Managing the Financial and Operational Issues Associated with the Hickam Air Force Base Trunked Land Mobile Radio Project

by

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Master of Science in Information Systems

Hawaii Pacific University

Spring 1995

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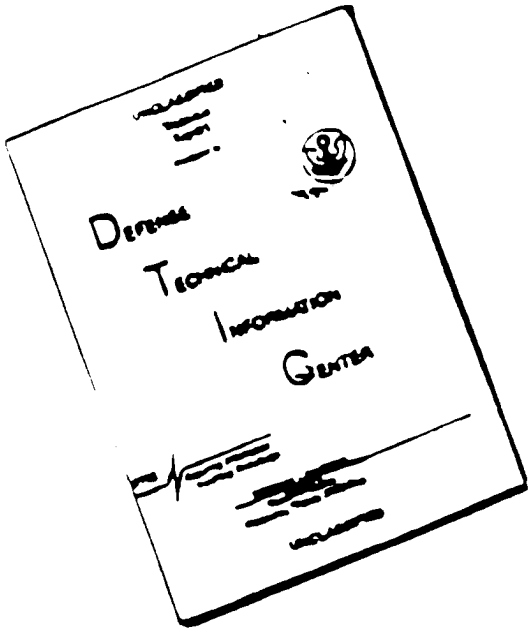

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	3 Nov 95	

4. TITLE AND SUBTITLE Managing the Financial and Operational Issues Associated with the Hickam Air Force Base Trunked Land Mobile Radio Project

5. FUNDING NUMBERS

6. AUTHOR(S)

Donald T. Carter

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Hawai'i Pacific University

8. PERFORMING ORGANIZATION REPORT NUMBER

95-131

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

DEPARTMENT OF THE AIR FORCE
AFIT/CI
2950 P STREET, BLDG 125
WRIGHT-PATTERSON AFB OH 45433-7765

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for Public Release IAW AFR 190-1
Distribution Unlimited
BRIAN D. GAUTHIER, MSgt, USAF
Chief, Administration

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

14. SUBJECT TERMS

15. NUMBER OF PAGES
187

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

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Student Name: Donald T. Carter

Social Security Number: [redacted]

Title of Professional Paper: Managing the Financial and Operational Issues Associated with the Hickam Air Force Base Trunked Land Mobile Radio Project

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Information Systems

May 2, 1995
Date

Executive Summary

The 15th Communications Squadron (15 CS), located on Hickam AFB, HI, currently manages 36 conventional VHF land mobile radio (LMR) networks for various units operating on the base. Due to a lack of interoperability between the networks, an absence of additional frequency space in their current spectrum, and a mandate by the federal government to move to narrowband technology, the 15 CS has initiated a project to convert the conventional networks to a UHF trunked LMR system. Many of the trunking equipment items will be shared among all users, whereas with the conventional system, each network operated with its own equipment, isolated from all other networks. There are several key financial and operational issues which the 15 CS must consider and resolve for the project to be successful.

This study examined the management question: How can the 15 CS manage the installation and operation of the new trunked LMR system. The 15 CS needs to determine who should be responsible for paying for equipment purchases, and equipment operation and maintenance costs. The 15 CS also needs to determine how to manage the talkgroup and feature assignment process, which system activity reports are needed, and what will be done with the information in the reports.

In the area of financial responsibility, current policies and procedures were studied, along with relevant regulations, to determine if these sources provided any specific guidance. An Army unit operating in Alaska has successfully installed a similar trunked LMR system. Their system managers were interviewed to determine their actions concerning the financial and operational issues reviewed in this study. Literature which discussed elements of a successful cost allocation system and managing shared systems was also reviewed. A questionnaire was

sent to Wing and tenant units on Hickam to determine their opinions concerning the financial and operational issues reviewed in this study. Both the chi-square and ANOVA tests were used to analyze the responses.

The relevant regulations did not specify who should be responsible for paying for the various LMR equipment items. Survey respondents agreed to maintain the policy of each unit paying for their own radios. All other trunking equipment items should be purchased using Wing funds. Tenant units should be asked to pay for some portion of these costs since the Wing is not funded to support tenant units. The survey responses and the actions of the Alaskan Army unit showed that charges to any units for using the trunking system should be based upon the number of radios owned by that unit. Current host-tenant support agreements must be revised to state specifically who will be responsible for paying for which specific trunked LMR operational and maintenance charges.

Based on the research, it was determined that the trunking terminals had the capabilities to manage the talkgroup and feature assignment process in accordance with user requirements. The 15 CS should also use these terminals to generate monthly reports showing organization phone calls, the cost for those phone calls, the effect those calls had on other system activity, the number of calls processed, the peak and low periods of system activity, queue times, and telephone interconnect vs. dispatch times. The 15 CS LMR manager should use this information to compare with previous activity, educate system users, and watch for any possible system misuse.

The 15 CS commander should grant access to the telephone interconnect feature based upon the following criteria: safety, unit commander, need for off-base communication, and consideration of other means of communication available.

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Chapter I

INTRODUCTION

Background

The 15th Communications Squadron (15 CS) is located on Hickam Air Force Base and is aligned directly under the 15th Air Base Wing (15 ABW). The 15 CS is responsible for providing communications and computer systems support to Department of Defense personnel within the jurisdiction of the 15 ABW. The area of responsibility encompasses nearly the entire island of Oahu, as well as several off-island sites.

Many units supported by the 15 CS use land mobile radios (LMRs) to communicate with each other in carrying out their daily business. As a result, one of the functions of the 15 CS is to provide LMR management to units and personnel within the jurisdiction of the 15 ABW. The 15 CS LMR office provides acquisition, accountability, reutilization, engineering, and maintenance support services to the 15 ABW and supported agencies for all users of pagers, LMRs, and cellular telephones. Currently, LMR operations are conducted in the VHF band, 138 MHz to 174 MHz; this spectrum is broken into three non-continuous sub-bands and wideband technology (25 kHz separation) is employed. Each network is assigned a pair of frequencies to use and users are limited to communicating only with those personnel on the same network. Thus, the number of networks (nets) is limited by the number of frequencies available. The only way to communicate with someone on another network is to use one of their LMRs or to call them on the telephone (cellular or landline). The 15 CS currently manages 36 LMR

networks, each with its own assigned frequencies as shown in Appendix A. The other services on the island (i.e. Army, Navy, Marines) also operate in the same manner, with each of their networks having its own pair of frequencies. Should situations arise where the different services need to communicate (i.e. exercises or real world emergencies), personnel could not use the current LMR networks because of a lack of interoperability. There is also a lack of privacy when using the current LMR network. All personnel with LMRs on the same network will hear any conversation taking place over the network.

Based on the problems identified above, in fiscal year 1991 (FY91), the 15 CS initiated a VHF trunked LMR project. The project aimed to achieve interoperability between nets; allow users on one net to talk to those on another net in times of crisis or emergency; and improve wide area coverage. However, since project initiation, several events have triggered the need to procure all new LMR equipment.

On August 9, 1993, President Clinton signed the Omnibus Reconciliation Act of 1993 into law. Title VI of the Act (AKA "Emerging Telecommunication Technologies Act - 1993", or "Dingell Bill"), requires the transfer of 200 MHz of federal spectrum below 5 GHz to the private sector. While 150 MHz may be transferred over a period not to exceed fifteen years, the remaining 50 MHz must be transferred within 18 months of the Act. As a result of the Dingell Bill, the NTIA (National Telecommunications Information Agency) has mandated all government radio networks begin moving to narrowband technology (12 kHz separation) beginning January 1, 1995, and completing the transition by January 1, 2005. The migration to narrowband will effectively double the number of channels available for use by all agencies. As a result of this mandate, all wideband LMR

equipment currently in 15 CS inventory must be replaced with narrowband-capable equipment.

As a result of the above technical problems and a need to modernize LMR equipment, the 15 CS has initiated a Wide Area Joint Trunking System. The proposed system will operate in the 406 MHz - 420 MHz (UHF) spectrum. This range has been reserved by the Federal Communications Commission (FCC) for trunking initiatives, is available for expansion, and can support digital narrowband trunking technology. A joint service system has been proposed by the 15 CS which would cover all of Oahu with a secure voice capable, digital, narrowband system. The system will allow interoperability between all networks, to include Air Force as well as other services. The new system also offers an extensive list of features (see Appendix B) available to users as a result of digital technology.

The proposed schedule for installing the new system is to first build the backbone, consisting of three nodes. Thereafter, the 41 nets located at Hickam would be migrated to UHF trunked radios over a five year period. The equipment is scheduled to be procured according to a prioritized list developed by the 15 CS based on the need for interoperability.

The first step in the migration to UHF has been to upgrade the 15 ABW Commander's net. Started in FY91, the project seeks to provide wide area, secure voice, command and control radio communications for the 15 ABW Commander. Thus far, the 15 CS has installed the primary UHF site at building 988 on Hickam AFB with a five-channel system. Cross-banding equipment has been installed to allow users of the LMRs on the new UHF

system (15 ABW Commander's net personnel) to communicate with those on the older VHF system. The current proposal calls for additional capacity at Hickam and for two other island sites: a repeater on Diamond Head and a repeater on Waimanalo Ridge. The prime site at Hickam would be upgraded to a 20 channel system, along with the computerized control equipment, and system management terminals. The approximate cost for the Hickam site is $900,000. Both the Diamond Head and the Waimanalo Ridge sites are proposed to consist of five channels, microwave equipment, and control equipment; costing approximately $400,000 per site.

The new equipment in-place allows all calls to be displayed on a central terminal. The 15 CS plans to purchase the SMARTNET II controller and a SIMS II terminal in July 1995. Several categories of reports are available regarding system usage. No system has yet been established to manage who will be assigned to which talk groups, how these talk groups can be dynamically maintained, how features will be assigned, and who will be responsible for financial expenditures.

There are several key issues which must be dealt with while developing and installing the new systems. Financial responsibility has not been determined. Who will be responsible for purchasing and installing new equipment? How will maintenance costs be accounted for? Will they be based on system usage, number of users, or some other parameter? Database management is also another critical issue. With the older system, it was clear who was assigned to which network and what frequencies were being used. Coordinating the management of different networks did not involve many variables. However, with the proposed system users are not assigned to particular frequencies.

Talkgroups will have to be set up to which each user will be assigned. Users, however, will not be restricted to communicating only with those in their own talkgroup.

Purpose of the Study

The purpose of the study is to examine several key issues which the 15 CS must deal with while developing, installing, and operating the trunked LMR system. Policies and procedures needed to determine financial responsibility for equipment purchase, operation, and maintenance were identified. I have examined not only what these procedures should be, but also the justification for selecting the appropriate policies and procedures. Database management is also another critical issue. With the older system, it was clear who was assigned to which network and what frequencies were being used. Coordinating the management of different networks did not involve many variables. However, with the proposed system, talkgroups will have to be set up to which each user will be assigned. Procedures needed to assign personnel to talkgroups and to assign features were also identified. The new equipment in-place allows all calls to be displayed on a central terminal. Several categories of reports are available regarding system usage. This paper examines which types of reports may be useful to both squadron and LMR managers. Based on these examinations, I have determined which reports should be used, how often they should be generated, and what should be done with the information contained in the reports.

