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Results of the receiver site manpower planning analysis are presented. The work systematically relates manpower requirements at each Naval communications station to the communications services it provides.

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Volume III: NavCommSta Receiver Site

January 1976

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COMMANDER,
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1. Enclosure (1) is forwarded as a matter of possible interest. It describes the receiver site manpower analysis and results obtained.

2. Volumes I and II of the Manpower Planning Handbook dealing with analysis of the transmitter site and the electronics maintenance division, respectively, have already been distributed. Volume IV, covering the fleet center division, is in preparation and will be distributed in the near future.

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FOREWORD

This volume presents the final results of the receiver site manpower planning analysis done for ComNavTelComm by the Operations Evaluation Group (OEG) of the Center for Naval Analyses. The objective of the work described here is to systematically relate billet requirements of each Naval communications station (NavCommSta, or NCS) to the communications services it provides.

Volumes I, II, and IV, cover similar analyses of the transmitter sites, electronic maintenance divisions, and fleet center divisions, respectively, at the same NavCommStas considered here.

The authors gratefully acknowledge the help of Diego R. Roque of OEG, particularly his work in obtaining work measurements at NCS Norfolk.

INTRODUCTION

To relate manpower requirements to communications services provided by a Naval communications station, representative NavCommSta sites were asked a number of questions concerning their work during calendar year 1974 and the personnel used to do it:

- What jobs were done at the site within the scope of operations, maintenance, and support?

- How often were these jobs done?

- How many man-hours were needed to do each job?

- When a job was not done properly (that is, according to acceptibility standards) because of a manpower shortage, how many man-hours would have been required to do so?

- How many people are now "on board," and how many were there during the past year?

Communications functions analyzed were: the transmitter site, the receiver site, the electronics maintenance division, and the fleet center division. These functions were the ones that would be most affected by the transition from high-frequency (HF) equipment to satellites. To reduce the amount of data obtained to some reasonable size, only the 4 automated NavCommStas participated in the project: Honolulu, Guam, Norfolk, and Italy. However, since Norfolk has 2 separate receiver sites (Northwest and Sugar Grove), data from the 5 sites was kept separate for the comparison.

Most of these receiver sites performed three major functions:

- Conventional receiver operations and maintenance.

- Ship-to-shore message processing.

- Satellite terminal operations and maintenance.

This volume describes the analytical results of the first function only. The results of ship-to-shore message processing appear in volume IV, which deals with the fleet center division. And although data relating to the satellite terminal was collected, it was not analyzed for this study.

The data obtained from the 5 sites was structured so that the number of man-hours required to do identical work could be compared and a consensus arrived at to perhaps serve as a reasonable manpower standard for this unit of work. By determining the units of each type of work associated with a particular site, the manpower units required could then be calculated. Such calculations are needed when:

- The annual manpower budget at each station is being prepared.

- Realignment options are prepared as the communications system is changed.

Based on the data gathered from the 5 participating receiver sites, we were able to construct a ComNavTelComm Receiver Site Planning Guide containing:

Planning Factors Data Base

- A set of all operations, maintenance, and support jobs and the manpower required during 1974.

- A set of operating hours expended for each communications circuit and receiver type; this set should be useful in predicting future operating work loads.

- A set of Navy-approved work standards that can be compared with the set of jobs and operating hours and used as a basis for establishing ComNavTelComm planning standards.

Planning Logic

- A method of calculating total man-hours required in these personnel categories:

  - Operators.
  - Maintenance technicians.
  - Various support categories.

- A method of calculating billets required, based on the number of man-hours required, standard work-week characteristics, and various operational constraints.

The entire manpower planning process, including the standards recommended, has been reviewed and informally approved by Op-124.

To properly use the planning system, ComNavTelComm must now make these policy decisions:

- It and the sites should validate the planning factors data base and make certain that no required jobs are missing.

- Review the numerical values associated with the planning factors (particularly with the unit man-hour requirements at each site) among all 5 sites and against all Navy standards available. Then, for each work activity, decide on either one standard that will be applicable to all NavCommStas, or separate standards for each site based on factors unique to that site.

- Confirm which jobs are to be included as part of the site's work load in the planning process. There are many jobs that are not done at every site. For example, the NCS Public Works Department may service an outlying site; in other cases, the site may service itself. In the case of maintenance jobs, there is no common policy regarding which maintenance tasks are required. Consequently, certain sites do planned maintenance tasks beyond those required in the Maintenance Requirements Card (MRC).

- Decide whether the difference in manpower observed among sites for a given job during 1974 resulted from some distinguishable difference, such as quality of manpower or environment, or from "statistical variations" and, therefore, some mean value can be assumed as a ComNavTelComm-wide standard.

- Validate the planning logic proposed. The results of this review will result in the required inputs to the planner regarding which planning factor values to use in his analyses.

STRUCTURE OF THIS HANDBOOK

The sequence of topics covered by this handbook is:

- Overview of the Planning System -- describes the proposed manpower planning process in terms of the inputs the planner must provide and the various planning factors used to convert the inputs into billet requirements.

- Summary of Planning Factors Data Base -- describes each planning factor generated.

- Planning Logic -- contains the procedures for calculating the number of billets needed to operate, maintain and support a given receiver site; this section also includes a set of work tables useful in systematically implementing the procedures.

- Appendix A -- contains the details of the analysis and derivation of the planning factors; annex 1 to the appendix contains the sets of tables containing the actual data used and derived. (The data in the tables is also available on cards or 7-track magnetic tape for computer processing.)

- Appendix B -- contains flow diagrams of receiver activities at Guam for its communications circuits.

OVERVIEW OF THE PLANNING SYSTEM

Figure 1 is a diagram of the manpower planning process as envisioned. Inputs to the process are the characteristics describing a specific system configuration at each site being analyzed. These characteristics include:

- Numbers and types of equipment to be kept in inventory at the site.

- Maintenance policy to be implemented, including what types of non-corrective (planned) maintenance jobs are to be done and how often.

- Operational use of the equipment in terms of the communications circuits being operated, the number of hours per year each circuit operates, and the type and frequency of operating jobs being done.

- The type and frequency of support jobs, such as cleaning and field days.

The system characteristics are then combined with planning factors (table 1) to give the man-hours needed for the various jobs. These man-hours are then converted to billets, using Navy standards for a work week.

BASIC ASSUMPTIONS

This section describes the various assumptions underlying the results.

The planning factors (table 1) were derived from 1974 operational data and are based on the best data available from each site as well as other sources. However, each site has been asked to upgrade its record keeping (primarily with respect to maintenance) and ensure it is recording the data requested. This way, more accurate information can be obtained in the future to revalidate the planning factors and upgrade their accuracy. But it is assumed here that the planning factors are valid and that an annual revalidation of the factors, based on 1975 work experience, will amend the data base as needed.

The planning factors derived in this report consist of localized factors; in other words, the manpower required to do the same job may differ from site to site. Unfortunately, the data collected does not show whether differences can be accounted for by factors such as environment, personnel quality in terms of training and experience, or age of equipment. These factors can be used when a specific NavCommSta (or one similar to it) is undergoing realignment.

From each set of five local factors, ComNavTelComm can generate one command-wide planning factor that relates to an "average environment," rather than a specific NCS. The ComNavTelComm factors can be used for those calculations where environmental differences

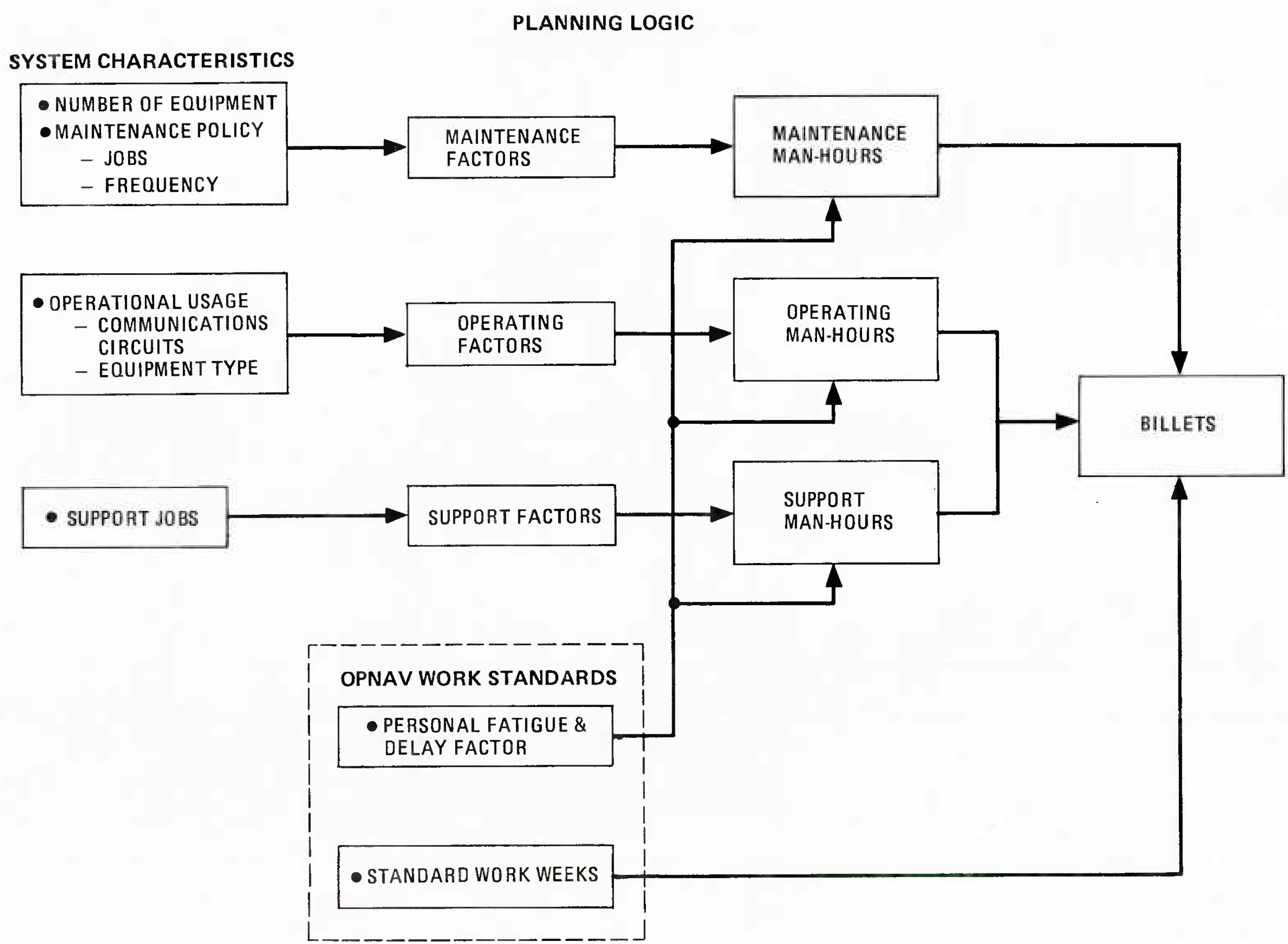

FIG. 1: MANPOWER PLANNING LOGIC

TABLE 1

RECEIVER PLANNING FACTORS

Maintenance

1. Conventional operator planned maintenance subsystem (PMS) factors
2. Conventional technician PMS factors
3. Make-ready, put-away time factor
4. Other noncorrective maintenance (non-CM) factors
5. CM factors

Operations

6. Operating usage factors
7. Tunings/retunings factors
8. Tuning/retuning unit time factors
9. Quality control (QC) checks factors
10. Other operational activities factors

Support

11. Support primary duty factors
12. Support collateral duty factors
13. Supervisory factors

OpNav work standards

14. Personal fatigue and delay (PF&D)
15. Standard work week

need not be taken into account. Since a number of different sites are being included in the realignment effort, individual deviations will tend to compensate for one another.

The objective of this analysis was to develop some rational basis for ComNavTelComm planning standards. Thus, when a Navy standard is greater than the actual work time needed, the standard is listed here as the requirement, recognizing that its use permits some slack in the system. Such a cushion may be used one of two ways:

- To do more than the minimum work -- for instance, more equipment QC checks -- at the discretion of the officer-in-charge.
- Not to man some billets depending on budget constraints.

USE OF PLANNING FACTORS

The context in which the planning factors are to be used can be summarized this way. The systems planner performs a set of preliminary analyses. He examines the need for communications services of various types, including: geographical coverage; number of messages per unit time to be handled by each communications circuit (such as full-period termination vs. broadcast); division of responsibilities among NavCommStas; operating loads to be accommodated for both peak operations and the entire year; and the division of these loads between satellite and HF equipment. Further system design considerations are then made, culminating in the configuration of alternative designs.

For each alternative being considered, this kind of information must be specified as inputs to the manpower planning system:

- The set of equipment to be in inventory at the station being considered.
- Total maintenance policy to be followed; that is, whether the prescribed PMS schedule is being followed for each unit of equipment, frequency of equipment overhaul, and the like.
- Specific operating procedures, as selected from the set of operational jobs listed in the data base.
- Operational use of the equipment.
- All support jobs required, as selected from the set of support jobs listed in the data base.

To help the planner estimate the number of equipment hours expected, he may use the operational planning factors provided, which include the number of receiver operating hours for each communications circuit/receiver type combination at each receiver site.

The basic question is: For each system configuration being analyzed, how many billets of what type are required at each site for operation, maintenance, and support? The procedure followed is similar to the approach used by Op-124 and the Navy Manpower and Material Center (NavMMaC) in calculating billets required as a function of the average weekly work load at the site. Work loads that deviate from the average are accommodated this way:

- Using peak loaders for predictable peaks.
- Using the electronic technician to help the operator when needed.
- Having the maintenance man do CM work before he does PM work.
- Bringing support personnel into operations and maintenance (O&M) activities if they can be trained to take on some of the simpler jobs during a peak.
- Working longer than the average standard shift or work week.

Overtime should be repaid with compensatory time off. This policy is implicitly included in calculating billets based on the total annual work load because peaks are included in that total. All other assumptions are noted in appendix A.

SUMMARY OF PLANNING FACTORS DATA BASE

This section describes the planning factors derived. The values of these factors and the method used in deriving them appear in appendix A.

MAINTENANCE MANPOWER REQUIREMENTS

These planning factors consist of the man-hours per year needed to do various kinds of maintenance for each type of equipment at each site. There are two types of maintenance manpower requirements:

- Site requirements--the number of maintenance man-hours that each site states it needs to achieve an acceptable performance level.
- Navy requirements--the number of maintenance man-hours that OpNav allows as acceptable for budgeting manpower.

Fortunately, all sites can do the work within the allowable Navy requirements.

Specific planning factors have been generated for all the maintenance jobs. These include Navy requirements, when available, for comparison.

Conventional PMS Factors

The allowable Navy requirement is to do the PMS actions specified on the Maintenance Requirement Cards (MRC) within the man-hours also specified on the cards. The man-hours do not include make-ready and put-away time or personal fatigue and delay. The PMS man-hours for each equipment type are given in table II-1.[1]

Make-Ready, Put-Away Factor (No. 3)

The allowable Navy requirement is 30 percent of the PMS time specified on the MRC cards.

Personal Fátigue and Delay Factor (No. 14)

The allowable Navy requirement is 17 percent of the PMS time.

[1]All tables cited in this section appear in annex 1 of appendix A.

Total Requirement for PMS

From the preceding considerations, the total allowable Navy requirement for each equipment unit is 1.47 times the PMS time. Table II-1 gives the site requirement for each equipment type. The total site requirement is considerably below the Navy requirement.

Conventional Operator PMS Factors (No. 1)

These make up that portion of the total conventional PMS action done by operators rather than by technicians. These times are given in table II-1.

Conventional Technician PMS Factors (No. 2)

These make up that remaining portion of the total conventional PMS actions done by technicians. These times are given in table II-1.

Other Non-CM Factors (No. 4)

These are the man-hours required to perform all non-CM actions now being done at the various sites but not listed on the MRC card. These jobs and the man-hours required are given in table II-2.

CM Factors (No. 5)

The allowable Navy requirement is equal to the total conventional PMS man-hours allowed, or 1.47 times more than that listed on the MRC cards. The CM requirement for each equipment at each site is listed in table II-1. The requirement for all sites is considerably below the Navy requirement.

Total Requirement for Maintenance

From the preceding considerations, the total allowable Navy requirement for each equipment unit is 2.94 times the PMS time. The requirement for all sites is below the Navy requirement.

OPERATIONS MANPOWER REQUIREMENTS

These planning factors relate receiver usage to the three main operational work categories:

- Tuning/retuning.
- Quality control checks.
- Other operational actions.

In addition to these jobs, there is some message processing (such as primary ship-shore and single-channel broadcast) done at many receiver sites. Volume IV of the handbook contains an analysis of these jobs.

Operational Usage Factors (No. 6)

Tables III-1, -3, -4, and -5 contain the total hours of receiver use during 1974 for each communications circuit/receiver type as submitted by Honolulu, Sugar Grove, Northwest, and Italy. These factors are provided as a guide in estimating future operating workload.

Tunings/Retunings Factors (No. 7)

Tables III-1 through III-5 and figures A-1 through A-3 (appendix A) contain information that can be used to calculate the number of tunings and retunings as a function of operating time for the communications circuits/receivers used.

Tuning/Retuning Unit Times Factors (No. 8)

Tables III-1 through III-5 contain information such as the unit time required to perform the various activities associated with a receiver tuning. This data can be used to calculate the average total time required to tune or retune a particular type of receiver, including orderwire, logging time, and antenna selection, as required. Using factors 6, 7, and 8, the total man-hours per year required for tuning/retuning receiver can be calculated.

QC Checks Factors (No. 9)

Tables III-11 and -12 and figure A-4 can be used to calculate the man-hours per year required by each site for its load of full-time equivalent (FTE) receivers operating.

Other Operational Activities Factors (No. 10)

The man-hours required to do other operational activities -- such as on-the-job training and adjustments after power outages -- are listed in tables IV-2 and -3. Only the off-line nonproductive portion of the on-the-job training man-hours should be used.

SUPPORT MANPOWER REQUIREMENTS

Support-Primary-Duty Factors (No. 11)

These deal with the work done by nonsupervisory personnel whose primary duty is to support the site, as opposed to "hands-on" operations and maintenance services. The billets required at each of the 5 sites for these services are shown in table IV-1.

Support Collateral Duty Factors (No. 12)

These are concerned with the work done by nonsupervisory personnel in addition to their other duties. The man-hours required for these services are shown in tables IV-2 and -3.

Supervisory Factors (No. 13)

The supervisory overhead rates associated with each overall site and its subordinate components (excluding ship-to-shore message processing and satellite terminal) are given in tables I-3 and IV-4.

OPNAV WORK STANDARDS

Personal Fatigue and Delay Factor (No. 14)

This totals 17 percent of the working time applied to all jobs whose measurements consist only of productive work and do not include permissible breaks.

Standard Work Week (No. 15)

A standard work week of 40 hours and a "5-man-for-4-section"[1] watch is to be used. Taking into account service diversions, training, leave, and holidays, the hours available for work are 31.94 for military and 33.38 for civilian personnel.

[1] Assigning 4 men for every watch position being manned continuously constitutes a 4-duty section watch. This results in a 42-hour work week (including meal time). Assigning a fifth man for each watch position allows for service diversions, training, leave, and holidays, and results in 33.6 hours per week available for work (including meal time).

PLANNING LOGIC

Procedures for calculating the number of billets needed to operate, maintain, and support the equipment for the alternative being proposed are outlined in this section. Data used in making the calculations can be entered in the manpower planning work tables; suggested formats for these tables appear at the end of the section (work tables 1 through 5).

MAINTENANCE MANPOWER REQUIREMENTS

Work Table 1

Equipment Needs

Decide on the numbers and types of equipment needed to be kept operationally ready for peak operations, such as major fleet exercises or contingencies, by the receiver maintenance division. This information can be obtained from the users. The number includes spares. However, such needs should be confirmed by comparing the list of stated user needs with former usage under similar conditions. Such data is not now part of the planning data base; it should be collected as exercises are conducted. List the equipment type in column 1 and the total number required in column 2.

Planning Factors

Decide which set of planning factors is to be used for the realignment alternative under consideration: either the ComNavTelComm-wide planning factors, or the set of planning factors related to a particular geographical zone as represented by one of the 5 sites.

Equipment Inventory

Decide on the equipment inventory to be maintained at full readiness. Also decide what PMS schedule to follow, including all non-CM actions such as overhauls and appropriate work schedules.[1]

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[1] According to current policy, all site equipment is to be fully maintained for both CM and PM. However, manpower may be saved (at the cost of more time to reach full operational readiness) when all equipment is not fully maintained all year, and greater use is made of strategic warning in starting the readiness process early enough. Further analysis of such a proposed policy change is required. If current policy were changed, the calculations of PMS and CM man-hours would be modified accordingly.

PMS Man-Hours

Based on the PMS schedule to be followed, calculate the total PMS man-hours required for each equipment type. First, calculate the sum of the unit PM man-hours[1] needed for the total PMS schedule over the full year (from the list of all PMS jobs and their unit manpower requirements as included among the maintenance planning factors). List the unit PMS factors for operating personnel in column 3, and the PMS factors for maintenance personnel in column 4. The product of columns 2 and 3 gives the PMS man-hours required of operators; this number is listed in column 5. The product of columns 2 and 4 gives the PMS man-hours required of technicians, and is listed in column 6. Find the total operator PMS man-hours (sum of column 5 entries) and total technician PMS man-hours (sum of column 6 entries).

The total operator and technician man-hours required (columns 5 and 6) should also include the appropriate "make ready and put-away" and PF&D factors. The OpNav requirement for these two factors are 30 and 17 percent, respectively. Thus, the OpNav requirement for operator and technician PMS man-hours would be 1.47 times each of the totals shown in columns 5 and 6. These totals should be listed as the last lines of columns 5 and 6.

CM Man-Hours

Calculate the CM man-hours required for each equipment type and list the total in column 8. This number consists of the product of the number of equipment units in inventory (column 2) and the CM planning factors listed in column 7. Find the total CM man-hours required (the sum of column 8 entries).

Calculating the OpNav CM requirement is a simpler process, since the CM requirement is defined to be equal to the total PMS requirement (including the additional 47 percent factor). Thus, the separate CM factors do not have to be listed in column 7, and the total of column 8 is equal to the total of the last line of column 5 plus the last line of column 6.

TUNING/RETUNING MANPOWER REQUIREMENTS

Work Table 2a

Equipment Needs

List, in columns 1 and 2, each communications circuit and the types of equipment to be operated during the coming year.

[1] Unit PM man-hours is the annual man-hours needed to do PM for one piece of this equipment.

Operating Hours

Estimate the number of operating circuit-days for each communications circuit during the coming year; enter the estimate in column 3. In this estimate, you may wish to consider operational usage factors at particular sites as a "baseline," adjusting the estimate up or down to reflect the proposed operation. Find the total operating circuit-days (the sum of column 3 entries) for these categories:

- Circuits requiring frequency tunings/retunings.
- Circuits requiring frequency selection.
- Circuits requiring converter tuning.

List each of these totals at the bottom of column 3. Divide each total by 365 to convert it into a full-time equivalent (FTE) receiver; list these entries at the bottom of column 4 (in the same row as its counterpart in column 3).

Tunings/Retunings Factors

Based on the total FTE receivers involved in each of the three tuning activities, estimates:

- The total number of tunings/retunings needed per week, using figure A-2: that figure relates the number of tunings/retunings to the number of FTE receivers being operated (sum of column 3). List this information in column 5 in the same row as its FTE receiver total.
- The number of frequency selections needed per week, using figure A-3. List in column 5.
- The number of converter tunings needed per week, also using figure A-3. List in column 5.

Man-Hours for Tuning/Retuning Activities

List the time required for each of these activities:

- The total time in minutes for all activities involved in a receiver tuning/retuning (including all aspects of circuit coordination), but excluding frequency selection and converter tuning, as shown in table III-6. This time is obtained from the data in tables III-6, -8, and -10. List this time in column 6 in the same row as the total number of tunings/retunings required.

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[1] Unit PM man-hours is the annual man-hours needed to do PM for one piece of this equipment.

- The time required in a frequency selection, as obtained from table III-9. List this time in column 6 for the same row as the number of frequency selections required.

- The time required in a converter tuning, as obtained from table III-9. List this time in column 6 in the same row as the number of converter tunings required.

Calculate the man-hours per year required for receiver tunings/retunings as the product of the number of receiver tunings/retunings and its unit factor (from columns 5 and 6), converted into man-hours (also by dividing by 0.87). The same way, calculate the additional man-hours per year required for frequency selection (the product of the number of frequency selections and the additional unit times required, from columns 5 and 6), converted into man-hours (also by dividing by 0.87). Do the same for the additional man-hours per year required for converter tuning. List each value for these man-hours per year in column 7 and find the total man-hours as the sum of these three entries.

ADDITIONAL MAN-HOUR REQUIREMENTS

Work Table 2b and 3

Quality Control Checks

Decide on what QC checks are to be made and how often.

Manpower for QC Checks

The recommended (that is, the most accurate but most time-consuming) way to make this estimate to standardize on the list of QC checks for which the command is willing to supply billets, and use this as the command standard. This would involve reviewing the list of QC checks contained in ComNavTelComm instruction 2300.13, the data submitted by the sites (see table III-12), and the results of the work samples taken (shown in table III-11). The command must then decide which QC checks are required, how often per week, and the time (in minutes) required for each. List this in columns 1, 2, and 3 of work table 2b. In column 4, list the average number of channels involved during each check. In column 5, calculate the annual man-hours required for each check by multiplying column 2 x column 3 x column 4 x 0.87. The sum of the entries in column 5 is the total QC man-hours required.

Another way (easier but much less accurate) is to assume that the man-hours submitted by each site for QC checks (listed in table III-7 and plotted in figure A-4) are valid. Each site would be given the amount it submitted, but in direct proportion to the number of FTE receivers operating, if this were changed from its current operations.

A third way is to construct a command standard. This standard would be based on constructing a linear regression through all of the non-outlier points being considered (see figure A-4); from this, the man-hours required for the number of FTE receivers at the site would be obtained. Unfortunately, this alternative is not very accurate, since the data does not correlate well (since the sites apparently are doing different QC tasks).

Power Failures

If this factor is to be included, the total man-hours needed to cope with power failures is calculated the same way as QC requirements. First, list all operational activities that must be done following each power disturbance (such as retuning/readjustment) in work table 3, column 1. Next, list the average number of work units expected each week (annual estimated divided by 52) and the man-hours associated with each disturbance in columns 2 and 3. The total man-hours required will again be the product of columns 2 and 3. Record this in column 4.

DIRECT SUPPORT LABOR

Work Tables 3 and 4

Support Needs

Decide which support jobs are needed at the site by reviewing the data base on support jobs as well as the indirect maintenance activities (on-the-job training and excessive travel), and determining which of these the site has to do for itself, thus requiring site billets. In column 1 of work table 4, list the direct-labor support primary-duty functions (see appendix A), such as medical services, in which billets are to be provided by the NavCommSta rather than by outside organizations. The number of direct-labor support billets required for these functions is listed in column 2. The support primary-duty planning factors may be used in deciding how many billets should be allocated to these functions. List those support jobs being done as collateral duty in work table 3, along with the average number of work units done per week and the unit man-hours required for each work unit (columns 1, 2, and 3). Calculate the total man-hours per year required for each job and list this total in column 4.

Support Man-Hours

Determine who will do each job in terms of these categories:

- On watch.
- Maintenance technicians on day shift.
- Primary-duty support personnel.
- Supervisors.

Allocate the total support man-hours required among these billet categories and list in columns 5, 6, 7, and 8 of work table 3. While using O&M personnel for this purpose may not seem efficient, it does offer the advantage of having extra O&M workers available for peak operations. Add the total man-hours required for each category.

TOTAL BILLET REQUIREMENTS

Work Table 5

The remainder of this section explains how to calculate billet requirements for each class of personnel. The characteristic being calculated is given in column 1 of work table 5. The data for each calculation should be listed in column 5.

Work elements

In column 1, list the various work elements done by the operator watch personnel. These elements are:

- Tuning/retuning operations.
- QC checks.
- Power failures.
- Operator PMS actions.
- Support collateral duty work load done by operator watch personnel.

Man-Hours per Work Element

In column 2, list the man-hours required for each work element. In all appropriate cases, the working man-hours must be converted into total man-hours by applying the PF&D factor appearing in column 3. Thus, the total number of man-hours for each work element is:

$$TMH = (1 + PF\&D)(WMH),$$

where TMH = total man-hours;
WMH = working man-hours;
and PF&D = personal fatigue and delay factor

The PF&D factor should have been included in the operator PMS requirements calculated in work table 1. Obtain the total operating man-hours required (row 6 of the table) by adding the man-hours of the five work elements and listing the total in column 4.

Number of Watchstanders

The next step is to calculate the total number of operator watchstanders required (row 8 of the table). There are three major factors to consider in this determination:

- Average work load.
- Peak work load the system is designed for, and how flexible the system is in sharing operating work load with other watchstanders (such as maintenance and supervisory personnel).
- Constraints, such as safety.

Each factor is considered in greater detail here. The number of operator billets, B_o, based on average work load is determined first:

$$B_o = TOW/52\,(TAW),$$

where TOW = total operator work load per year,

and TAW = time available for work per week.

