | 00 |
| Adjust noise limiter | 73 | 11 | 14 | 60 | 00 |
| Estimate and check to see whether the frequency is within desired limits | 57 | 30 | 00 | 85 | 12 |
| Replace coils | 61 | 18 | 00 | 00 | 50 |
| Replace potentiometers | 89 | 47 | 00 | 00 | 88 |
| Repair terminal posts, plugs and connections | 91 | 42 | 00 | 00 | 81 |
| Requisition spare parts | 77 | 26 | 14 | 05 | 88 |
| Clean air filters | 61 | 40 | 48 | 10 | 50 |
| Check for open coil | 84 | 35 | 00 | 00 | 62 |
| Measure transformer voltage | 82 | 44 | 00 | 00 | 69 |

Table 33
(continued)

| ACTIVITY | ET | SO | RD | RM | FC |
|---|---|---|---|---|---|
| Replace fixed capacitors | 91 | 49 | 05 | 00 | 69 |
| Replace brushes in generators | 52 | 09 | 10 | 00 | 62 |
| Test vacuum tube for intermittent shorts by rocking it in tube tester | 93 | 47 | 14 | 20 | 62 |
| Supervise corrective maintenance activities | 56 | 40 | 14 | 30 | 88 |
| Measure tube transconductance with tube tester | 95 | 44 | 00 | 10 | 69 |
| Measure generator voltage output | 86 | 09 | 00 | 00 | 62 |
| Replace brushes in motors | 59 | 14 | 05 | 00 | 75 |
| Clean switch contact points | 91 | 49 | 19 | 20 | 69 |
| Replace transformers | 77 | 33 | 00 | 00 | 56 |
| Correct instruction books when field change is made | 50 | 33 | 10 | 10 | 81 |
| Visually inspect brushes in generators | 74 | 28 | 00 | 10 | 69 |
| Check spare parts bins | 57 | 14 | 00 | 00 | 81 |
| Take inventory of all spare parts | 50 | 16 | 00 | 05 | 88 |
| Take inventory of all portable testing equipment | 50 | 12 | 00 | 00 | 50 |
| Take inventory of ordinary hand tools | 50 | 30 | 14 | 10 | 88 |
| Check continuity of transmission lines with chmmeter | 57 | 26 | 00 | 00 | 56 |

*The underlined percentages represent those instances in which 50% or more of a rating selected the activity as best describing their job.

An analysis of the "two ratings" stage of the table permits further delineations of the jobs. In this stage, it appears that the first column job (ET) and the fifth column job (FC) are more similar to each other than the jobs in any other pair of columns. It is of considerable interest to note that the job of the sonarman has so few of these activities in common with the jobs of the ET and FC. The paucity of underlines in the third and fourth columns clearly indicates that the ratings contributing this information do not ordinarily engage in very many maintenance activities.

## A Comparison of Selected Duties

The ET, SO, RD, RM, and FC groups were asked to indicate which of their duties they considered to be most important. Table 34 presents a percentage breakdown of these responses. Those response categories which applied to more than 5% of at least one of the rating groups have been included in this table.[12] (Table 34 is shown on page 87)

[12] For complete results see Table 51, Data Supplement of Report No. 2 of this series.

Table 34

The Percentages of Each Group Listing Various Duties Considered to be Most Important

| Most Important Duty | ET % | SO % | RD % | RM % | FC % |
|---|---|---|---|---|---|
| Supervising | 1 | 3 | 8 | 11 | 5 |
| Corrective Maintenance | 66 | 8 | 1 | 0 | 55 |
| Equipment Operating | 0 | 72 | 52 | 70 | 17 |
| Preventive Maintenance | 21 | 0 | 0 | 1 | 22 |
| Phone Talker | 0 | 2 | 5 | 0 | 0 |
| Plotting | 0 | 0 | 10 | 0 | 0 |

Certain trends in this table support the relationships among the ratings as pointed out above. The majority of ETs and FCs state that corrective maintenance of electronic equipment is the most important feature of their jobs and a large percentage of them (21% and 22%, respectively) report that they regard the preventive maintenance of equipment as the most important feature. The SOs, RDs, and RMs emphasize the operation of electronic equipment as the major feature of their jobs and few of them indicate strong maintenance interests. Ten per cent of the radarmen report plotting as their most important duty.