Importance of the Study

Presently, the 15 CS has no plan for resolving the financial and database issues raised earlier. Funding is a major obstacle to implementing the proposed system. The 15 CS has discussed the proposed system with many interested parties including the 15 ABW Commander, Pacific Air Forces (PACAF) personnel, and the Commander-in-Chief, Pacific Command (CINCPAC). As a result of the Dingell Bill, incompatibility and lack of expansion capability in the current spectrum, and the mandate to move to a UHF narrowband system, the 15 CS must implement the proposed system or a variation thereof which will satisfy the above requirements. The 15 CS must begin this transition by January 1, 1995, and complete the transition by January 1, 2005. Currently, there is no plan defining financial responsibilities or database and system management procedures. Unless these functions are specifically defined through the development of appropriate policies and procedures, the chances are small that the 15 CS can install, operate, and maintain a successful system by the required deadlines. Therefore, it is critical that a plan be developed to establish funding responsibility for initial equipment purchase, operation, and maintenance. Once the plan has been developed, the 15 CS may proceed to implement the plan and the new system.

The new system is much more complicated than the current VHF system. With the current system, it was clear with whom each user could talk. If someone wanted to talk to a user on the Civil Engineering network, he was required to procure a radio pre-programmed with the appropriate frequency. However, with the new system, instead of each net having its own frequencies, talkgroups are set up. Each person on the same

talkgroup can speak with others on the talkgroup. Additionally, the radios may switch between talkgroups, to enable users to speak with personnel on different talkgroups. This process is markedly more complicated than the current situation. A plan must be developed to manage the talkgroups. Procedures need to be developed to request, approve, and assign users to talkgroups. Additionally, some method must be developed to allow users to know the identifications of the other talkgroups. Since the talkgroups may be changing continuously, this process may not be simple.

An extensive list of features is available with the new system (see Appendix B). Some of the features have limited capacity (i.e. telephone interconnect). Only a limited number of users may use these features. Procedures need to be developed to determine who will get access to such features. Additionally, some system must be developed to maintain a current record of the features to which each user has access. This is critical for user training and accountability.

If the new system is to be successful, the 15 CS must develop a plan to address the financial and database issues raised above. These issues are critical to the successful implementation of a new UHF trunked system. Clearly, the new system is more complicated than the current system. To properly manage the procurement, installation, operation, and maintenance of a new system, policies and procedures must be developed which address these issues. A failure to properly address and resolve these issues may result in any of the following undesirable situations: no system; a system which fails to meet user requirements; massive confusion concerning talkgroup and/or feature assignment; finger-pointing concerning financial responsibility; system overload; and a lack

of proper system monitoring. This study may be used by 15 CS management and LMR managers to develop appropriate plans, policies, and procedures for the proposed system. The study may also be used by other organizations considering the implementation of a trunked LMR system which will be shared among several organizations.

Statement of the Problem

The management question is: How can the 15 CS manage the installation and operation of the new trunked LMR system? More specifically, how can the 15 CS manage the financial responsibilities, talkgroup and feature assignments, and databases associated with the trunked LMR system? Concerning financial responsibilities, the 15 CS needs to determine who will pay for equipment purchases, and equipment operation and maintenance. The 15 CS also needs to determine how these charges will be determined. Concerning the database management functions, the 15 CS needs to determine how to manage the talkgroup and feature assignment process, which system reports are needed, and what will be done with the information contained in the reports.

Assumptions

1) It is assumed that the policies and procedures recommended in this paper apply only to the trunked LMR system as an Air Force system. The other services have not yet implemented similar systems. Should the other services decide to implement their own systems or to add additional equipment to the Air Force system for their own use, the policies and procedures recommended in this paper may or may not be appropriate. If

either of these actions are taken, the recommendations must be examined for their applicability to the given situation.

2) It is assumed that Motorola, as designer and provider of the equipment for the trunking system, is a valuable source of information for providing recommendations on the issues in this paper.

3) It is assumed that The Genesis Group, as a developer of software for the Motorola trunking systems, is a valuable and knowledgeable source of information for providing recommendations on database management, cost allocation procedures, billing management, and report generation.

Related Issues or Questions

The research goals are to determine how best to allocate costs for the new trunking system and to determine the appropriate processes and procedures for managing the trunking database and associated features. The research questions are:

1. How can the 15 CS manage the financial responsibilities associated with the trunked LMR system?

2. How can the 15 CS manage the trunking system operations?

To answer these questions, several investigative and measurement questions have been formulated (each grouped under their respective research question):

1. How can the 15 CS manage the financial responsibilities associated with the trunked LMR system?

A. Who should pay for equipment purchases (includes radios, terminals, repeaters, and backbone equipment)?

To complement this investigative question, the following measurement questions have been developed:

1. The current LMR system is going to be upgraded to a system which will provide greater interoperability and enhanced features. Would you be willing to contribute towards the purchase and support costs for the new system?
2. If not, is it because:
    a. 15 CS should be responsible for paying for all comm equipment and services.
    b. the increase in service/capabilities is not worth the extra cost to me.
    c. some other reason.
3. Who do you think should be responsible for paying for the initial purchase of the following equipment items?
    a. radios used by individual
    b. repeaters
    c. central controllers
    d. other backbone equipment

B. How can payment responsibility for equipment purchases be justified?

C. Who should pay for maintenance costs (includes radios, terminals, repeaters, and backbone equipment)?

To complement this investigative question, the following measurement questions have been developed:

1. The current LMR system is going to be upgraded to a system which will provide greater interoperability and enhanced features. Would you be willing to contribute towards the purchase and support costs for the new system?

2. If not, is it because:

    a. 15 CS should be responsible for paying for all comm equipment and services.

    b. the increase in service/capabilities is not worth the extra cost to me.

    c. some other reason.

3. Who do you think should be responsible for paying for the maintenance and support costs for the following equipment items?

    a. radios used by individual units

    b. repeaters

    c. central controllers

    d. other backbone equipment

4. Do you think that tenant units (non-15 ABW units) should be responsible for paying a monthly fee for using the trunking system?

5. If so, how much financial responsibility should the tenant units have when compared to 15 ABW units?

D. How can payment responsibility for equipment maintenance be justified?

E. Should costs be based upon equipment ownership, system usage, geographic coverage needed, or some other parameter?

To complement this investigative question, the following measurement question was developed:

1. Do you think charges should be based on:

(1) how many radios your organization has.

(2) how often you use your LMR.

(3) the geographic coverage you require (how far away from HAFB you need to be able to communicate).

(4) some other parameter.

F. If costs are based on assigned features, how can the cost per feature be determined?

G. What are the current policies toward paying for LMR equipment within the 15 ABW?

2. How can the 15 CS manage the trunking system operations?

A. What should the procedures be to request, approve, and assign features to individuals?

B. How will the information regarding who has which features be maintained?

C. What criteria will be used to determine who gets access to features with limited accessibility (i.e. telephone interconnect)?

To complement this investigative question, the following measurement question was developed:

1. What should the criteria be to assign features with limited access (e.g., only a few users may have access to certain features like telephone interconnect)?

D. What should the procedures be to request, assign, and reassign personnel to talkgroups?

E. How will the information regarding who is assigned to which talkgroups be maintained?

F. Which system reports will be used?

To complement this investigative question, the following measurement question was developed:

1. The new trunked LMR system will be capable of generating reports showing various system usage statistics. Please rate the following statistics concerning their usefulness to you.

System use by your organization (total minutes of air time)

Total system use by all units (total minutes of air time)

Phone calls by your organization

Cost for phone calls placed by your organization

Total phone calls by the system

G. How often should the reports be generated?

To complement this investigative question, the following measurement question was developed:

1. How often would you like to see reports with these statistics sent to you?

H. What will be done with the information in the reports?

Alternatives

Concerning financial responsibility, there are several possible alternatives.

1. The 15 CS could pay for the entire system backbone and charge users for system use based upon either: a) number of radios owned by the unit.

b) system use (frequency of use) by the unit.

or c) some other parameter.

Individual units could purchase their own radios.

2. Individual units could contribute towards the payment for the system backbone if they desire access. Only those units contributing to the payment for the system will be allowed access.

3. The funding for major equipment purchases could come from a level above the 15 ABW; either: a) HQ PACAF.

b) CINCPAC.

or c) HQ USAF.

These systems could be managed by the 15 CS which would have some of the same options listed above:

a) charge users for system use to pay for system management and maintenance based on: 1) frequency of use.

2) number of radios owned by the unit.

3) geographic coverage needed by the unit.

or 4) some other parameter.

b) 15 CS funds for all maintenance.

or c) maintenance payments are divided equally among all system users.

Concerning database management, procedures need to be defined which will: facilitate the initiation and processing of user requests for service; facilitate reliable record maintenance; permit some prioritization mechanism; not overload the system; and allow system managers to effectively monitor and manage the system using the generated reports. Possible alternatives are:

1) Users who request service and/or features only need to call the 15 CS for service.

2) Users who request service must fill out a form specifying their network needs including who they need to talk to and what features they require.

3) The 15 CS LMR manager will assign features with limited access (i.e. telephone interconnect) based upon either:

a) rank.

b) position held of requester.

c) examination of requester's stated need.

or d) 15 CS or 15 ABW commander approval.

4) Generate reports either weekly, monthly, quarterly, or annually.

5) Generated reports will contain the following information:

a) total network usage within the specified period by individual unit (i.e. squadron).

b) total telephone interconnect time by individual unit.

c) total system use by all units.

d) total system busy time within specified period.

Method of Inquiry

The study may be viewed as formal. Observational studies were conducted to gather information on how other organizations have handled problems similar to those listed above. Articles were searched and documentation from organizations who have installed similar systems was gathered. The survey study mode was also applied. I interviewed personnel both within the 15th Communications Squadron (15 CS) and throughout the 15th Air Base Wing to determine their views on the above issues. I also interviewed Motorola (the contractor supplying the trunking system) personnel and those personnel in organizations which have installed similar systems (either on- or off-island).

The study was ex post facto. I have reported the actions of other organizations in reaction to similar problems. Based upon these actions and the information gathered within the 15 ABW, I made recommendations concerning the appropriate approach(s) to

take to solve the problems listed above. I also considered the information collected from Motorola personnel when making these recommendations.

The study is descriptive. I have attempted to determine what other organizations have had similar problems. Once I identified appropriate organizations, I determined what actions they took/are taking to handle the issues. Both 15 ABW personnel attitudes and Motorola recommendations were considered when formulating a recommended solution.

The study is primarily cross-sectional. I have surveyed or interviewed members of the 15 ABW, PACAF, Motorola, and other relevant organizations to gather their ideas on the issues. However, when gathering information concerning what other organizations have done to solve similar problems, I also attempted to determine any lessons learned by those organizations as a result of their actions.

The study is statistical. Although specific actions may have been appropriate for one organization to solve the same problems, those actions may not be appropriate for the 15 CS. I attempted to determine if that was the case through a partial examination of the organization's environment.

Criteria

Personal opinions concerning financial responsibility were evaluated using an appropriate scaling mechanism. These results were compared with established standards within the Air Force, PACAF, and the 15 ABW. The weighting of opinions varied depending upon personal experience dealing with the relevant issues. Data gathered from

other organizations concerning these issues were examined to determine trends, standards, and the appropriateness of such actions for the 15 CS.