According to the standard work week of 40 hours (where dependents are authorized), TAW equals 31.94 hours per week for military and 33.98 hours per week for civilian personnel (reference 1). An assumption here is that a watchstander assigned to a 5-man-for-4-section watch also has about 32 hours per week available for work because of time out for meals.

TAW thus is based on a weighted average of these two factors and depends on the civilian-to-military ratio at the site. For example, if there were 10 civilian to 40 military direct labor personnel at a site, TAW, the weighted average would be:

$$TAW = 10/50\,(33.98) + 40/50\,(31.94) = 32.35 \text{ hours per week.}$$

Enter this weighted average of TAW in row 7. Enter the results of the calculation of B_o in row 8, column 5. Carry the billet calculations to the nearest 100th of a billet until all calculations are completed and a final "round off" of fractional billets is made.

Determine the number of watch supervisors, B_{ws}, assigned to the watch:

$$B_{ws} = B_{wo} S_{rw},$$

where B_{ws} = number of watch supervisor billets required (row 10);

B_{wo} = number of watch operator billets required (row 8);

and S_{rw} = watch supervisor overhead ratio (row 9).

Enter the values for these characteristics in work table 5, column 5, in the appropriate rows.

Allocate the watch operators and supervisors among the four watches and receiver buildings, and see that anticipated peak loads during the week are accommodated. Note that watches do not have to be manned equally, and peak loaders can be used. After the allocation is made, check to see that the safety constraint is satisfied (minimum of 2 men per watch at a given location). When either of these factors is a problem, it can be alleviated by adding maintenance technicians to the watch (plus the proportional amount of supervisors). Insert this information in rows 11 and 12. This strategy may yield two benefits simultaneously. First, the technician can satisfy the safety constraint; second, because of his flexibility, the technician can be always gainfully employed either doing CM or PM actions or aiding the operator(s) during a peak.

But this gain costs something. Recall that we have provided enough operator billets to meet the total operator work load. If the maintenance technician assists the operator during peak activities, the amount of operator work he does results in the operator's being "idle" during slow times, since the number of operators was based on total yearly work load. (Unless you assume that the operator, when he is not busy, can help the maintenance technician with some of his work.) As discussed elsewhere in this section, if this strategy is used, some additional man-hours will have to be added to the maintenance technician work load calculated previously. This planning factor will have to be estimated, since no data is available.

Finally, since the total operator work load includes PMS work, and since the PMS work can be dropped during a peak, some extra manpower is available for peak demands for tuning/retuning.

Additional Direct-Labor Maintenance Personnel

Determine the total number of additional direct-labor maintenance personnel required during the day shift by following the items listed in column 1, entering the data requested in column 5.

First, enter the PM and CM work loads to be done by technicians (either on watch or day shift) in rows 13 and 14. Enter the total in row 15. Enter the total maintenance watch man-hours available in row 16:

$$TMWM = 52B_{mw}\,TAW,$$

where TMWM = total maintenance watch man-hours available;

B_{mw} = number of assigned maintenance watch billets;

and TAW = time available for work per week, as already described.

Then enter, in row 17, an estimated percentage of time to be spent by the maintenance man doing the peak operating load. As discussed, operating peaks, when they occur, are handled by a maintenance watchstander (when such an assignment exists) or watch supervisor. In either case, the individual drops his normal work and responds to the peak operating request. Thus, this time is used in operations and is not available for maintenance or supervision.

A working supervisor's time is already properly allocated between direct labor and supervision. For a maintenance technician on watch, including day shift, some fractional part of a billet needs to be added to this operating function to account for that fraction of time when he is taken off his maintenance work to help the operator during a peak:

$$TMWMA = (TMWM)\,(1 - p/100),$$

where TMWMA = time available for maintenance work by the watch maintenance technician;

and p = percentage time on peak operating load.

Enter TMWMA in row 18.

Next, determine the resulting maintenance work load to be done by the day shift (row 19). This is equal to the total PM required of technicians plus the CM to be done (as previously calculated) minus the maintenance man-hours spent by maintenance technician watchstanders. In calculating the total maintenance man-hours, the CM planning factors have nonproductive time built in, whereas the PM planning factors do not. Hence, only the latter time must consider the PF&D factor as well as make-ready, put-away factor; these were included in work table 1. Finally the number of maintenance billets, B_m, required on the day shift (row 20) is:

$$B_m = TMW/52\,(TAW),$$

where B_m = direct labor maintenance billets required (row 20);

TMW = total maintenance work load to be performed by maintenance personnel on day shift (row 19);

and TAW = time available for work per week, as previously described.

Maintenance Supervisors

Determine the number of maintenance supervisors required (row 22):

$$B_{ms} = B_m S_{rm} ,$$

where B_{ms} = number of maintenance supervisor billets (row 22);

B_m = number of maintenance billets on day shift (row 20);

and S_{rm} = maintenance supervisor overhead ratio (row 21).

Support Primary-Duty Supervisors

Determine the number of support primary-duty supervisors required:

$$B_{ss} = B_{sp} S_{rs} ,$$

where B_{ss} = support primary duty supervisors (row 25);

B_{sp} = support primary duty billets (row 23);

and S_{rs} = support primary duty supervisor overhead ratio (row 24).

The service diversion work load should be examined as part of the entire service diversion requirement to ensure that the total does not exceed an average of 8 hours per week. When it does, an appropriate number of additional billets may be added.

Fractional Manning

After the number of billets for each function has been calculated to the nearest 100th of a billet, fractional manning problems may arise. In the past, this was solved by arbitrarily selecting the equivalent of one-half (0.5) as the cutoff point. Any work load that earned at least one-half space was awarded the next whole number without regard to work center size. Those that earned less than one-half did not get the extra manpower (reference 2).

Overload factors are established based on the premise that separate criteria should be applied to small and large work centers. A maximum individual work overload is established at 1/2 hour per working day, and is cumulative until reaching a maximum of 1/2 billet. The cutoff point is the highest value the fractional manpower can equate to before the manpower requirement is rounded to the next higher integer. Table 2 reflects fractional manpower cutoff points for both military and civilian manpower.

WORK TABLE 1

MAINTENANCE MAN-HOUR REQUIREMENTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Equipment required		Total operator PMS factors	Total technician PMS factors	PMS operator man-hours	PMS technician man-hours	CM factors	CM man-hours
Type	number						

WORK TABLE 2a

TUNING/RETUNING OPERATING MAN-HOUR REQUIREMENTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Communications circuit	Equipment type	Operating circuit-days	Full-time equivalent receivers	Number of tuning/retuning activities	Unit activities times (minutes)	Tuning/retuning man-hours

WORK TABLE 2b

MAN-HOUR REQUIREMENTS FOR QC CHECKS

(1)	(2)	(3)	(4)	(5)
QC check	Average number QC checks made per week	Unit time required	Average number channels checked	Total man-hours per year

WORK TABLE 3

MAN-HOUR REQUIREMENTS FOR ADDITIONAL JOBS

(1) Job description	(2) Average work units per week	(3) Support planning factor	(4) Total man-hours per-year	(5) Watch allocation	(6) Maintenance technician allocation	(7) Primary duty/support allocation	(8) Supervisor allocation

WORK TABLE 4

SUPPORT PRIMARY DUTY REQUIREMENTS

(1) Support primary duty functions required	(2) Billets required

WORK TABLE 5

CALCULATING TOTAL BILLET REQUIREMENTS

(1) Characteristic being analyzed	(2) Working man-hours required	(3) PF&D factor	(4) Total man-hours required	(5) Numerical factor
1. Tuning/retuning operations		1.17		
2. QC checks		1.17		
3. Powerfailures		1.17		
4. Operator PMS actions		Included		
5. Support collateral duty work load done by watch personnel		Included		
6. Total operating man-hours required				
7. Standard work week (for labor mix)				
8. Number operating billets required				
9. Watch supervisory overhead ratio				
10. Number watch supervisors required				
11. Additional maintenance workers added to watch				
12. Additional supervisors added to watch				
13. Total maintanance technician PM work load				
14. Total maintenance technician CM work load				
15. Total maintenance technician work load				
16. Total maintenance watch man-hours available				
17. Percent time watch technician does peak operating load				
18. Total maintenance watch man-hours available for maintenance				
19. Maintenance work load done by day shift				
20. Maintenance billets required for day shift				
21. Maintenance supervisory overhead ratio				
22. Number maintenance supervisors required				
23. Number support primary duty personnel				
24. Support supervisory overhead ratio				
25. Number support primary duty supervisors required				

Qualitative Requirements

Next, determine the qualitative requirements of each position in terms of designator, grade, rate, and series. This should be done uniformly, based on the total number of people required in each functional unit.

TABLE 2

FRACTIONAL MANPOWER CUTOFFS FOR COMPUTING STANDARDS

Manpower authorized		Fractional manpower cutoff	
		Military	Civilian
1		1.081	1.078
2		2.162	2.155
3		3.243	3.233
4		4.324	4.310
5		5.405	5.388
6		6.486	6.466
7		7.500	7.500
Over 7	Authorized manpower	+0.500	0.500

REFERENCES

1. OpNav 12P-6, "Manpower Requirements Program" Unclassified, 29 May 1974

2. OpNav 12P-8, "Manpower Requirements Program" Chapter IV, Unclassified, 23 Jan 1973

APPENDIX A

ANALYSIS AND DERIVATION OF PLANNING FACTORS

This appendix describes the planning factors and how they were derived for the operations, maintenance, and support functions analyzed. Data as submitted by each site is on file at CNA. As table 1 of the main text shows, 15 basic planning factors have been derived for those functions. Each factor is described here, indicating:

- Numerical values of the recommended planning factors.

- How the original data submitted by the 5 sites was converted into planning factors.

- Existence of Navy work standards and their use in this analysis.

- Organization of the planning factors data base so that the planner, following the planning logic described in the main section, can retrieve desired values from the data base.

- Other planning information derived during the analysis.

PERSONNEL INFORMATION

The main objective of this analysis was to determine the appropriate supervisory "overhead" factor now associated with each work function. However, one by-product was a list of all billet titles for all personnel at each site. A comparison of each station's billet titles with a master list that was generated, and each station's title preferences are given. This structure was generated to aid Code-01 in formulating a final, preferred set of standard billet titles.

Uniform Billet Titles

Table I-1 of annex 1 is a composite of all billets filled as of the survey date and as submitted by each receiver site. Column 1 of the table is a master list of practically all billets commonly associated with receiver sites, grouped into divisions and branches.

The billets reported at Honolulu, Guam, Sugar Grove, Northwest, and Italy were then matched against this list, as shown in columns 2, 3, 4, 5, and 6, respectively. As in the original data, the word "same" in place of a billet title indicates that the site uses the master position title; another title indicates the title now used there.

Billets that do not correspond to the master list are also listed in the division in which they exist, with the same letter designation used in that site's original data. Note that billet A at one site need not be the same as billet A at another site, since the original data forms were completed independently with only the master billet list as a guide. Lettered billets from different sites apparently relating to one another yet having different billet titles are clustered.

Although all billets in the master list appear in column 1, there are billets that do not exist at any of the sites.

Table I-1 was created to help in developing a set of uniform billet titles. Titles now in use can be compared with this list and a decision made by the command concerning the preferred set of billet titles.

Manning Distribution

Table I-2 gives total manning used for receiver operations (but excluding ship-shore message processing), maintenance, support, and general management (supervisors in the receiver's division office) at the sites. The number of direct labor, functional support, and supervisory personnel are also indicated within each division, as is the military-civilian composition of each category.

Table I-3 also shows the manning distribution of labor between day workers and watchstanders. The purpose of tables I-2 and I-3 is to compare personnel distributions among sites, as well as provide a basis for deriving supervisory overhead rates (described under support manpower requirements).

MAINTENANCE MANPOWER REQUIREMENTS

To minimize differences among the sites in the number of man-hours each spent in its PMS and CM functions for one unit of equipment, 3 classes of maintenance work were defined.

Conventional PMS Work

This first work category is defined as the annual man-hours required to perform the minimum PMS actions specified on the MRC card for one unit of equipment, but does not include any extra non-CM work the site does because it feels it is necessary. The conventional PMS man-hours are defined to include all maintenance man-hours, including those required for "make-ready and put-away" and all breaks taken. Any excessive travel time to other sites has been separated from work times and is included elsewhere.

Since the operator may do part of the PMS actions, it is necessary to know his share so that a division of the total PMS time can be made between operator and maintenance technician.

Other Non-CM Work

There are a number of maintenance activities that are not done at all sites, or are done differently at each site. To identify these differences -- and still allow the planner the choice of including those work functions he desires in his analysis -- we have structured all of the nonstandard, non-CM maintenance work and the man-hours each requires as additional jobs. But to obtain official billet credit for such work as part of the PMS system, ComNavTelComm will have to make such recommendations and submit them to NavMat for approval.

CM Work

This category is the annual man-hours required to perform all CM actions, including replacement of parts during PMS.

Data Organization

Tables II-1 and -2 deal with the maintenance planning factors and are derived from the data submitted by 5 sites.

Table II-1 gives numbers and types of all equipment being maintained at the 5 receiver sites. This equipment is listed alphabetically and described in column 2 and numbered sequentially in column 1. As a cross-reference to locate the data in that table, the maintenance numbers as originally given by each site are listed in column 3.

Column 4 gives the number of units of equipment of each type at the sites. When the number maintained is different from the total number on hand, this is also indicated, and the latter figure is the one used in all calculations to determine unit times.

The total man-hours per year needed for both CM and conventional PMS maintenance (not including extra jobs) for one unit of each piece of equipment is given in column 5. In all cases, these include time for breaks and make-ready, put-away.

Columns 6, 7, and 8 list man-hours needed for different aspects of conventional planned maintenance, as specified on MRC cards. Column 6 gives the standard times reported by the sites for planned maintenance by operator personnel on one equipment unit (planning factor 1). Column 7 gives the equivalent standard times by maintenance technician personnel (planning factor 2). Column 8 gives the total of these two times, which is the annual man-hours required to perform minimum PMS on one unit of equipment. These times do not include extra non-CM work, which is covered in table II-2.

Column 8 of table II-1 also includes the official MRC standards for PMS as obtained from Code-04 Readiness Department. In some cases, the standard differs with different models of the same equipment; the range of values separated by a slash is given for those instances.

Column 9 gives the annual man-hours the sites reported as necessary for conventional planned maintenance on one unit of equipment (not including the time required to do the extra jobs listed in table II-2). These times usually were very close to the PMS standards. This was expected, since all sites indicated they did not keep records of PM work times; instead, they based their PM requirements on the PMS standards.

Another source of maintenance manpower standards were also examined -- the maintenance standards used by the Navy Security Group. These maintenance standards are important to this project because:

- The Navy Security Group has many kinds of equipment common to NavCommSta equipment at other sites being analyzed.

- The logic used to derive maintenance requirements correlates closely with the logic proposed in this analysis.

- The Navy Security Group's maintenance needs compare favorably with those of the U.S. Army and Air Force maintenance records for the same equipment; these have been officially approved as the Service Cryptologic Agencies (SCA) standard by the Director of Defense Research and Engineering (DDR&E).

The SCA standards obtained also appear in column 5. Use of this standard is described elsewhere in this analysis.

Column 10 is used to display the corrective maintenance planning factors (number 5). This is the average man-hours per year for one equipment unit that the sites reported as required to do all corrective maintenance, including parts replacement during PM.

Table II-2 is a list of non-CM jobs done over and above those listed on the MRC cards. The table lists the name of the equipment, the description of each job, and the additional man-hours per year per unit equipment required to do the extra maintenance. The sites feel these jobs are necessary, although they have not been formally approved by ComNavTelComm or the Naval Electronics Systems Command. This data can be reviewed by ComNavTelComm, which can then decide on a proper maintenance policy based on environmental conditions at a particular site, the man-hours needed, and the value of doing the work. This data constitutes planning factor number 4.

ANALYSIS OF MAINTENANCE DATA

This section contains the analytical results obtained by correlating all the maintenance data collected during this project. These results also can be applied to other NavCommSta maintenance areas.

Basically, the analysis consisted of two types of data comparisons. First, the man-hours reported required by each site to do a work element were compared. Second, official Navy standards (approved by Op-124) were also identified, and these were compared with the requirements stated by each site. Table II-3 of annex 1 shows the results of this comparison.

Consider first the intersite comparison. The analysis consisted of calculating a number of ratios using the PMS standard as the uniform basis of comparison, thus eliminating differences in the numbers and mix of equipment among stations. In the analysis:

- Line 1 shows the sum of PMS standard man-hours for all equipment at each site.

- Line 2 shows the total man-hours required by each site to do all PM jobs, both conventional PMS and all extra non-CM jobs (both recurring and nonrecurring). It also includes time for make-ready, put-away and work breaks in its PMS requirements. All 5 sites indicated they took work samples as the basis for their estimates.

- Line 3 shows the man-hours used for the extra non-CM jobs done at each site.

- Line 4 shows the man-hours used to do the conventional PM jobs.

- Line 5 shows the total man-hours required for CM.

- Line 6 shows the ratios of total requirements for PM and CM as reported by each site (including all extra non-CM jobs) to the PMS standard. This was the most important result.

These ratios were then compared with Navy maintenance standards approved by Op-124. While these standards were constructed for communications equipment used by the fleet, they are the best data available to Op-124. The standards were obtained this way:

- The PMS standard listed on the MRC card is the official requirement for PM actions. But the PMS standard is for working time only; an additional 17 percent is allowed for PF&D (planning factor 14).

- The PMS standard does not include make-ready and put-away time, which is allowed as an additional factor (number 3); no official time has been set by the Navy. The exact amount of time is a function of the distance between where the tools and parts are kept and where the equipment is located, and how many times the same tools are used in maintenance at that location. Op-124 permits a factor of 30 percent for the fleet and has indicated it will also permit a 30-percent factor for shore stations until a more thorough study can be conducted.

Thus, the total Navy PM requirement for work specified on the MRC card is 1.47 times the PMS standard.

While there is no Navy CM standard similar to the PMS standard, there is an OpNav policy used for fleet manning purposes -- paragraph 106.1.c(6) of reference A-2. This policy states that for every hour of CM action, one hour of PM action is needed for electronic equipment. Op-124 further interprets this policy for determining billet requirements by estimating the CM man-hours required for the fleet as being equal to the total PMS man-hours required. Again, it will permit this factor to be used as the Navy requirement for shore stations until a more thorough study can be made. The CM-to-PM man-hour ratio was therefore calculated for each station, using the PMS standard man-hours as a reference. An appropriate CM-to-PM ratio thus can be used as a standard for each site or for the entire command.

The total maintenance requirement for fleet operations is therefore 2.94 PMS time. Additional man-hours for extra non-CM maintenance appear on MRC cards when officially approved by NavMat. The maintenance standard used by SCA was 3 times the PMS man-hours, reasonably close to the Op-124 standard.

With the preceding discussion in mind, we next compared each of the site's total maintenance requirements ratio (line 6 of table II-3) with the derived Navy requirement, whose ratio is 2.94. All sites are well within the Navy requirement.

While the intent is to use the PMS standard as the basis for allocating billets, the NavCommStas themselves differed in their numerical values of the same PMS standard, as shown in table II-1. In some cases, the value given is even lower than the official standard. When a set of numbers differs considerably, ComNavTelComm should determine why and assign a correct value for each site.

The reasons for the differences include:

- Differences in the amount of work being done, particularly in "as-required" work.

- Differences in PMS standards for different models of the same equipment; column 8 of table II-1 shows the range of values of the standard for different models.

- Arithmetic errors by the site in calculating the standards.

Because of the differences in ratios among the sites, several other analyses were also made at the next level of detail. The first was a calculation of the man-hours required to do both the PMS jobs and the extra, non-CM jobs now being done (and listed in table II-2). This comparison among sites of the extra man-hours required is best shown by taking the ratio of the total PM man-hours required to the man-hours associated with the PMS standard. These ratios (line 7 of table II-3) show that all sites deviate only slightly from the PMS standard, even counting the extra jobs done. Rows 8 and 9 confirm that the extra jobs require only a small amount of manpower, and that conventional PM is also done in less time than the PMS standard.

A second analysis was concerned with finding the ratio of CM man-hours to the Navy man-hours allowance for PM and comparing this ratio with the Navy requirement (unity). This is shown in line 10 of table II-3. Line 11 of table II-3 provides a similar ratio of CM required to the PMS standard, rather than to the Navy PM required. These results show that all sites fall well below the Navy requirement.

OPERATIONAL MANPOWER REQUIREMENTS

This section describes the analysis of operations performed on the receiver equipment. As indicated, the message-processing work done by radiomen at many receiver sites for circuits such as primary ship-shore and submarine broadcast are really fleet center functions. Therefore, the analysis of these jobs and the derivation of their planning factors appears in volume IV rather than in this volume. In addition, data relating to satellite operations is not included in this analysis.

Organization of Operational Data Submitted by Sites

Unfortunately, all sites did not describe their operational work the same way. In some cases, certain data was not provided; in others, the same operating job was described differently. Since the analytical strategy was to provide as accurate an answer as possible within the available time, the analysis was completed using the data available. The results can be reviewed by the sites and by the command, with the sites providing any missing data that can be used later.

To compare the operational data received from the sites, all the original data received from the 5 receiver sites was analyzed and restructured into tables III-1 through III-5, based on this logic:

- Three basic operational work functions:

  – "Bringing up" receivers and retuning them as required, defined as "receiver tuning."[1]

[1] Representative flow diagrams and descriptions of the various operational activities associated with the different types of communications circuits were provided by Guam; these appear in appendix B.

– Quality control (QC) checks.

– Other miscellaneous activities.

- A more detailed analysis of the receiver tuning showed that it consisted of the activities listed in table III-6. Estimates of the times required by Sugar Grove for each activity are also shown.

Similar activities are performed when tech control asks for QC check or receiver readjustment (retuning).

Unfortunately, the data submitted by the 5 sites was not submitted in the form of table III-6 but was clustered around 4 major work functions and subfunctions:

- Receiver tuning, including:

  – Frequency selection, initial determination of a preferred frequency, and confirmation that the frequency is unoccupied.

  – Frequency tuning, including the initial receiver setup and the readjustment required after periodic QC checks.

  – Converter tuning, including setup and periodic adjustment.

  – Antenna selection, including making an audio patch and selecting an antenna for optimum reception.[1]

  – Circuit coordination with external sites, primarily the technical control facility and by orderwire.

  – QC checks, including audio evaluation, audio level readings, and frequency accuracy checks.

  – Miscellaneous functions not fitting the above categories.

Returning to the data originally submitted by the sites, columns 1 and 2 of tables III-1 through III-15 list the number and name of each communications circuit operated, as submitted by the site. Columns 3, 4, and 5 list the nomenclature of the receivers used for the circuit, the number of receivers used, and the number of circuit-days each circuit was

[1] No estimate of walking time was given by the sites, either because it was overlooked or because it was included in subsequent work activity.

operated during the year. Columns 6 and 7 list the unit time required to do the job listed and the average number of times the job is done per week. Column 8 is the man-hours per year required for each job, calculated as (52 x column 6 x column 7)/60.

The circuits are listed in order of their equipment types and, within this category, by the unit time taken to do the job using that equipment. This way, the time each site takes to do the same job using the same equipment could be compared.

Honolulu submitted essentially all of the data requested. No data was supplied for the orderwire coordination function. (This deficiency is discussed in the analysis of this function.) All jobs done by Honolulu fit the first three categories; the miscellaneous function therefore was not needed. Italy and Sugar Grove also submitted essentially all the data requested. Northwest submitted just about all the data requested except for one item. While that site was able to estimate the total number of times a given job was done per week for each equipment type, it was unable to subdivide these times among the various communications circuits using this equipment.

Guam went into fine detail in describing the various tasks that make up the individual jobs. However, that site provided receiver tuning data only on the full-period terminations, and, like Northwest, did not subdivide the total number of times that a job was done for each communications circuit. Nor did Guam provide the circuit-days of receiver use for each communications circuit listed.

Analysis of Total Receiver Operations

Since the detailed work elements furnished by the sites were different, the first analysis performed was to develop a model that would relate the total operational manpower requirement of each site with its receiver usage. Table III-7 and figure A-1 attempt to do so.

The bottom row (row 11) of table III-7 shows the receiver usage at each site, measured as the number of FTE receivers used during the year at each site. Rows 1, 2, 3, and 4 list the man-hours required to do the three major work functions and their total; the miscellaneous activities are treated under other operational activities, planning factor 10. The total operating man-hours required was then obtained (row 5) by adding the 17-percent PF&D factor to row 4. Relating the total operating man-hours required by each site to its receiver usage was based on the notion that the greater the usage, the greater should be the quantity of work and the man-hours required.

Figure A-1 shows the plot of total operating man-hours required as a function of the FTE receivers operated at each site. While Guam did not provide operational usage data, it did provide the total number of receivers in inventory. Calculation of the receiver usage at Honolulu, Sugar Grove, Northwest, and Italy revealed that the total receivers at each site operated 67, 48, 74, and 73 percent of the time, with the total inventory of receivers

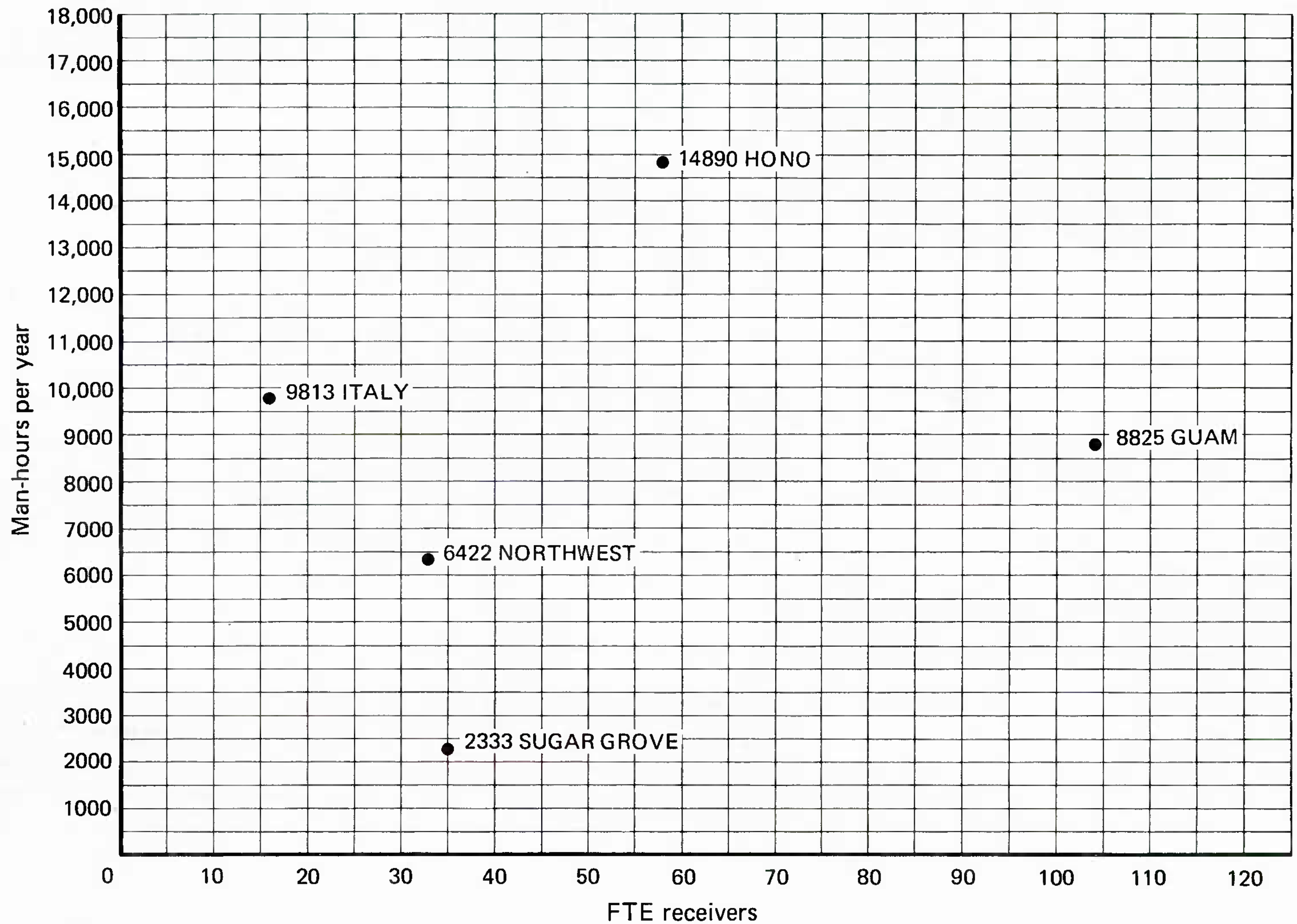

FIG. A-1: TOTAL OPERATING MAN-HOURS REQUIRED operated 63 percent of the time. This statistic enabled us to estimate that Guam had 104 FTE receivers operating.

Unfortunately, the data plotted in figure A-1 shows that the total operating man-hours required at each site does not correlate well with the number of FTE receivers. Because of this, more detailed analyses were required to determine why the sites should differ so.