## The Distribution of Total Shipboard Times

While it is not customary to emphasize the allocation of time in job descriptions, it is none the less quite meaningful to do so. Most jobs are made up of a large number of specific activities and it is usually necessary to describe the job in terms of a selection of those activities which are judged to be most characteristic. A knowledge of the relative amounts of time spent on an activity permits the ranking of specific activities and thus provides a basis for a systematic selection of the most characteristic ones.

Figure 40 (page 89) contains five pie diagrams each of which represents the total time that the men of a given rating spend aboard ship. These circles have been presented previously as a part of the Summary Diagrams of Section II. They are repeated here in order to facilitate a ready comparison of the distribution of the total shipboard times. The largest single segment of the electronics technician's duty time is labeled "corrective maintenance." He spends about a third of his time restoring electronic equipment to operation; about a third of his time doing preventive maintenance, keeping records, and discharging his petty officer responsibilities; and the remainder of his time off duty.

Sonarmen spend about a quarter of their total shipboard time operating the sonar equipment. On the basis of the diagram, it appears that the activities of the sonarman are more varied than those of the electronics technician.

The largest segment of the radarmen's total time is associated with the operation of radar equipment. The total time of the radarmen appears to be distributed rather evenly over the various activities.

Forty per cent of the radiomen's total time is devoted to the operation of radio equipment. Thirty-two per cent of their time aboard ship is spent off duty, and the balance of time is spent on lesser responsibilities.

Those fire controlmen on each ship who have the most to do with the maintenance of fire control radar spend the greatest proportion of their duty time maintaining that equipment.

Since much of the research effort was directed toward the problems of adequate electronic maintenance, it may be well at this time to inspect Figure 40 in order to determine the percentage of time that each of the ratings devote to electronic maintenance activities.

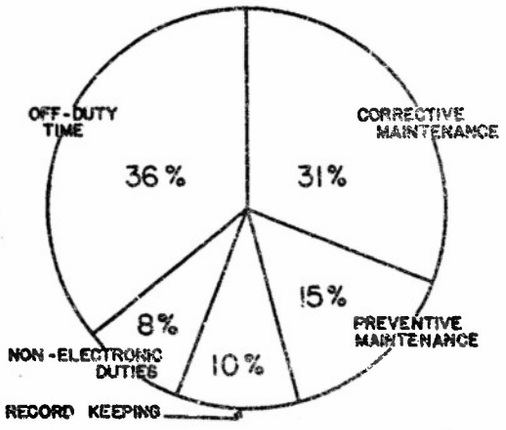
The electronics technicians report that they spend 46% of their total shipboard time engaging in some form of maintenance. The fire controlmen in the sample reported that they spent 31% of their total shipboard time on maintenance. Sonarmen, radiomen, and radarmen report that 11%, 8%, and 5% of their time, respectively, is devoted to electronic maintenance.

Additional information regarding preventive maintenance of electronic gear is found in the general questionnaire employed in the accumulation of the data.[13] In that questionnaire, the electronics materiel officers, the anti-submarine warfare officers, and the combat information center officers were asked to give their opinions regarding the amounts of time that the enlisted men under their control should spend performing preventive maintenance.

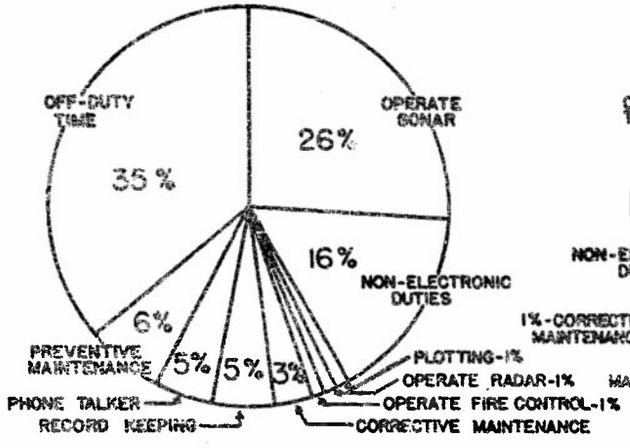
Figure 41 (page 91) compares the opinions of the cognizant officers with the actual time reported by the ETs, SOs, and RDs. The figure indicates that the ETs spend a larger proportion of their time on preventive maintenance than the other ratings. None of the ratings spend as much of their time engaging in preventive maintenance as their cognizant officers think they should. The greatest discrepancy occurs with regard to the preventive maintenance time of the radarmen who spend five per cent of their total shipboard time on this activity while the CIC officers indicate that these men should spend 21% of their time on it. Comparative information with regard to the percentage of total time which RMs and FCs should spend on preventive maintenance is not available because the opinions of the cognizant officers were not sought.