The measures of personnel opinions were examined for reliability, validity, and meaningfulness. Air Force Regulations and Instructions were examined for pertinent guidance and its relevance to the current issues. Documentation gathered from external sources was examined for applicability to the situation at Hickam AFB.

Measures of personnel opinions included:

1. Responses from surveys.
2. Responses from personal interviews.

Measures of related problems and their solutions included:

1. Information gathered from secondary sources from organizations experiencing(ed) similar problems.
2. Information gathered from industry experts (i.e. Motorola, The Genesis Group) on similar problems.

Personal responses and secondary source information were examined and compared to appropriate Air Force Regulations and Instructions to determine the best methods for: 1) determining financial responsibility; and 2) managing talkgroup and feature assignments and system reports.

Limitations and Delimitations

Two primary limitations to this study were time and money. The time constraint was set in advance according to class schedule and submission deadlines. This constraint has

limited the type and amount of research conducted. As a result, the number of sources (i.e. people, documentation) examined and the depth which the survey was conducted with each source was limited. There may be organizations which have experienced and found appropriate solutions to the issues discussed in this paper. The time constraint may have kept me from discovering such organizations. This time constraint (April 1995) should not necessarily affect the 15 CS. The 15 CS has just completed the installation of the first portion of the system (the Commander's network with five channels). The recommendations provided in this paper should be useful to the 15 CS when this paper is submitted.

Cost was also a key limitation. Motorola offers a class for personnel implementing trunking systems which may have proven valuable to this study if I had attended. Due to cost and time constraints, class attendance was not possible. However, I obtained some of the materials used during the class for use in my research. Another limitation was data availability. Some of the information requested of Motorola is sensitive and proprietary. As a result, I was not able to obtain all relevant information from Motorola concerning the issues in this paper. As the worst case, Motorola may have information not provided to me which would help the 15 CS manage and solve the issues discussed in this paper.

Overview of the Paper

The issues described in this chapter were first examined through a review of the literature in Chapter II. Secondary sources were examined for information relating to the problems experienced by the 15 CS. I collected and researched appropriate literature from

Motorola, The Genesis Group, and other communications organizations. Although I did not find much information about the issues as they relate to LMR trunking systems, I did find information concerning the issues as they relate to shared systems in general. Chapter III contains a discussion of the methodology to be used when analyzing the data. The chapter explains what data is required, where the data is coming from, the method of inquiry, and a description of the analysis which will be performed on the data. Much of the data has been obtained through a review of the literature contained in Chapter II. However, a questionnaire was also used to obtain opinions of base personnel concerning financial responsibility and database management. Chapter IV contains an analysis of the data. The chapter describes the statistical tests performed on the data and interprets the results. The data obtained with the questionnaire was analyzed using both parametric (i.e. analysis of variance (ANOVA)) and nonparametric tools (i.e. chi-square), depending upon the data type. Chapter V discusses my findings, conclusions, and recommendations to the 15 CS.

Chapter II

LITERATURE REVIEW

Introduction

The two primary areas researched are financial management and database management. Air Force Instructions were examined for relevant financial and database guidance concerning trunked LMR systems. Several pricing strategies were also studied to learn some of the prevalent practices and characteristics of a successful cost allocation system. Documentation from The Genesis Group was also examined to gauge its applicability to the proposed trunking system at Hickam AFB. Finally, a plan developed by the National Library of Australia was studied to gain insight concerning the actions of another organization faced with the problems of managing a shared system.

Financial Management

There are several issues to consider when investigating the 15 CS concerns of financial responsibility and cost allocation for the LMR trunking system. One of these issues is determining who should pay for equipment and services. This includes both the initial purchase and installation of the systems, and the on-going operation and maintenance outlays. Once the financial responsibility has been placed upon one or several organizations, the issue of how to determine the amount of the actual payments must be considered.

Investigative question under financial management:

A. Who should pay for equipment purchases (includes radios, terminals, repeaters, and backbone equipment)?

Pertinent Air Force Instructions (AFI) and 15 ABW Guidelines

Air Force Instruction 33-101 Command, Control, Communications, and Computer (C4) System Management Guidance and Responsibilities, 30 June 1994 (Appendix C), "provides management procedures for commanders to ensure availability, interoperability, and maintainability of C4 systems in support of mission readiness and war fighting capability" (p. 1). Section 1.9 of the instruction dictates that all commanders plan for and manage C4 systems under their control. Any requirements of the base-level C4 Systems Officer (CSO), the 15 CS commander, are general in nature, stating that the CSO will:

1. manage the base-level infrastructure
2. ensure elements of the base C4 environment and infrastructure continue to satisfy customers' mission needs, including mobile C4 assets
3. plan the evolution of C4 systems supporting the base user's missions (AFI 33-101, 1994, p. 4)

AFI 33-101 (1994) addresses the trunking system database management issues by stating, "Requirements specifications will call for relational database management systems where database management services are needed" (p. 5). When addressing resource allocation, the instruction merely states, "After the CSO provides a certified technical solution, allocation of resources by the appropriate authority constitutes approval for

implementation" (p. 6). However, the instruction does not state which organization is the appropriate authority for the allocation of resources.

AFI 33-103, Requirements Development and Processing, 24 June 1994 (Appendix D), details the requirements development and response process. The instruction applies only to those C4 systems with an expected life-cycle cost of less than $5 million (applicable for the proposed trunking system). Section 5 of the instruction discusses the allocation of resources. "After accepting the CSO-provided certified technical solution, the requesting organization, with assistance from the CSO, follows established local, MAJCOM, and Air Force procedures to obtain resources (such as money, manpower, and facilities) to implement the technical solution" (AFI 33-103, p. 4). The certified technical solution specifies in detail the cost data for the proposed system to include C4 hardware and software; contractual services; personnel; training; system equipment operation and maintenance costs; and facilities or facility modification.

AFI 33-106, Managing High Frequency Radios, Land Mobile Radios, and the Military-Affiliate Radio System, 3 June 1994 (Appendix E), identifies the responsibilities to implement and support Air Force land mobile radios. The instruction dictates that all MAJCOM LMR managers will process requirements for LMRs in accordance with AFI 33-103. Instruction given to unit or base LMR managers (15 CS LMR manager) pertains primarily to handling radios requiring communications security (COMSEC) or data encryption. There is no guidance in the instruction related to LMR trunking systems or how they will be managed. According to Lt Col R. D. Walker (personal communication, November 20, 1994), 15 CS Commander, the 15 CS has historically been responsible for

providing communications and computer equipment and services to members of the 15 ABW and HQ PACAF personnel. This support includes funding for all initial equipment purchases, installation, and operation and maintenance (O&M) costs. Radios, however, have historically been purchased by each unit. The proposed trunking system will require a large amount of up-front funding. Most of the funds for initial purchase and installation of the equipment for each of the proposed sites may come from a source above HQ PACAF in addition to individual tenant unit contributions. If this is the case, the 15 CS must decide how to handle the on-going O&M costs for the entire system. The 59th Signal Battalion, an Army unit operating a LMR trunking system in Alaska, also used the equivalent of wing-level funds to purchase LMR equipment which would be shared among all users.

Other Pricing Strategies

Learn (1989) stated there are primarily three pricing principles and strategies worthy of consideration within the telecommunications industry: 1) Value-based pricing; 2) Cost-based pricing; and 3) Strategic (market-based) pricing. Value-based pricing is based on the principle that the customer's cost of services is not necessarily directly related to the cost of providing those services. However, Learn notes that "value-based pricing tended to send inaccurate messages to consumers regarding specific services, and in general often tended to promote inefficient use of facilities or resources" (p. 72). This strategy lead many organizations to build their networks on the basis of comparatively inexpensive services. When competition exists for the provision of certain services, cost-based pricing may become a factor. Cost-based pricing is a structure wherein services are "priced to at

least recover the cost to provide that service" (Learn, p. 72). This structure has caused problems and customer dissatisfaction when the rates for services have increased substantially within a short period of time. This pricing structure is not appropriate for the 15 CS because there is no competition for the provision of LMR services. All units must procure their LMR services through the 15 CS. Learn does not see the increase in the rates charged for certain services as the primary problem. "The problem generally is subscriber expectations regarding the value of the service as a result of the message that has been sent with subsidized pricing over many years, and the rate at which the changes have been attempted" (p. 74). According to this view, the 15 CS must strategically consider the value of the services it provides, the cost of providing those services, and the prices customers have been charged for those services in the past. Learn states that steps must be "taken to control the rate or rise of prices for certain services where particular sensitivity to rapid increase has been identified" (p. 74). The survey may reveal any sensitivities which exist to the pricing structure of the trunking system.

Finding: Relevant AFIs require the CSO to plan for and manage the base C4 environment and infrastructure. The AFIs do not indicate who the appropriate authority is from whom funding for the LMR resources will come.

Finding: The 15 CS has historically been responsible for providing communications and computer equipment and services to members of the 15 ABW and HQ PACAF personnel. Both 15 ABW and tenant units have typically purchased their own radios in the past.

Finding: The U.S Army's 59th Signal Battalion in Alaska used wing-level funds to purchase the LMR equipment which would be shared among all system users (i.e. repeaters, central controllers, and backbone equipment).

Finding: Should the 15 CS decide to charge users for LMR services, 15 CS management must consider the charges which each unit has typically been responsible for in the past, and their sensitivity to changes to those charges as shown in the questionnaire responses. Questionnaire data was also used to answer this question.

Investigative question under financial management:

B. How can payment responsibility for equipment purchases be justified?

System Governance

Robert Walton (1990b) states that each organization will need some sort of contractual obligation or agreement with the system manager (15 CS) which defines the rights and obligations of both parties. Before developing these agreements, the 15 CS must first determine how new units may be added to the trunking system. Should the new units only be required to ask? Should they be required to bring financial commitments along with their request? A second question which Walton poses is,

> What are the guidelines and requirements for qualification of a [unit] to apply for membership in the project? If there are different classes of membership and/or customers, what are the differences in costs, rights, and services between these different groups? (p. 68).

From a financial viewpoint, the trunking system project does involve several different classes of customers: 1) 15 ABW units and HQ PACAF, and 2) tenant units (any units not under the jurisdiction of the 15 ABW). In the past, the 15 CS has paid for all operation and maintenance (O&M) expenses for 15 ABW units and HQ PACAF. However, all tenant units were required to fund for their own communication and computer equipment and services. Given the proposed trunking system, it would seem that most units could be given the same level of services, with some exceptions (i.e. telephone interconnect access). However, the tenant units and perhaps all other units may be required to bring money if they desire service on the new system.

A third issue which Walton (1990b) addresses is that of equipment ownership. The 15 CS must determine which equipment will be owned by the units and which equipment will be owned by the 15 CS. Walton poses the question,

> Who establishes the cost of services, the eligibility requirements of platforms of service, and the priorities for new service additions or expansions? What are the different categories of cost, which costs are the responsibility of the [unit] and what costs are the responsibility of the [entire group of users]? (p. 68)

Since the 15 CS is the system manager, they may be the unit which establishes these requirements. Through discussions with the 15 CS Commander, Lt Col R. D. Walker (personal communication, November 20, 1994), each unit, 15 ABW and tenant, will be responsible for funding their own radios, portables, and base stations. However, the cost of operating and maintaining the system backbone equipment has yet to be determined. The questionnaire may provide some guidance on this issue.