Even though the data in figure A-1 showed poor correlation with the number of FTE receivers, the operating man-hours each site required were actually low, considering that each site must have a minimum of 2 men per watch (or 10 billets) just for safety. Therefore, the operator PM requirement in two forms was added to the operating man-hours required.

The PM requirement, as submitted by the sites, is shown in row 6; the Navy requirement for operator PM was also calculated (row 8) as 1.47 times the operator PMS standard (row 7). The total operating man-hours required (row 9) was then calculated as the sum of rows 5 and 8, and the total billets required (line 10) calculated by dividing row 9 by 1,661 man-hours/year/billet. Thus, not counting support collateral duty jobs, the operator requirements for all sites are less than the 10 men required for safety.

Therefore, it could have been possible to drop the more detailed analysis of the specific operating jobs and billet for a minimum of 10 billets per site (resulting in low utilization for Italy and Norfolk), except for one thing: Italy solves its operator utilization problem with a 2-man watch consisting of one operator and one technician. This is ideal because:

- The operator can devote primary attention to receiver duties, giving secondary attention to operator PMS when he is not busy with operations. (Incidently, the data indicates that Italy and Honolulu do not use operator PMS. This is satisfactory as long as their utilization is high enough.)

- The technician is available on watch to satisfy the second man safety limitation; he can assist the operator during peak operations, and he can do PM and most CM activities during the watch.[1]

Because this more efficient use of personnel is possible, an analysis in greater depth of the various operations was required. Correlation of the data submitted by the sites on similar types of jobs shows that:

- Some tasks or job elements are missing in some cases.

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[1] The maintenance chief at Sugar Grove estimates that 70 to 80 percent of CM actions can be done on the receiver deck. The remaining receivers would be serviced at the maintenance shop by the maintenance day workers.

- The time required to complete one unit of the same work differs among sites.
- The frequency with which work is done varies among sites.

Thus, the analytical objective was to focus on the data consistencies (and inconsistencies) among similar jobs and attempt to explain these, if only by suggesting that more work is probably being done at one site than another. Validation, or modification, of any of these explanations should be made by the sites during their review of this handbook.

Detailed Analysis of Receiver Operations

Each of the more detailed jobs associated with receiver operations was then analyzed; out of this analysis, planning factors 6 through 10 were developed:

- Operational usage factors (No. 6) presents the 1974 receiver usage by circuit and type of receiver used at each site reporting such data.
- Tunings/retunings factors (No. 7) presents the number of times that receivers require tunings or retunings, including:
  - Frequency selection.
  - Frequency tuning/retuning, including antenna selection.
  - Converter tuning.
  - Coordination with tech control.
- Tuning/retuning unit time factors (No. 8) presents the unit times required to perform the work functions associated with planning factor 7.
- QC checks factors contain factors pertaining to the man-hours required for the checks at each site.
- Other operational activities factors (No. 10) presents all other operational activities performed at the sites and the man-hours they require.

Analysis of Receiver Tuning Operation

The first function analyzed in detail consisted of these receiver tuning operations:

- Frequency selection.
- Frequency tuning/retuning, including antenna selection.
- Converter tuning.

The man-hours required for these operations were analyzed the same way as for the transmitter site, except that the orderwire time spent in conjunction with these functions is treated as a separate planning factor and analyzed under the circuit coordination function. Also, as with the transmitter site, it was assumed that all walking time (such as from the orderwire to a receiver) is included as part of the time required to do the receiver operations. Estimating the number of receiver tunings/retunings is described here.

As tables III-1 through III-5 show, only Honolulu, Sugar Grove, and Italy submitted data on the number of tunings/retunings for each of their communications circuits. Thus, the most accurate way of estimating the number of receiver tunings/retunings required in the future at each of these sites is to use their data as a means of extrapolation, assuming:

- The site being analyzed will function like its 1974 data.
- Each future communications circuit receiver will require a number of tunings/retunings proportional to the number of operating circuit-days estimated for the coming year. The planner must then estimate the new number of circuit-days expected for each communications circuit/receiver type (using the 1974 data as a guide), and extrapolate the data in columns 5 and 7 of the appropriate table accordingly. The planner then multiplies this number of tunings/retunings by the unit time required for each (as given in column 6) to obtain the man-minutes of work required.

A similar approach could be used in estimating the number of tunings/retunings for other sites. In this case, the planner must also determine which of the 3 sites for which data is available most closely resembles the site for which the estimate is being made.

Estimating the number of converter tunings and frequency selections for a given site follows the same approach.

We also tried to develop a simpler way to relate the total number of tunings/retunings to total operating hours, since:

- The calculations would be easier for the planner.
- The estimating model could be used for all receiver sites.[1]

To develop this more simplified model, we tabulated the total number of tunings/retunings and the total number of FTE receivers at each site; the number of tunings/retunings made for all continuously operated circuits and the number of FTE receivers used at each site; the number of tunings/retunings made for all intermittently operated systems; and the FTE receivers used at each site. These are shown in table III-8, rows 1 through 6. The total number of tunings/retunings vs. the total number of FTE receivers used was plotted in figure A-2 (including the incomplete data submitted by Guam).

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[1] If the number of tunings/retunings at a site were known, the man-hours required could be calculated as the product of the number of tunings/retunings and the average time required for tuning based on the receiver mix at the site.

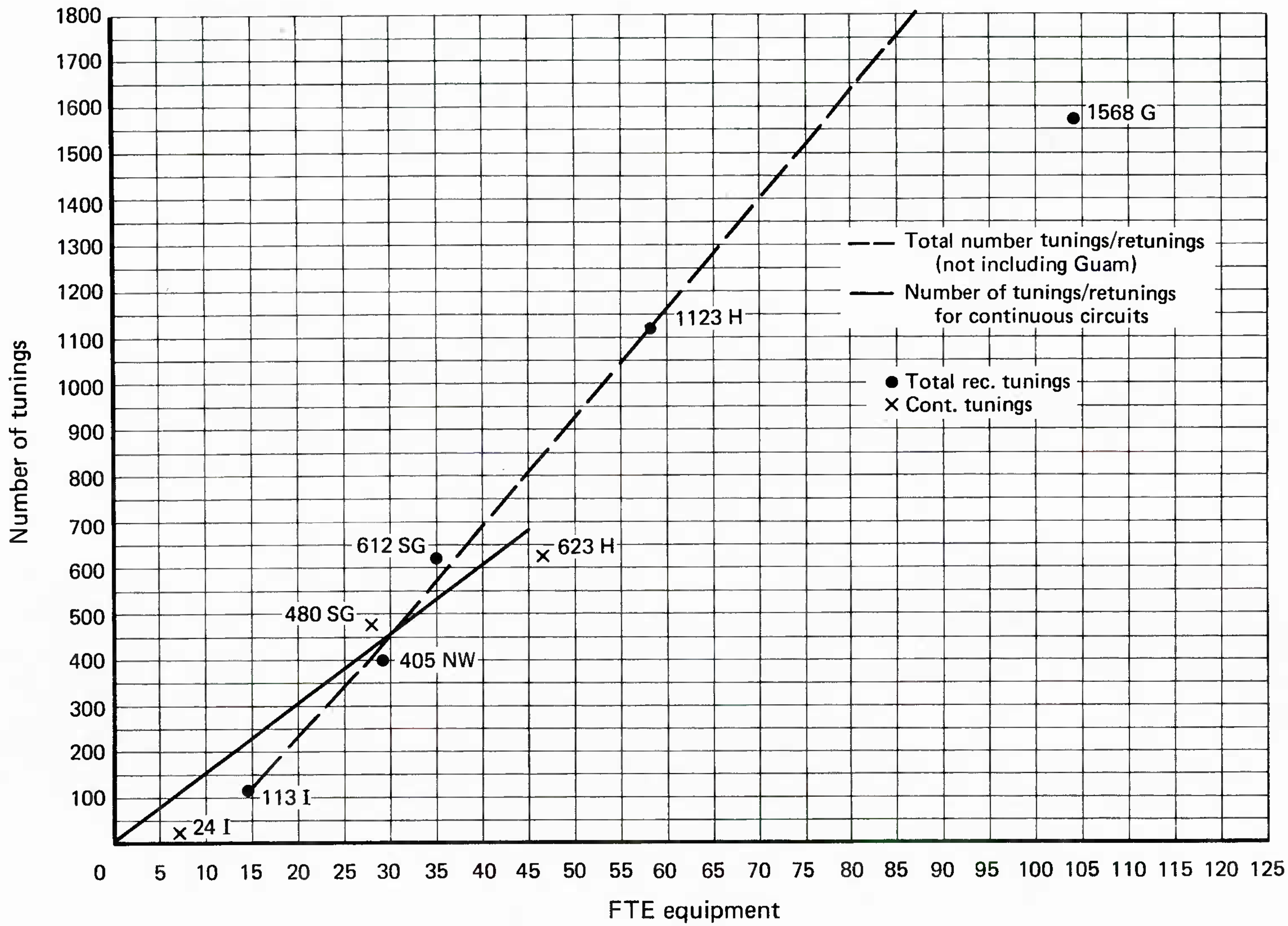
Number of tunings
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
FTE equipment
1568 G
1123 H
612 SG
623 H
480 SG
405 NW
113 I
24 I
Total number tunings/retunings (not including Guam)
Number of tunings/retunings for continuous circuits
Total rec. tunings
Cont. tunings

FIGURE A-2

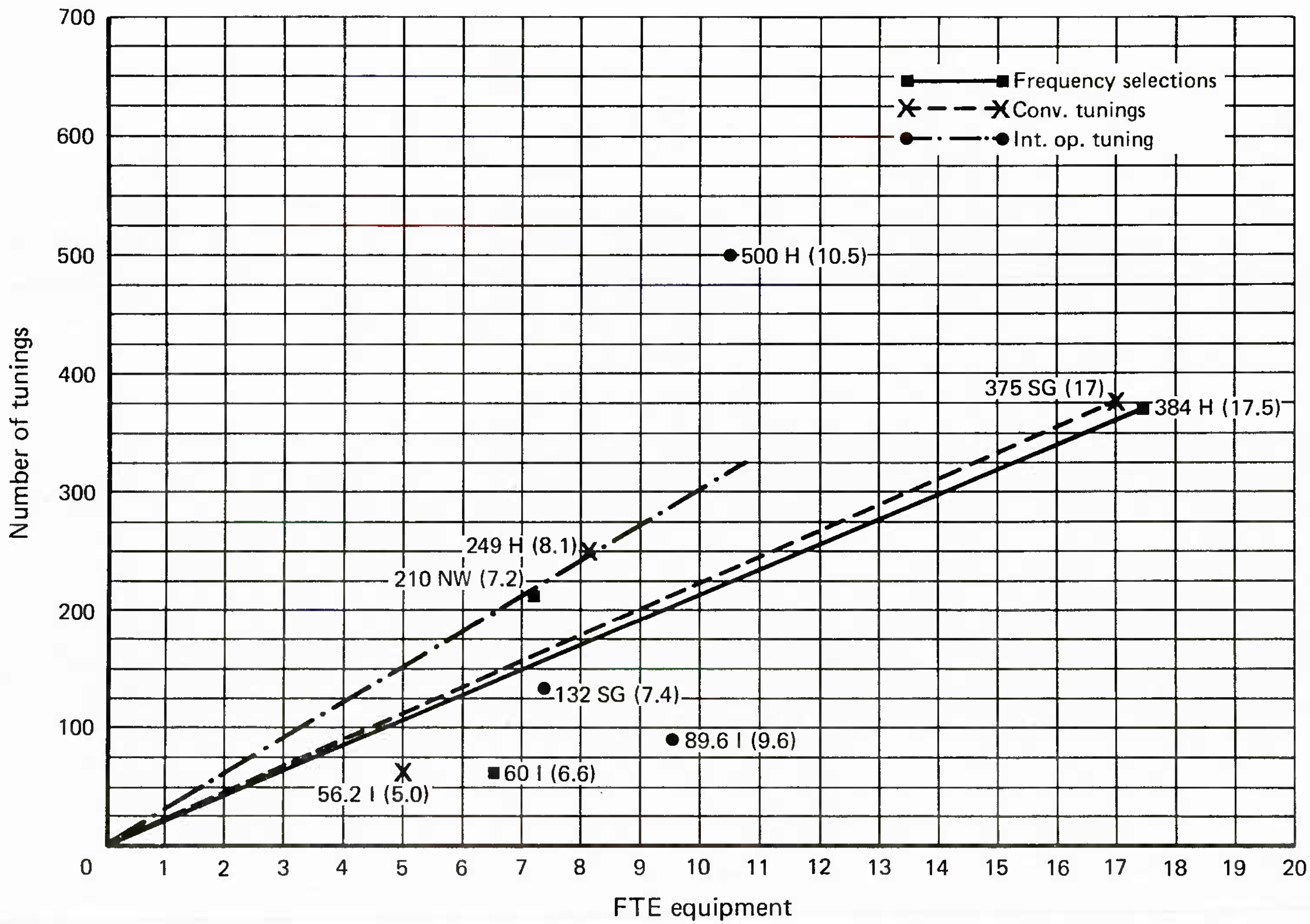

FIG. A-3: NUMBER OF OPERATIONS vs. NUMBER OF FTE EQUIPMENT

Because of the good correlation obtained, this function could be used (instead of tables III-1, -3, and -5) so long as the mix of systems used is not changed radically at a different site. Further data could be obtained from other sites to provide additional validation of this model.

Plots of the number of tunings/retunings for the continuous systems and intermittently operated system vs. the number of FTE receivers associated with each type were also made; see figures A-2 and A-3. The correlation obtained was not as good as the total number of tunings of figure A-2. Figure A-2 should therefore be used as the estimation model.

Once the number of tunings/retunings has been estimated at a site, the average time required per tuning/retuning needs to be determined:

- The mean time required at each site for each frequency tuning was calculated for each receiver type as the average of times taken for all communication circuits using this equipment type, weighted by the number of tunings involved. The mean time calculated for each site is listed in row 7 of table III-8.
- A command standard should be calculated for each equipment unit, taking a weighted mean of the times required by each site.
- A site average unit time should then be derived, taking into account the particular mix of receivers at each site weighted by their operating times.

For example, consider that within a class of receivers at the site, we have estimated these amounts of receiver usage:

R-1051: 30 FTE receivers

FRR-60: 20 FTE receivers

Also, assume that the command standards for tunings/retunings are 1.0 and 1.5 minutes.

The weighted average tuning/retuning time for the receiver mix is:

$$\frac{30}{50}(1 \text{ min.}) + \frac{20}{50}(1.5 \text{ min.}) = 1.2 \text{ minutes.}$$

To further validate the time required for receiver tuning, work samples of the total tuning time required at Northwest were taken from the time a new frequency was requested until the new frequency was brought up and approved. During this time, the operators perform the activities listed in table III-6.

On the basis of 14 measurements taken, the frequency tuning function on all receiver types at Northwest requires 1.05 ± 0.94 minutes, which compares well with the reported data. Only 3 antenna selections were required in connection with these tunings, and the times observed (4.70, 0.45, and 0.39 minutes) were too small a sample to be of use. In addition, the total tuning interval (including all activities of table III-6) was also measured.

On the basis of 12 measurements taken, the total time required is 18.75 $\pm$ 5.98 minutes (based on a 90-percent confidence level, using a t-statistic). In analyzing the results, it is assumed that the operator can do other operational work during the total interval, since no station reported a working time as high as 19 minutes.

The frequency selection job was analyzed next, as shown in table III-9. Rows 1 and 2 list the total number of frequency selections made per week and the FTE receivers associated with these selections. This data is also plotted in figure A-3. Unfortunately, the data does not correlate well for no apparent reason. Since the total man-hours involved are not very great, and if no reasons are given by the site or the command, it is recommended that an arbitrary function be plotted through these points.

The remaining rows list the unit times required for frequency selection. It is not readily apparent why these times should vary so, and this will have to be resolved.

Following the resolution of the two planning factors, the total man-hours will be based on the product of:

- The number of frequency selections, as determined by the number of FTE receivers used at the site.

- The unit time required at each site, which would be a weighted average, considering the types of receivers and circuits involved.

Similarly, the converter tuning and antenna selection planning factors were developed, as shown in table III-9 and figure A-3.

Analysis of Circuit Coordination Function

While the original instructions to the sites were for them to include the time required for any circuit coordination required as part of the operational job for which it was performed, Guam, Northwest, Sugar Grove, and Italy submitted separate data for this function. Honolulu also listed in a footnote that

> "Coordination with tech control requires that a man continuously watch this circuit. Receiver site had two separate order wires between Defense receivers area and control, and between tactical receiver's area and CALS. On September 25, 1974, these order wires were combined, but this did not alleviate the requirement of two operators since the Defense receivers area and the tactical receivers area are physically separated by 30 yards."

We assume that Honolulu literally does not have a man continually occupied at each orderwire. Conferences with 2 other receiver sites indicate that while the orderwire must be monitored constantly, it can be done by listening for a message. (Some sites use an alarm to signal the operator that a message is coming in.) It is therefore assumed that while 2 men may be needed for monitoring, they are free to do other operational jobs when the orderwire is not operating.

A review of the circuit coordination jobs reported by the sites indicates that the times were basically spent in keeping tech control informed of receiver status and maintaining the status board. A comparison of the circuit coordination man-hours required by the various sites and the data elements involved are shown in table III-10. Row 3 shows the total man-hours required per year per FTE receiver by each site (as obtained from rows 1 and 2). Italy's man-hours are extremely high compared with the other sites. A second indicator is the man-minutes per year per tuning/retuning, listed in row 5 (as obtained from rows 3 and 4). Again, Italy is very high.

It is recommended that the command review this data and determine an appropriate set of numbers that can be used as a standard planning factor.

ORGANIZATION AND ANALYSIS OF QC CHECKS

Four kinds of data were assembled and analyzed in determining the QC checks planning factor. The first was the man-hours used at each site for this job. This data, obtained from each of the 5 sites, was plotted against the number of FTE receivers at each site; see figure A-4. While this data could be used to establish planning factor number 9, it is apparent that all stations are not performing the same QC checks as specified in ComNavTelComm instruction 2300.13, which was the second set of data examined.

The third set of data obtained (table III-11) consisted of measurements of various QC checks at Northwest:

- Total peak distortion (send) -- every 8 hours.
- D.C. loop current level -- once daily during the day watch.
- Composite levels -- every 2 hours.
- Composite data transmission levels -- once during midwatch.
- Frequency accuracy test -- every 4 hours on every frequency change (QSY) and daily on a new termination.

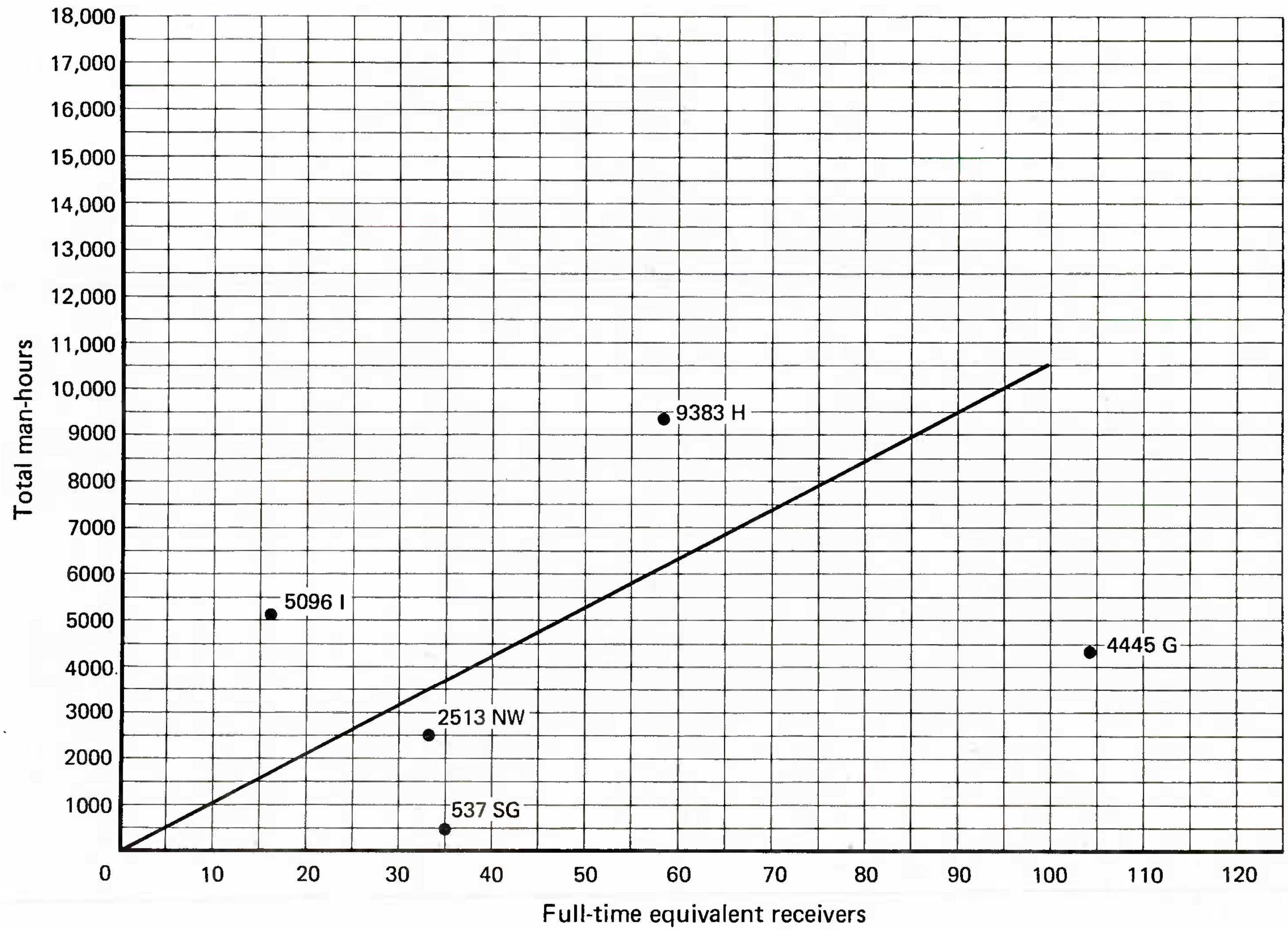

FIG. A-4: MAN-HOURS REQUIRED FOR QC CHECKS

Test No. 1

Using the DACV analyzer, measure the peak distortion on all RFCS terminations and broadcasts.

Basic Operation of DACV

- Plug D.C. loop patch cord in the low zin jack.
- Place the distortion select switch in the peak position.
- Set this input polarity switch in the 75 based position (normally).
- Transmission select switch in the space/mark position and 1.
- Input select switch in the 60 position.
- Plug the patch cord in the set jack of proper channel to measure the peak distortion.

Test No. 2

Using milliampmeters, the operator measures the D.C. loop in all channels of the RD and RE systems. He takes the measurements from the set jacks of both the send-and-receive sides of the system.

Test No. 3

Using the TTS-85CR transmission measuring set, the operator measures the composite levels in all channels being used to send data to control via the microwave system. All levels should read about 13 db. When an adjustment is necessary, he goes to the equipment supplying the input and makes the adjustment to the proper levels.

Test No. 4

Using the TTS-85CR, the operator measures the composite levels in the receive channels on the microwave system coming from control.

Test No. 5

Using the oscillograph and frequency counter installed, the operator selects various channels to be checked. He cuts into them one at a time. Using the audio patch cord, he plugs into the monitor jack of the audio board that is "normaled" through to the equipment.

When the transmitter being checked is on frequency, he should get a revolving circle on the scope. If it does not show one, he adjusts the audio oscillator until the circle appears, then informs control of the difference via the covered orderwire.

The time it takes to perform these tests is sometimes related to the number of channels or circuits the operator has to check. Both information items were therefore recorded, and measurements translated into time per channel to obtain a uniform sample.

Columns 2 and 3 of table III-11 list the sample size (number of measurements made) and the resulting estimated time for each test. Each time includes a confidence interval obtained for a 90-percent confidence level using a t-statistic.

Column 4 of table III-11 lists the average number of channels tested during the year at Northwest; this number coincided with the number of channels tested in the work samples taken. Column 5 lists how often each check is made each day. Column 6 lists the working time required each day, based on the QC check characteristics defined, and is equal to the product of columns 3 and 5. These times do not include walking time or the 17 percent PF&D factor.

Column 7 is the measured planning factor derived for each test (the average time required per channel) by dividing column 3 by column 4. A total of 334 man-hours are required for QC checks, according to these measurements. This does not compare well with the 2,513 man-hours previously given by Northwest, and reasons for this discrepancy should be explored.

A fourth set of data collected was a more detailed breakdown of the man-hours required as reported by each site; see table III-12. This data shows:

- Specific QC checks to be done at each site.
- How often these checks are to be done.
- Time required to do each check.

If the jobs were described the same way, it would be easier to compare sites; but the descriptions were not the same. Guam and Northwest came closest to supplying the information desired; it should be possible to compare that data with ComNavTelComm instruction 2300.13. The other 3 sites provided what was essentially an average unit time per circuit and the number of times each check was made. Not only could we not compare the differences in unit times reported, but there was no way to validate these times.

Based on the data available, it is recommended that the QC checks planning factor be derived using one of these approaches:

- Use the reported site requirements; this would be the least accurate (but easiest to implement method).

- Derive a command standard from the man-hours per FTE channel tested, based on the average man-hours per FTE channel for the set of channels reported on (eliminating any other data). Here, a channel is a receiver, microwave channel, or line.

- Compare the command instructions with the results of the work measurements shown in table III-11 and estimate a standard unit time per channel from the data shown and from experience; this would be an even more accurate method.

OTHER OPERATIONAL ACTIVITIES FACTORS

The man-hours required to perform other operational activities at a site were also gathered. These make up the additional planning factor (number 10), which is unique to each station. Examples of these activities are:

- Tuning/readjusting of equipment following a power outage.

- On-the-job training for both operations and maintenance.

While these activities are operational, their descriptions and times required are included in table IV-2 under support collateral duty jobs, since the data follows the same format.

A considerable amount of on-the-job training time for both operations and maintenance results in the completion of part of the operations and maintenance workload. Thus, if on-the-job training time were added to the O&M work load requirements, "double counting" of the same work load would result. Therefore, we must estimate the amount of on-the-job training man-hours that is the equivalent amount of productive O&M work load and not count these man-hours in on-the-job training requirements. The expression "equivalent amount" of productive O&M work load is used, since the trainee may take more man-hours than the average trained person to do the same job.

To illustrate this point, consider Italy's on-the-job training needs at its transmitter site. New radio men and electronic technicians are each trained on off-the-air circuits for 60 man-hours per year. Each is also assigned for 176 man-hours to on-the-air circuits. However, it can be assumed that this productive work is done at a lower efficiency than by trained personnel (assume 70 percent efficiency). Thus, $[60 + (0.30)(176)]/(60 + 176)$ or 48 percent of this part of the on-the-job training was nonproductive and should be counted.

Also, according to Op-124, on-the-job training requirements must be based on raising the capabilities of those unqualified for the job -- for example, training for specific equipment. The requirements cannot be based on assigning persons with lower grades or incorrect Naval Enlisted Codes.

SUPPORT MANPOWER REQUIREMENTS

There are three types of support work loads:

- Support primary duty work load -- that work done by nonsupervisory personnel whose primary duty is to support the site, as opposed to "hands on" operations and maintenance services, as well as any O&M work not analyzed in detail during this study.
- Support collateral duty work load -- that work done by nonsupervisory personnel in addition to their primary duties.
- Supervisory work load -- that work done by nondirect labor supervisors.

Support Primary Duty Factors

Table IV-1 is a list of all support primary duty billets filled at the 5 sites and not analyzed in detail during this study. This list constitutes planning factor 11. Column 1 gives the position titles from the master billet list, and columns 2 through 5 show the titles that are used for filled billets at all the sites. If the site uses the same title as shown in column 1, "same" is indicated. Support billets that do not correspond to a billet from the master list are preceded by the letter used to identify the position submitted by that site.

After each site's billet title is the number of persons now in that billet (when that number is more than one). Also indicated is the percentage of time (when under 100 percent) that the person is involved in direct labor. Part of this direct labor time may be spent in collateral duty support jobs (see the next section).

Only those support billets from the master list that are filled at one or more of the sites are listed in column 1. Most of these billets are organizationally located in the support divisions of each site. Those that are in operations or maintenance at a given site are so designated.

No work analysis was made of these support primary duty jobs. However, to systematically assign these support billets, the command must analyze table IV-1 and determine:

- Whether the work function is required at each site that has the billet listed. It must also be confirmed that the support activity cannot be done by the station's public works department or other Navy support activities because of the site's distance from a regular Navy base. (Appendix B of reference A-3 contains the set of tasks relating to the master billets listed.)

- How many full-time equivalent workers are required for this work function at each site. This depends on the size and layout of each site and whether the function is (or can be) provided to any extent by the main station or by other Navy support services (such as regional medical services).

This way, judgment has to be used in allocating these billets.

Support Collateral Duty Factors

Table IV-2 is a composite of support collateral duty jobs now being done at the 4 sites and constitutes planning factor 12. Column 1 briefly describes the type of job involved, such as cleaning. This is followed by a list of support jobs, by number, as a cross reference to the data submitted by each site, and the total man-hours per year required to do each job clustered in that job category. A more detailed description of those collateral support jobs appears in table IV-3, including the method for calculating support.