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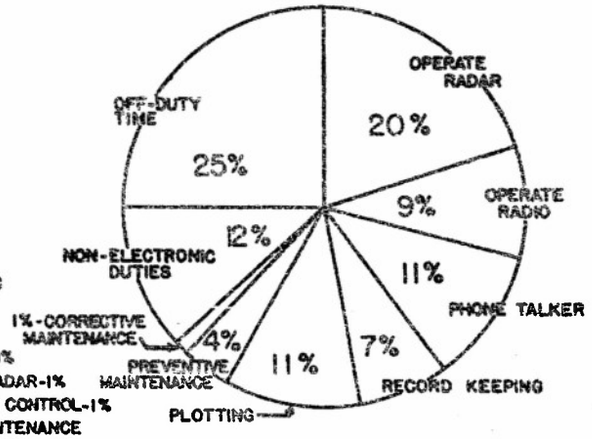
[13] A complete description of this technique is contained in Report No. 2 of this series.



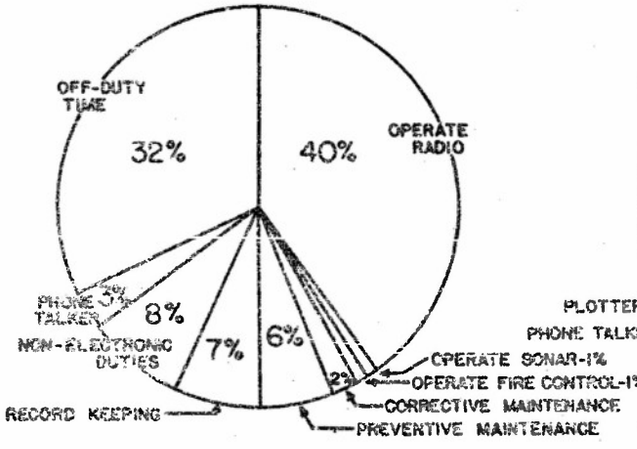

ELECTRONICS TECHNICIAN



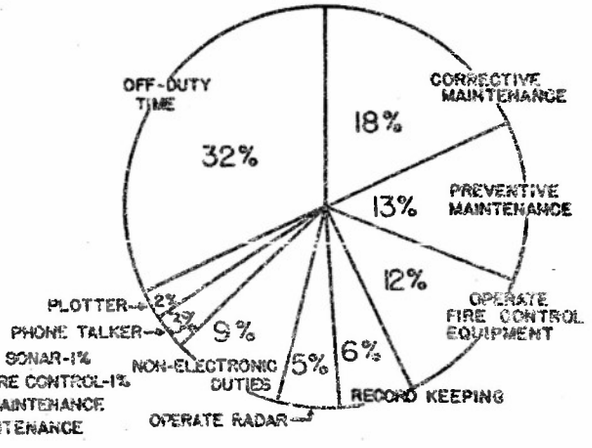

SONARMAN




RADARMAN




RADIOMAN




FIRE CONTROLMAN

FIG. 40. A COMPARISON OF THE DISTRIBUTION OF EACH RATING'S TOTAL SHIPBOARD TIME.