Justifying Cost Allocations

Should the 15 CS decide to charge units for providing service on the trunking system, it is imperative that the charges be understandable to the units, fair, predictable, and justified. Several organizations have gotten themselves in trouble when the costs charged were not justified. Hamilton discusses this problem in relation to universities abusing funds received in the form of research grants. United States Representative John Dingell (D-MI) discovered that Stanford president Donald Kennedy had charged costs related to a yacht and a campus shopping center to overhead on research grants. The Defense Contract Audit Agency (DCAA) deputy director Fred Newton says "his agency has uncovered a total of $389.9 million owed the government" (Hamilton, 1992, p. 679) from Stanford, Massachusetts Institute of Technology (MIT), and Pennsylvania State University. Newton also points out that MIT has charged 49 percent of its library costs to federal research, where DCAA recommends only a 20.8 percent allocation. The Department of Health and Human Services (HHS) report they have saved the government an additional $82.7 million "through tough negotiation that removed further charges from recent indirect cost rates" (Hamilton, 1992, p. 679). These savings have come from fourteen different universities throughout the United States.

One reason for these high figures is that auditors have shifted their focus away from the specific unallowable costs to those areas where institutions may hide overhead costs. Hamilton (1992) quotes Dingell as saying, "The unallowable and questionable costs are attention-getters, but in reality, the problem is deeper and broader in that the allocation practices significantly alter the costs at hand" (p. 679). As a result of these findings, many

government institutions are canceling their memoranda of understanding (MOU) with universities. The DCAA has recommended canceling 74 percent of all outstanding MOUs and special studies for the schools it oversees. DCAA also recommended the Office of Naval Research cancel all 124 of its MOUs with Stanford. The universities have objected to this action, claiming that the "MOUs are binding contracts that cannot be unilaterally canceled by the government" (Hamilton, p. 679). However, DCAA legal counsel argues that "retroactive challenge is entirely legal when the facts or costs reported to support the MOU are materially different from facts and costs actually in place or incurred in performance of the agreement" (Hamilton, p. 679).

Both the General Accounting Office (GAO) and DCAA agree that the blame for this situation should not rest entirely on the individual parties, but also on the indirect cost system itself. GAO assistant comptroller general J. Dexter Peach calls for a "need to have constructive ways to simplify the system with adequate controls to protect the government's interest" (Hamilton, 1992, p. 679).

As illustrated above, a poorly written MOU can spark abuse and trouble. Walton (1990b) had also mentioned the importance of defining a "permissible formula or method to define overhead or indirect costs?" (p. 68). The 15 CS must learn from these actions and address them when drafting any agreements involving the reimbursement or payment for LMR trunking services and equipment. The agreements must clearly state who is responsible for funding specific services and products. As stated earlier, the method used to determine costs must be relatively easy to understand, and auditable. The universities mentioned above had placed some of their questionable costs into the overhead cost

category, which would be partially funded through their grants. The 15 CS must specifically state how costs are allocated and, perhaps more importantly, which types of costs can contribute to the category of allocated costs. Spitzer & Tobia (1993) state that, "Successful business leaders work hard to understand their cost of doing business" (p. 24). This includes not just those costs allocated under the standard cost systems, but all expenses which may be justifiably aligned with the system being considered.

The Air Force, among other organizations, has been going through a period of downsizing and cost-cutting for the past several years. In such an environment, it is important that managers manage their costs, not just cut them. The proposed trunking system will inevitably involve some major financial commitments. It is critical that management not get lost in the shuffle of cutting costs, when attempting to implement, operate, and maintain the new trunking system. Spitzer and Tobia (1993) mention that, "Senior managers who fail to use strategy as a guide throughout a reduction plan run the risk of compromising the long-term competitive advantage of their organizations" (p. 23). 15 CS management must determine the most appropriate method for allocating costs for the system. Included in the methodology must be strict controls defining who is responsible for payments, under what conditions these payments may be changed, and who is authorized to make these changes. The cost allocation structure implemented for the trunking system should directly reflect the strategic nature of the system and the capabilities it provides. The 15 CS must also ensure that other key managers whose units use the system understand the reasoning for the cost allocation method developed. If this process is complete, the risk of reducing costs in the short term at the expense of losing

long term operational capabilities will be reduced. Managers will not be allowed to simply cut costs wherever they want. System costs may be reduced only where and when permitted by the cost allocation procedures implemented by the 15 CS and user units.

"Organizations with a vital strategy - those that know what business they are and are not in - will be more successful in managing their costs than companies that are confused strategically" (Spitzer & Tobia, 1993, p. 24). The 15 CS and other units who propose to use the trunking system must know their strategic purpose and how the system relates to it. This knowledge will enable them to make informed decisions concerning the commitment of funds dedicated for the new system. Units should not make financial commitments without realizing how the system will help them achieve their vision and strategic goal(s). Not only should managers in these units know the vision and goals, but this information must be communicated throughout the organization and understood by everyone involved. They must also see how the trunking system relates to this vision and goals. As a result, they will understand why certain resources are dedicated to the system. Spitzer et al. continues, "having a clearly communicated vision can help with that most intangible asset of all - morale. With strategic focus, painful cuts are more palatable and the reasons for decisions are more apparent" (p. 24).

All personnel involved with the trunking system must understand the costs involved with the system. They must know the value of the products, features, and services which they are using. "When an organization knows its true costs, it is poised to make more incisive decisions about such critical issues as which products and services it should be offering [and] which customers it should be serving . . ."(Spitzer et al., 1993, p. 24).

However, personnel must not just know the true costs, but management must ensure that costs really mean something to every employee.

> When [assembly plant manager Joseph D.] Smith of Harley-Davidson talked to manufacturing employees about millions of dollars of savings, he found it didn't mean a thing. Telling them that the part they were handling cost $5 and reworking it would run another $8 put the information in an accessible format. Employees could relate it to their wallets. (Spitzer et al., p. 25)

All radio users must know the value of the services and products they use. They must realize that a radio-based telephone call will tie up a channel for the duration of the call. They must realize the cost of making such a call. This kind of user understanding can come from a carefully designed and implemented cost allocation system where individual units and users see their own cost of doing business.

When making substantial expenditures in a period of cost-cutting, it is critical to appropriately allocate costs. United States Fidelity and Guarantee CEO Norm P. Blake, Jr., formed task forces of middle managers "to look at how we could be more effective - not just 'What are your recommendations for reducing costs?'" (Spitzer et al., 1993, p. 25). Blake also realized that when determining an appropriate cost allocation strategy, the key decision-making power must be given to those who would implement the plan. This idea reinforces Quinlan's (1989) strategy to "coordinate the means for controlling cost with the capabilities of controlling cost" (p. 62). Applying this strategy to the 15 CS, the unit LMR managers involved in the trunking project should get together and develop a plan to allocate costs for the new system. As a result, the key decision-making power

would be placed upon those who would implement the cost allocation plan for the trunking system. These individuals must be held accountable for the plan they develop. Spitzer et al. mention that, "Costs won't be reduced unless employees want them reduced" (p. 25). By the same token, a plan will not work unless employees want it to work. To help the plan succeed, an appropriate performance system must be developed. "Unless the organization is committed to reconfiguring every element of the performance system, individual behavior is not likely to change" (Spitzer et al., p. 25). When considering the trunking system, individual units should be notified of their system use statistics, especially abnormal statistics (i.e. an excessive number of telephone interconnect calls).

Finding: The 15 CS must determine how new units may be added to the system and the financial responsibility of all units using the system. Any new agreements involving the reimbursement for charges related to the trunking system must be very specific in stating who is responsible for which specific charges. According to Learn, the 15 CS must consider the value of the services it provides and the prices which customers have been charged for those services in the past (data presented following investigative question A). Questionnaire data in addition to the AFIs following investigative question A under financial management also contributed to the answer of this question.

Investigative question under financial management:

C. Who should pay for maintenance costs (includes radios, terminals, repeaters, and backbone equipment)?

The 59th Signal Battalion manages a General Electric trunked LMR system at Ft. Richardson, Alaska. The system, installed approximately five years ago and owned by the Army, is used by both Army and Air Force personnel. The original interservice support agreement dictated a fifty-fifty split between the Army and Air Force for funding the operations and maintenance costs for the system backbone equipment. The backbone equipment maintenance is performed by Army radio maintenance personnel. The Air Force contracts out the maintenance for its hand-held radios, portables, and base stations, while the Army maintains its own with Army personnel. According to John Halloway (personal communication, January 17, 1995), working from the Maintenance Division under the US Army Alaska (USARAK) Director of Logistics, negotiations began in February 1995 to consider changing the agreement between the Army and Air Force governing backbone equipment maintenance. Personnel are currently looking at basing the charges for backbone equipment maintenance on the number of radios owned.

Information presented following investigative questions A and B under financial management also contribute to the answer of this question.

Finding: Funding for backbone equipment maintenance on the trunked LMR system managed by the 59th Signal Battalion is split evenly between the Army and the Air Force. Negotiations began in February 1995 to consider changing this practice and basing charges on the number of radios owned. According to Learn, the 15 CS must consider the value of the services it provides and the prices which customers have been charged for those services in the past (data presented following investigative question A). Any new agreements involving the reimbursement for charges related to the trunking system must

be very specific in stating who is responsible for which specific charges. The AFI information provided under investigative question A did not specify who should be responsible for LMR equipment maintenance costs. Questionnaire data was also used to answer this question.

Investigative question under financial management:

D. How can payment responsibility for equipment maintenance be justified?

Information which contributes to the answer of this question was presented following investigative questions A, B, and C under financial management.

Finding: The findings following questions A, B, and C also apply to this question. Questionnaire data was also used to answer this question.

Investigative question under financial management:

E. Should costs be based upon equipment ownership, system usage, geographic coverage needed, or some other parameter?

Characteristics of a Cost Allocation System

Quinlan (1989) states that when considering the implementation of a transfer pricing system, the first task is to define the objectives of the system. This task must be performed by the 15 CS management, LMR and finance managers from across the base, and members of the user community. Quinlan outlines several desirable characteristics which can be designed into a cost allocation system. These characteristics and their related system components are shown in Appendix G.

Quinlan states that any cost allocation system must reflect an appropriate balance among the following elements:

1) The objectives of providing cost data to plan, control, price, evaluate, and make decisions.

2) The effectiveness of achieving the objectives through the characteristics of equitability, repeatability, and so on.

3) The economics of the development, implementation, and maintenance of the system. (p. 56)

According to Quinlan (1989), equitability is the most important characteristic of the cost allocation system. However, he also states that this characteristic may be the most difficult to define and achieve. "No system could economically satisfy all clients' expectations of equitability, understandability, and so on" (Quinlan, p. 59). The 15 CS must decide to bill system users based on specific resources used, actual resource usage, or cost-based prices. The 15 CS must also establish standards to give users a means of evaluating their charges. A critical decision which the 15 CS must make is determining whether to bill for the resources (i.e. repeaters, backbone equipment) or to bill based on system usage (i.e. number of calls).

Fundamental to the decision to bill clients on the basis of resource usage or transaction volumes is whether the client will control their EDP costs more effectively if attention is focused on the amount of resources used or the amount of transactions processed (Quinlan, p. 60).