Columns 1, 2, and 3 of the table describe the job and the work unit measure. Column 4 is the hours needed by one man to complete one work unit. Column 5 is the number of work units done per week by all the men involved; it is thus the product of the number of times each man does a work unit per week and the number of men doing them simultaneously. Column 6 is the total man-hours per year required for the job, and consists of 52 times columns 4 and 5.

In some cases, only the total man-hours (column 6) was given by the site; columns 4 and 5 were missing. In other cases, the product of 52 times columns 4 and 5 does not correspond to column 6. This is indicated by a question mark in column 1. It is important that, during its review of this report, each site make the necessary additions and corrections to its data so that ComNavTelComm can review these lists and decide:

- Which collateral jobs must be done, and how often.

- Which jobs are really part of service diversions or off-hours' activities and not counted as productive work.

- How many man-hours are needed for each job. Op-124 stresses that requirements can include only working time; for "on-call" duty, only actual working time can be counted.

- Who should do the work -- operational or maintenance (or both), primary duty, or outside personnel.

As described elsewhere in this handbook, requirements for collateral support stated by the sites absorb a substantial part of the division's total direct labor. Further analysis and validation of these requirements by the command is therefore very important.

Supervisory Factors

Another support planning factor is the supervisory overhead rate (planning factor 13), which is the total number of full-time equivalent supervisors divided by the full-time equivalent nonsupervisory (now on board) personnel in the organizational unit being analyzed.

This calculation was made for each of these organizational components:

- Total site overhead.
- General management (percent of total direct labor).
- Watch operations (percent of total direct labor, including maintenance personnel but excluding ship-to-shore personnel on watch).
- Total operations division (percent of total watch and day operations personnel).
- Maintenance division (percent of maintenance personnel, excluding those on watch).

The data shown in table I-3 is organized into the above components and arranged into total full-time equivalent direct labor and supervisors and the calculated supervisory overhead factors within these components. The results of these calculations were taken out of table I-3 and summarized in table IV-4. The most important set of numbers is the overall site supervisory overhead ratio, which varies from 15 percent at Honolulu to 68 percent at Italy. There is no Navy requirement for this ratio.

Further analysis of table IV-4 shows that there are significant differences in component overhead rates, both among and within sites; some of these rates are quite high. Discussions at transmitter and receiver sites regarding the division of work between the supervisor and workers revealed that:

- The supervisor works side by side with the workers doing some of the operating work load previously described, particularly during busy hours.

- The only operating work load not listed and done by the supervisor consists of on-the-job training; spot-checking the quality of work of his personnel; being available as the senior person for any problem that arises during the watch; and evaluating personnel.

- While the supervisor has overall responsibility for proper operations during the watch, he delegates this responsibility among all watch personnel. Thus, the only man-hours this ultimate responsibility really costs is in performing the tasks described in the preceding item.

Since the overhead ratios calculated in table IV-4 were obtained from estimates based on job titles and not on an analysis of work function, their accuracy is doubtful. Experience indicates that the overhead ratios are probably smaller than those shown in the table. A satisfactory estimate of the supervisory overhead planning factor may be obtained in one of these ways:

- For supervisors who do not perform direct labor, determine their work functions to substantiate the need for a full-time position with respect to the size of site and the number of direct-labor personnel. For example, large sites might require an assistant officer in charge; small sites might require only a chief-in-charge.

- For working supervisors, estimate the amount of supervisory tasks not already being counted under direct labor (or listed among the support jobs) and estimate the time required to do these. Recalculate the supervisory overhead ratio as before. Excluding the planning function, the overhead ratio probably should be 5 to 15 percent.

OP-124 WORK STANDARDS

Op-124 work standards are described in this section.

PF&D Factor (Planning Factor 14)

Op-124 allows a PF&D factor of 17 percent of productive work time for blue-collar workers for all work stoppages, including personal relief. When deriving the total man-hours, it is therefore necessary to determine whether the measure consisted of only productive work time (such as would be obtained through work samples), or whether the time also included various work stoppages -- such as coffee breaks -- as in the corrective maintenance times recorded.

Standard Work Week (Planning Factor 15)

Standard Work Week for Military Personnel Ashore

The standard work week (reference 1 of the main text) for military personnel at CONUS activities and overseas bases where dependents are authorized is 40 hours. Included in this work week is an allowance for service diversions; this allowance provides for quarters, sick call, personal business, etc. The 40-hour standard work week for military consists of:

	Hours per week
Service diversion training	4.83
Leave	1.85
Holidays	1.38
Time available for work	31.94
Total	40.00

The standard work week for military ashore at CONUS activities and overseas where dependents are not authorized should be computed this way:

	Time available for work	Nonavailable hours	Total
Continuous shift watchstander	60.0	6.0	66.0
Duty status watch-stander	61.7	6.0	67.7
Nonwatchstander	51.0	6.0	57.0

The work week for military firefighters and other watchstanding personnel using the 72-hour work week is:

	Hours per week
Service diversions, training	4.83
Leave	5.07
Available for work	62.10
Total	72.00

Standard Work Week for Civilians

The standard work week for civilians is 40 hours. Training includes classroom lectures, on-the-job instructions, and safety indoctrination. Diversions include minor unavoidable delays such as fire drills, chest X-rays, voting, blood donations, etc. The 40-hour standard work week for civilians consists of:

	Hours per week
Leave	4.60
Holidays	1.38
Training	0.22
Diversions	0.44
Time available for work	33.38
Total	40.00

The standard work week for civilian supervisory fire-fighters using the 56-hour work week is:

	Hours per week
Leave	6.37
Training	0.20
Diversions	0.44
Available for work	48.99
Total	56.00

The standard work week for civilian firefighters using the 72-hour work week is:

	Hours per week
Leave	8.21
Training	0.20
Diversions	0.44
Available for work	63.15
Total	72.00

MANPOWER REQUIREMENTS AND UTILIZATION ANALYSIS OF O&M PERSONNEL

The main objectives of this analysis were to:

- Compile relative manpower requirements for each work category performed by O&M personnel. This would be useful in sensitivity analyses, since the impact of any approximation on total error could be more readily evaluated.
- Provide a first calculation of the billets required based on the work loads and make a first step in comparing these billets with personnel on board.
- Perform a "check and balance" on some of the data provided by the sites.

Man-Hours Required

Table V-1 gives the man-hours required for each job as defined. This calculation was made two ways: in terms of the stated site requirements (lower bound), and the Navy requirement (upper bound).

For example, in terms of the Navy requirement, the Honolulu workload requirements are in these proportions (as percentages, rounded off):

Maintenance by technicians	
CM:	17
PM:	17
	34
Collateral duty support:	18
Operations	
PM:	0
Main receiver operations:	48
Other:	0
	48

Billets Required and Utilization

The next set of calculations involved converting the man-hours required in each category into direct-labor billets; this was done by dividing by 1,661 man-hours productive time per billet per year. (This is for military personnel only. A more accurate calculation would consider the military-to-civilian mix. This approach does not include any limitations, such as having a minimum of 2 men per watch section.) This was then compared with the total number of direct-labor personnel now on board in each work category. A personnel utilization calculation was then made by taking the ratio of billets required to current manning. These results (see table V-2) indicate the average proportion of time that current manning would spend working in these categories:

- Watch direct-labor personnel doing operations and PM (excluding the ship-to-shore functions).

- Maintenance direct-labor personnel doing CM and technician PM.

- Total O&M direct-labor personnel doing collateral duty support.

- Total O&M direct-labor personnel doing all required work.

As discussed elsewhere in this handbook, some of the supervisory percentages seem too high. Therefore, a recalculation of personnel utilization was made in tables V-1 and -2, based on total current manning in each category and including both direct-labor and supervisory personnel. While this total unit utilization is less than the first case (since total personnel is the denominator of the ratio), it is probably a more realistic number than the one obtained from the first calculation. Also, this number can be extrapolated to the direct-labor force by subtracting perhaps 10 percent for supervision.

Low utilization merely indicates that there are too many billets assigned. Other constraints -- such as assigning a minimum of 2 billets per watch at each location -- may be the determining factor in billet allocation. This is especially true for smaller sites, such as receiver sites, and particularly at Italy. But Italy improved its utilization by assigning one operator and one maintenance man to each shift, rather than 2 operators.

REFERENCES

A-1. Navy Manpower Shore Survey Team, Norfolk #2, Navy Manpower and Material Analysis Center, Atlantic, "Shore Manning Document, NCS Washington, Cheltenham Survey Dates: 12 Sep-13 Oct 1972," Unclassified; "NCS San Francisco Survey Dates: 7 Nov-1 Dec 1972," Unclassified

A-2. OpNav 12P-4, "Guide to the Preparation of Ship Manning Document," Unclassified 1971

A-3. Center for Naval Analyses Memorandum, (CNA)1897-74.10, "NAVCOMMSTA Manpower Planning Analysis, Receiver Site," Unclassified 11 Dec 1974

APPENDIX A

ANNEX 1

DATA

TABLE I-1

RECEIVER SITE CURRENT BILLET TITLES USED

(1) Master Billet/Position Title	(2) Honolulu	(3) Guam	(4) Northwest	(5) Sugar Grove	(6) Italy
Receivers Division Office					
1. Receiver Division Officer	same	same	Receivers/SatComm Officer		RCVRS/SatComm Division Officer RCVRS/SatComm Division Chief(A)
2. Receiver Maintenance Officer		same Assistant Rcvrs Maint officer (A-maint)	Asst. Receivers/ SatComm officer (A)		
3. Admin/Supply Clerk	same	Admin/Yeoman (covers 3 and 4)	Admin. Asst.	Electronics Div. Supply Petty Officer	
4. Yeoman	same		Supply clerk		
		Building maint.(A) Operations Chief CMS custodian Division career counselor	(B)		
Receivers Branch					
5. CPO in Charge	Operations/ Trfc. Analyst(A) Comtac/CMS/RM training (B)	same	Receiver operations and division training LPO	QPS CPO	Leading Petty Officer
6. Maintenance Chief	same	same	Maintenance LPO	Maint. Chief	PO in charge maintenance
7. Crypto Equipment Maint.				Crypto Repair	
8. Elect. Maintenance	CSE Maintenance/ ET training (C) Receiver Maint. (D)				
9. Diversity Receivers Maintenance			Receiver Operations Maint. Tech.		
10. Ancillary Equip. Maint.	same				
11. Fleet SSB Maintenance	same				

TABLE I-1 (Cont'd)

	(1) Master Billet/Position Title	(2) Honolulu	(3) Guam	(4) Northwest	(5) Sugar Grove	(6) Italy
12.	Maintenance Watch		same			
13.	Leader Elec. Mechanic	same			Electronic Mech.	
14.	Electronics Mechanic	same		same	TTY Electronic Mech. (H)	
15.	Watch Chief	same		Chief-of-the watch	Watch Oper. (B)	
			Ship-shore Chief TACAMO/ABNCP/VIP ACFT Coordinator } (E)			
16.	Watch Suprvr.	same	Receiver Deck Suprvr/operator	Receiver Operations/ Optr.	Watch Supvr.	same
			Receiver Deck Operator (D)	Receiver Operator (H)		
17.	Primary Ship/Shore Operator	same	same			
18.	Orestes Air/Ground Operator		Primary Ship-shore operator			
19.	S/C Ship/Shore Operator					
20.	M/C Ship/Shore Operator	same				
21.	M/C Pt. to Pt. Operator	same				Receiver's operator
22.	SAR ASW Operator					
23.	CW Ship/Shore Operator		same		Training P.O.	
24.	Quality Control					
25.	Training P.O.					
				Microwave Elect. Tech (L)		
			Crypto equipment, asst. maint. chief (B-maint)	Crypto Maint. Tech. (J)		
			*Billet not included in analysis; assume not filled			

TABLE I-1 (Cont'd)

(1) Master Billet/Position Title	(2) Honolulu	(3) Guam	(4) Northwest	(5) Sugar Grove	(6) Italy
	CW Operator (E)			Rcvr. Desk Supr(C)	
		Supply clerk Receiver desk chief Division training P.O. Recreation committee member	(C)		
		ECC operator (F)		Traffic Ckr(A)	
		Tape cutter (G)		Test Equip(D) Petty Officer	
		Traffic checker (H)		Duty ET Watch Standers (E)	
		Proof reader (I)		Day Working ET (F)	
				Communication Specialist(G)	
				Console Oper(I)	

BILLET DESCRIPTIONS PROVIDED BY RECEIVER SITES

HONOLULU

Due to the vacated billet of Division Officer, the CPO in Charge (billet 5) also has the responsibilities of Division Officer.

Watch Maint. Personnel are also responsible for Fleet SSB Maint.(Billet 11)

Watch Supervisor also performs the Duties of Orestes Air/Ground Operator. He also assists with other Receiver Site Operations as necessary.

CW Operator Monitors Tacamo and CinCPac ABNCP down link. U.S.C.G. has responsiblity for all Secondary Ship/Shore in Hawaiian area.

GUAM

Tasks that are actually performed in addition to those listed for that billet

BILLET

2-- Recvrs Maint Officer-- 18, 19, 24, 20, 23, 32, 37, 104, 20,23,32,37,104, 47, 66, 29[1]

Asst Keyrs Maint Officer --18, 19, 24, 20, 23, 22, 37, 104, 47, 66, 25, 29

6--Maint Chief -- 105, 106

Crypto, Equip Maint--Asst Maint Chief--81-82-83-56

14--Elect Mechanic--74-75-77(OJT)

[1]See reference A-2 for a description of these tasks.

ITALY

LPO RCVR site serves as site supply Petty Officer.

RCVRS Petty Officer in charge of maintenance was supervisor of the watch for four months during reporting period.

Satellite Operations Chief serves as site Supply Petty Officer.

SATCOMM Special Projects PO initiates and supervises all work orders for site improvements, such as patch panel and equipment reconfiguration and interface. Also plans for and supervises required site support work such as incinerator facility, electrical and plumbing work and site beautification.

One ET2 functions as supervisor/operator and also performs maintenance functions for his watch.

Magnavox Tech Rep on board for repair and training on URC-61 (Modem). Also advisor to OIC.

Microwave Specialist onboard for repair and training of techs on microwave systems at NavCommSta Italy and throughout Europe.

TABLE I-1 (Cont'd)

RECEIVER SITE (SatComm)

Master Billet/Position Title	Honolulu	Guam	Norfolk	Italy
1. Receiver Division Officer			Receivers/SatComm Officer	Rcvrs./SatComm Division Officer
				Rcvrs /Satcomm Division Chief (A)
			Asst. Receivers/Sat-Comm Officer (A)	
			SatComm Operations Chief (C)	SatComm Operations Chief (B)
				SatComm Maintenance Chief (C)
			SatComm Operations LPO (D)	
			SatComm Operations Maint LPO (E)	
				SatComm Special Projects PO (D)
				SatComm Supvr/Operator (E)
			SatComm/Operator (F)	
			SatComm Operations Maint. Tech. (G)	
				SatComm Operator/Technician (F)
			SatComm Operating Gen/AC Maint. (K)	

TABLE I-2

MANNING DISTRIBUTION

	Operations					Maintenance					Support					Total				
	Hono	Guam	Sugar Grove	North-west	Italy	Hono	Guam	Sugar Grove	North-west	Italy	Hono	Guam	Sugar Grove	North-west	Italy	Hono	Guam	Sugar Grove	North-west	Italy
Direct labor																				
Military	7.6	6.1	4	8	6.18	9.05	9.05	12.675	5.8	1.22	2	3.15	0	2.5	0.32	18.65	18.3	16.675	16.3	7.72
Civilian	0	0	0	0	0	2.1	0.9	2.95	1	0	0	0	0	0	0	2.1	0.9	2.95	1	0
Total	7.6	6.1	4	8	6.18	11.15	9.95	15.625	6.8	1.22	2	3.15	0	2.5	0.32	20.75	19.2	19.625	17.3	7.72
General management (all military)																1	2	-	2	2
Supervisors (number)																				
Military	2.4	2.4	0	0	1.65	0.95	2.95	1.325	0.2	1.55	0	1.35	0	0.5	0.08	4.35[a]	8.7[a]	1.325	2.7[a]	5.28[a]
Civilian	0	0	0	0	0.	0.9	0.1	1.05	0	0	0	0	0	0	0	0.9	0.1	1.05	0	0
Total	2.4	2.4	0	0	1.65	1.85	3.05	2.375	0.2	1.55	0	1.35	0	0.5	0.08	5.25[a]	8.8[a]	2.375	2.7[a]	5.28[a]
All																				
Military																23	27	18	19	13
Civilian																3	1	4	1	0
Total																26	28	22	20	13

[a]Includes general management.

TABLE I-3

MANNING DISTRIBUTION AND SUPERVISORY OVERHEAD RATES

	Operations					Maintenance					Support					Total				
	Hono	Guam	Sugar Grove	North-west	Italy	Hono	Guam	Sugar Grove	North-west	Italy	Hono	Guam	Sugar Grove	North-west	Italy	Hono	Guam	Sugar Grove	North-west	Italy
Direct labor																				
Day	1.0	0.1	0	0	0.16	6.15	2.35	11.625	6.8	0.13	2	3.15	0	2.5	0.32	9.15	5.6	11.625	9.3	.61
Watch	6.6	6	4	8	6.02	5	7.6	4	0	1.09	0	0	0	0	0	11.6	13.6	8.0	8	7.11
Total	7.6	6.1	4	8	6.18	11.15	9.95	15.625	6.8	1.22	2	3.15	0	2.5	0.32	20.75	19.2	19.625	17.3	7.72
General management																1	2	-	2	2
Supervisors (number)																				
Day	1.0	0.4	0	0	0.61	1.85	2.65	2.375	0.2	0.42	0	1.35	0	0.5	0.08	3.85[a]	6.4[a]	2.375	2.7[a]	3.11[a]
Watch	1.4	2	0	0	1.04	0	0.4	0	0	1.13	0	0	0	0	0	1.4	2.4	0	0	2.17
Total	2.4	2.4	0	0	1.65	1.85	3.05	2.375	0.2	1.55	0	1.35	0	0.5	0.08	5.25[a]	8.8[a]	2.375	2.7[a]	5.28[a]
Supervisors (percent)																				
Day	100.0	400.0	b	b	381.3	30.1	112.8	20.4	2.9	3.2	0	42.9	b	20.0	25.0	42.1	114.3	20.4	29.0	509.8
Watch	21.2	33.3	0	0	17.3	0	5.3	0	b	103.7	b	b	b	b	b	12.1	17.6	0	0	30.5
Total	31.6	39.3	0	0	26.7	16.6	30.7	15.2	2.9	127.0	0	42.9	b	20.0	25.0	25.3	45.8	12.1	15.6	68.4
All																				
Day																13	12	14	12	3.72
Watch																13	16	8	8	9.28
Total																26	28	22	20	13

[a]Includes general management.

[b]No direct labor or supervisors.

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) PLANNED MAINT. STD. BY MAINT. PERS.	(8) PLANNED MAINT. STD. TOTAL	(9) REQUIREMENT PM	(10) REQUIREMENT CM
1	-								
	DC PATCH PANEL								
	GUAM	22	6	.6	-	-	-	-	.6
2	-								
	DAILY ANTENNA CHECKS								
	GUAM	23	-	48.1	-	-	-	43.6	4.5
3	-								
	ANTENNA SWITCH								
	GUAM	34	10	2.7	-	-	-	-	2.7
4	-								
	SPEAKER PANELS								
	GUAM	38	25	.6	-	-	-	-	.6
5	ANCILLARY EQUIP								
	-								
	SUGAR GROVE	20	-	-	-	-	-	-	-
6	NON REPAIRABLE TEST EQUIP								
	TEST EQUIP								
	NORTHWEST	36	175	-	-	-	-	-	-
7	REPAIRABLE TEST EQUIP								
	TEST EQUIP								
	NORTHWEST	35	8	2.5	-	1.2	1.2	1.2	1.3
8	RF,AF,ANT,DC PATCH PANELS								
	PATCH PANELS								
	NORTHWEST	34	50	6.9	5.5	-	5.5	5.9	1
9	R.F. SWITCH GEAR ANT.								
	-								
	SUGAR GROVE	21	-	-	-	-	-	-	-
10	TEST EQUIP								
	-								
	HONO	24	-	-	-	-	-	-	-

CONTINUED ON NEXT PAGE

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) BY MAINT. PERS.	(8) TOTAL	(9) REQUIREMENT PM	(10) CM
10	TEST EQUIP	(CONTINUED)							
	SUGAR GROVE	22	156	3.9	0	2	2	-	-
11	AM-2123								
	DISTRIBUTION AMPLIFIER								
	HONO	1	1	.4	-	.4	.4	.4	0
12	AM-413								
	AUDIO AMPLIFIER								
	HONO	2	12	.6	-	.4	.4	.4	.2
	GUAM	2	5	2.6	-	1.6	1.6	.8	1.8
	CODE 04 STD						.4		
13	AM-413/6								
	AUDIO AMP								
	NORTHWEST	29	3	10.8	-	4.8	4.8	4.8	6
	CODE 04 STD						.4		
14	AM/BRR-3								
	VLF RCVR								
	HONO	3	4	11.3	-	6.8	6.8	10	1.3
15	AN/ARC-161								
	TRANSCEIVER								
	GUAM	28	2	-	-	-	-	-	-
16	AN/BRR-3								
	RECEIVER								
	GUAM	17	2	9.2	-	6.2	6.2	6.7	2.5
17	AN/FCC-17								
	MICROWAVE								
	ITALY	24	1	-	-	-	-	-	-
	CODE 04 STD						14		
18	AN/FCC-38								
	SYSTEM								
	GUAM	1	2	69.5	10.4	7.5	17.9	34.9	31

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TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) PLANNED MAINT. STD. BY MAINT. PERS.	(8) PLANNED MAINT. STD. TOTAL	(9) REQUIREMENT PM	(10) REQUIREMENT CM
18	AN/FCC-38		(CONTINUED)						
	CODE 04 STD						17.9		
19	AN/FCC-66								
	VFCT								
	ITALY	9	1	12.4	-	17.9	17.9	11.4	1
	CODE 04 STD						17.9		
20	AN/FCC-67								
	TELEGRAPH TERMINAL								
	HONO	4	2	20.1	-	18.4	18.4	16	4.1
	GUAM	25	1	-	-	125.4	125.4	-	-
	NORTHWEST	22	2	23.9	-	21.4	21.4	21.4	2.5
	CODE 04 STD						15.9		
21	AN/FCC-69								
	TELETYPE VFCT TERMINAL								
	NORTHWEST	23	2	15.7	-	13.2	13.2	13.2	2.5
	CODE 04 STD						10.7		
22	AN/FCC-70								
	SYSTEM								
	GUAM	9	2	27.8	236.6	43.4	280	21.6	4.2
	NORTHWEST	29	2	15.1	-	12.6	12.6	12.6	2.5
	CODE 04 STD						12.6		
23	AN/FRC-100								
	-								
	SUGAR GROVE	23	1	115	0	112	112	115	0
24	AN/FRC-72								
	RECEIVER								
	GUAM	27	2	32.1	10.4	15.6	26	19.1	12.9
25	AN/FRC-84								
	MICROWAVE								
	ITALY	25	2	-	-	-	-	-	-

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TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) BY MAINT. PERS.	(8) TOTAL	(9) REQUIREMENT PM	(10) CM
25	AN/FRC-84		(CONTINUED)						
	CODE 04 STD						36.8		
26	AN/FRR-59/URR								
	HF RCVR								
	ITALY	2	10	29.4+1	-	19	19	19.1	10.4
	CODE 04 STD						19		
27	AN/FRR-60								
	HF RCVR								
	HONO	5	8	63.0	-	60	60	52.8	10.2
	SUGAR GROVE	1	31	159.3	0	27.8	27.8	78.4	80.8
	ITALY	8	.08	-	-	-	-	-	-
28	AN/FRR-60/DDR-5C								
	RECEIVER(HF)								
	NORTHWEST	6	2	216	-	96	96	96	120
29	AN/FRR-60(V)								
	RECEIVER								
	GUAM	14	39	34.8	10.4	18.6	29	26.3	8.6
	NORTHWEST	3	2	216	-	96	96	96	120
	SCA STD			350					
	CODE 04 STD						26		
30	AN/FRR-60V1								
	RECEIVER (HF)								
	NORTHWEST	4	6	168	-	48	48	48	120
31	AN/FRR-60V12								
	RECEIVER (HF)								
	NORTHWEST	5	1	216	-	96	96	96	120
32	AN/FRR-73								
	HF RCVR								
	HONO	6	2	72.2	-	99.2	99.2	68.4	3.8
	NORTHWEST	7	4	264	-	144	144	144	120

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TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) BY MAINT. PERS.	(8) TOTAL	(9) REQUIREMENT PM	(10) CM
32	AN/FRR-73		(CONTINUED)						
	CODE 04 STD						51.6		
33	AN/FRR-73/DDR-5C								
	RECEIVER (HF)								
	NORTHWEST	8	2	264	-	144	144	144	120
34	AN/FRR-73S MSA UNIT								
	MULTIPLE SIDE-BAND ADAPTOR								
	NORTHWEST	9	6	-	-	-	-	-	-
35	AN/FTA-15								
	VOICE TERMINAL								
	NORTHWEST	28	2	24.6	-	24.6	24.6	4.6	20
	CODE 04 STD						5.6		
36	AN/GRC-169								
	MICROWAVE TRANSCEIVER								
	NORTHWEST	30	1	122	-	22	22	22	100
37	AN/GSA-33								
	VOICE AMP								
	NORTHWEST	32	1	5.4	-	.4	.4	.4	5
	ITALY	10	5	.4	-	.4	.4	.4	0
	CODE 04 STD						.4		
38	AN/SRR-11								
	VLF/LF RCVR								
	ITALY	5	3	91.7	-	-	-	-	91.6
39	AN/SRR-19								
	VLF RCVR								
	HONO	7	1	13.5	-	11.4	11.4	13.5	0
	GUAM	4	5	12.2	3.4	5	8.4	11.2	.9
	CODE 04 STD						11.4		

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) PLANNED MAINT. STD. BY MAINT. PERS.	(8) PLANNED MAINT. STD. TOTAL	(9) REQUIREMENT PM	(10) REQUIREMENT CM
40	AN/SRR-19B								
	RECEIVER (LF)								
	NORTHWEST	10	2	14.4	3.4	4	7.4	9.4	5
41	AN/UCC-4								
	MICROWAVE MUX/TERMINAL								
	NORTHWEST	31	1	114	-	14	14	114	100
42	AN/UGA-4								
	AUDIO AMP								
	ITALY	12	2	3.6	-	2.4	2.4	1.8	0
	CODE 04 STD						2.4		
43	AN/UGC-20								
	-								
	SUGAR GROVE	15	13	57.4	0	28.2	28.2	32.8	14.6
44	AN/UGC-25								
	-								
	SUGAR GROVE	16	3	40.5	0	28.2	28.2	32.5	8.0
45	AN/UGC-25X								
	TELETYPEWRITER								
	ITALY	28	1	-	-	-	-	-	-
	CODE 04 STD						28		
46	AN/UGC-48								
	-								
	SUGAR GROVE	17	1	68	0	48	48	50	18.0
47	AN/UGC-6								
	-								
	SUGAR GROVE	13	1	73	0	48	48	50	23
	CODE 04 STD						54		
48	AN/UGC-6K								
	-								
	SUGAR GROVE	14	1	80	0	48	48	50	32

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TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) PLANNED MAINT. STD. BY MAINT. PERS.	(8) PLANNED MAINT. STD. TOTAL	(9) REQUIREMENT PM	(10) REQUIREMENT CM
48	AN/UGC-6K		(CONTINUED)						
	CODE 04 STD						54		
49	AN/UGR-9								
	-								
	SUGAR GROVE	18	11	53.6	0	28.2	28.2	30.9	12.7
50	AN/UPR-2								
	IOHOSPERIC SOUNDER								
	HONO	8	1	50.4	-	37.2	37.2	50.4	0
51	AN/URA-17								
	COMPARATOR CONVERTER								
	HONO	9	21	16.1	-	18.4	18.4	14.4	1.7
	SUGAR GROVE	19	60	13	0	3.6	3.6	10	3.0
	NORTHWEST	17	2	28.4	15.6	8.4	24	8.4	20
	ITALY	4	7	27.1	-	24	24	22.8	4.3
	CODE 04 STD						24		
52	AN/URA-17B								
	TTY COMPARATOR CONVERTER								
	NORTHWEST	18	4	28.8	15.6	8.4	24	8.8	20
	CODE 04 STD						24		
53	AN/URA-17C								
	TTY COMPARATOR CONVERTER								
	NORTHWEST	19	8	28.4	15.5	8.4	24	8.4	20
	CODE 04 STD						24		
54	AN/URA-8								
	FSK CONV								
	ITALY	11	.4	22.5	-	-	-	-	22.5
55	AN/URQ-10								
	FREQUENCY STANDARD								
	HONO	10	1	3.6	-	3.6	3.6	3.6	0
	ITALY	30	1	-	-	-	-	-	-