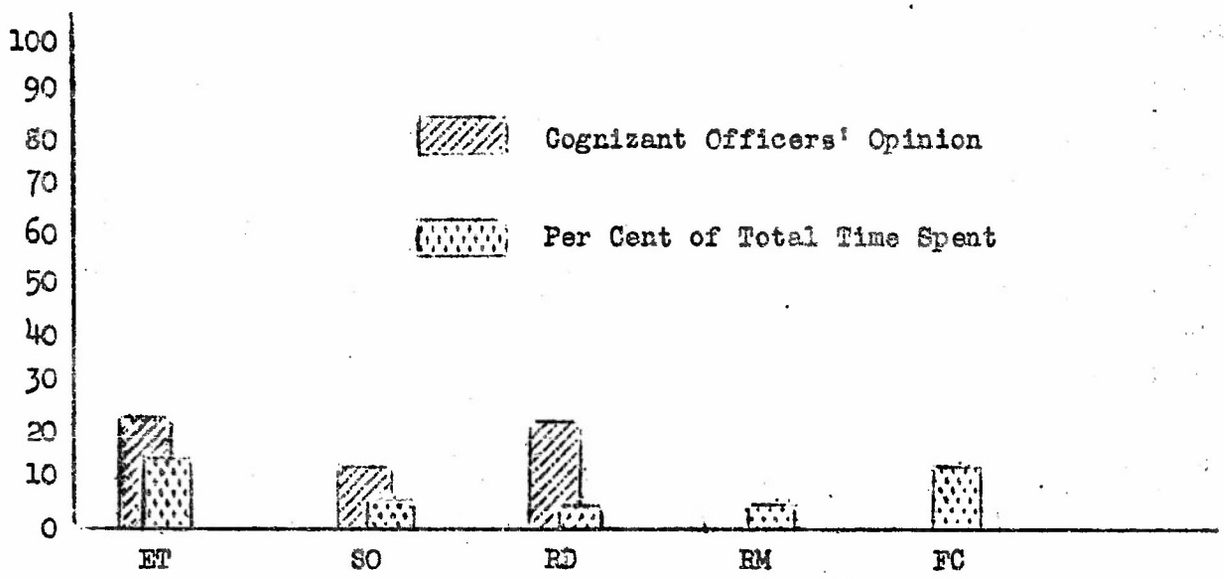
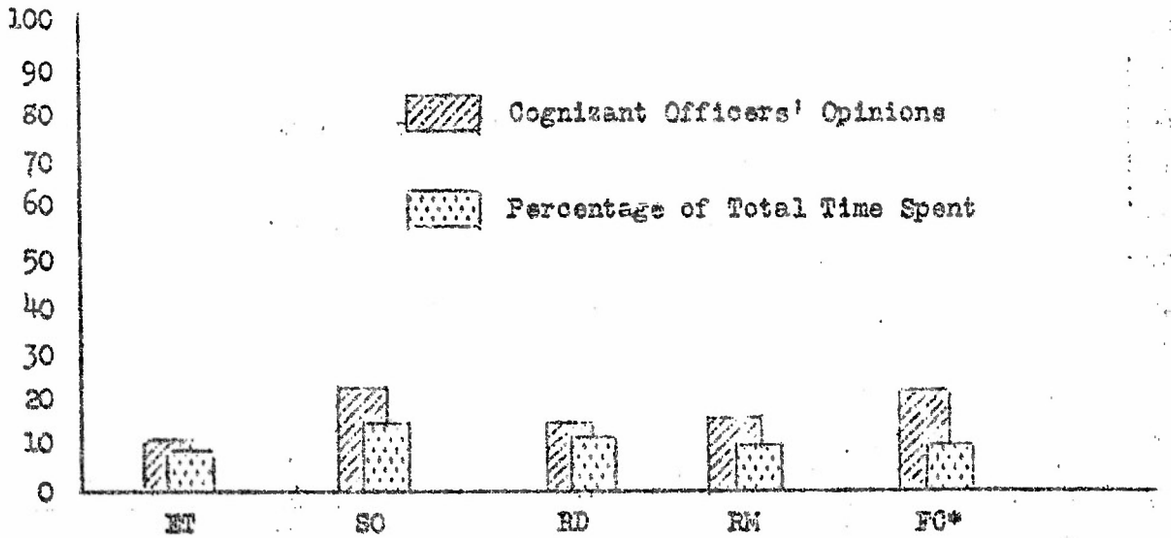



Fig. 41. Percentage of Total Shipboard Time Devoted to Preventive Maintenance.

In terms of corrective maintenance, only the electronics technicians and the fire controlmen report that an appreciable percentage of their time is expended on repairing electronic equipment (31% and 18%, respectively). The sonarmen reported that they spent 5% of their time in this manner, the radiomen spent 2% of their time, and the radarmen 1% of their time doing corrective maintenance.