A billing statement which reflects resource usage tells the units to reduce the usage of specific resources to reduce its costs. A billing statement which reflects transaction volumes tells the units to reduce the number of transactions to reduce costs. This second method may be appropriate for billing resources whose costs are directly related to their use (i.e. telephone interconnect calls). However, the first method may be appropriate to show each unit how much it is spending on physical resources (i.e. repeaters, backbone equipment) as a percentage of the total system configuration.

Quinlan (1989) also states that the cost allocation system must be sensitive to customer changes in system use. If the 15th Civil Engineering Squadron makes only two telephone interconnect calls this month and they made ten last month, the charges for that resource should reflect the decrease in use. A third critical factor is concerned with the destination of the billing information. For the 15 CS, this factor could include not only the billing information but also the reports on system use. Quinlan states,

> The appropriate level of detail needs to be supplied to the level of management that has the authority to incur the cost and the responsibility to control it. . . It is important to coordinate the means for controlling cost with the capabilities of controlling cost. (p. 62)

With this in mind, the bills and reports regarding system use, should not merely be sent to the billing clerks. More effective and efficient control of the system may result if the appropriate information is sent to the LMR managers and the commanders of those organizations using the trunking system.

If the 15 CS is going to achieve maximum effectiveness and efficiency of the trunking system, the system users must be motivated to use system resources appropriately. "The success of the transfer pricing system is critically dependent on the system properly motivating clients to control their costs" (Quinlan, 1989, p. 62). The 15 CS must solve the cost allocation problem now, before the system is operational. Quinlan reinforces this idea by stating, "It is difficult to accept being charged for services that previously were free or considered soft dollars" (p. 62). The cost allocation system implemented must also use differential prices for alternative services levels. Charging a low price for certain services will encourage their use, while high prices will discourage the use of those resources or services.

Finding: A statement or report must be developed where costs are related to usage (e.g. telephone calls), the statement properly reflects this; and, where costs are related to fixed equipment items (e.g. backbone equipment maintenance), the charges should be consistent (i.e. not based on system usage). The reports and statements must be sent to those personnel responsible for controlling costs. The 15 CS should attempt to develop charging procedures which are equitable, understandable, and repeatable. The actions of the 59th Signal Battalion (i.e. their charging parameters), discussed following investigative question C under financial management, in addition to questionnaire data also contributed to the answer of this question.

Investigative question under financial management:

F. If costs are based on assigned features, how can the cost per feature be determined?

Development of a Cost Allocation Formula

As stated in Chapter I, the technology involved with land mobile radio systems has been evolving and becoming more sophisticated since its inception. The features and capabilities available with current systems are markedly different from those available a mere ten years ago. As a result, many users have more aggressive expectations concerning what is included in the definition of "land mobile radio service". Although the capabilities of these systems have grown immensely, there remains a noticeable lack of management skills related to the collective ownership, operation, and use of shared LMR trunking systems. The 15 CS has "jumped into the water" and purchased a system, yet there is no structure in place to manage the financial responsibilities and trunking operations associated with the new system.

Due to the high cost of the system, much of the funding may come from a level above the 15 ABW, perhaps from HQ USAF. However, even with this funding for the initial equipment purchase and installation, the 15 CS must develop a fair cost allocation method to ensure the project is successful. The on-going costs of operations, amortization of the investment, and system expansion require each financially responsible unit to commit funds which may be due for several years. According to Robert Walton (1990a), it is the "negotiation of cost allocation formulas that has limited the number of successful projects" (p. 70). Walton says that some issues which need to be determined are: Should each participating unit pay for their own communication costs, or should the total cost of the

system be divided equally among the units? What if some units have considerably more resources than other units? Concerning the cost allocation formula, Walton says, "the data elements selected should provide consistent and reliable results throughout the fiscal period" (p. 70). If some units operate for extended periods of infrequent system use, the 15 CS may not be able to recover the costs of the system should the formula be based on some system use factor.

Walton's (1990a) second point is that the "data elements selected should be drawn from an auditable and nonsubjective source of information" (p. 70). The system installed by the 15 CS includes a terminal which provides system use data to include caller identification, time and duration of call, and features used. Therefore, this terminal may be considered to be an auditable and nonsubjective source of the information it provides.

Walton's (1990a) third point is that "the formula should enable a [unit using the system] to independently, or with only a modest amount of assistance, calculate and predict the costs for [its own system use]" (p. 70). Walton continues by stating "the formula must be constructed to enable [individual unit LMR managers] to present and defend the costs to the [unit commanders] as being fair, equitable, and in the [unit's] best interest" (p. 70). Even if the formula is technically fair, it must be understood by someone not intimately familiar with trunked LMR operations. Finally, Walton suggests that the formula "be constructed so that a [squadron or wing commander] can conceive of and philosophically understand the general design of the formula" (p. 70). There should be no complex mathematical calculations involved. Walton concludes that "a good cost allocation formula should contain *no* Greek symbols of any kind" (p. 70). Harley-

Davidson assembly plant manager Joseph D. Smith is "trying to simplify cost information so everyone understands it . . ." (Spitzer & Tobia, 1993, p. 24).

Database and Billing Management

The Genesis Group was established in 1988 in Tyler, Texas, to assist trunked LMR system owners. Their services include answering simple questions to implementation of full, daily operations training. The company has developed and markets several software and hardware products to help the trunking operator. Table 1 shows some of these products.

Table 1: The Genesis Group software products designed to assist with managing and operating Motorola trunked LMR systems.

Product Name	Product Description
EzBill+	billing, database functions for Motorola trunking
EzSaveII	backup for the Motorola trunking central controller
EzTrac	graph traffic analysis from the Motorola central controller
EzWatch	Motorola trunking end user software to identify 'who is calling'
EzBeep	billing and database for paging companies
EzBilLTR	billing and database for LTR format trunking systems
EzID	trunking end user box to identify 'who is calling'

EzBill+ is a PC based software program designed to automate as much of the monthly Motorola trunk system billing operations as possible. The program also allows the user to maintain a comprehensive database of all units (radios) using a system and whom the units belong to (i.e. 15th Civil Engineering Squadron, HQ PACAF, 15th Transportation Squadron). The unit database tracks serial numbers, user name, stolen units, DID numbers in addition to several other parameters. The system can automatically bill for telephone usage uniquely by the unit, by the minute and second. Up to six price levels can be developed to bill fixed charges for each account monthly, quarterly, semi-annually, or annually. The program allows the system owners to bill up to ten additional items either once or on a recurring basis. The 15 CS may want to consider using such a system to handle its billing and report generation functions.

The following table displays cost data for several Motorola equipment items either purchased or scheduled to be purchased for the LMR trunking system at Hickam AFB. The data may be used to develop an appropriate cost allocation formula, should the 15 CS decide to charge units for using the system.

Table 2: Trunking Equipment Prices

Equipment Item	Cost	Already Purchased
MBX (Telephone Interconnect Equip.)	**$78,000**	**No**
SMARTNET SystemWatch II Terminal software (includes 1 RF modem and 1 radio)	**$6,280**	**Yes**
SIMS II Terminal software (includes 2 RF modems and 2 radios)	**$100,000**	**No**

Finding: Any billing statement sent to user units must be clear, understandable, and predictable for both recurring and non-recurring charges. EzBill+ may be used to determine costs and generate bills to system users. The cost data shown in Table 2 may be used in the development of a cost allocation formula to charge user units.

Investigative question under financial management:

G. What are the current policies toward paying for LMR equipment within the 15 ABW?

Tenant units (those not under the 15 ABW) have historically been financially responsible for their own equipment. Support agreements have been developed between each tenant unit and the 15 ABW to specify which types of support the tenant units will receive and what, if any, the reimbursement charges will be. In the area of LMRs, the tenant units have typically purchased their own systems. These systems have been maintained (using the 15 CS LMR maintenance contract) through the support agreements

with the 15 CS. Only the 15th Medical Group and Air Mobility Command units have reimbursed the 15 CS for charges made through the LMR maintenance contract (TSgt L. Arthur, personal communication, January 17, 1995). However, since the new trunking system involves equipment which is shared among all system users and owned by the 15 ABW, new support agreements will have to be developed to handle the support and reimbursement issues.

Information presented following investigative question A also contributed to the answer of this question.

Finding: LMR support for tenant units has generally been handled through host-tenant support agreements. Current host-tenant support agreements will not be adequate to handle the shared equipment items to be utilized with the trunked LMR system. Additionally, the finding following investigative question A under financial management contributes to the answer of this question.

Managing Trunking System Operations

The following questions relate to issues which must be resolved for the 15 CS to effectively manage the operations of the LMR trunking system. Indicated along with each finding is whether the question has been answered or questionnaire data was used to contribute to the answer.

Investigative question under managing trunking system operations:

A. What should the procedures be to request, approve, and assign features to individuals?

The 15 ABW C4 Systems Requirements Management Guide (Appendix F) contains the detailed steps which must be taken for customers to request services from the 15 CS (i.e. LMR services and features).

Finding: The 15 ABW C4 Systems Requirements Management Guide and AFI 33-103, discussed under investigative question A under financial management, provide the necessary steps to request LMR services (i.e. feature assignment).

Investigative question under managing trunking system operations:

B. How will the information regarding who has which features be maintained?

Documentation received from Motorola provided substantial information concerning how the trunking system hardware and software maintain the system operational data. The SMARTNET SystemWatch II Terminal is a system diagnostic tool which provides real time system activity monitoring, including control channel diagnostics. The 15 CS currently uses this system with their StartSite trunking system. This system may be used to monitor, control, and update talkgroup and feature assignments. Statistical summaries may be compiled on total system usage, channel usage, talkgroups, and individual radio activity, daily and at regular intervals. The tool provides a quick overview of system capacity and response which may be used as a planning tool for expanding the current system. The terminal's data logging feature allows the network manager to specify the activity which he or she would like to store or print. This feature allows the network

manager to track specific call types, talkgroups, individuals, or any other type of system activity. Therefore, once the 15 CS determines which types of system information they would like to see generated, this terminal may be used to store the information for later report generation. The system stores the data on either the hard disk or a floppy, as specified by the network manager. The files may then be loaded into a word processor or spreadsheet application for further analysis and report generation. The selected information may also be sent through the computer's second serial port (COM2:). This feature enables the network manager to send the data to a dumb terminal or a different computer for further processing. The option may be selected in conjunction with The Genesis Group software (discussed following investigative question F under financial management), should the 15 CS decide they wish to use The Genesis Group's products for report generation and billing.

The SMARTNET Information Management System II (SIMS II) is a multiple-user management and dispatch tool. The 15 CS is planning to purchase the system in July 1995 in conjunction with the SMARTNET II controller. The system can monitor and display in real time all radio traffic, emergency messages, and any special status messages. The system user can send call alert pages, perform selective radio inhibit, and execute dynamic regrouping commands from the terminal. SIMS II also allows the user to check the operating mode of any individual radio in the trunking system, including the talkgroup assignment and some feature capabilities. The SIMS II dynamic regrouping capability allows the user to reassign talkgroup units without any action on the part of mobile or radio operators. The system may also be configured to save specific information which

may be used later for report generation (e.g. radio traffic by individual, talkgroup or system-wide; telephone interconnect traffic; system busies).