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) PLANNED MAINT. STD. BY MAINT. PERS.	(8) PLANNED MAINT. STD. TOTAL	(9) REQUIREMENT PM	(10) REQUIREMENT CM
56	AN/URQ-10A								
	RF OSCILLATOR								
	HONO	11	1	3.6	-	3.6	3.6	3.6	0
	NORTHWEST	16	1	4.2	-	4.2	4.2	4.2	0
57	AN/URR-38								
	RECEIVER (LF)								
	NORTHWEST	11	3	5.5	1.6	.6	2.2	2.2	3.3
58	AN/URR-35								
	RECEIVER (UHF)								
	NORTHWEST	13	1	16.6	3	3.6	6.6	6.6	10
	CODE 04 STD						13		
59	AN/WRR-3								
	VLF/LF RCVR								
	ITALY	6	1.7	17.5	-	2.2	2.2	2.2	15.3
60	AN/WRR-3B								
	RECEIVER								
	GUAM	18	3	17.6	7	-	7	3.1	14.5
	CODE 04 STD						100.8		
61	CCL/FACILITY								
	MDF/IDF								
	HONO	25	1	300	-	0	0	300	-
62	CCLX-LFD-1								
	LF DISTRIBUTION UNIT								
	HONO	12	5	.1	-	.1	.1	.1	0
63	CCLX-LRRA								
	RECEIVER (LF)								
	NORTHWEST	14	2	13.8	-	17.6	17.6	8.8	5
64	CU-1138								
	REMOTE UNITS								
	GUAM	29	4	.5	-	-	-	-	.5

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) BY MAINT. PERS.	(8) TOTAL	(9) REQUIREMENT PM	(10) CM
65	CU-1382								
	MULTI-COUPLER								
	HONO	13	39	1.1	-	.4	.4	.6	.5
	ITALY	13	5	.7	-	.4	.4	.4	.3
66	CU-1382A,B,D								
	MULTI-COUPLER								
	GUAM	8	40	1.2	-	1.6	1.6	.9	.3
67	CU-1382A/FRR								
	ANTENNA MULTI-COUPLER								
	NORTHWEST	20	2	6.4	-	.4	.4	.4	6
	CODE 04 STD						.4		
68	CU-1382D/FRR								
	ANTENNA MULTI-COUPLER								
	NORTHWEST	21	10	6.4	-	.4	.4	.4	6
69	CU-168								
	MULTI-COUPLER								
	GUAM	7	14	4.8	-	4.8	4.8	4.5	.3
	ITALY	14	1	4.8	-	4.8	4.8	4.8	0
70	CU-1931								
	MULTI-COUPLER								
	HONO	14	2	.6	-	.4	.4	.6	0
	GUAM	35	2	12	-	-	-	-	12
71	CV-2124A								
	MORSE/TTY CONVERTER								
	ITALY	15	2	-	-	-	-	-	-
72	CV-2124A/U								
	CW TO TTY CONVERTER								
	GUAM	5	2	25.4	-	-	-	-	25.4

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) BY MAINT. PERS.	(8) TOTAL	(9) REQUIREMENT PM	(10) CM
73	CV-483C/URA-17								
	CONVERTOR								
	GUAM	11	31	19.2	15.6	2.4	18	18.5	.4
74	CV-483/URA-17								
	CONVERTOR								
	GUAM	10	27	18.9	15.3	2.8	18.1	18.1	.7
75	DDC								
	DIGITAL DATA CONVERTOR								
	GUAM	32	1	2.3	-	-	-	-	2.3
76	DT-325A								
	AUDIO DC CONVERTOR								
	GUAM	31	1	2.1	-	-	-	-	2.1
	ITALY	16	2	-	-	-	-	-	-
77	GRR-3								
	VLF/LF RCVR								
	ITALY	7	2	6.5	-	6.2	6.2	6.2	.3
78	HI 69/U								
	HANDSET								
	GUAM	21	3	.8	-	-	-	-	.8
79	LFD 1								
	MULTI-COUPLERS								
	GUAM	36	2	-	-	-	-	-	-
80	LS-169G								
	SPEAKER								
	ITALY	22	2	-	-	-	-	-	-
81	LS-474								
	SPEAKER								
	ITALY	23	2	-	-	-	-	-	-

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) PLANNED MAINT. STD. BY MAINT. PERS.	(8) PLANNED MAINT. STD. TOTAL	(9) REQUIREMENT PM	(10) REQUIREMENT CM
82	MC-1002								
	MULTI-COUPLER								
	HONO	15	23	.7	-	1.5	1.5	.6	.1
83	PP-447								
	DC POWER SUPPLY								
	ITALY	17	2	-	-	-	-	-	-
84	PP-4473/UG								
	POWER SUPPLY								
	GUAM	19	2	3.4	-	-	-	2.4	1
	NORTHWEST	33	2	17.5	-	12	12	12	2.5
85	PP-652/FG								
	POWER SUPPLY								
	HONO	16	3	1.6	-	1.1	1.1	1.5	0
86	PW-300								
	-								
	SUGAR GROVE	5	16	.8	0	0	0	0	0.8
87	R1051								
	HF RCVR								
	HONO	17	71	26	-	32	32	23.8	2.2
	SUGAR GROVE	6	50	26.5	10.4	10.6	21	23.5	3.0
88	R1051B/URR								
	RECEIVER								
	GUAM	13	70	16.6	10.4	8.4	18.8	14.5	2.2
	NORTHWEST	1	3	40.1	10.8	5.3	16.1	16.1	24
	CODE 04 STD						6.4		
89	R1051D/URR								
	RECEIVER								
	GUAM	12	41	35.2	10.4	11.6	22	31.5	3.7
	NORTHWEST	2	24	45	10.8	10.6	21.4	21	24

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) BY MAINT. PERS.	(8) TOTAL	(9) REQUIREMENT PM	(10) CM
90	R-1051/URR								
	RECEIVER								
	GUAM	24	1	4.8	-	-	-	-	4.8
	ITALY	1	18	20.5	-	20.1	20.1	17.2	3.3
91	R-1401								
	VLF RCVR								
	HONO	18	3	14.4	-	10.4	10.4	14.4	0
92	R-1407								
	VLF RCVR								
	HONO	19	1	19.2	-	37.3	37.3	19.2	0
93	R-1663(XN-1)/URR								
	DIGITAL DATA RECEIVER								
	GUAM	37	1	.3	-	-	-	-	.3
94	R390A/URR								
	RECEIVER (HF)								
	NORTHWEST	12	4	30.8	2.8	3	5.8	5.8	25
95	R-390/URR								
	HF RCVR								
	ITALY	3	4	34.4	-	6.3	6.3	5.8	30
	CODE 04 STD						6.3		
96	RD-219								
	TAPE RECORDER								
	GUAM	30	1	17.3	10.4	-	10.4	15.6	1.7
97	SB-1642								
	RESISTANCE CONTROL PANEL								
	ITALY	18	1	-	-	-	-	-	-
98	SB-3092A								
	AUDIO BOARD								
	ITALY	19	6	-	-	-	-	-	-

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) BY MAINT. PERS.	(8) TOTAL	(9) REQUIREMENT PM	(10) CM
99	SB-3158/U								
	TELEGRAPH KEY								
	GUAM	20	4	1.3	-	-	-	-	1.3
100	SB-3189								
	DC BOARD								
	ITALY	20	2	-	-	-	-	-	-
101	SP-40416								
	RF PATCH PANELS								
	GUAM	39	6	.5	-	-	-	-	.5
102	SRC-20								
	TRANSCEIVER(UHF)								
	NORTHWEST	15	1	154.2	36.4	21.8	58.2	58.2	96
103	TD-909								
	TONE CONVERTOR								
	GUAM	26	4	-	-	.8	.8	-	-
	ITALY	21	2	-	-	-	-	-	-
104	TH-39A								
	TONE KEYER								
	GUAM	6	3	12.6	2	-	2	2.4	10.2
	CODE 04 STD						2.0		
105	TH-83A/FGC								
	TELEGRAPH REPEATER								
	HONO	20	2	9.6	-	9	9	9.6	0
106	TSEC/KW-7								
	CRYPTO								
	HONO	21	18	8.5	-	11	11	2	6.5
	GUAM	3	20	26.1	-	22	22	16.8	9.2
	SUGAR GROVE	2	32	56.3	0	10	10	22.4	23.9
	NORTHWEST	25	4	20.5	-	8.5	8.5	8.5	12
	ITALY	29	2	-	-	-	-	-	-

CONTINUED ON NEXT PAGE

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) PLANNED MAINT. STD. BY MAINT. PERS.	(8) PLANNED MAINT. STD. TOTAL	(9) REQUIREMENT PM	(10) REQUIREMENT CM
106	TSEC/KW-7		(CONTINUED)						
	SCA STD			32					
	CODE 04 STD						10.0		
107	TSEC/KWK-7								
	CRYPTO								
	NORTHWEST	27	8	15.6	5	-	5	5	10.6
108	TSEC/KWX-11								
	CRYPTO ADAPTORS								
	GUAM	16	20	.2	-	-	-	-	.3
	SUGAR GROVE	4	29	0.2	0	0	0	0	0.2
	SCA STD			24					
109	TSEC/KWX-8								
	REMOTE UNIT CRYPTO								
	HONO	22	9	.2	-	0	0	0	.2
	GUAM	15	14	1.3	-	-	-	-	1.3
	SUGAR GROVE	3	1	1.1	0	0	0	0	1.1
	NORTHWEST	26	2	1.3	-	.3	.3	.3	1
	SCA STD			18					
110	TSEC/ST-14								
	MOD CHECKER								
	GUAM	33	1	1.5	-	-	-	-	1.5
	SUGAR GROVE	7	1	2.6	0	0	0	0	12.0
	SCA STD			1					
111	TT-187A								
	-								
	SUGAR GROVE	9	15	48.5	0	30.4	30.4	33.7	4.8
112	TT-187C								
	-								
	SUGAR GROVE	10	2	36.9	0	30.4	30.4	31.9	5.0

TABLE II-1

MAINTENANCE MANPOWER REQUIREMENTS (Cont'd)

(1) MAINT. NO.	(2) EQUIP. TYPE	(3) ORIG. MN. NO.	(4) NO. ON HAND/ACTIVE	(5) CONV. CM+PM REQ.	(6) PLANNED MAINT. STD. BY OPER. PERS.	(7) BY MAINT. PERS.	(8) TOTAL	(9) REQUIREMENT PM	(10) CM
113	TT-192A - SUGAR GROVE	11	12	41.9	0	28	28	32.2	8.7
114	TT-333A - SUGAR GROVE	12	2	120.0	0	64	64	67.5	52.5
115	TT-47 - SUGAR GROVE	8	2	72.2	0	50	50	55	17.2
116	TT-47J TELETYPEWRITER ITALY	26	1	-	-	-	-	-	-
117	TT-48C TELETYPEWRITER ITALY	27	1	-	-	-	-	-	-
118	WVTR WWV RECV HONO	23	1	1.6	-	1.6	1.6	1.6	0

TABLE II-2

EXTRA NON-CM JOBS

RECURRING EXTRA JOBS

Sugar Grove

AN/FRR 60 (V) 2	Wilkerson	:	20.0 man-hours
	W-2	:	10.4
	M-3	:	15.6
	D-1	:	36.5
AN/FRR 60 (V) 8	Wilkerson	:	20.0 man-hours
	W-2	:	3.9
	M-3	:	12.6
	D-1	:	5.2
AN/FRR 60 (V) 10 + 11	Wilkerson	:	12.0 man-hours
	W-2	:	5.2
	M-3	:	12.0
	D-1	:	5.2

Wilkerson: Once every 2 months a complete check of receiver performance. All D.C. and signal voltages are compared against previous checks. Receiver HFR, HFS, and HFI are aligned for optimum sensitivity and stability.

W-2: Each AN/FRR-60 power supply is checked weekly for proper B+ voltages and minimum A.C. ripple adjustments; corrections made at this time.

M-3: Each AN/FRR-60 is checked for overall sensitivity and that a sufficient ABC is being developed.

D-1: Each AN/FRR-60 is checked about 6 times within 24 hours for proper sync indication/output.

URA-17 M-1 : 6 man-hours

M-1: Consists of a distortion check of unit under controlled input. Necessary adjustments are made at this time.

Italy

FRR-59 Q-2, clean air filters was done monthly instead of quarterly -- 9.8 man-hours

TABLE II-2 (Cont'd)

NONRECURRING EXTRA JOBS

Honolulu

R1051 Field change #3: 33 man-hours

CCL/facility: Coordinating and making changes to keep cable records and wiring correct whenever cross connects or new installations come into the geographical area adjacent to receivers : 300 man-hours

TABLE II-3

RESULTS OF MAINTENANCE ANALYSIS

		(1) Hono	(2) Guam	(3) Sugar Grove	(4) Northwest	(5) Italy	(6) Op-124	(7) SCA
1.	PMS standard (man-hours/yr)	3605	5296	4858	3261	794	-	-
2.	Total PM req (man-hours/yr)	3496	5131	7567	3002	723	-	-
3.	Extra non-CM jobs (man-hours/yr)	333	-	a	-	10	-	-
4.	Conventional PM (man-hours/yr)	3163	5131	a	3002	713	-	-
5.	CM req (man-hours/yr)	435	1260	4674	3389	341	-	-
6.	(PM req + CM req)/PMS	1.1	1.2	2.5	2.0	1.3	2.94	3
7.	PM req/PMS	1.0	1.0	1.6	0.9	0.9	1.47	1.5
8.	Conventional PM req/PMS	0.9	1.0	a	0.9	0.9	1	1
9.	Extra jobs/PMS	0.1	0	a	0	0.01	0	0
10.	CM req/(PMS x 1.47)	0.1	0.2	0.7	0.7	0.3	1	1
11.	CM req/PMS	0.1	0.2	1.0	1.0	0.4	1.47	1.47

[a]Not available; see table II-2.

TABLE III-1

HONOLULU RECEIVER OPERATIONS

(1) Comm. circuit no.	(2) Circuit name	(3) Equipment Type	(4) Equipment Total	(5) Circuit Days[a]	(6) Time to complete 1 unit (min)	(7) No. of work units/week	(8) MH/yr.	Subtotal
I.	Receiver tuning							
21	Freq selection — P-P (Canberra)	FRR-60	1	12	1	0.5	0.4	
22	P-P (Eniwetok)	FRR-60	1	257	1	7	6.1	
20	P-P (Adak, Wellington & Midway)	FRR-60	1	1095	2	90.5	156.9	
23	CinCPAC ABNCP	R-1051	2	730	3	2	5.2	
24	VIP Acft	R-1051	2	730	3	1.5	3.9	
17	M/C S/S Terms	R-1051	6	1950	3	169	439.4	
18	S/C S/S Terms	R-1051	4	1617	3	113	293.8	
				6391		383.5		905.7
				= 17.5 FTE				
1	Freq. tuning — Primary shipshore orestes	R-1051	8	2920	1	138	119.6	
4	Flt FAX broadcast	R-1051	1	365	1	21	18.2	
6	Barbers Point circuit	R-1051	2	730	1	28	24.3	
7	HUB 4/5	R-1051	2	730	1	28	24.3	
8	EastPAC Hi-Com	R-1051	2	730	1	56	48.5	
9	WestPAC Hi-Com	R-1051	1	365	1	28	24.3	
10	Norats	R-1051	2	730	1	15	13	
11	WWVH	R-1051	1	365	1	28	24.3	
12	PacFlt TacAmo Ratt Bcst "GABN"	R-1051	2	730	1	60	52	
13	FSPG Bcst	R-1051	2	730	1	28	24.3	
23	CincPAC ABNCP	R-1051	2	730	1	4	3.5	
24	VIP Acft	R-1051	2	730	1	0.375	0.325	
2	Flt M/C Bcst	R-1051	5	1825	2	60	104	
17	M/C S/S Terms	R-1051	6	1950	2	250	433.3	
18	S/C S/S Terms	R-1051	4	1617	2	168	291.2	
5	Flt/General CW broadcast	R-1051	2	730	3	35	91	
14	HSUB bcst	R-1051	2	730	b	b	b	
3	Flt M/C bcst	SRR-19	1	365	1	3	2.6	
14	HSUB bcst	BRR-3	2	730	1	7	6.1	
15	TACAMO Down Link	BRR-3	2	730	3	18	46.8	
20	P-P (Adak, Wellington & Midway)	FRR-60	3	1095	2	63	109.2	
21	P-P (Canberra)		1	12		2	3.5	
22	P-P (Eniwetok)		1	257		80	138.7	
16	CincPAC ABNCP Down Link	R-1401-G	3	1095	5	3	13	
				20991		1123.375		1616
				= 57.5 FTE				
1	Converter tuning — Primary S/S orestes	URA-17	4	146	0.5	138	59.8	
12	PacFlt TACAMO Ratt Bcst "GABN"		1	365	0.5	28	12.1	
13	FSPG Bcst		1	365	0.5	28	12.1	
14	HSUB Bcst		1	365	0.5	7	3.0	
15	TACAMO Down Link		1	365	0.5	18	7.8	
16	CincPAC ABNCP Down Link		1	365	0.5	3	1.3	
23	CincPAC ABNCP		1	365	0.5	4	1.7	
24	VIP Acft		1	365	0.5	2	0.9	
22	P-P (Eniwetok)		1	257	0.5	21	9.1	
				2958		249		107.8
				= 8.1 FTE				
1	Ant. selection — Primary S/S Orestes	R-1051	8	2920	1	138	119.6	
17	— M/C S/S Terms	R-1051	6	1950	2	206	357.1	
18	— S/C S/S Terms	R-1051	4	1617		137	237.5	
				6487		481		714.2
				= 17.8 FTE				3343.7
II.	Circuit coordination[b]							
III.	QC checks							
2	Flt M/C Bcst	R-1051	5		0.8	1680	1164.8	
4	Flt FAX Bcst	R-1051	1		0.8	336	232.96	
5	Flt/General CW Bcst	R-1051	2		0.8	672	465.92	
6	Barbers Point Circuit	R-1051	2		0.8	672	465.92	
7	HSUB 4/5	R-1051	2		0.8	672	465.92	
8	EastPAC Hi-Com	R-1051	2		0.8	672	465.92	
9	WestPAC Hi-Com	R-1051	1		0.8	336	232.96	
10	Norats	R-1051	2		0.8	20	13.87	

TABLE III-1 (Cont'd)

(1) Comm. circuit no.	(2) Circuit name	(3) Equipment Type	(4) Total	(5) Circuit Days[a]	(6) Time to complete 1 unit (min)	(7) No. of work units/week	(8) MH/yr.	Subtotal
11	WWVH	R-1051	1		0.8	336	232.96	
12	PacFlt TACAMO Ratt Bcst "GABN"	R-1051	2		0.8	336	232.96	
13	FSPG Bcst	R-1051	2		0.8	336	232.96	
17	M/C S/S Terms	R-1051	6		0.8	2016	1397.8	
18	S/C S/S Terms	R-1051	4		0.8	1344	931.84	
1	Primary S/S Orestes	R-1051	8		1.5	320	416	
23	CincPAC ABNCP	R-1051	2		4	21	72.8	
		R-1051	2		1	8	6.9	
24	VIP Acft	R-1051	2		4	21	72.8	
		R-1051	2		1	7	6.1	
19	Freq. Acc. Chks. — QC Recvr	R-1051	2		4	48	166.4	
14	HSUB Bcst	R-1051	2		b	b	b	
16	CincPAC ABNCP Down Link	R-1401-G	3		0.8	7	4.9	
20	P-P (Adak, Wellington & Midway)	FRR-60	3		0.8	1008	698.9	
21	P-P (Canberra)	FRR-60	1		0.8	36	25	
22	P-P (Eniwetok)	FRR-60	1		0.8	336	233	
3	Flt M/C Bcst	SRR-19	1		0.8	336	233	
14	HSUB Bcst	BRR-3	2		0.8	336	233	
15	TACAMO Down Link	BRR-3	2		0.8	32	22.2	
26	M/C Trunk (Rcvrs to TCC)	FCC-67	1		30	14	364	
25	Readings taken — Ionospheric sounder	UPR-2	1		2	168	291.2	
								9383
	Total operating workload							12726.6

[a]Based on freq. tuning ckt days.

[b]No data supplied.

TABLE III-2

GUAM RECEIVER OPERATIONS

(1) Comm. circuit no.	(2) Circuit name	(3) Equipment Type	(4) Total	(5) Circuit Days	(6) Time to complete 1 unit (min)	(7) No. of work units/week	(8) MH/yr.	Subtotal
I.	Receiver tuning							
2	Initial rec. tuning (incl. freq. selection) for FP M/S channel terms	R-1051	62		1	462	400.4	
3	Freq. shifts, FP M/S channel	R-1051	62		0.25	1064	230.5	
10	Rec. tuning, FP Multi channel	SSB-60	42		5/12	42	15.2	
	Subtotal					1568		646.1
II.	Circuit coordination							
1	Operate crypto synth remote units	KWX-8	3		1/12	2716	196.2	
5	Operate crypto synth units	KW-7	3		0.25	2716	588.5	
7	Told to conduct various QC cks for diff. act., eg level cks, ant. shifts, etc.				1	413	715.9	
13	Phone calls — coordination	Phone	1		1	84	72.8	
11	Rec. tuning, returning ships back to control (following QC cks of new freq. on air, antenna levels)		81		0.25	462	100.1	
15	Log entries	Typewriter	1		1/6	2800	404.4	
16	Status bd. changes	Status bd	2		1/6	462	66.7	
17	Paper change	Tty	5		2	15	26	
18	New day — close out logs & OW — take monitors from tty's, type new logs				10	7	60.7	
19	Watch sec. chng, status & info. passed to new on-coming sections				15	21	273	
22	TR reports, logging equip down, check returned equip				4	20	69.3	
								2573.6
III.	QC checks							
4	Check levels on FP S/Rec + Flt Bcst	(Daven-12B)			45	21	819	
6	Check audio output levels	Audio BD (Audio amplf.)			5/12	644	232.6	
8	Check distortion and adjust levels	DC BD (DAC-5)	112		20	63	1092	
9	Check all rec. levels, shift ant's when needed & adj. rec. levels by returning audio amplifier	Audio & ant bd			25	105	2275	
21	Accuracy checks on receivers and URA-17				30	1	26	
	Subtotal							4444.6
IV.	Miscellaneous							
12	Normalize audio/DC/ant. bds (remove patches) 1/watch				20	21	364	
								364
	Total operating workload							8028.3

TABLE III-3

SUGAR GROVE RECEIVER OPERATIONS

(1) Comm. circuit no.	(2) Circuit name	(3) Equipment Type	(4) Equipment Total	(5) Circuit Days	(6) Time to complete 1 unit (min)	(7) No. of work units/week	(8) MH/yr.	Subtotal
I.	Receiver tuning							
1a	Freq. tuning — Pri S/S orestes	R-1051	16	5840	1	60	52	
2a	Autec	R-1051	2	730	1	14	12.1	
4a	Coast Guard	R-1051	2	730	1	14	12.1	
7a	S/C Nato Bcst	R-1051	1	312	1	1/52	1 Min	
9a	TACAMO	R-1051	2	48	1	4	3.5	
11a	S/C Bcst (NRTT)	R-1051	1	365	1	1/52	1 Min	
12a	NEACP/ABNCP	R-1051	2	5	1	1/52	1 Min	
18a	QC recv	R-1051	1	365	1	315	273	
3a	Pt to Pt (RIO)	FRR-60	2	730	1.5	56	72.8	
6a	DCSCS	FRR-60	2	240	1.5	2	2.6	
8a	CINCPACFLT/CINCPAC	FRR-60	2	80	1.5	1/52	1.5 Min	
10a	NFAX Bcst	FRR-60	1	365	1.5	7	9.1	
13a	COMUSFOR	FRR-60	2	365	1.5	1/52	1.5 Min	
14a	WHCA	FRR-60	1	365	1.5	1/52	1.5 Min	
15a	WWVH	FRR-60	1	365	1.5	14	18.2	
16a	S/C Ship/Shore Term	FRR-60	17	828	1.5	42	54.6	
17a	M/C Ship/Shore Term	FRR-60	18	828	1.5	84	109.2	
5a	UP Link	R-1401	1	365	1.5	1/52	1.5 min	
				12926 = 35.4 FTE		612.14		619.2
1c	Converter tuning — Pri S/S orestes	URA-17	16	5840	0.5	60	26	
18b	M/C S/S Term	URA-17	1	365	0.5	315	136.5	
				6205 = 17 FTE				162.5
16	Ant. Selection — Pri S/S orestes	R-1051	16	5840 = 16 FTE	1	779	675.1	
								1456.8
II.	Circuit coordination[a]							
III.	QC checks							
2b	Autec	R-1051	2		0.5	42	18.2	
4b	Coast Guard	R-1051	2		0.5	a	a	
7b	S/C Nato Bcst	R-1051	1		0.5	a	a	
9b	TACAMO	R-1051	2		0.5	42	18.2	
11b	S/C Bcst (NRTT)	R-1051	1		0.5	42	18.2	
12b	NEACP/ABNCP	R-1051	2		0.5	42	18.2	
18c	QC Recv	R-1051	1		1	42	36.4	
1d	Pri S/S orestes	R-1051	16		1.5	168	218.4	
3b	Point to Point (RIO)	FRR-60	2		0.5	42	18.2	
6b	DCSCS	FRR-60	2		0.5	a	a	
8b	CINCPACFLT/CINCPAC	FRR-60	2		0.5	a	a	
10b	NFAX Bcst	FRR-60	1		0.5	42	18.2	
13b	COMUSFOR	FRR-60	2		0.5	42	18.2	
14b	WHCA	FRR-60	1		0.5	42	18.2	
15b	WWVH	FRR-60	1		0.5	21	9.1	
16b	S/C S/S Term	FRR-60	17		0.5	42	18.2	
17b	M/C S/S Term	FRR-60	18		1.5	84	109.2	
5b	UP Link	R-1401	1		0.5	a		
								536.9
IV.	Miscellaneous							
19a	Patching System — VHF S/C S/S Term	KW-7	2		2	1/52	2 Min	
								2
	Total operating workload							1993.7

[a]No data supplied.

TABLE III-4

NORTHWEST RECEIVER OPERATIONS

(1) Comm. circuit no.	(2) Circuit name	(3) Equipment Type	(4) Equipment Total	(5) Circuit Days	(6) Time to complete 1 unit (min)	(7) No. of work units/week	(8) MH/yr.	Subtotal
I.	Receiver tuning							
38	Set. freq. range	NTP-6 (Book)		7.2 FTE	1 } 2.3[a]		60.7	
1	Freq. selection	FRR-60			2	210	364	
						210		424.7
2	Freq. tuning	FRR-60		2263	1	70	60.7	
3		FRR-60		1460	1	35	30.3	
4		FRR-73		724	1	105		
5		R-1051		2587	1	105	91.0	
6				2197		70	60.7	
7		LRRA		365	1	7	6.1	
8		SRR-19		365	2	7	12.1	
10		URR-35		0	2	2	3.5	
12		SRC-20		0	2	2	3.5	
11		R-390		b	5	1	4.3	
9		WRR-3		365	120	1	104.0	
				10326 = 28.3 FTE		405		467.2
18	Rec. Demux/TTY Converter	URA-17			0.5	70	30.3	
								30.3
26	Circuit patching	Ant patch panels			0.6	700	364	
28	Circuit patching	Multi coupler patch panels			0.2	70	12.1	
								376.1
II.	Circuit coordination							1298.3
19	O/W	KWX-8			1/6	2800	404.4	
29	O/W	UG-47			1/4	2800	606.7	
22	O/W	KW-7			30	7	182	
30	Administer circuit log				1/2	280	121.3	
31	Maintain status bd				1/2	280	121.3	
39	Telephone coord				1	280	242.7	
								1678.4
III.	QC checks							
20		AM-413/G			1/60	140	2	
42		M.W. patch panel – Daven 12B			15	84	1092	
45		All rec.			1	280	242.7	
44		All rec.			1.875	168	273	
43		DC patch panels			7.5	56	364	
41		R-1051			60	1	52	
32	Circuit monitoring	Any rec.			120	2	208	
46		CU-1382			120	0.23	23.9	
47		All ant.			240	0.23	47.8	
48		All rec.			b	0.23	b	
49		GRC-169/UCC-4			240	0.69	143.5	
50		Rec. RF Cabling			960	0.077	64.1	
								2513
IV.	Miscellaneous							
14	Microwave Ops	GRC-169/UCC-4			120	7	728	
23	Circuit patching	DC patch panels			1/2	70	30.3	

TABLE III-4 (Cont'd)

(1) Comm. circuit no.	(2) Circuit name	(3) Equipment Type	(4) Equipment Total	(5) Circuit Days	(6) Time to complete 1 unit (min)	(7) No. of work units/week	(8) MH/yr.	Subtotal
24	Circuit patching	Audio patch panels			1/2	35	15.2	
25	Circuit patching	M/W patch panels			1/4	140	30.3	
33	Emergency generator monitor	Emer. gen.			90	1/2	39	
								842.8
	Total operating workload							6332.5

[a]Time to complete increased to 2.3 based on an additional 70 work units/week, each requiring 1 minute to consult NTP-6 book.

[b]No data supplied.