All of the members of a ship's crew are required to assist with the ship's work and to engage in activities which are not, strictly speaking, a part of their specialties. These activities are generally of two types with regard to the sample of men employed in the present study. On the one hand, there are general petty officer duties such as quarterdeck watches and shore patrol and, on the other hand, menial duties such as working parties, mess cooking, and laundry details. Figure 42 presents the percentage of time that each of the ratings in question spend on these "non-electronic" duties. As in Figure 41, the opinions of the cognizant officers are presented in order to facilitate a comparison of the times that the officers think should be devoted to these non-electronic duties with the times that the men report. Figure 42 is shown on page 92.




*FCs are represented by a sample consisting of one man per ship.

Fig. 42. Percentage of Total Shipboard Time Spent on Non-Electronic Duties.

## A Comparative Analysis of Materials Used

Similarities and differences among jobs are often highlighted by a consideration of the materials used in connection with the jobs. This section of the report includes tables concerning the records which the men of each rating keep, the publications they read, and the tools and test equipments they use.

Nineteen kinds of records were reported as being used by 50% of one or more of the five ratings. These records are listed in Table 35 in the order of their popularity. One of the records (monthly equipment check list) was indicated by all of the ratings. More frequent check lists (daily and weekly) were cited by all of the ratings except electronics technicians. Generally speaking, it appears that the fire controlmen employ check-off lists to a greater extent than the other ratings while the ETs use them relatively less than any of the other four ratings.

Patterning of the underlined values does not occur to an appreciable degree throughout the table but there is an indication of such patterning at the "two rating" level. Here it will be noted that the electronics technician's job and the fire controlman's job are similar with respect to the records that each keep. By the same token, there is a slight indication that the jobs of radarmen and radiomen have certain records in common. Again it must be pointed out, that this information is neither new nor surprising but is presented in the interest of developing a complete and adequate set of job descriptions.

Table 35

A Summary of the Records Kept by Electronics Ratings

| Record | ET % | SO % | RD % | RM % | FC % |
|---|---|---|---|---|---|
| Five ratings | | | | | |
| Monthly equipment check list | 51* | 65 | 51 | 54 | 83 |
| Four ratings | | | | | |
| Daily equipment check list | 43 | 66 | 50 | 54 | 94 |
| Weekly equipment check list | 43 | 66 | 55 | 56 | 94 |
| Three ratings | | | | | |
| Equipment log | 27 | 64 | 56 | 29 | 94 |
| Operating log | 00 | 74 | 54 | 49 | 83 |
| Corrective maintenance record | 68 | 51 | 20 | 29 | 72 |
| Two ratings | | | | | |
| Failure report | 84 | 48 | 10 | 25 | 67 |
| Repair record | 77 | 48 | 00 | 00 | 72 |
| Standard navy stock card | 67 | 00 | 00 | 00 | 50 |
| Spare parts record | 71 | 15 | 00 | 00 | 56 |
| Radio log | 00 | 00 | 87 | 80 | 00 |
| Radio operator recorder log | 00 | 00 | 58 | 63 | 00 |
| One rating | | | | | |
| Electronic equipment history | 76 | 44 | 10 | 00 | 39 |
| Field change record | 76 | 39 | 00 | 00 | 28 |
| Electronic service repair report | 54 | 22 | 00 | 00 | 28 |
| CIC logs | 00 | 00 | 75 | 00 | 00 |
| DRT logs | 00 | 00 | 50 | 00 | 00 |
| Equipment installation record | 48 | 34 | 00 | 00 | 50 |
| Resistance test record | 39 | 19 | 00 | 00 | 50 |

*The underlined percentages indicate those instances in which 50% or more of a rating indicated that they kept the designated record.

The publications used by the various electronics ratings are listed in Table 36. Only those publications which were used by at least 50% of one of the ratings are included in the list. There is little evidence of job-family grouping with respect to the publications that are used. Table 36 is shown on page 94.