Finding: The SMARTNET SystemWatch II terminal may be used to monitor, control, and change talkgroup and feature assignment data for individual radios, talkgroups, and system-wide. The SIMS II terminal is also capable of performing these functions.

Investigative question under managing trunking system operations:

C. What criteria will be used to determine who gets access to features with limited accessibility (i.e. telephone interconnect)?

Joseph Loperfido (personal communication, January 17, 1995), one of the managers of the trunked LMR system in the 59th Signal Battalion, stated that telephone interconnect access is granted by the post signal commander (a position equivalent to the 15 CS Commander at Hickam AFB). The signal commander uses the following criteria when determining who should be given access: personnel who deal with safety issues (i.e. fire department, security police), commanders (i.e. consider their need for additional communications capability), the need for off-post communications (i.e. to communicate with contractors), and if the individual currently has any other means of communication. Loperfido also stated the system managers try to keep the number of users with telephone interconnect access below fifteen percent of the total number of system users.

Finding: The 59th Signal Battalion uses the following criteria to determine who gets access to the telephone interconnect feature: safety, unit commanders, need for off-post

communications, and consideration of other means of communication available. Questionnaire data was also used to answer this question.

Investigative question under managing trunking system operations:

D. What should the procedures be to request, assign, and reassign personnel to talkgroups?

Joseph Loperfido (personal communication, January 17, 1995) of the 59th Signal Battalion stated that initially, each individual network under their conventional LMR system was given its own talkgroup. He also stated that the most efficient method of setting up the talkgroups would be to get all of the individual unit LMR managers together to discuss their functional requirements (i.e. who their personnel needed to talk to). TSgt Louis Arthur (personal communication, January 17, 1995), 15 CS LMR manager, stated that initially, each conventional network would be given its own talkgroup. However, after the system was operational, they would relook at the talkgroup setup to determine if there was a more efficient method of designing the talkgroup assignments.

Information concerning requirements processing presented following investigative question A under financial management (AFI 33-103) and following investigative question A under managing trunking system operations (15 ABW C4 Systems Requirements Management Guide) were also used to answer this question.

Finding: The 59th Signal Battalion initially set up their talkgroups by giving each conventional network its own talkgroup. Network managers recommended that once the system is operational, the LMR managers from each unit discuss their functional

requirements (i.e. who their personnel need to talk to) in order to optimize the system configuration. Each conventional network managed by the 15 CS will initially be given its own talkgroup. Once the trunked LMR system is operational, LMR managers will determine if there is a more efficient method of designing the talkgroup assignments. Users will follow the requirements processing procedures outlined in AFI 33-103 and the 15 ABW C4 Systems Requirements Management Guide to request talkgroup changes.

Investigative question under managing trunking system operations:

E. How will the information regarding who is assigned to which talkgroups be maintained?

The information providing the answer to this question was presented in the section following investigative question B under managing trunking system operations.

Finding: The SMARTNET SystemWatch II terminal may be used to monitor, control, and change talkgroup and feature assignment data for individual radios, talkgroups, and system-wide. The SIMS II terminal is also capable of performing these functions.

Investigative question under managing trunking system operations:

F. Which system reports will be used?

Joseph Loperfido (personal communication, January 17, 1995) of the 59th Signal Battalion stated that system reports are generated at least monthly. Reports are used primarily for system management within the battalion and are not sent out to user units. He primarily looks at the number of calls processed, the peak and low periods of system

activity, and the queue times (i.e. the length of time users must wait for system access). Another area which he monitors is the telephone interconnect versus dispatch (i.e. normal radio calls) times. This information is compared with data from previous periods to monitor any significant changes. The information is used to educate system users. Loperfido states that many users do not understand the trunked LMR system. The reports may help Loperfido and other managers focus on areas which may cause potential problems for users (i.e. users keep getting a busy signal when trying to use the system). Users are told when the system peak and low periods are so they may schedule their activity accordingly. The reports also may flag any system misuse (i.e. making unofficial phone calls) and allow the system managers to follow-up on such activity.

Appendix H shows part of a plan developed by the National Library of Australia (1976) to manage resource sharing networks. Section 4.0 of the plan discusses system outputs. This portion of the plan may be used by the 15 CS in developing their requirements for output of the trunking system in terms of information displayed on the controller terminal(s) and reports generated. Section 4.0 specifies exactly what information will be contained in the various forms of output (i.e. terminal output, and hardcopy output). It also specifies where the specific information will be displayed and who may produce the output. Section 4.11 discusses the output of statistical data concerning system use by individual units as well as total system use.

> At regular intervals, probably weekly, each user of the system will receive a statistical summary of system resource usage for the period subject to analysis. . . The information contained on these reports will be used as the basis for customer billing. . .

> The summary will be divided into two sections. One section will deal with the system activity of the individual user . . . The second section will provide the same information but for the total system. This will give users the opportunity to compare their own usage of the system with the usage by the total user population and thus provide a guide for the purpose of operational tuning (National Library of Australia, 1976, pp. 15-16).

The plan also states, "In addition to user statistical information there will be produced a number of outputs for the purposes of central site control" (p. 16). The 15 CS may want to consider using this section of the plan as a guide for developing its own plan for producing and using system output. The information from the EzBill+ program identified earlier may be used to provide the detailed information for these outputs.

Section 5.0 of the National Library of Australia plan (1976) discusses system management. The section specifies: 1) who may access the system; 2) how information entered into the system may be edited and validated; and 3) which system statistics will be required to manage the system. If an analogy is made to the trunking system, the following statistics may be required to manage the system.

System use by user

System use by unit (squadron)

Total system use in terms of the percentage of time the system was loaded at certain levels (i.e. system was 75 percent loaded for 30 percent of the time period under consideration)

Number of telephone interconnect calls by user and total call time

Number of telephone interconnect calls by unit (squadron) and total call time

Number of unsuccessful attempts to use the system (system busies)

Number of unsuccessful attempts to make a telephone interconnect call

Listing of users (serial number, name, unit, direct identification number) including which talkgroups they are assigned to and authorized special features (i.e. telephone interconnect)

Through further analysis using a questionnaire (see Chapter IV), this study has determined if these statistics are indeed useful and necessary to manage the trunking system.

Quinlan (1989) also states that customers must understand the figures they see in the billing statements and reports if they are going to be held accountable for the resources and services used. However, "The literature has documented over and over again that clients do not understand their . . . charges" (Quinlan, p. 63). To better help customers to understand their charges, the 15 CS must consider: 1) unit-of-measure terminology; 2) provide an explanation for any change in monthly charge; 3) provide adequate billing information; 4) provide appropriate information for the purposes the billing statements and/or reports were designed. Quinlan recommends that the 15 CS "relate the cost in familiar client terminology, activities, and functions" (p. 65).

Quinlan (1989) states that charges to customers must be repeatable. "Repeatability implies that identical [services] cost the same, or about the same, each time they are [used]" (Quinlan, p. 65). If the users of the trunking system are charged materially different amounts for using the same services, the credibility of the developers of the cost

allocation system will be diminished. Should such a condition occur frequently, the 15 CS may lose effective control of the cost allocation system.

Finding: The 59th Signal Battalion has found the following system report statistics to be useful: number of calls processed, system peak and low periods, queue times, and telephone interconnect versus dispatch times. The plan in Appendix H may be useful to the 15 CS while developing their procedures to manage the report generation function of the trunking system. The statistics which the 15 CS decides to use in their reports must be understandable to their customers and repeatable. Questionnaire data was also used to contribute to the answer of this question.

Investigative question under managing trunking system operations:

G. How often should the reports be generated?

Information which contributes to the answer of this question was presented in the section following investigative question F under managing trunking system operations.

Finding: The 59th Signal Battalion generates their reports at least monthly. The questionnaire was also used to provide data necessary to answer this question.

Investigative question under managing trunking system operations:

H. What will be done with the information in the reports?

The information which answered this question was presented in the section following investigative question F under managing trunking system operations.

Finding: The report information generated by the 59th Signal Battalion is used to monitor system activity, educate system users, and monitor any possible system misuse. The 15 CS commander and LMR manager also indicated the same uses for report information, in addition to validating frequency requirements, contain costs, and redistribute talkgroup assignments based on system loading factors.

Summary of the Chapter

This literature review has examined the issues of financial management and trunking system operations management as they may apply to the 15 CS trunked LMR project. The relevant Air Force Instructions examined provide guidance which is general in nature. Several financial and system management actions taken by the managers of the 59th Signal Battalion's LMR trunking system were presented. Key to the development of a successful cost allocation system are equitability; understandability; and, giving appropriate information to those who have the responsibility to control costs and system use. The Genesis Group provides software which may prove useful to the 15 CS in managing the billing and report generation functions associated with the new system. Motorola systems, including SystemWatch II and the SIMS II, may also be quite useful in monitoring system activity and providing critical data for report generation. Finally, the ideas presented in the plan developed by the National Library of Australia may serve as a template for the 15 CS' own plan for managing the trunking system and its outputs.

Chapter III

METHODOLOGY

Introduction

The purpose of this chapter is to describe the methodology used to analyze the data collected by the questionnaire (see Appendix I) and the information obtained from the literature review. The analysis is focused on answering the management question: How can the 15 CS manage the installation and operation of the new trunked LMR system? To answer this question, several research, investigative, and measurement questions have been formulated. The two research questions are:

1. How can the 15 CS manage the financial responsibilities associated with the trunked LMR system?
2. How can the 15 CS manage the trunking system operations?

These questions are discussed in this chapter along with the data required to answer the questions, where the data came from, how the data was obtained, and the analysis which was performed on the data.

Data Required

The data required for this study is based upon the research questions stated above. The required data is shown below in the form of investigative and measurement questions

which, when answered, will provide the basis for answering the two research questions and the management question.

1. How can the 15 CS manage the financial responsibilities associated with the trunked LMR system?

There were several issues examined during the study which pertain to managing financial responsibilities. Many of these issues were answered with data obtained through the questionnaire. The investigative and measurement questions are:

A. Who should pay for equipment purchases (includes radios, terminals, repeaters, and backbone equipment)?

The data required includes the identification of individual units (squadrons), or organizations who should be responsible for paying for equipment purchases.

B. How can payment responsibility for equipment purchases be justified?

The data required includes current policies, procedures, AFIs, and the personal opinions of those personnel surveyed concerning financial responsibility for communications equipment.

C. Who should pay for maintenance costs (includes radios, terminals, repeaters, and backbone equipment)?

The data required includes the identification of individual units (squadrons), or organizations who should be responsible for paying for equipment maintenance.

D. How can payment responsibility for equipment maintenance be justified?

The data required includes current policies, procedures, AFIs, and the personal opinions of those personnel surveyed concerning financial responsibility for communications equipment.

E. Should costs be based upon equipment ownership, system usage, geographic coverage needed, assigned features, or some other parameter?

The data required includes personal opinions of those personnel surveyed and actions by other organizations concerning how costs are/should be allocated.

F. If costs are based on assigned features, how can the cost per feature be determined?

The data required is cost data for trunking equipment and feature capabilities.

G. What are the current policies toward paying for LMR equipment within the 15 ABW?

The data required is current policies, procedures and AFIs concerning financial responsibility for LMR systems within the 15 ABW.