TABLE III-5

ITALY RECEIVER OPERATIONS

(1) Comm. circuit no.	(2) Circuit name	(3) Equipment Type	(4) Equipment Total	(5) Circuit Days	(6) Time to complete 1 unit (min)	(7) No. of work units/week	(8) MH/yr.	Subtotal
I.	Receiver tuning							
1a	Freq. selection – Ship/shore voice	R-1051	1	49	5	1.423	6.2	
5a	DCS pt to pt USN	R-1051	2	1095		10	43.3	
3a	Multichannel ship shore	R-1051	1	511	10	19.904	172.5	
2a	Single channel ship shore	FRR-59	1	743	10	28.462	246.7	
				2398 = 6.6 FTE		59.789		468.7
1b	Freq. tuning – Ship/shore voice	R-1051	1	49	1	0.769	0.7	
3b	Multichannel ship/shore	R-1051	4	511		29.846	25.9	
5b	Italy/USN Morococo/USN Greece	R-1051	4	1095		10	8.7	
11a	ASW warning/command NET ASW patrol air coord NET	R-1051	2	730	5	0.019	0.1	
16a	USCINCEUR Alert NET	R-1051	1	365		0.019	0.1	
8a	Mass NET	FRR-59	1	365	1	7.019	6.1	
15a	Submarine/subase commun.	FRR-59	1	365		14.038	12.2	
12a	Eastlantmed sub Bcst	FRR-59	2	365	2	6.692	11.6	
2b	Single channel ship/shore	FRR-59	4	743	5	42.308	183.3	
12d	Eastlantmed sub Broadcast	WRR-3	2	730	1	2.404	2.1	
				5318 = 14.6 FTE		113.114		250.8
2c	TTY converter – Single channel ship/shore	URA-17	4	743	.5	28.462	12.3	
8b	– Mass NET	URA-17	1	365		7.019	3.0	
12b	Eastlantmed sub BCST	URA-17	2	365		6.692	2.9	
15b	Submarine subase communications	URA-17	1	365		14.038	6.1	
				1838 = 5.0 FTE		56.211		24.3
								743.8
II.	Circuit coordination							
17	Send/receive crypto	KW-7	a		2	910	1581.7	
19	Telephone coord	Phone	a		3	175	456.3	
18	Administer ckt log	Typewriter	a		1	552.212	478.6	
21	Maintain status Bd	Status Bd	a		.5	70	30.4	
								2547
III	QC checks							
12b	Eastlantmed sub BCST	Daven-12B/WRR-3	1		0.5	336		
1c	Ship/shore voice	Daven-12B/R-1051	2		2	5.692	9.9	
3c	Multichannel ship/shore	Daven-12B/R-1051	1		2	295.385	512	
5c	Pt to pt circuit	Daven-12B/R-1051	1		2	336	584	
11b	ASW warning/command NET	Daven-12B/R-1051	1		2	672	1168	
16b	USCINCEUR	Daven-12B/R-1051	1		2	336	584	
2d	Single channel ship/shore	DAC-5/FRR-59	1		2	336	584	
8c	MASS NET	DAC-5/FRR-59	1		2	336	584	
12c	Eastlantmed sub BCST	DAC-5/FRR-59	1		2	160.615	278.4	
15c	Submarine/subase commun.	DAC-5/FRR-59	1		2	336	584	
6	VFCT Trunk to NCS RCVR site	Daven-12B DAC-5 /FCC-66	1,1		4	7	24.3	
4	Visual/audible alarm chks, microwave Int. MT Camaldoli/Lago Patria	FRC-84	2		2	14.038	24.3	
22	QC after power failure	a	a		2	7.692	13.3	
								5096.2
	Total operating workload							8387.0

[a]No data supplied.

TABLE III-6

SEQUENCE OF ACTIVITIES -- RECEIVER TUNING

- Operator at receiver site walks to orderwire and reads message received from tech control requesting that a receiver be brought up initially; 42 seconds
- Operate crypto units; 12 seconds
- Transmit "Roger" for message; 90 seconds
- Operator selects frequency range from NTP-6; 60 seconds[a]
- Operator finds available frequency using monitor receiver; 120 seconds[a]
- Operator walks to receiver selected; 27 seconds[b]
- Operator tunes receiver (including antenna selection and converter tuning, if required); 90 seconds
- Operator walks back (time previously counted)
- Operator checks patch panels; 6 seconds
- Operator crypto units; 12 seconds
- Transmit message that receiver is tuned; 48 seconds
- Wait for "Roger" from tech control; 90 seconds
- Change status board; 12 seconds
- Enter status change in master log; 30 seconds

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[a]Northwest data.

[b]This time depends on receiver layout. Sugar Grove estimates a round-trip walking time of 12 seconds to the front of the receiver deck and 42 seconds to the rear. It further estimates that half of the trips are to the front. Thus, the average walking time is 27 seconds.

TABLE III-7

RECEIVER SITE MAN-HOURS REQUIRED

	Guam	Hono	Sugar Grove	Northwest	Italy
1. Receiver tuning	624	3, 344	1, 457	1, 298	744
2. Orderwire coordination	2, 474	-	-	1, 678	2, 547
3. QC checks	4, 445	9, 383	537	2, 513	5, 096
4. Total operating work	7, 543	12, 727	1, 994	5, 489	8, 387
5. 1.17 (total operating work man-hours)	8, 825.3	14, 890.6	2, 333.0	6, 422.1	9, 812.8
6. Operator PM required	2, 460.9	-	810	816.6	-
7. Operator PMS standard	2, 540	0	520	887	0
8. Navy operator PM required	3, 733.8	-	764.4	1, 303.9	-
9. Total operator man-hours required (Navy standard)	12, 559.1	14, 890.6	3, 097.4	7, 726.0	9, 812.8
10. Total operator billets required	7.6	9.0	1.9	4.7	5.9
11. FTE receivers	104	58	35	33	16

TABLE III-8

RECEIVER TUNING/RETUNING ANALYSIS

	Guam	Hono	Sugar Grove	Northwest	Italy
1. Total tunings/retunings per week	1,568[a]	1,123	612	405	113
2. Total FTE receivers	104	58	35	28.3	14.6
3. Total tunings/retunings per week (continuous)	b	623	480	b	23.5
4. FTE continuous receivers	b	47	28	b	7
5. Total tunings/retunings per week (intermittently operated)	b	500	132	b	89.6
6. FTE intermittently operated receivers	b	10.5	7.4	b	9.6
7. Unit time for frequency tuning (minutes)					
R1051	0.25	1.6	1	1	1
SRR-19		1		2	
BRR-3		2.4			
FRR-60		2	1.5	1	
R1401-G		5	1.5		
WRR-3				120	2
FRR-59					3.5
FRR-73				1	
LRRA				1	
URR-35				2	
SRC-20				2	
R-390				5	
SSB60	5/12				

[a]Data for only 104 receivers used for full-period terminations out of 166 total receivers used.

[b]Data not available.

TABLE III-9

ANALYSIS OF OTHER RECEIVER FUNCTIONS

	Guam[a]	Hono	Sugar Grove	Northwest	Italy
1. No. frequency selections/week		384		210	60
2. No. FTE receivers requiring frequency selection		17.5		7.2	6.6
3. Unit time for frequency selection (min)					
Ship-shore voice, DCS pt-pt (R1051)		3			5
M/C, S/C, ship-shore					
(R1051)					10
(FRR-59)					10
FRR-60 (including NTP-6)		2		2.3	
4. No. converter tunings/week (URA-17)		249	375	70	56.2
5. No. FTE receivers requiring converter tuning		8.1	17		5.0
6. Unit time for tuning (min.)		0.5	0.5	0.5	0.5
7. No. antenna selections/week		481	779		
8. No. FTE receivers requiring antenna selection		17.8	16		
9. Unit time for antenna selection (min.)		1.7			

[a]Data not given by site.

TABLE III-10

CIRCUIT COORDINATION ANALYSIS

	Guam	Hono	Sugar Grove	Northwest	Italy
1. Total man-hours required per year	2,573.6	-	-	1,678	2,547
2. FTE receivers	104	58	35	33	16
3. Total man-hours/FTE receivers (man/hours/rec)	24.8			50.8	159.2
4. Total tunings/retunings per week	1,568[a]	1,123	612	405	113
5. Total coordination time per tuning/retuning (min.)	1.9	-	-	4.9	26

[a]For full-period terminations only.

TABLE III-11

QC CHECKS DONE AT NORTHWEST

(1) QC check number	(2) Sample size	(3) Estimated time (min)	(4) Average no. channels	(5) Frequency per day	(6) Average time per day	(7) Measured planning factor (min/chan)
1	11	1.58 ± .446	8	3	4.7	0.2
2	10	4.09 ± .705	64	1	4.1	0.1
3	10	3.62 ± 1.06	24	12	43.4	0.2
4	10	0.47 ± .15	5	1	0.5	0.1
5	10	0.373 ± .11	1	6	2.2	0.4
					54.9 min/day 334 man-hours/yr	

TABLE III-12

QC CHECKS ANALYSIS--MEAN TIME (MIN.)

Equipment	Number of FTE receivers					Mean time per check (min.)					Total number checks made/week				
	Guam	Hono	Sugar Grove	North-west	Italy	Guam	Hono	Sugar Grove	North-west[a]	Italy	Guam	Hono	Sugar Grove	North-west[a]	Italy
R1051		45.7	23.0	13.1	7.5		0.9	1.1	4.6	2[b]		9853	378	1	1645.077
									1.9					253	
FRR-60		3.7	11.4	10.2			0.8	0.8	1.9			1380	315	197	
BRR-3		4.0					0.8					368			
FCC-66										7[b,c]					7
FCC-67							30					14			
FRC-84										2					14.038
FRR-59					6.0					2[c]					1168.315
FRR-73				1.9											
LRRA				1.0											
R1401/G		3.0					0.8					7			
SRR-19		1.0		1.0			0.8					336			
UPR-2							2					168			
WRR-3				2.0	2.0					0.5[b]					336
Accuracy cks on REC +URA-17						0.28					109				
R1401			1.0					0.5					--		
Daven-12B						45					21				
Audio BD (audio amplif.)						0.4					644				
DC BD (DAC-5)						20					63				
Audio+Amp BD						25					105				
AM 413/G									0.02					140	
M. W. patch panel-Daven-12B									15					84	
All receivers									1.9					450	
D.C. patch panel									7.5					56	
CR-1382									120					0.23	
All antennas									240					0.23	
GRC-169/UCC-4									240					0.69	
Rec. RF cabling									960					0.077	
QC ck. after pwr. failure										7.692					2

[a] Northwest makes an additional weekly QC check on all R1051; mean times and number of checks per week prorated among number of receivers operative.

[b] Using Daven-12B.

[c] Using DAC-5.

TABLE IV-1

SUPPORT PRIMARY DUTY BILLETS

Master list	Hono	Guam	S.G.	N.W.	Italy
3. Admin/supply clerk	Same	Same		Admin Assist. (B) Supply clerk	
4. Yeoman	Same				
		(A) building maintenance (C) Supply clerk (70%)			
	(A) Operatings/trfc.[a] analyst (50%) (B) Comtac/CMS/[a] RM training (50%)				
5. CPO in charge				Rec. operations and Div. training LPO (50%)	Leading Petty Officer (40%)

[a]Support to operations.

TABLE IV-2

SUPPORT COLLATERAL DUTY MAN-HOUR REQUIREMENTS

Job	Hono No.	Hono Total Man-hours	Guam No.	Guam Total Man-hours	Sugar Grove No.	Sugar Grove Total Man-hours	Northwest No.	Northwest Total Man-hours	Italy No.	Italy Total Man-hours
Travel	22c	104	7, 8	489	3	288				
Training (OJT and other)	10, 11	1040	12	829	4	335				
Other oper. activities				364				843		
Cleaning	1, 2	1742	1, 10, 11	3028	1	1482	1, 2, 7	1170	1, 2	2037
Mil watches and security	15	156	9, 16, 17, 18	969			3	520		
Meetings	9, 22, 22a, 22b, 23	390							3, 4	300
Bldg. & ground & vehicle maint.	4, 5, 7	693	2	520	6	936	4, 5, 8	388		
Supply, inventory, etc.	17	390	3, 4, 13	962						
Burn run	6	104	6	208						
Mail, messages	3	390	5	2184			6	182		
Admin.	8, 18, 19 20, 25	617	15	280						
Fire drills	12	52								
Equipment & operation	13, 14, 21	650			2, 5	860				
Non-allowable-supervisory	16, 24	-								
Misc.			14	480	7	2574				

Table IV-3 CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: NCS Honolulu FUNCTION: Receiver Site 12 MONTH PERIOD COVERED: From January 74 To December 74

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) BILLET NUMBER
	Receivers Branch					
1.	Maintain cleanliness of spaces, sweep make and clean coffee mess. Empty trash cans, change burn bags after every watch. 40 mins. 3 times a day. Mid watches-dust all equipment, sweep, swab, wax and buff all areas. 2.5 hrs - 1 time a day.	cleaning	4.5	7	1,638	12,17,20,21,&8
2. Field Day	Clean and dust cabinets, desk tops. Sweep, swab, wax&buff all day working spaces 2 hrs	field day	2	1	104	4,D
3.	Message, supply, mail, pick-up and delivery.	guard mail run	.75	10	390	3,4
4.	Trip ticket and gas up vehicle	vehicle maint.	.33	1	17.2	3,4
5.	Maintaining outside area of building, cutting grass, trimming, & picking up paper.	upkeep	3	1	156	17,18,21
6.	Take classified material to mulcher, and destroy classified material	destruction of classified material	1	2	104	B
7.	Maintaining building, laying tile, hanging bulletin boards, general assistance of PWC	maint	2	5	520	D
8.	PMS coordination, make up schedules and reports & ensure completion of same	PMS	2	1	104	B

Table IV-3 CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: NCS Honolulu FUNCTION: Receiver Site 12 MONTH PERIOD COVERED: From Jan 74 To December 74

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) BILLET NUMBER
9.	Career counselor, indoctrinates, processes, and counsels all new arrivals. Assists all personnel understanding rights, benefits, and programs of the Navy.	counselling	2	1	104	6
10.	Training P.O. - ET's . Hold training on all techs write up lectures and coordinate training with RM's local and command training. Indoctrinate new personnel, and turn in training reports.	ET training	6	1	312	C
11.	Training P.O. RM	RM training	14	1	728	B
12.	Fire Warden-Weigh CO2 bottles, check emergency lites, fire fighting equipment, and first aid box. Correct discrepancies and hold fire drills.	Fire Warden	1	1	52	C
13.	Test equipment - submit for calibration and/or repair, inventory equipment and turn in excess to EMO.	Test equipment	1.5	1	78	10
14.	Traffic analysis-Check monitor rolls (send/RCV) and CIM both for improper operations.	Traffic Analysis	2	5	520	A
15.	Building MAA-Check security, maintenance, cleanliness of building.	Building MAA	1	3	156	A
16.	Operations supervisor - Ensure circuit requirements are met and electronic and material needs are current and up to date.	Operations Supervisor	1	5	260	A

Table IV-3 : CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: NCS Honolulu FUNCTION: Receiver Site 12 MONTH PERIOD COVERED: From Jan 74 To December 74

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) BILLET NUMBER
17.	Supply - Order parts, pick up supplies, and turn in returnable items. Keep records and budget. Ensure adequate supplies on hand.	Supply	1.5	5	390	3
18.	CMS-Draw CMS material, destroy superceded material, make destruction report and keep current material available to crews.	CMS	.25	5	65	B
19.	Comtac-Make Pub corrections, page checks, inventory monthly	Comtac	.25	1	13	B
20.	Admin-Make all reports, ensure accuracy and correct routings-Submit to Receivers Chief for dissemination and file all material that requires a record to be kept.	Admin	.75	5	195	3
21.	Sounder - Replace recorder tape once every 4 days tear off strip chart daily, retime sounder as needed	Sounder	.5	2	52	12
22.	Division Officer Meetings-morning briefing	Division Officer	.5	5	130	1
22a.	Various coordination, information, and indoctrination lectures.	Division Officer	.25	1	13	1
22b.	Division Officers meeting	Division Officer	.2	1	104	1
22c.	Travel to and from meetings	travel	.4	5	104	1
23.	Department LCPO meetings	CPO	3	.25	39	1
24.	Evaluations-Evaluate performance of all personnel in leadership, appearance, professional performance, military behavior, and adaptability	Evaluations	3	1 avg.	156	1,6 and 15

Table IV-3 . CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: NCS Honolulu FUNCTION: Receiver Site 12 MONTH PERIOD COVERED: *From* January 74 *To* December 74

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) BILLET NUMBER
25. ?	Manpower evaluation-Evaluation of all facets of operations and maintenance of Receiver Site.	Analysis	-	-	240	12,15

Table IV-3 CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: NCS Guam FUNCTION: Receiver Site 12 MONTH PERIOD COVERED: From 30 Nov 1973 To 3 Nov 1974

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) BILLET NUMBER
	Receivers Branch					A
1. Cleaning	Maintain cleanliness of spaces, clean heads (3) once a day, sweep swab/buff operating spaces once a day, @ 3 hours a day	Cleaning	3	5	780	
2. Maintenance	Maintain grounds surrounding receiver bldg, mow/trim grass, police area, remove weeds @ 2 hours a day	maintenance	2	5	520	A
3. Supply	Restock consumables from stone room for heads and operating spaces @ 30 min per day	supply	.5	5	130	A
4. Supply	Requisition materials from supply @2 hours per week	supply	2	1	104	A,C
5.	Pick up guard mail, regular mail, + messages 1 hour/6 times a day	Mail run	1	42	2184	3, 19
6.	Burn message residue 2 hours/twice a week	Burn Run	2	2	208	A,3
7.	Travel time to and from burn run, mail run @ 10 mins per trip/ 6 times daily for mail, twice weekly for burn	Travel	.18	44	411	A,3
8.	Travel time to and from servmart to pick up supplies	Travel	1.5	1	78	A,C
? 9. Security Check	Tour bldg 150 every weekday	Tours	.3	2.3	121.3	2 & 2A
? 10. Daily Cleaning	Sweep down all electronic spaces	Cleaning	.3	5.3	2073.7	12 & 16
? 11.	Field Day weekly	Cleanup	1.5	3.0	174	12+16+3

Table IV-3 CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: NCS Guam FUNCTION: Receiver Site 12 MONTH PERIOD COVERED: From 30 Nov 73 To 30 Nov 74

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) BILLET NUMBER
12. ?	Training	Lectures Movies &DJT	2.3	15.9	829	2,2A,6,6A,3 14, 16, 12
13.	Message/Supply Pickup	Messages	1	14	728	3,16,12
14.	Antenna Field	Setting Poles	1.3	9.2	480	2, 6A 12, 16
15.	Miscellaneous Reports	Surveys & Test	.8	5.3	280	2, 2A, 3 6, 6A
16. ?	OOD	Watch	8.	2.	112	2
17. ?	POOW	Watch	8.	2.	112	2A, 6
18. ?	Ambulance Driver/Duty Driver	Watch	24.	12.	624	6A,3

TABLE 5 IV-3 CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: NCS Norfolk FUNCTION: Receiver Site (N.W.) 12 MONTH PERIOD COVERED: From 1 Dec 1973 To 30 Nov 1974

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) BILLET NUMBER
1	Maintain cleanliness of spaces. Sweep down every watch, clean coffee mess 15 min 3 times daily in SatCom and Receiver spaces (watch standers)	Cleaning	1.5	10.5	546.0	16,H,F, & G
2	Field day/4 hrs once a week in SatCom and Receivers (watch standers)	Cleaning	8.0	8.0	416.0	F,G,16 & H
3	Security check every 2 hrs after normal working hours and every 2 hrs weekend and holidays. 10 min each tours (watch standers) 1 man @ 61 days outside	Security checks Ideal: 6-10 min/2 hrs - part of watch	10.0	10.0	520.0	16 & H Watchstanders
4	Ground maintenance - police grounds, 1 hr week	Ground maintenance	1.0	1.0	52.0	Dayworkers F,G, & 9
5	Ground maintenance - mow, edge, 4 hrs week April-Nov (8 men)*	Ground maintenance	4.0	4.0	128.0*	F & G
6	Message pickup delivery 30 minutes a day	Messages	.5	3.5	182.0	16 & H
7	Field day by day workers, 4 hrs wk	Cleanup	4	4	208	3, B & 9
8	avg 4 hrs wk Building maintenance, painting etc.	Building maintenance	4	4	208	9

TABLE IV-3: CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: Sugar Grove FUNCTION: Receiver Site 12 MONTH PERIOD COVERED: *From* Not Submitted *To* ____

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) ? BILLET NUMBER
1 ?	Cleaning/trash run done jointly by 9 direct labor ETs.	Upkeep of Ops site			1482	
2 ?	Repair of TV system	Base TV system			760	
3 ?	Driver for run 24 hrs/month	Bus runs to Vint Hills Farms	12	2/month	288	
4 ?	Training of personnel, installation of field changes, records, bulletins, trouble reports, inventory, mechanical drawing	Test equipment operations minus CM & PM			335	
5 ?	Maintenance on base FM equipment	Base FM net	3 days	2/yr (3 men)	100	
6 ?	Field day/upkeep of spaces	Field day/upkeep of spaces	3	1 (6 men)	936	
7 ?	Eating	Chow	1.1	5 (9 men)	2574	

IV-3

TABLE ~~5~~: CURRENT SUPPORT MANPOWER REQUIREMENT

SITE LOCATION: NCS Italy FUNCTION: Receiver Facility 12 MONTH PERIOD COVERED: From 1 Jan 1974 To 31 Dec 1974

(1) JOB	(2) DESCRIPTION	(3) WORK UNIT	(4) HOURS TO COMPLETE	(5) NUMBER OF WORK UNITS PER WEEK	(6) TOTAL HOURS PER YEAR	(7) BILLET NUMBER
	RECEIVERS BRANCH					
1 ?	Maintain cleanliness of spaces and sweep after every watch 30 min/3 times/day	Cleaning	3.5	7.0	1307	6/9/16-24
	midwatch cleans equipment 2 hrs each day					
2 ?	Field day, general clean up	Field day	2	7.0	730	6/9/16-24
3 ?	Division meeting	All hands division meeting	2	2.5	240	5/6/9/16-24
4 ?	Commanders call	All hands meeting with commanding ofcr	3	.125	60	5/6/9/16-24
5 ?	Mess facility, antenna maintenance, recreation	Provided by NATO				
6 ?	Other logistics/facilities	Provided by NavCommSta/NSA and Naval Hospital				

TABLE IV-4

SUPERVISORY OVERHEAD ANALYSIS RESULTS
(Percent)

	Hono	Guam	Sugar Grove	Northwest	Italy
Total supervisory overhead	25.3	45.8	12.1	15.6	68.4
Watch operations	21.2	33.3	0	0	17.3
Day operations	100.0	400.0	[a]	[a]	381.3
Total operations division	31.6	39.3	0	0	26.7
Maintenance division	16.6	30.7	15.2	2.9	127.0
General management	4.8	10.4	0	11.6	25.9

[a] No direct labor or supervisors.

TABLE V-1

MANPOWER REQUIREMENTS OF O&M PERSONNEL
DIRECT LABOR FULL-TIME EQUIVALENT

	Manhours required					Required/on hand				
	Hono	Guam	Sugar Grove	Northwest	Italy	Hono	Guam	Sugar Grove	Northwest	Italy
Operations										
Receiver operations[a]	14,890.6	8,825.3	2,333.0	6,422.1	9,812.8					
Oper. PM										
Site req.	-	2,460.9	810.0	816.6	-					
Navy req.	-	3,733.8	764.4	1,303.9	-					
Total										
Site req.	14,890.6	11,286.2	3,143.0	7,238.7	9,812.8	9.0/6.6	6.8/6.1	1.9/4	4.4/8	5.9/6.2
Navy req.	14,890.6	12,559.1	3,097.4	7,726.0	9,812.8	9.0/6.6	7.6/6.1	1.9/4	4.7/8	5.9/6.2
					(Incl. supvrs.)	/9.0	/8.5	/4	/8	/7.8
Maintenance										
Tech. PM										
Site req.	3,495.6	2,669.9	6,756.9	2,185.4	723.1					
Navy req.	5,298.6	4,055.4	6,376.9	3,489.8	1,166.4					
CM										
Site req.	434.6	1,259.8	4,674.4	3,389.0	341.4					
Navy req.	5,298.6	7,784.8	7,141.3	4,793.7	1,166.4					
Total										
Site req.	3,930.2	3,929.7	11,431.3	5,574.4	1,064.5	2.4/11.2	2.4/10.0	6.9/15.6	3.4/6.8	.6/1.2
Navy req.	10,597.2	11,840.2	13,518.2	8,283.5	2,332.8	6.4/11.2	7.1/10.0	8.1/15.6	5.0/6.8	1.4/1.2
					(incl. supvrs.)	/13.0	/13.0	/18.0	/7.0	/2.8
Support (O&M direct-labor man-hours)[a]	5,756.4	11,022.6	3,767.4	3,588.4	2,734.3	3.5/	6.6	2.3/	2.2/	1.6/
Total										
Site req.	24,577.2	26,238.5	18,341.7	16,401.5	13,611.6	14.8/17.8	15.8/16.1	11.0/19.6	9.9/14.8	8.2/7.4
Navy req.	31,244.2	35,421.9	20,383.0	19,597.9	14,879.9	18.8/17.8	21.3/16.1	12.3/19.6	11.8/14.8	9.0/7.4
					(Incl. supvrs.)	/22.0	/21.5	/22.0	/15.0	/10.6

[a]Includes 17% PF&D factor.

TABLE V-2

UTILIZATION OF O&M PERSONNEL

	Hono	Guam	Sugar Grove	Northwest	Italy
Operations					
Site req - direct labor only	1.36	1.11	0.48	0.55	0.95
- incl. supvr's	1.00	0.80	0.48	0.55	0.75
Navy req - direct labor only	1.36	1.25	0.48	0.59	0.95
- incl. supvr's.	1.00	0.89	0.48	0.59	0.75
Maintenance					
Site req - direct labor only	0.21	0.24	0.44	0.50	0.50
- incl. supvr's	0.18	0.18	0.38	0.49	0.21
Navy req - direct labor only	0.57	0.71	0.52	0.74	1.17
- incl. supvr's	0.49	0.55	0.45	0.71	0.50
Support (of total direct labor personnel)	0.20	0.41	0.12	0.15	0.22
Total (incl. collateral support)					
Site req - direct labor only	0.83	0.98	0.56	0.67	1.11
- incl. supvr's	0.67	0.73	0.50	0.66	0.77
Navy req - direct labor only	1.06	1.32	0.63	0.80	1.22
- incl. supvr's	0.85	0.99	0.56	0.79	0.85

APPENDIX B

FLOW DIAGRAMS OF GUAM OPERATIONS

APPENDIX B

FLOW DIAGRAMS OF GUAM OPERATIONS

FULL-PERIOD TERMINATIONS (VFCT)

Multichannel Reception

Figure B-1 is the receive systems flow diagram for multichannel terminations.

a. Rhombic antenna: Receives signal from ship's terminated VFCT. Operators select optimum antenna, based on ship's location and direction.

b. Radio receiver R-1051D: Operators select clear frequencies and shift receivers to new frequencies upon controls request.

c. Audio patch panel: Operators check for signal strength, interference, and signal fading, reporting all discrepancies to control for action. Signal normalled from audio patch panel to tech control.

d. Quality monitoring equipment: Operators check VFCT tone packs maintaining a 2 Hz tolerance on each new frequency shift and every 8 hours as part of QC checks.

e. TA-629A/U audio level test panel: Operators check receiver level settings every 30 minutes.

f. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

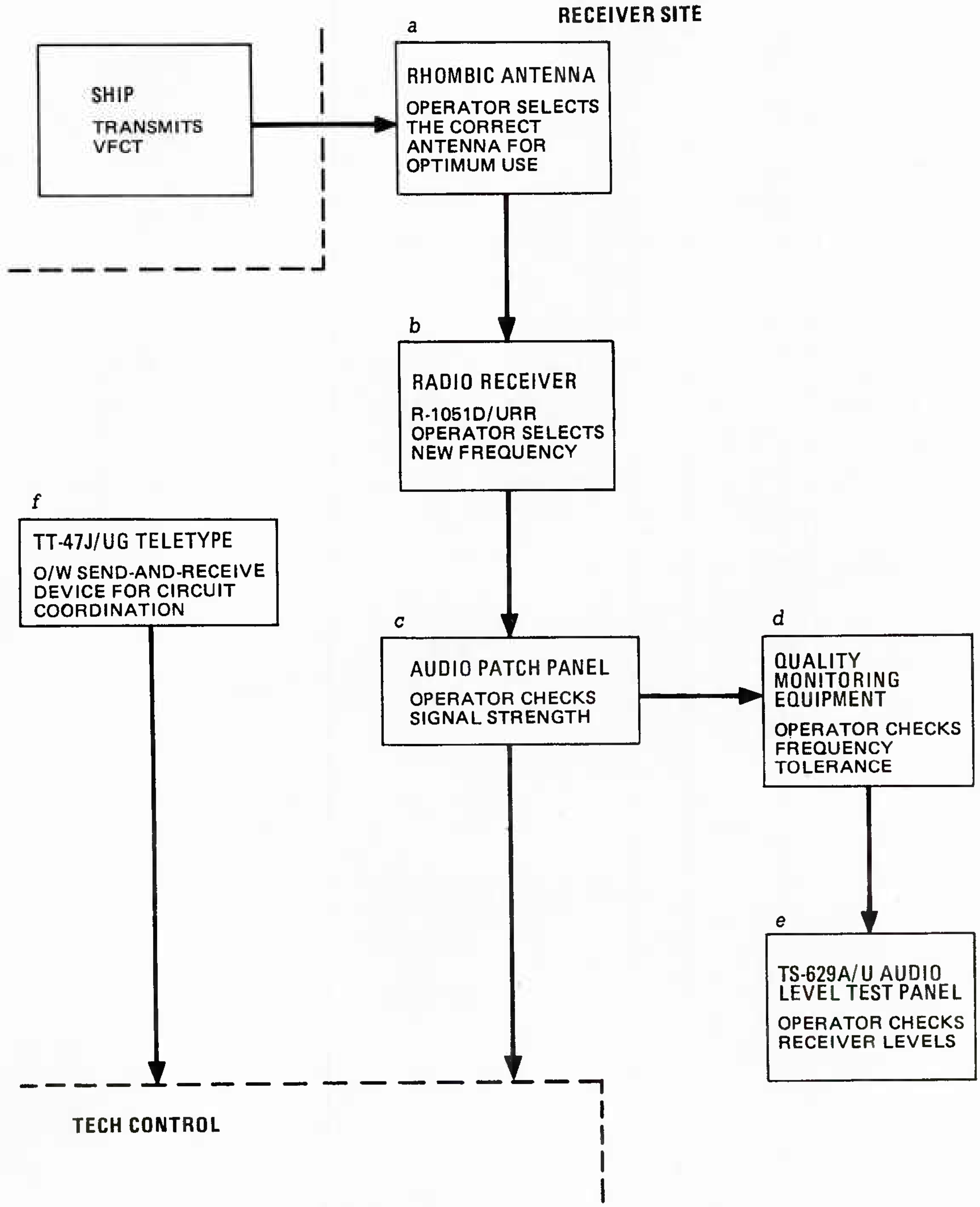

FIG. B-1: SEQUENCE OF ACTIVITIES TO COMPLETE VFCT FULL-PERIOD TERMINATION

CLARINET PILGRIM, CSUB RECEPTION

Five signal inputs to the Clarinet Pilgrim produce a single majority vote output, derived from an odd number of input channels.