Table 36

A Summary of the Publications Used by Electronics Ratings

| Publication | ET % | SO % | RD % | RM % | FC % |
|---|---|---|---|---|---|
| Five ratings | | | | | |
| Instruction books (general) | 93* | 81 | 50 | 75 | 83 |
| Four ratings | | | | | |
| (None) | | | | | |
| Three ratings | | | | | |
| NAVShip's instruction books for each equipment | 89 | 76 | 30 | 36 | 67 |
| Textbooks pertaining to electronics | 84 | 72 | 25 | 46 | 78 |
| USF publications | 11 | 84 | 59 | 79 | 28 |
| BUShip's manuals | 72 | 67 | 21 | 08 | 50 |
| Two ratings | | | | | |
| JANAP publications | 25 | 17 | 58 | 99 | 00 |
| ACP publications | 00 | 15 | 58 | 96 | 00 |
| One rating | | | | | |
| Radar maintenance bulletin | 87 | 00 | 30 | 00 | 39 |
| Electron | 91 | 49 | 10 | 00 | 28 |
| Communications electronic maintenance bulletin | 88 | 00 | 00 | 12 | 11 |
| Sonar maintenance bulletin | 44 | 81 | 00 | 00 | 20 |
| General signal books | 00 | 30 | 59 | 49 | 00 |
| CSP publications | 00 | 26 | 48 | 59 | 00 |
| DNC publications | 00 | 00 | 33 | 95 | 00 |
| JANP publications | 20 | 12 | 42 | 69 | 11 |

*The underlined percentages indicate that 50% or more of the men in the rating use the publication.

Table 37 (page 95) compares five of the electronics ratings in terms of the tools that they use on their jobs. Only those tools used by at least 50% of any rating are included. The most striking features of this table are exemplified in that part labeled "three ratings." Here it is found that the three so-called maintenance ratings stand out from the two operating ratings. The similarity between the jobs of the electronics technicians and the fire controlmen is still evident at the "two ratings" stage although the sonarmen have dropped out. It is interesting to note that the similarity between the job of the RDs and that of the RMs in terms of the tools they use is negative rather than positive, that is, these two jobs tend to group together because they don't use tools rather than because both groups report the use of the same tools.

Table 37

A Summary of the Tools Used by
Electronics Ratings

| Tool | ET % | SO % | RD % | RM % | FC % |
|---|---|---|---|---|---|
| Five ratings | | | | | |
| Screwdrivers | 99* | 94 | 59 | 50 | 100 |
| Pencils | 91 | 92 | 98 | 97 | 94 |
| Four ratings | | | | | |
| (None) | | | | | |
| Three ratings | | | | | |
| Long-nose pliers | 98 | 87 | 29 | 32 | 100 |
| Files | 93 | 67 | 18 | 16 | 100 |
| End wrenches | 90 | 74 | 16 | 00 | 100 |
| Allen wrenches | 95 | 75 | 25 | 10 | 100 |
| Hammers | 88 | 59 | 22 | 15 | 100 |
| Dike pliers | 90 | 57 | 10 | 10 | 83 |
| Drills | 88 | 55 | 17 | 14 | 100 |
| Soldering gun | 95 | 66 | 00 | 12 | 72 |
| Crescent wrenches | 95 | 75 | 18 | 10 | 100 |
| Socket wrenches | 89 | 53 | 00 | 00 | 100 |
| Two ratings | | | | | |
| Power drill | 67 | 43 | 16 | 10 | 89 |
| Punches | 79 | 45 | 12 | 00 | 83 |
| Hacksaws | 80 | 45 | 12 | 00 | 89 |
| Alignment tools | 88 | 43 | 00 | 00 | 78 |
| Strippers | 63 | 32 | 00 | 00 | 78 |
| Hand drill | 80 | 44 | 14 | 11 | 89 |
| Typewriters | 57 | 33 | 28 | 97 | 28 |
| Dividers | 11 | 19 | 86 | 00 | 61 |
| One rating | | | | | |
| Parallel rulers | 10 | 35 | 87 | 00 | 22 |
| DRT arm | 00 | 24 | 98 | 00 | 00 |
| Nautical slide rule | 00 | 10 | 77 | 00 | 11 |
| Tap and dies | 45 | 24 | 00 | 00 | 94 |
| Reamers | 22 | 00 | 00 | 00 | 89 |

*The underlined percentages indicate that 50% or more of the men in the rating use the tool.