2. How can the 15 CS manage the trunking system operations?

There were several issues examined during the study which pertain to managing the trunking system operations. Many of these issues were answered with data obtained through the questionnaire, while others were answered after a review of relevant literature. The investigative and measurement questions are:

A. What should the procedures be to request, approve, and assign features to individuals?

The data required includes any existing 15 ABW and 15 CS requirements processing procedures.

B. How will the information regarding who has which features be maintained?

The data required includes trunking system capabilities for the proposed system (i.e. what capabilities the system has to maintain feature assignment data).

C. What criteria will be used to determine who gets access to features with limited accessibility (i.e. telephone interconnect)?

The data required includes any existing procedures used by other organizations and the personal opinions of those surveyed concerning assignment of these types of features.

D. What should the procedures be to request, assign, and reassign personnel to talkgroups?

The data required includes any existing talkgroup assignment procedures used by the 15 CS.

E. How will the information regarding who is assigned to which talkgroups be maintained?

The data required includes trunking system capabilities for the proposed system (i.e. what capabilities the system has to maintain talkgroup assignment data).

F. Which system reports will be used?

The data required includes those reports used by other organizations with similar systems, identification of data which may be extracted for reports, and the personal

opinions of those personnel surveyed concerning what types of information they would like to see generated by the trunking system.

G. How often should the reports be generated?

The data required includes how often other organizations have generated their system reports and the personal opinions of those personnel surveyed concerning how often they would like to see the system reports.

H. What will be done with the information in the reports?

The data required includes what other organizations have done with the information contained in the reports and the opinions of 15 CS management and the 15 CS LMR manager concerning how the report information should be used.

Location of the Data

The required data mentioned above has been obtained from primary and secondary sources. The secondary source data was discussed in Chapter II. The primary source data was obtained with a questionnaire (see Appendix I).

1. How can the 15 CS manage the financial responsibilities associated with the trunked LMR system?

A. Who should pay for equipment purchases (includes radios, terminals, repeaters, and backbone equipment)? This data was obtained from both the questionnaire and secondary sources. Chapter II reviewed the literature search of policies, procedures, and AFIs relevant to this issue. Questionnaire responses in addition to

guidance provided in Chapter II provided the data required to answer this question.

B. How can payment responsibility for equipment purchases be justified? This data was obtained with both the questionnaire and relevant policies, procedures, and AFIs. Questionnaire responses were analyzed along with the relevant guidance provided in the AFIs.

C. Who should pay for maintenance costs (includes radios, terminals, repeaters, and backbone equipment)? This data was obtained from both the questionnaire and secondary sources. Chapter II reviewed the literature search of policies, procedures, AFIs, and contained a discussion of how other organizations have handled this issue. Questionnaire responses in addition to guidance provided in Chapter II provided the data required to answer this question.

D. How can payment responsibility for equipment maintenance be justified? This data was obtained with both the questionnaire and secondary sources. Chapter II reviewed the literature search of policies, procedures, and AFIs pertaining to communications equipment maintenance. Questionnaire responses were analyzed along with the guidance provided in Chapter II.

E. Should costs be based upon equipment ownership, system usage, geographic coverage needed, assigned features, or some other parameter? This data was obtained from the questionnaire and secondary sources. Questionnaire responses were analyzed along with the literature which revealed how other organizations have assigned costs.

F. If costs are based on assigned features, how can the cost per feature be determined? This data was obtained through a review of literature provided by Motorola and discussions with Motorola personnel. The literature discusses pricing for systems, equipment, and features.

G. What are the current policies toward paying for LMR equipment within the 15 ABW? This data was obtained through discussions with 15 CS personnel, and relevant 15 ABW documentation and AFIs.

2. How can the 15 CS manage the trunking system operations?

A. What should the procedures be to request, approve, and assign features to individuals? This data was obtained from secondary sources which discuss 15 ABW and 15 CS requirements processing procedures.

B. How will the information regarding who has which features be maintained? This data was obtained from secondary sources. Literature provided by Motorola concerning the trunking system database and system equipment was able to answer this question.

C. What criteria will be used to determine who gets access to features with limited accessibility (i.e. telephone interconnect)? This data was obtained from the questionnaire and secondary sources. Chapter II contained a discussion concerning how another organization has handled this issue. Questionnaire responses were analyzed along with the information in Chapter II to determine how the features should be assigned.

D. What should the procedures be to request, assign, and reassign personnel to talkgroups? This data was obtained through discussions with the 15 CS LMR manager.

E. How will the information regarding who is assigned to which talkgroups be maintained? This data was obtained from secondary sources. Literature provided by Motorola, discussed in Chapter II, revealed how the trunking system controller maintains the talkgroup assignment information.

F. Which system reports will be used? This data was obtained from the questionnaire and secondary sources. The literature search provided information concerning the types of data which may be extracted for report generation. Questionnaire responses were analyzed along with which reports another organization has found useful to determine which reports would be most useful for the proposed system.

G. How often should the reports be generated? This data was obtained from the questionnaire and secondary sources. Chapter II discussed report usage by another organization. Questionnaire responses were analyzed along with how frequently another organization has generated their reports to determine how frequently the system reports should be generated.

H. What will be done with the information in the reports? This data was obtained from secondary sources. Discussions with 15 CS management and the 15 CS LMR manager were analyzed along with how another organization has used the

information in their reports to determine what should be done with the information in the system reports.

Method of Inquiry

This study is formal, ex post facto, descriptive, and cross-sectional. Relevant literature was gathered to learn how other organizations have handled similar problems. The survey study mode was also applied. A questionnaire was distributed to 15 ABW and HQ PACAF personnel to determine their views on several of the issues. After drafting the questionnaire, it was provided to the 15 CS Commander for review. After several drafts, he understood the questions and was able to make appropriate responses. The final questionnaire was sent to the Commander, LMR manager, and finance officer of each organization which currently uses an LMR managed by the 15 CS. It was also sent to HQ PACAF personnel who are responsible for developing LMR policies and procedures for the Command. Below is the specific method of inquiry used to gather the data to answer the investigative and measurement questions.

1. How can the 15 CS manage the financial responsibilities associated with the trunked LMR system?

A. Who should pay for equipment purchases (includes radios, terminals, repeaters, and backbone equipment)? This data was obtained with the questionnaire, a review of relevant policies, procedures, and AFIs, and through a search of organizations which have experienced similar problems. The opinions provided by

the personnel surveyed, the secondary source information, and the actions of the other organizations formed the basis for answering this question.

B. How can payment responsibility for equipment purchases be justified? This data was obtained with the questionnaire and a review of relevant 15 CS and 15 ABW policies, procedures, and AFIs.

C. Who should pay for maintenance costs (includes radios, terminals, repeaters, and backbone equipment)? This data was obtained with the questionnaire, relevant AFIs, and responses from organizations which have experienced similar problems.

D. How can payment responsibility for equipment maintenance be justified? This data was obtained with both the questionnaire and a review of relevant 15 CS and 15 ABW policies and procedures, and AFIs.

E. Should costs be based upon equipment ownership, system usage, geographic coverage needed, assigned features, or some other parameter? This data was obtained with the questionnaire and secondary sources. Chapter II discussed the actions of another organization to handle this issue. Questionnaire responses were analyzed along with the literature which revealed how another organization has assigned costs.

F. If costs are based on assigned features, how can the cost per feature be determined? This data was obtained through a review of literature provided by Motorola, discussed in Chapter II. The literature discusses pricing for systems, equipment, and features.

G. What are the current policies toward paying for LMR equipment within the 15 ABW? This data was obtained through discussions with 15 CS personnel and a review of relevant 15 ABW documentation concerning financial responsibility. This information was presented in Chapter II.

2. How can the 15 CS manage the trunking system operations?

A. What should the procedures be to request, approve, and assign features to individuals? This data was obtained from secondary sources. The requirements processing documentation, discussed in Chapter II, provided information concerning the current procedures used to process customer requirements (i.e. requesting LMR features).

B. How will the information regarding who has which features be maintained? This data was obtained from secondary sources. Literature provided by Motorola concerning the trunking system database and system equipment, presented in Chapter II, was able to answer this question.

C. What criteria will be used to determine who gets access to features with limited accessibility (i.e. telephone interconnect)? This data was obtained with the questionnaire and through discussions with an organization which has experienced similar problems. The information concerning this organization was presented in Chapter II.

D. What should the procedures be to request, assign, and reassign personnel to talkgroups? This data was obtained through discussions with the 15 CS LMR manager.

E. How will the information regarding who is assigned to which talkgroups be maintained? This data was obtained with secondary sources. Literature provided by Motorola discusses how the trunking system controller maintains the talkgroup assignment information.

F. Which system reports will be used? This data was obtained with the questionnaire, secondary sources, and through discussions with the LMR manager of an organization which currently operates an LMR trunking system.

G. How often should the reports be generated? This data was obtained with the questionnaire and through discussions with the LMR manager of an organization which currently operates an LMR trunking system.

H. What will be done with the information in the reports? This data was obtained through discussions with the LMR manager of an organization which currently operates an LMR trunking system, 15 CS management, and the 15 CS LMR manager.

Analysis to be Performed on the Data

Personal opinions gathered with the questionnaire were analyzed using an appropriate statistical tool as identified below. Any prevalent opinions were then compared to guidance provided by the review of literature, including 15 CS and 15 ABW policies and

procedures, AFIs, and the actions of another organization to handle similar issues. Discrepancies between the prevalent opinions and the literature guidance were noted.

1. How can the 15 CS manage the financial responsibilities associated with the trunked LMR system?

A. Who should pay for equipment purchases (includes radios, terminals, repeaters, and backbone equipment)? The questionnaire responses are shown as a histogram, displaying responses for each category of equipment. A chi-square analysis was performed to discover if there was a significant difference of opinions depending upon the respondent's position (i.e. Commander, LMR manager, finance officer). Once any prevalent opinions were identified, they were compared with the information concerning how other organizations have handled this issue and the relevant literature (see Chapter II). A table was developed which displays the equipment categories, the various sources of information concerning the issue, and the opinion and/or information presented by each source concerning who is financially responsible. Any similarities and/or discrepancies concerning this issue between these sources of information were noted.

B. How can payment responsibility for equipment purchases be justified? The justification for payment responsibility is the product of the analysis of questionnaire responses concerning financial responsibility and information contained in relevant 15 CS, 15 ABW, and HQ PACAF policies, procedures, and AFIs. A table was developed which displays the issue, the various sources of information concerning the issue, and the opinion and/or information presented by

each source. The policies, procedures, and AFIs were the primary authority used to justify payment responsibility. However, the opinions provided through the questionnaire were also used to either support the literature guidance, thereby increasing the justification, or to show 15 CS management that the opinions of those surveyed differ from the literature guidance on this issue. Should the latter be the case, the questionnaire responses may be used as a vehicle for developing local policies which differ from the guidance provided in the literature.

C. Who should pay for maintenance costs (includes radios, terminals, repeaters, and backbone equipment)? The questionnaire responses are shown as a histogram, displaying responses for each category of equipment. A chi-square analysis was also performed to discover if there was a significant difference of opinions depending upon the respondent's position. Once any prevalent opinions were identified, they were compared with the information concerning how other organizations have handled this issue and the relevant literature (see Chapter II). This comparison is shown in a table displaying the issue, the various sources of information concerning the issue, and the opinion and/or information presented by each source. The policies and AFIs were the primary authority for answering this question. However, the opinions provided through the questionnaire and the actions of other organizations were also used to either support the literature guidance, if the results were similar, or to show 15 CS management that the opinions of those surveyed differ from the literature guidance and the actions of other organizations on this issue. Should the latter be the case, the questionnaire

responses may be used as a vehicle for developing local policies which differ from the guidance provided in the literature.