Figure B-2 is the system required to produce the single output from the Clarinet Pilgrim.

a. AN/WRR3 receiving set radio: Receiver is set at a constant 143.65 kHz; operators check signal quality every 8 hours as part of quality control.

b. CV/483C/URA-17 converter, frequency shift: A device that converts audio to DC; the signal is then fed directly to AUX-1 of the Clarinet Pilgrim.

c. Radio receiver R-1051D/URR: Two receivers used for frequency diversity. Their audio signals are fed to converter/comparator unit.

d. CV-483C/URA-17 converter, frequency shift: A device that converts audio to DC, the signal is then fed directly to AUX-2 of the Clarinet Pilgrim.

e. Clarinet Pilgrim R-1663 (XN-1/UR receiver), digital data: Channels A, B, and M are fed by the 100-kHz Loran signals received on the BESS antenna. The Clarinet Pilgrim takes three inputs from the Loran stations and two local inputs from the AUX-1 and AUX-2 channels, then combines them on a majority vote basis to give a single output that is fed to the DC patch panel.

f. DC patch panel: Receives the signal output from the Clarinet Pilgrim; it is then fed to the terminal equipment.

g. Data analysis center, DAC-V: A device that enables the operator to take distortion readings at the DC board.

h. AN/FCC-70 terminal telegraph: Receives the signal from the DC patch panel, converting the DC signal to audio, combining it with other channels for a composite 16-channel tone pack and normalled back to the audio patch panel.

i. Audio patch panel: Receives the composite tone pack from the terminal equipment, containing the Clarinet Pilgrim (CSUB), and feeds it to tech control.

j. Quality monitoring equipment: Operators select the channel containing the Clarinet Pilgrim (CSUB) signal for audio and frequency tolerance checks.

k. TS-629A/U audio level test panel: Operators check composite tone pack for correct level settings.

l. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

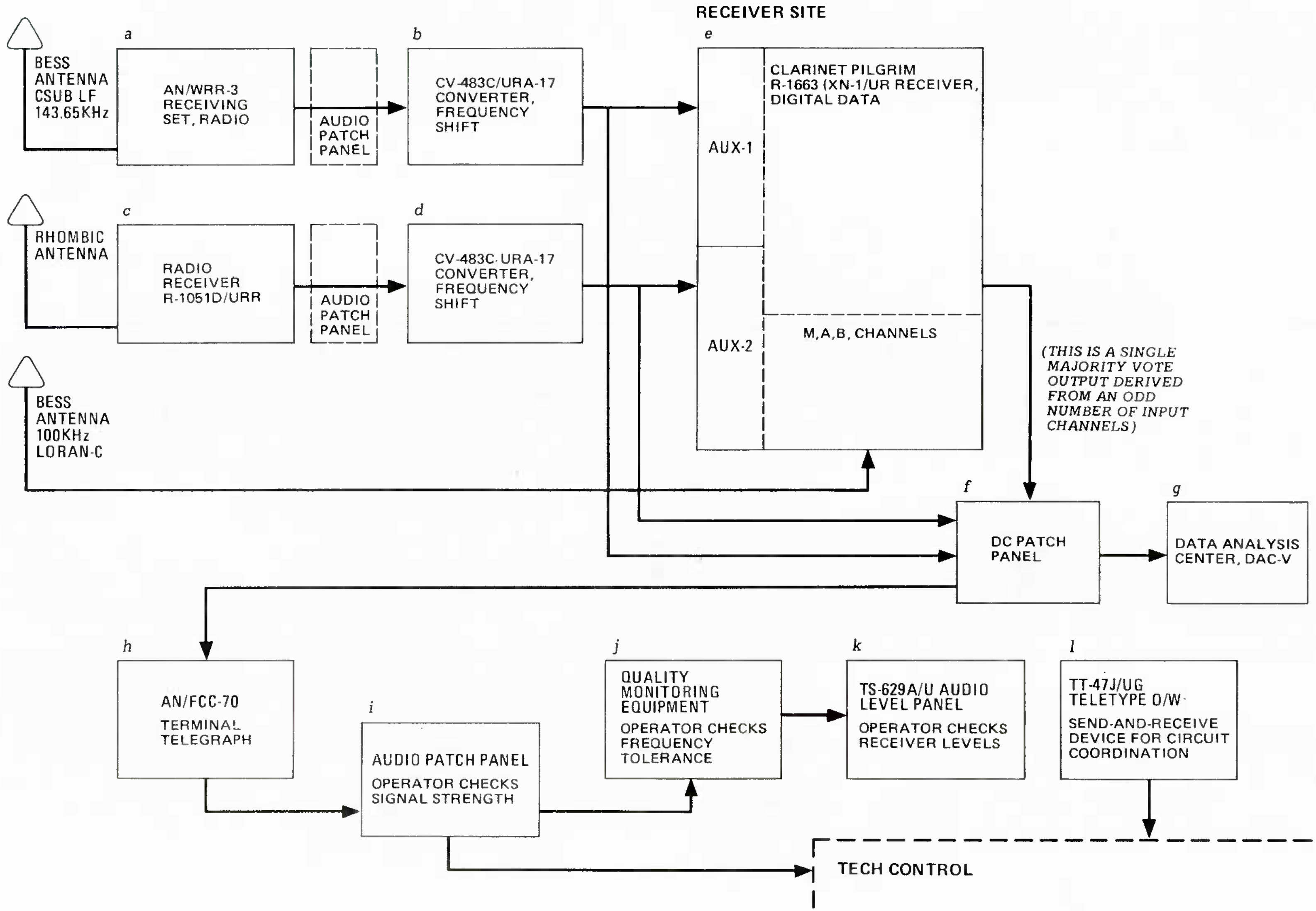

FIG. B-2: SEQUENCE OF ACTIVITIES IN CSUB RECEPTION

SHIP-TO-SHORE (RFCS) TERMINATIONS

Single-Channel Reception

Figure B-3 is the receive systems flow diagram for single channel terminations.

a. Rhombic antenna: Receives signal from ships terminated RFCS. Operators select optimum antenna, based on ship's location and direction.

b. Radio receiver R-1051D: Operators select clear working frequencies to accept ships traffic.

c. CV-483C/URA-17 converter, frequency shift: A device that converts audio to DC; the signal is then fed to the DC patch panel.

d. Data analysis center, DAV-V: A device that enables the operator to take distortion readings at the DC board.

e. DC patch panel: Receives the DC signal from the CV-483C/URA-17; it is then fed to the terminal equipment.

f. AN/FCC-70 terminal telegraph: Receives the signal from the DC patch panel, converting the DC signal to audio, combining it with other channels for a composite 16-channel tone pack; it is normalled to the audio patch panel.

g. Audio patch panel: Receives the composite tone pack from the terminal equipment containing the RFCS and feeds it to tech control.

h. Quality monitoring equipment: Operators check RFCS signals to maintain 30 Hz tolerance on each new frequency shift and every 8 hours, as part of QC checks.

i. TS-629A/U audio level test panel: Operators check receiver level settings every 30 minutes.

j. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

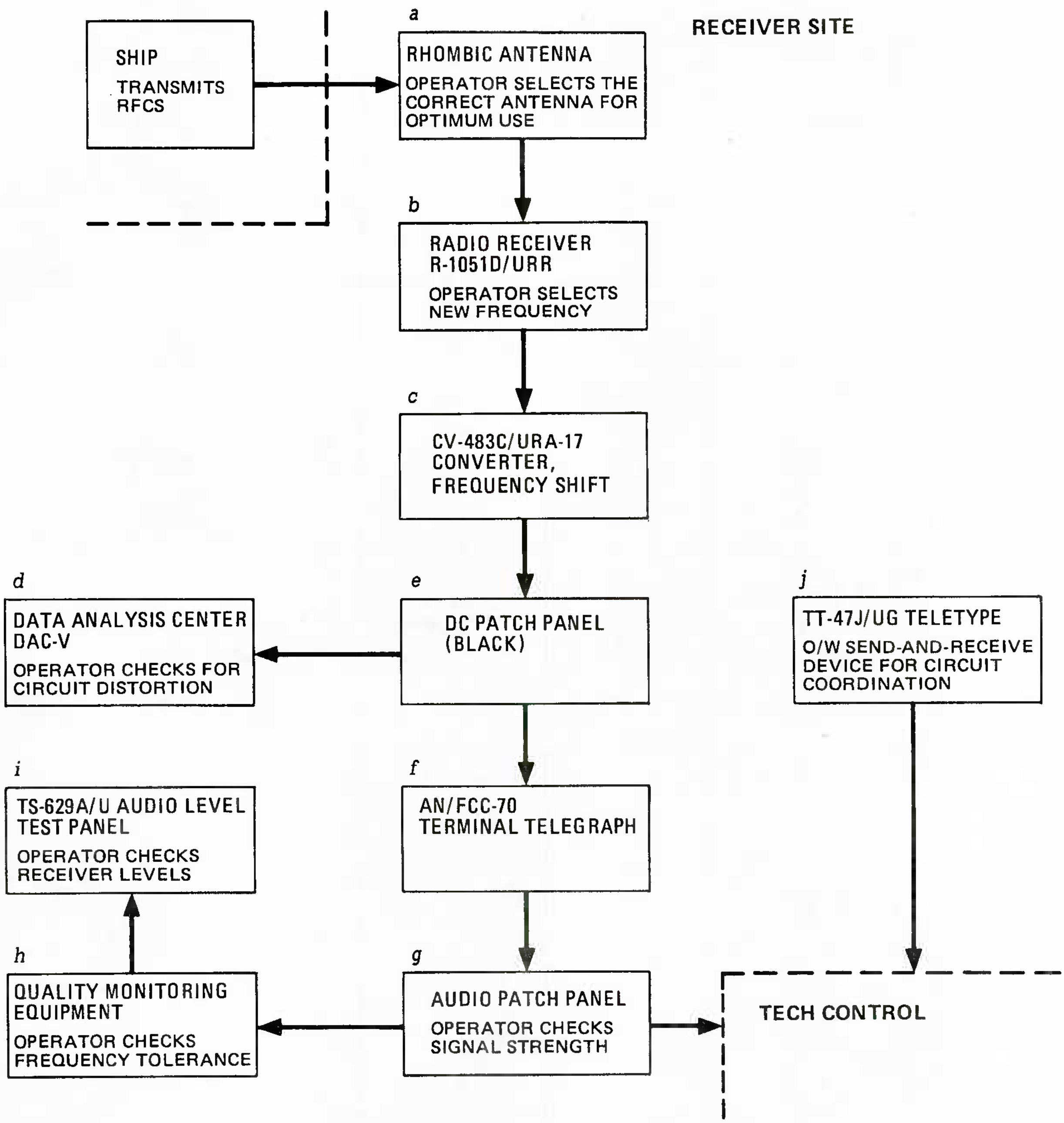

FIG. B-3: SEQUENCE OF ACTIVITIES TO COMPLETE RFCS FULL-PERIOD TERMINATION

QMUL BCST MONITORING

Multichannel Reception

Figure B-4 is the receive systems flow diagram for GMUL BCST.

a. Rhombic antenna: Receives GMUL BCST (RF) signal; operator selects optimum antenna.

b. Radio receiver R-1051D: Operators select sharpest BCST signal.

c. Audio patch panel: Receives the composite GMUL tone pack from the radio receiver and feeds it to tech control.

d. Quality monitoring equipment: Operators check GMUL tone pack maintaining a 2-Hz tolerance on each new frequency shift and every 8 hours as part of QC checks.

e. TS-629A/U audio level test panel: Operators check receiver level settings every 30 minutes.

f. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

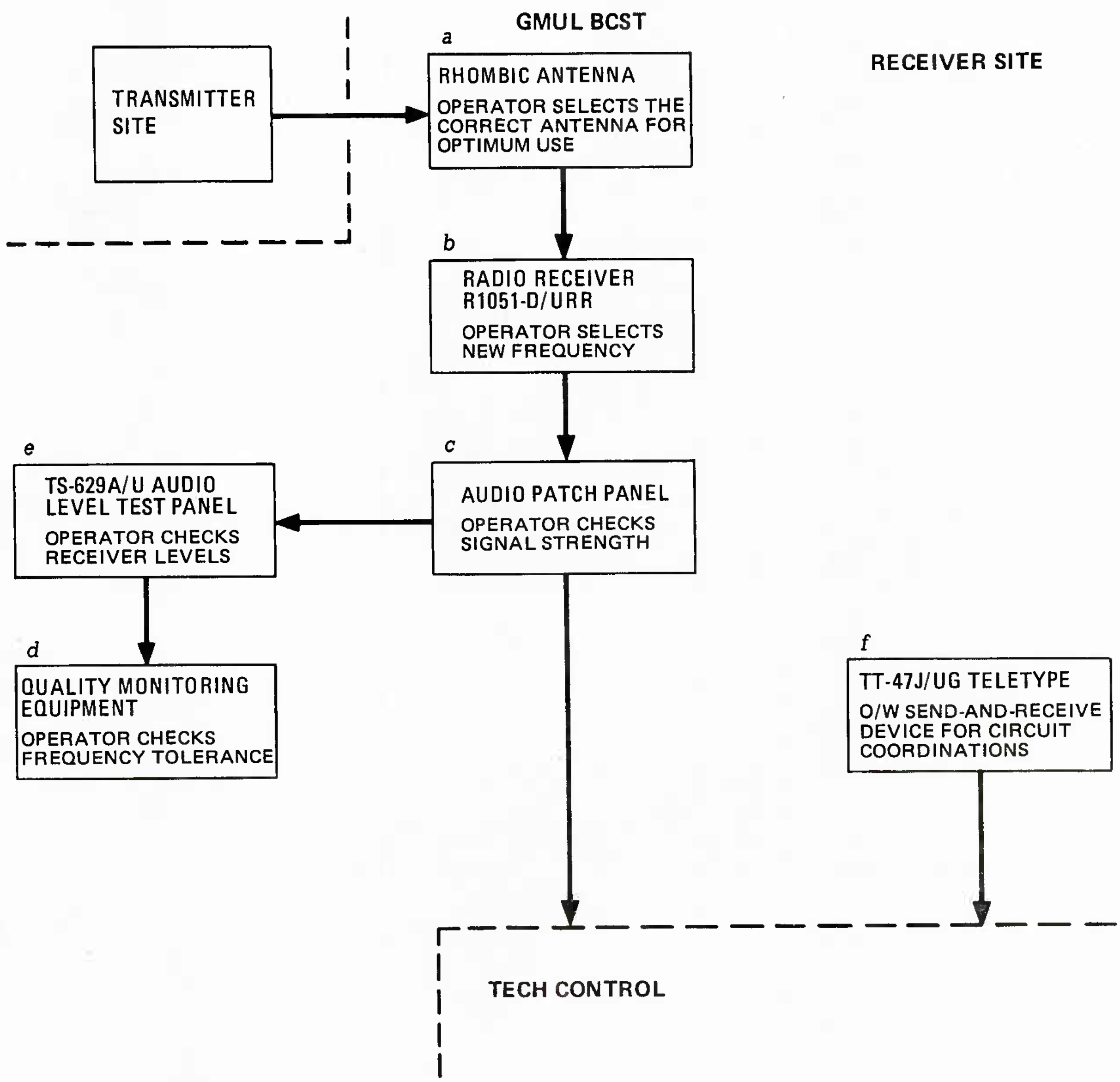

FIG. B-4: SEQUENCE OF EVENTS TO COMPLETE MONITORING OF GMUL BCST

Single-Channel Reception

Figure B-5 is the receive systems flow diagram for GABN BCST.

a. Rhombic antenna: Receives GABN BCST (RF) signal; operator selects optimum antenna.

b. Radio receiver R-1051D: Operators select sharpest GABN BCST signal.

c. CV-483C/URC-17 converter, frequency shift: A device that converts audio to DC; the signal is then fed to the DC patch panel.

d. DC patch panel: Receives the DC signal from the CV-483C/URA-17; it is then fed to the terminal equipment.

e. AN/FCC-70 terminal telegraph: Receives signal from the DC patch panel, converting it to audio, then combining it with other channels for a composite 16-channel tone pack; it is normalled to the audio patch panel.

f. Audio patch panel: Receives the composite tone pack from the terminal equipment containing the GABN BCST and feeds it to tech control.

g. Data analysis center, DAV-V: A device that enables the operator to take distortion readings at the DC board.

h. TS-629A/U audio level test panel: Operators check receiver level settings every 30 minutes.

i. Quality monitoring equipment: Operators check GABN RFCS signal to maintain 30-Hz tolerance on each new frequency shift and every 8 hours as part of QC checks.

j. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

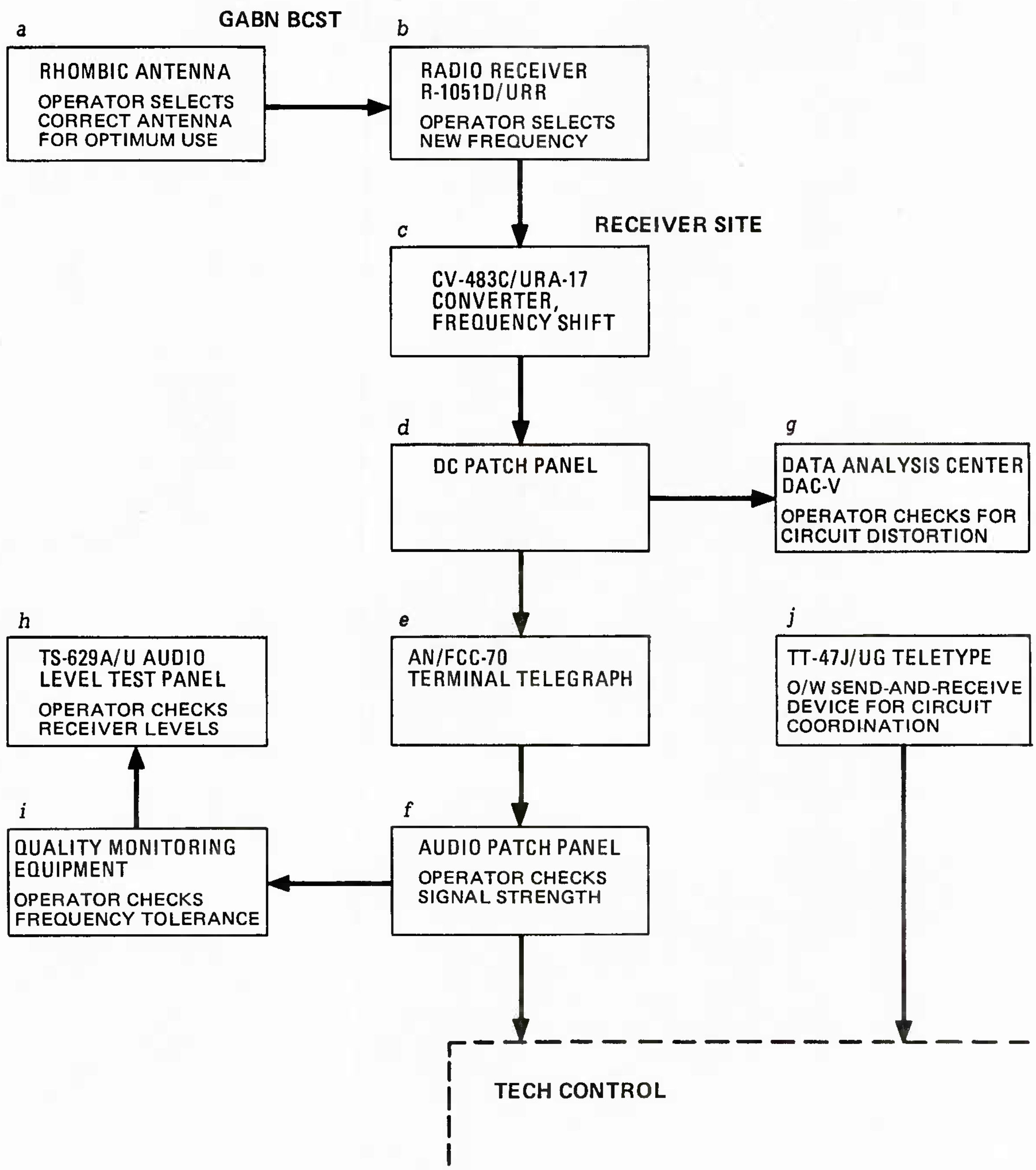

FIG. B-5: SEQUENCE OF ACTIVITIES IN GABN BCST MONITORING

Single-Channel Reception

Figure B-6 is the receive systems flow diagram for GCMP BCST.

a. Rhombic antenna: Receives GCMP BCST (RF) signal: operator selects optimum antenna.

b. Radio receiver R-1051D: Operators select sharpest GCMP signal.

c. DT-325A/U detector tone: Designed to serve as an interface between a conventional communications receiver and the Morse-to-teleprinter code converter.

d. CV-2124A/U converter Morse-to-teletypewriter code: Converts international Morse code into standard 7-unit start-stop code.

e. DC patch panel: Receives the DC signal from the CV-2124A/U; it is fed to the terminal equipment.

f. Data analysis center, DAV-V: A device that enables the operator to take distortion readings at the DC board.

g. AN/UGC-25 teletypewriter set: Operator monitors GCMP BCST for various problems in transmission or reception.

h. AN/FCC-70 terminal telegraph: Receives signal from the DC patch panel, converting the DC signal to Audio and combining it with other channels for a complete 16-channel tone pack; it is normalled to the audio patch panel.

i. Audio patch panel: Receives the composite tone pack from terminal equipment containing the GCMP BCST and feeds it to tech control.

j. Quality monitoring equipment: Operators check CW signals to maintain 30 Hz tolerance on each new frequency shift and every 8 hours, as part of QC checks.

k. TS-629A/U audio level test panel: Operators check receiver level settings every 30 minutes.

l. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

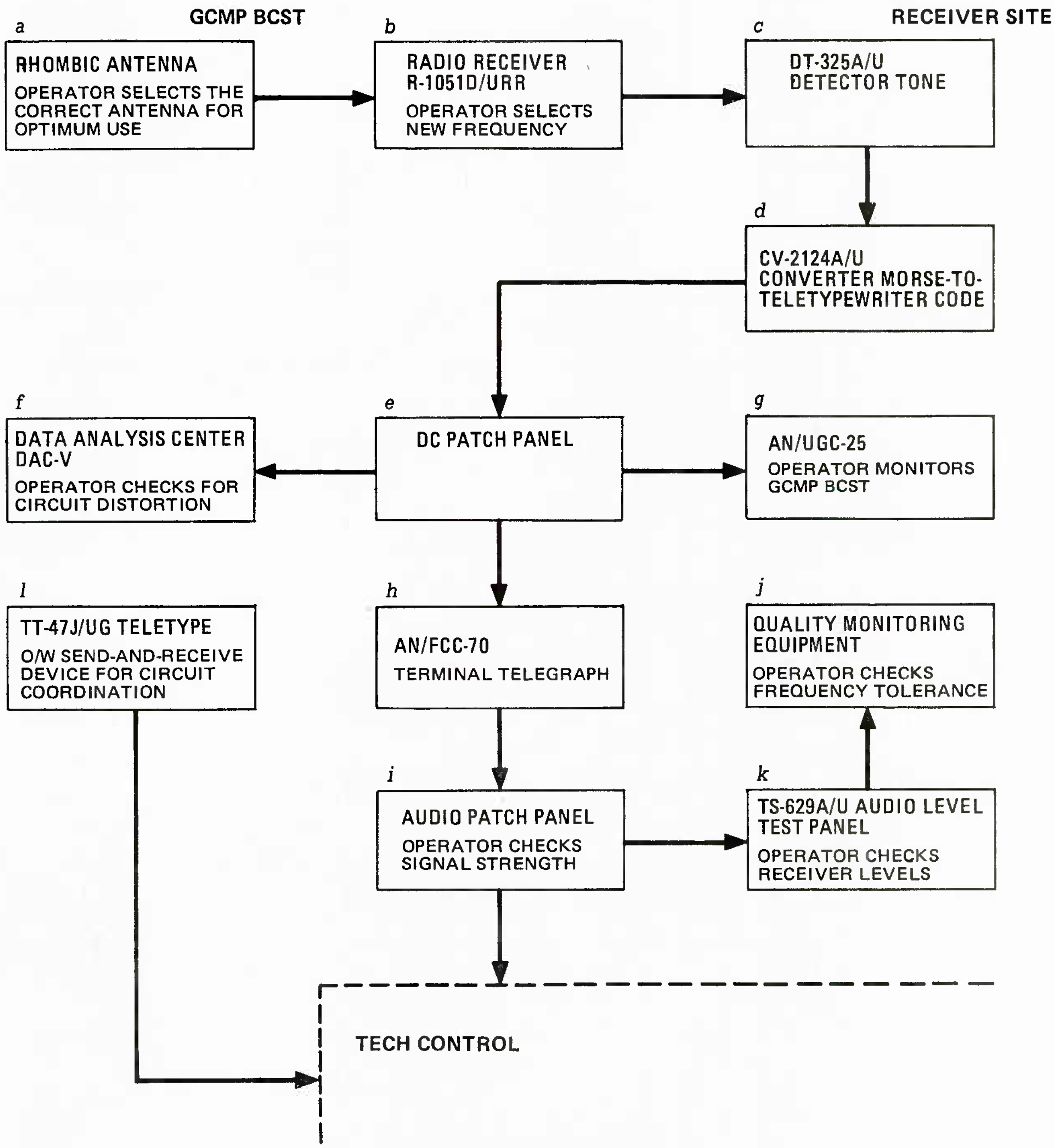

FIG. B-6: SEQUENCE OF ACTIVITIES IN GCMP BCST RECEPTION

SAR/ASW CIRCUITS

Single-Channel Reception

Figure B-7 is the receive systems flow diagram for SAR/ASW.

a. Omnidirectional antenna: Receives SAR/ASW (RF) signals; operator may select a directional antenna when needed.

b. Radio receiver R-1051D: Operators select sharpest SAR/ASW signals.

c. CV-483/URA-17 converter, frequency shift: A device that converts audio to DC; the signal is then fed to the DC parth panel.

d. DC patch panel: Receives the DC signal from the CV-483C/URA-17; it is then fed to the terminal equipment.

e. Data analysis center DAV-V: A device that enables the operator to take distortion readings at the DC board.

f. AN/FCC-70 terminal telegraph: Receives signal from the DC patch panel, converting the DC signal to audio and combining it with other channels for a composite 16-channel tone pack; it is normalled to the audio patch panel.

g. Audio patch panel: Receives the composite tone pack from terminal equipment containing the SAR/ASW and feeds it to tech control.

h. Quality monitoring equipment: Operators check SAR/ASW signal to maintain 30-Hz tolerance on each new frequency shift and every 8 hours as part of QC checks.

i. TS-629A/U audio level test panel: Operators check receiver level settings every 30 minutes.

j. TT-47J/UG teletype O/W: Send-and-receive device used for circuit co-ordination.