The final table consists of a listing of the test equipments and the percentage of men indicating that they use each. No pieces of test equipment are used by all of the ratings(under the 50% cut-off criterion). The

most popular equipments are the tube tester and volt-ohmmeter which are used by the ETs, the SOs, and the FCs. Again there is an indication that these three ratings have something in common which they do not share with the RDs and the RMs. At the "two ratings" stage of the table it is also apparent that the similarity between the ETs and the FCs persists after the sonarmen have dropped out of the group.

Table 38

A Summary of Test Equipments Used by Electronics Ratings

| Test Equipment | ET % | SO % | RD % | RM % | FC % |
|---|---|---|---|---|---|
| Five ratings | | | | | |
| (None) | | | | | |
| Four ratings | | | | | |
| (None) | | | | | |
| Three ratings | | | | | |
| Tube tester | 93* | 72 | 28 | 41 | 94 |
| Volt-ohmmeter | 87 | 57 | 10 | 00 | 89 |
| Two ratings | | | | | |
| Oscilloscope | 93 | 32 | 20 | 11 | 89 |
| Multimeter | 98 | 55 | 00 | 00 | 33 |
| Ohmmeter | 93 | 25 | 15 | 11 | 100 |
| Analyzer | 56 | 10 | 00 | 00 | 100 |
| Meggar | 91 | 17 | 00 | 00 | 100 |
| Milliammeter | 89 | 15 | 10 | 14 | 56 |
| Voltmeter | 93 | 22 | 15 | 19 | 94 |
| Frequency meter | 88 | 21 | 18 | 86 | 28 |
| Dummy antenna | 82 | 00 | 11 | 58 | 33 |
| Echo box | 85 | 00 | 48 | 00 | 50 |
| One rating | | | | | |
| Beat frequency oscillator | 51 | 30 | 00 | 29 | 00 |
| Signal generator | 84 | 39 | 11 | 00 | 17 |
| Vacuum tube voltmeter | 82 | 41 | 00 | 00 | 17 |
| Range calibrator | 55 | 00 | 29 | 00 | 00 |
| Condenser checker | 56 | 00 | 00 | 00 | 28 |
| Wattmeter | 83 | 00 | 00 | 18 | 17 |
| Capacity bridge | 50 | 00 | 00 | 00 | 11 |
| Ammeter | 65 | 15 | 00 | 14 | 17 |
| Audio oscillator | 74 | 00 | 00 | 21 | 11 |
| Galvanometer | 17 | 00 | 00 | 00 | 56 |

*The underlined percentages indicate that 50% or more of the men in the rating use the test equipment.

In this and the previous tables of this section (Tables 33 through 37, inclusive), the zero entries have interesting implications. For example, if a given rating uses very few tools or test equipments, keeps few or no maintenance records, and reads none of the maintenance publications, it must be assumed that men of that rating do very little electronic maintenance. On the other hand, those ratings which signify the use of many maintenance publications, tools, test equipment and records may be assumed to devote much of their time to maintenance.

## General Comments

A comparison of the ratings (ET, SO, RD, RM, FC) based upon their maintenance activities, the records they keep, the publications they read, and the tools and test equipment they use reveals that the job of electronics technician and the job performed by the fire control maintenance technician are quite similar. The sonarmen have a great deal in common with both the ET and the FC but generally appear to be less concerned with maintenance than either of these two ratings. All of the comparisons indicate that the radarman's and radioman's jobs have less in common with the other three jobs or with each other.

# Appendix A

## Procedure For Computing "Per Cent Time."

As a basis for comparison of the times spent under various shipboard conditions, it becomes necessary to derive a single number to represent each condition. The raw data consist of percentages reported by members of the sample group in response to questionnaire items. Each man was free to specify any activity and the percentage of his time devoted to it. The task of the writers, then, was to convert this set of percentages to a single number which was representative of the time spent by each rating on each activity, under each of the shipboard conditions.

The procedures which was developed required that the activities reported under a given shipboard condition be grouped into categories (such as "preventive maintenance"). When this was done the total number of percentage points reported for each category was determined. This figure became the numerator of a fraction. The denominator was calculated by multiplying 100% by N (where N equals the number of men responding under the given condition). Thus, if all of the men spent all of their time on some one activity, the fraction would be equal to 1.00 and would be equivalent to 100% of the total time. Or, if one-half of the men of a given rating spent one-half of their time on a certain activity, then this activity would consume 25% of that ratings' time under the specified shipboard condition.