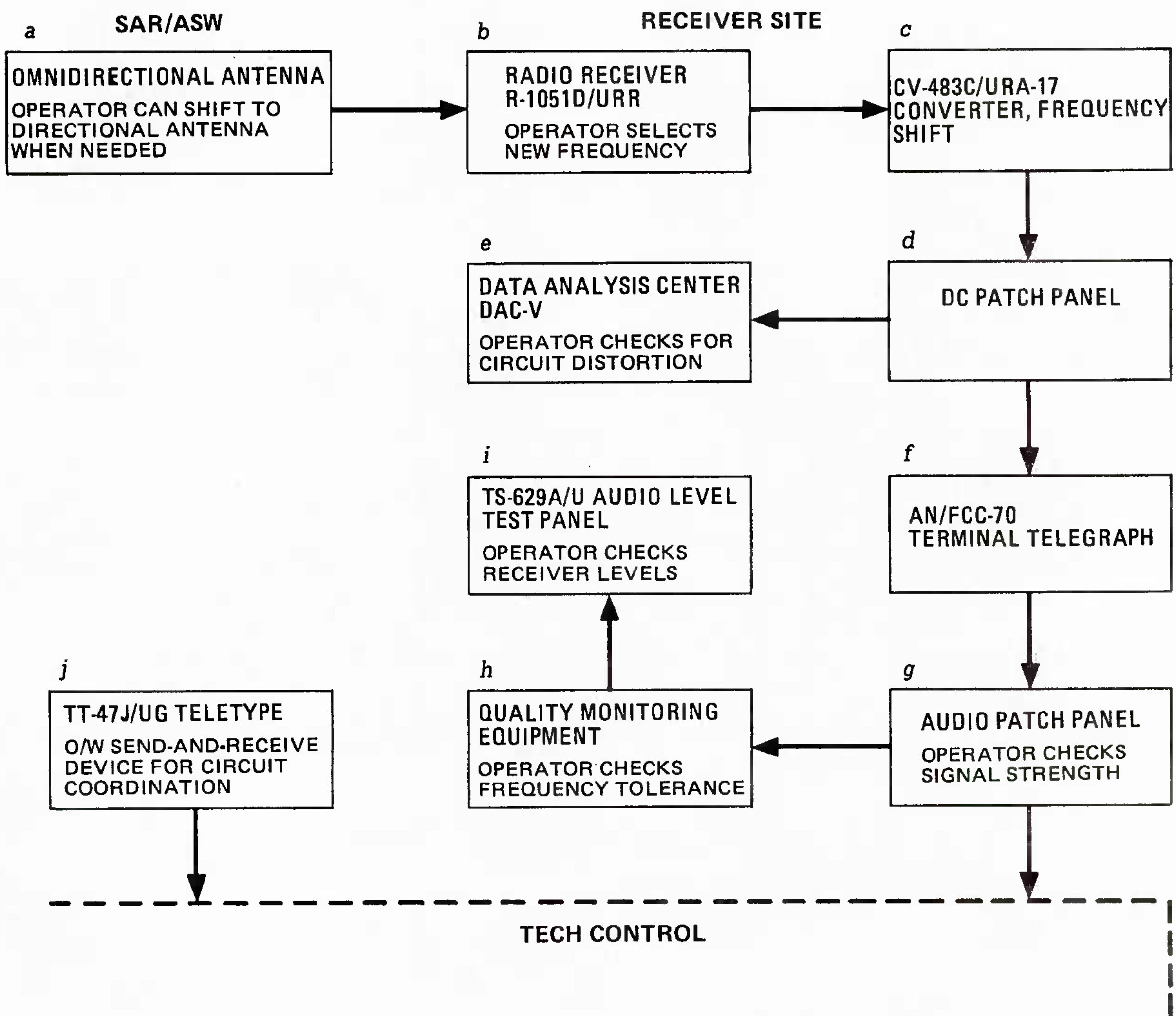

FIG. B-7: SEQUENCE OF ACTIVITIES INVOLVED IN SAR OR ASW RECEPTION

Single-Channel Reception

Figure B-8 is the receive systems flow diagram for the single-channel NWC VLF.

a. Cloverleaf antenna: Receives the VLF signal.

b. AN/BRR3 receiving set radio: Operator adjusts receiver when needed to maintain the clearest signal.

c. DC patch panel: Receives the DC signal from the converter section of the AN/BRR3 receiving set radio; it is then fed to the terminal equipment.

d. Data analysis center DAC-V: A device that enables the operator to take distortion readings at the DC board.

e. AN/FCC-70 terminal telegraph: Receives the signal from the DC patch panel, converting the DC signal to audio and combining it with other channels for a composite 16-channel tone pack; it is normalled to the audio patch panel.

f. Audio patch panel: Receives the composite tone pack from the terminal equipment containing the NWC VLF and feeds it to tech control.

g. Quality monitoring equipment: Operators check RATT signals to maintain 10-Hz tolerance on each new frequency shift and every 8 hours as part of QC checks.

h. TS-629A/U audio level test panel: Operators check receiver level settings every 30 minutes.

i. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

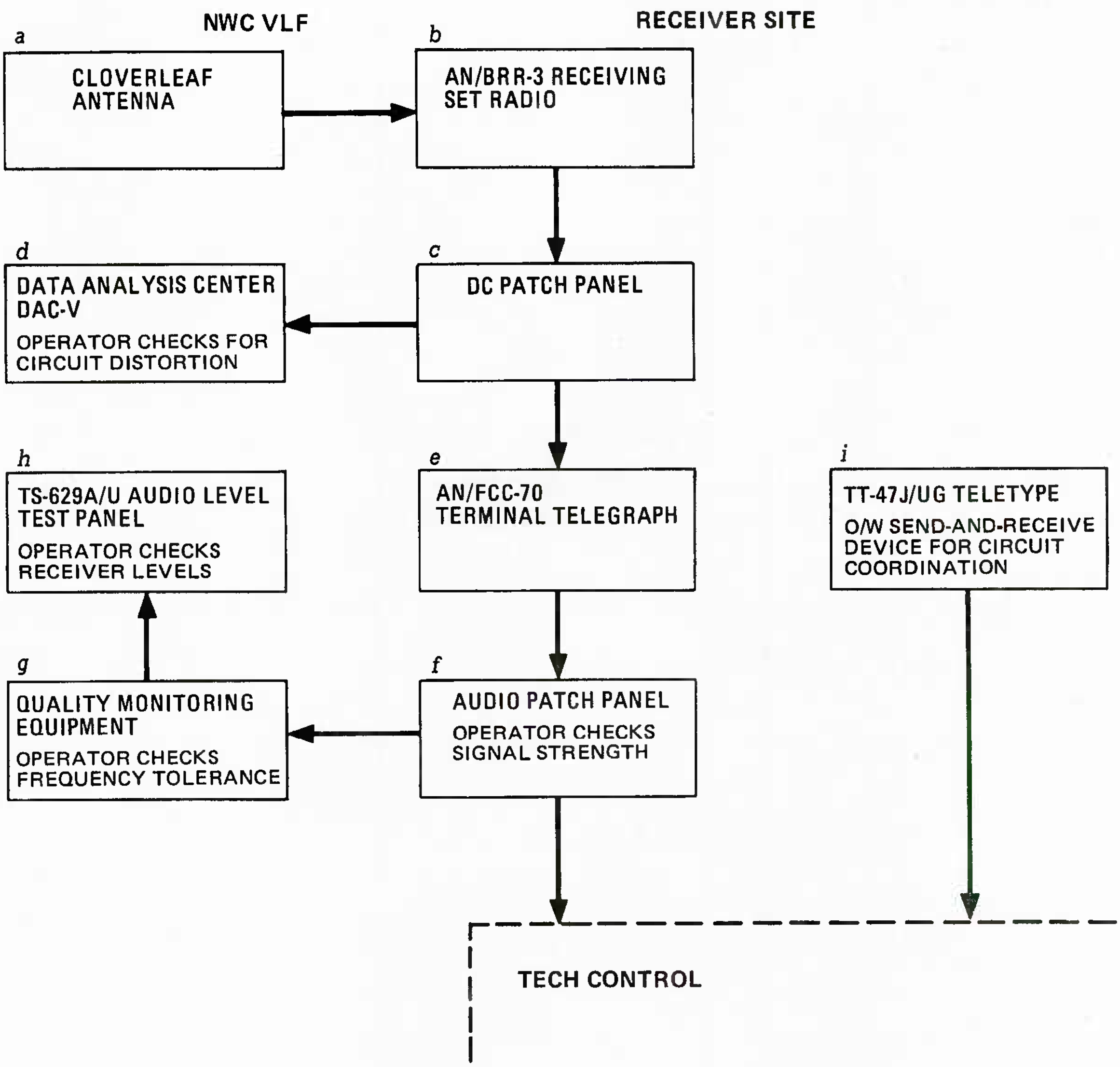

FIG. B-8: SEQUENCE OF ACTIVITIES IN NWC VLF RECEPTION

SHIP-TO-SHORE (RFCS) ON-CALL TERMINATIONS

Single-Channel Reception

Figure B-9 is the receive systems flow diagram for on-call, single-channel terminations.

a. Rhombic antenna: Receives signal from ships terminated RFCS. Operators select optimum antenna, based on ship's location and direction.

b. Radio receiver R-1051D: Operators select clear working frequencies to accept ship's traffic.

c. CV-483/URA-17 converter, frequency shift: A device that converts audio to DC; the signal is then sent to the DC patch panel.

d. DC patch panel: Receives the DC signal from the CV-483C/URA-17; it is then fed to the TSEC/KW-7.

e. TSEC/KW-7: A device that decrypts ship's traffic.

f. DC patch panel (RED): Receives decrypted DC signal from the TSEC/KW-7.

g. AN/UGR-9 teleyprinter set: Operators receive the decrypted traffic, checking it for completeness and errors.

h. Proofreader: Operator proofreads all traffic, checks for correct format, completeness, and errors. When an abnormality is found, it is sent to the repoke position for correction. When the message is errorless, it goes to the poney operator.

i. Repoke: Operator corrects error found by the proofreader and sends it back to him for a recheck.

j. Pony operator checks message again, then sends it to the pony alfa circuit to tech control.

k. Final traffic checker and SVC clerk: Operator checks the message for correct format, completeness, and errors; when the message is errorless, it is filed. When an error is found, the operator SVC's the message and sends it back to the proofreader.

l. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

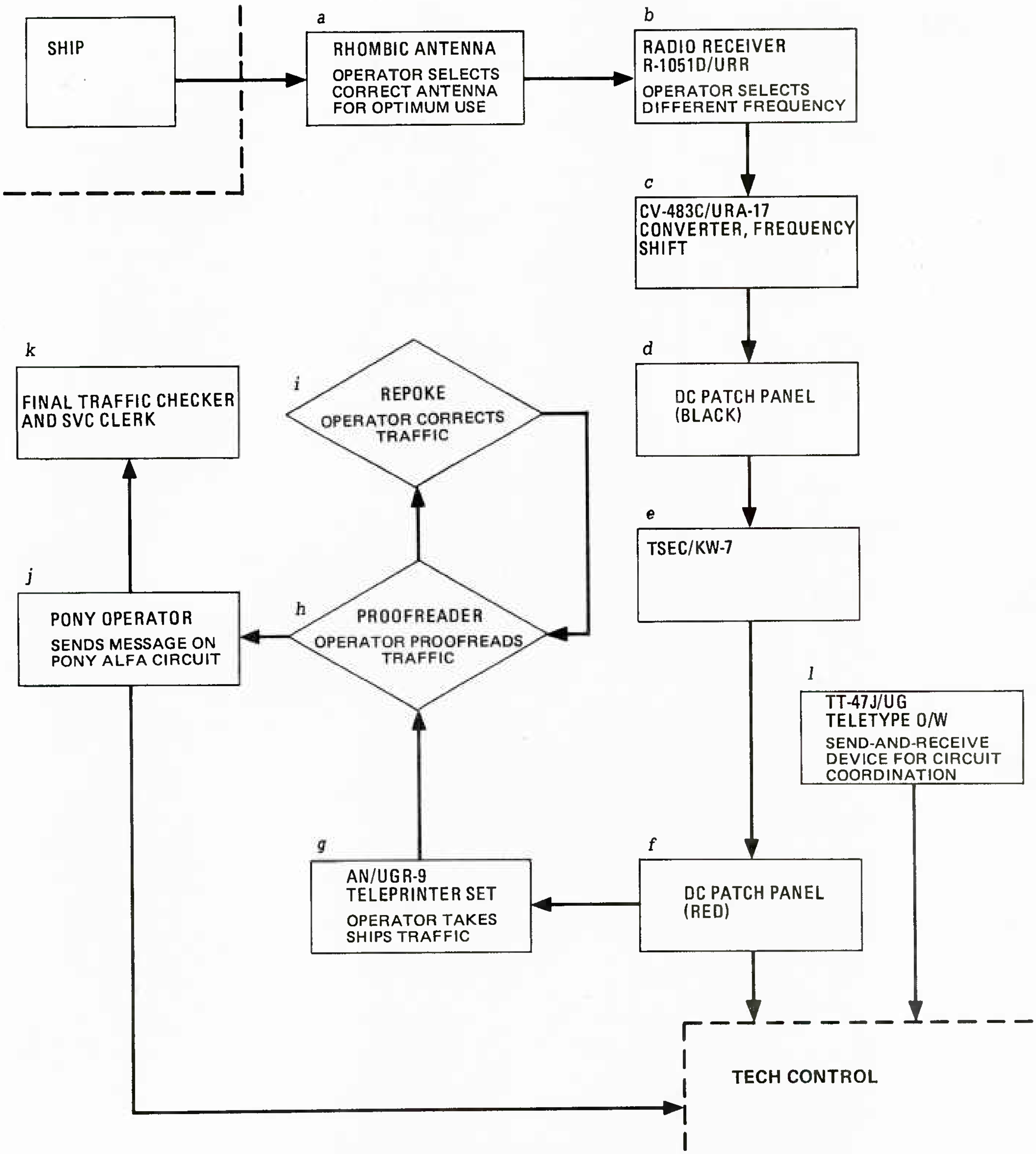

FIG. B-9: SEQUENCE OF ACTIVITIES IN RECEPTION OF SHIP-TO-SHORE (RFCS) TERMINATIONS

TACAMO AIRCRAFT VLF BCST TERMINATIONS

Single-Channel (RATT) or CW Reception)

Figure B-10 is the receive systems flow diagram for tacamo VLF BCST.

a. Cloverleaf antenna: Receives the aircraft's VLF BCST.

b. AN/BRR-3 receiving set radio: Operator adjusts receiver to obtain the optimum signal. The AN/BRR-3 contains a built-in converter.

c. DC patch panel: Receives the DC signal from the AN/BRR-3 converter section. The signal path from the DC board splits, one part going to the Orestes area, the other to the terminal telegraph.

d. Data analysis center DAC-V: A device that enables the operator to take distortion readings at the DC board.

e. AN/FCC-70 terminal telegraph: Receives the signal from the DC patch panel, converting the DC signal to audio and combining it with other channels for a composite 16-channel tone pack; it is normalled to the audio patch panel.

f. Audio patch panel: Receives the composite tone pack from the terminal equipment containing the tacamo VLF BCST and feeds it to tech control.

g. Quality monitoring equipment: Operator checks the VLF BCST signal to maintain 10-Hz tolerance on each new setting of the receiver and every 8 hours as part of QC checks.

h. TS-629A/U audio level test panel: Operators check receiver level settings every 30 minutes.

i. SB-3189A/FGC communication patching panel (black). Located in the Orestes area, it receives the signal from the DC patch panel in the deck area.

j. TSEC/KW-7: A device that decrypts the aircraft's BCST.

k. DC patch panel (red): Receives the decryped DC signal from the TSEC/KW-7.

l. AN/UGR-9 teleyprinter RCV: Operators receive the decrypted traffic, checking it for completeness and errors.

m. Speaker: Located in the CW area, operators monitor the tacamo VLF BCST for shifts from CW to RATTY.

n. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

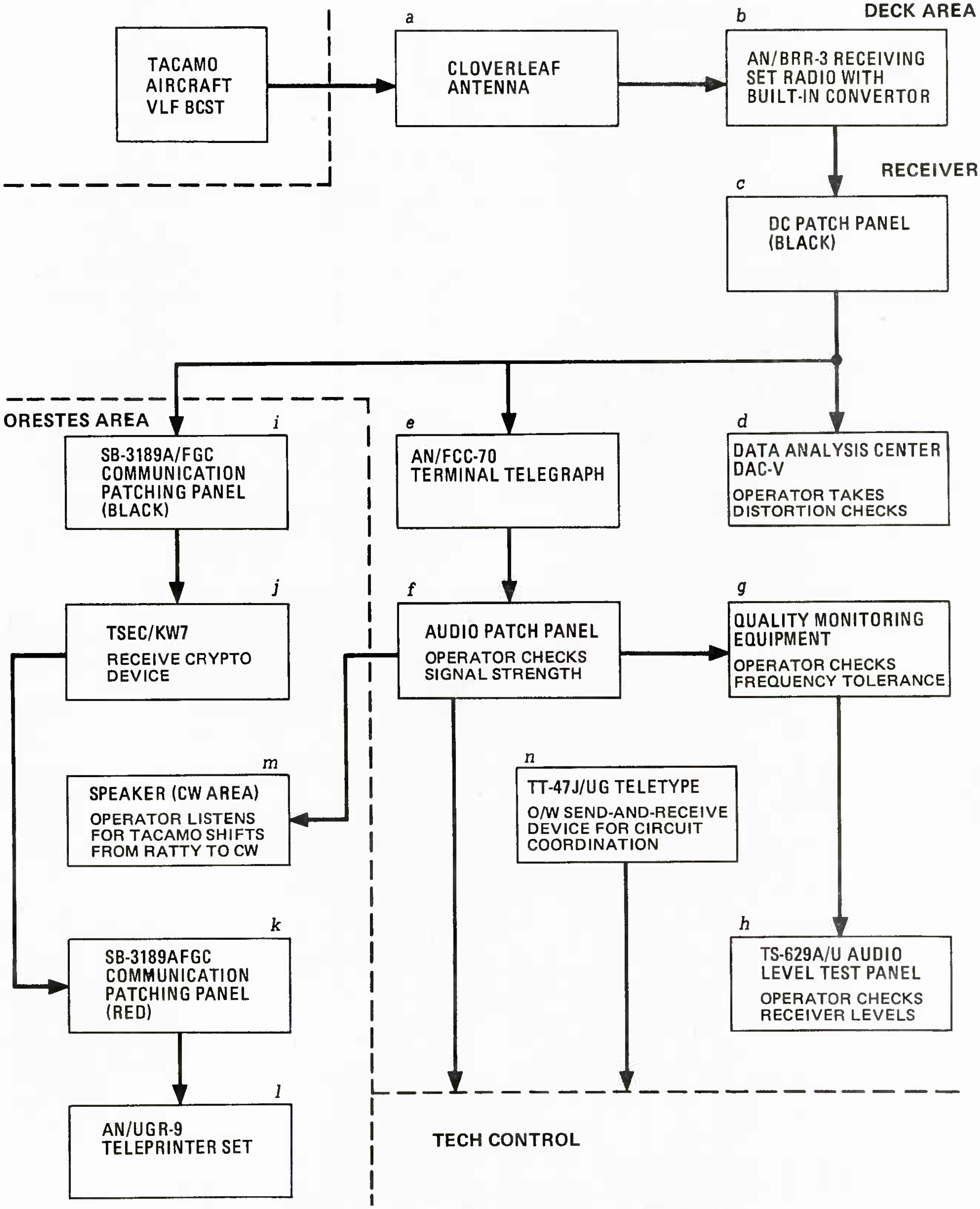

FIG. B-10: SEQUENCE OF ACTIVITIES IN TACAMO VLF BCST (RATT OR CW)

FULL-PERIOD VOICE CIRCUITS HICOM/NORATS

Voice-Circuits

Figure B-11 is the receive systems flow diagram for voice calls.

a. Rhombic antenna: Receives signal from ships calling on voice circuit.

b. Radio receiver R-1051D: Operators shift receivers to new frequencies upon controls request.

c. Audio patch panel: Operators check for signal strength, interference, and signal fading, reporting all discrepancies to control for action. Signal normalled from audio patch panel to tech control.

d. Quality monitoring equipment: Operators monitor the voice transmissions and check carrier frequencies.

e. TS-629A/U audio level test panel: Operators check receiver level settings while monitoring HICOM or NORATS.

f. TT-47J/UG teletype O/W: Send-and-receive device used for circuit coordination.

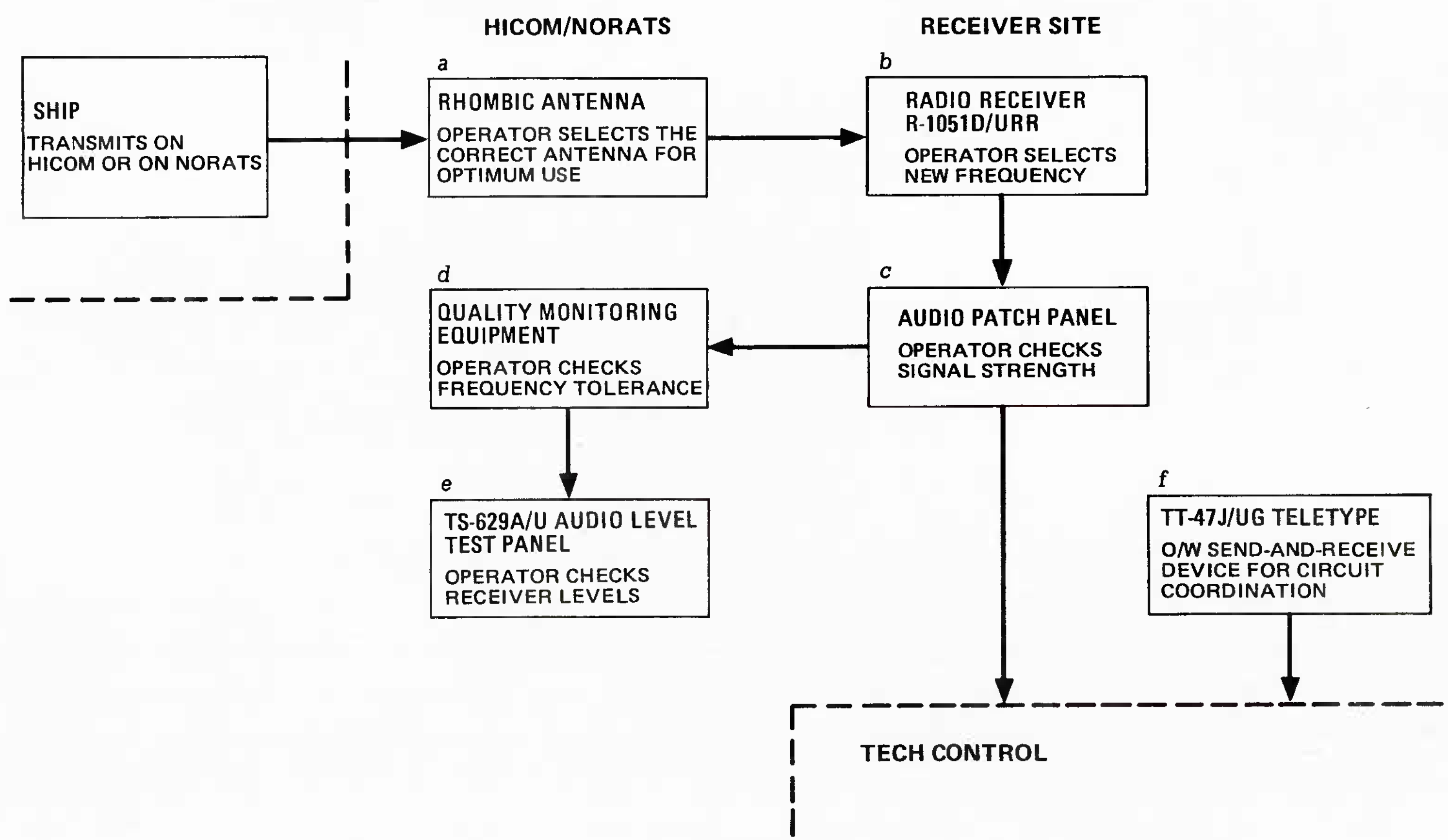

FIG. B-11: SEQUENCE OF ACTIVITIES IN RECEPTION OF HICOM/NORATS

SECONDARY SHIP/SHORE (CW) TERMINATIONS

CW Reception

Figure B-12 is the receive systems flow diagram for secondary ship/shore CW.

a. Rhombic antenna: Receives the CW signal from ship or station.

b. Radio receiver R-1051D: Operators select the sharpest CW signal by adjusting the BFO.

c. Dual SPKR AMPL Navelex DWG 31591-33081: A device that enables the operators to copy CW without headsets.

d. CW operator: Copies CW traffic, making sure the message is correct and complete, logs in the message, and hand carries it to the proofreader's box.

e. Proofreader: Operator proofreads all traffic, checks for correct format, completeness and errors. When an abnormality is found, the message is sent to the repoke position for correction. When the message is errorless, it goes to the pony operator.

f. Repoke: Operator corrects error found by the proofreader and sends it back to him for a recheck.

g. Pony operator: Operator checks message again, then sends it on the pony alfa circuit to tech control.

h. Final traffic checker and SVC clerk: Operator checks the message for correct format, completeness, and errors. When the message is errorless, he files it. When an error is found, he SVC's the message and sends it back to the proofreader.

i. TT-47J/UG teletype O/W: Send-and-receive device used for circuit co-ordination.

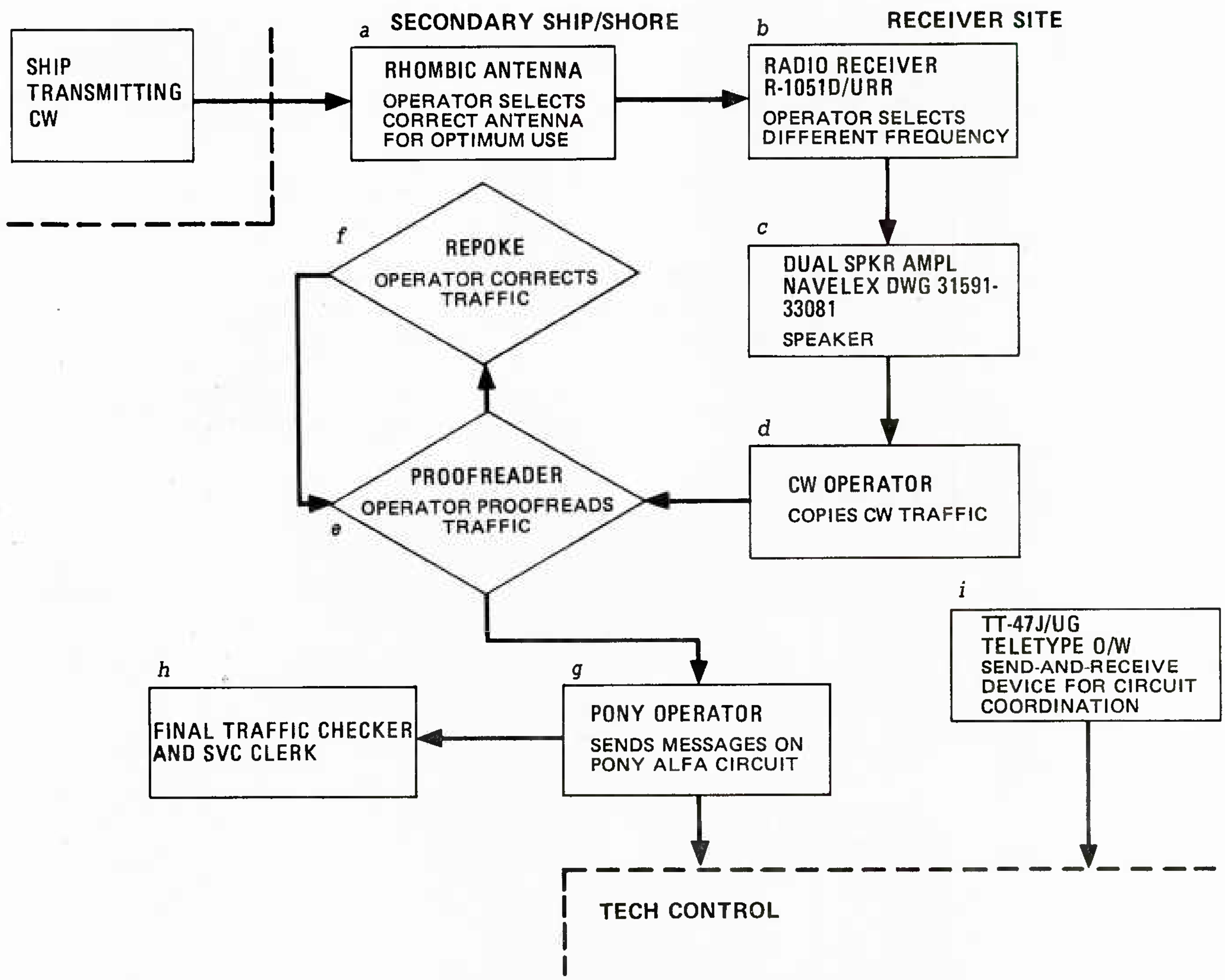

FIG. B-12: SEQUENCE OF ACTIVITIES IN RECEPTION
OF SECONDARY SHIP/SHORE MESSAGES