D. How can payment responsibility for equipment maintenance be justified? The justification for payment responsibility is the product of the analysis of questionnaire responses concerning financial responsibility and information contained in relevant 15 CS, 15 ABW, and HQ PACAF policies, procedures, and AFIs. A table was developed which displays the issue, the various sources of information concerning the issue, and the opinion and/or information presented by each source. The policies, procedures, and AFIs were the primary authority used to justify payment responsibility. However, the opinions provided through the questionnaire were also used to either support the literature guidance, thereby increasing the justification, or to show 15 CS management that the opinions of those surveyed differ from the literature guidance on this issue. Should the latter be the case, the questionnaire responses may be used as a vehicle for developing local policies which differ from the guidance provided in the literature.

E. Should costs be based upon equipment ownership, system usage, geographic coverage needed, assigned features, or some other parameter? The questionnaire responses are shown as a histogram, displaying responses for each cost parameter. A chi-square analysis was also performed to discover if there was a significant difference of opinions depending upon the respondent's position. Once any prevalent opinions were identified, they were compared with the information concerning how other organizations have handled this issue (see Chapter II). A

table was developed which displays the issue options, the various sources of information concerning the issue, and the opinion and/or information presented by each source. If other organizations handled this issue differently than the survey results, 15 CS management was notified of this fact.

F. If costs are based on assigned features, how can the cost per feature be determined? This data is simply listed as cost data, obtained from Motorola personnel and literature.

G. What are the current policies toward paying for LMR equipment within the 15 ABW? This data, discussed in Chapter II, was compared with the responses obtained with the questionnaire. A table was developed which displays the issue, the sources of information concerning the issue, and the information obtained from each source concerning the issue. Any major discrepancies between the sources were noted to alert 15 CS management.

2. How can the 15 CS manage the trunking system operations?

A. What should the procedures be to request, approve, and assign features to individuals? This data is shown as the current requirements processing procedures (i.e. requesting LMR features).

B. How will the information regarding who has which features be maintained? This data is included in a discussion of how Motorola's trunking systems maintain feature data.

C. What criteria will be used to determine who gets access to features with limited accessibility (i.e. telephone interconnect)? The questionnaire responses are shown as a histogram, displaying responses for each assignment option. A chi-square analysis was also performed to discover if there was a significant difference of opinions depending upon the respondent's position. The prevalent opinions are shown in a table which also displays the information concerning how another organization handled this issue.

D. What should the procedures be to request, assign, and reassign personnel to talkgroups? This information is presented as a discussion concerning how the 15 CS LMR manager sets up talkgroup assignments (see Chapter II).

E. How will the information regarding who is assigned to which talkgroups be maintained? This data is included in a discussion of how Motorola's trunking systems maintain talkgroup assignment data.

F. Which system reports will be used? The questionnaire responses are shown as a histogram, displaying responses for each category of report information. Once any prevalent opinions were identified, they were compared with the information concerning which reports another organization has found useful. A table was developed which displays the categories of report information, those categories the survey respondents would like to see, and those categories another organization has found useful. This table may be used by 15 CS management to determine which report items they will use with their system.

G. How often should the reports be generated? The questionnaire responses are shown as a histogram, displaying responses for each option. Once any prevalent opinions were identified, they were compared with the information concerning how often another organization has generated reports. A table was developed which displays both the respondents' opinions and the frequency of report generation by another organization. This table may be used by 15 CS management to determine the frequency of report generation to be used with their system.

H. What will be done with the information in the reports? This data was presented in Chapter II as a discussion of 15 CS management's ideas and the 15 CS LMR manager's ideas on this issue in comparison with what another organization has done with the information contained in the reports.

Summary of the Chapter

This chapter described the methodology used to analyze the data collected by the questionnaire and the information obtained from the literature review. The analysis focused on answering the management question: How can the 15 CS manage the installation and operation of the new trunked LMR system? The research, investigative, and measurement questions were discussed along with the data required to answer the questions, where the data came from, how the data was obtained, and the analysis which was performed on the data.

Chapter IV

Analysis

Introduction

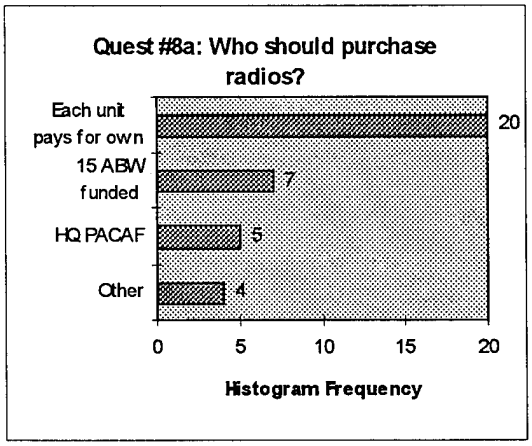
Data concerning financial management and trunking system operations was collected from secondary sources and a questionnaire (Appendix I). Chapter II discussed the data collected during the literature review and information received through discussions with 15 ABW, Motorola, and 59th Signal Battalion personnel. This chapter analyzes the data collected with the questionnaire and, where appropriate, compares the results to data identified in Chapter II. Both the chi-square and analysis of variance (ANOVA) tests were used to analyze the questionnaire data. Following the analysis of each investigative question is a brief interpretation of the results, shown as a finding.

Statistical Tests

The detailed responses from the questionnaire are shown in Appendix J. Approximately 78 questionnaires were sent out to 15 ABW, HQ PACAF, and tenant unit personnel on Hickam AFB. Thirty-seven questionnaires were returned completed or partially completed. Below is a presentation of the analysis performed for each of the investigative and measurement questions, identified in the Analysis to be Performed on the Data section of Chapter III. In each of the figures and tables, the following notation applies: CC: Unit commander; LMR: LMR manager; FIN: unit finance/budget officer; and PACAF: HQ PACAF personnel.

Managing Financial Responsibilities: Investigative Questions

A. Who should pay for equipment purchases (includes radios, terminals, repeaters, and backbone equipment)? Chapter II discussed information from the relevant literature concerning this issue. The AFIs provided guidance which was primarily general in nature. LMR services for tenant units were handled through support agreements with the 15 ABW. New support agreements have not been developed with the tenant units to handle services for the new trunking system. The following figures and tables show the questionnaire responses for each category of equipment as a histogram and as a chi-square analysis.



Other: 15 CS, HQ USAF

Figure 1: Questionnaire responses concerning who should purchase radios.

Table 3: Chi-square analysis of question 8a.

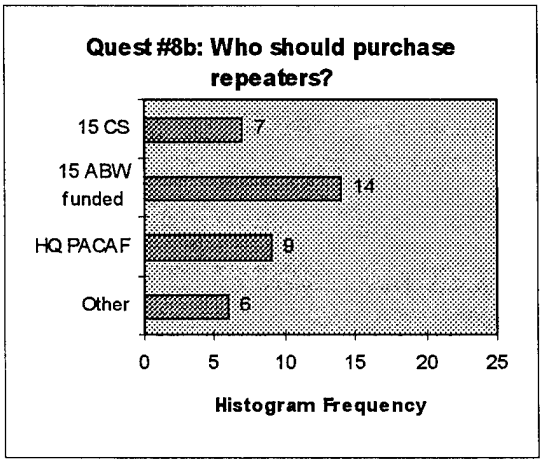
	1or 5	2	3	4	TOTALS
CC, PACAF	1	7	1	2	11
	1.222	6.11	2.14	1.5	
LMR	0	6	3	2	11
	1.222	6.11	2.14	1.5	
FIN, OTHER	3	7	3	1	14
	1.556	7.78	2.72	1.9	
TOTALS	4	20	7	5	36
CHI^2 =	4.55	alpha =	.05		
Crit Value	12.6				
Accept null					

1 or 5: 15 CS or HQ USAF funded
2: each unit pays for their own
3: 15 ABW funded
4: HQ PACAF funded

Figure 1 shows that 55 percent of respondents feel each unit should purchase their own radios. The other 45 percent of respondents were divided into three smaller groups. Two questionnaire responses, 1 and 5, were grouped into the Other category to meet the chi-

square test criteria (i.e. no expected frequencies may be less than one). There were no responses for option six: Other. Table 3 shows that there is no significant difference of opinions between the respondents, based upon their position. As stated in Chapter II, in the past each unit has typically purchased its own radios.

Finding: Each unit should purchase their own radios.



Other: total cost divided among user units, HQ USAF funded, or other

Table 4: Chi-square analysis of question 8b.

	1	3	4	2, 5, or 6	TOTALS
CC, PACAF	1	5	3	2	11
	2.139	4.28	2.75	1.83333	
LMR	1	5	3	2	11
	2.139	4.28	2.75	1.83333	
FIN, OTHER	5	4	3	2	14
	2.722	5.44	3.5	2.33333	
TOTALS	7	14	9	6	36
CHI^2 = 3.94	alpha = .05				
Crit Value	12.6				
Accept null					

1: 15 CS
2, 5, or 6: total cost divided among user units, HQ USAF funded, or other
3: 15 ABW funded
4: HQ PACAF funded

Figure 2: Questionnaire responses concerning who should purchase repeaters.

Figure 2 shows that 39 percent of respondents feel the repeater purchase costs should be paid for through 15 ABW funds. The other 61 percent of respondents were divided into three smaller groups. Three questionnaire responses, 2, 5, and 6, were grouped into the Other category to meet the chi-square test criteria. Table 4 shows that there is no

significant difference of opinions, based upon the respondent's position. Chapter II showed that relevant AFIs provided guidance which was not specific as to who should fund for these equipment items.

Finding: Repeater purchase costs should be paid for through 15 ABW funds.

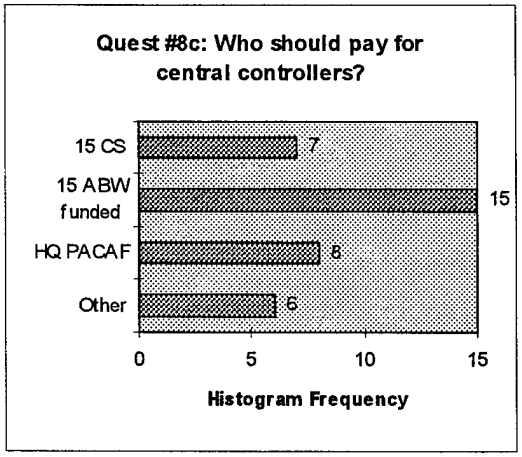


Table 5: Chi-square analysis of question 8c.

	1	3	4	2, 5, or 6	TOTALS
CC, PACAF	1	5	3	2	11
	2.139	4.58	2.44	1.83333	
LMR	1	5	2	3	11
	2.139	4.58	2.44	1.83333	
FIN, OTHER	5	5	3	1	14
	2.722	5.83	3.11	2.33333	
TOTALS	7	15	8	6	36
CHI^2 =	5.04	alpha =	.05		
Crit Value	12.6				
Accept null					

Other: total cost divided among user units, HQ USAF funded, or other

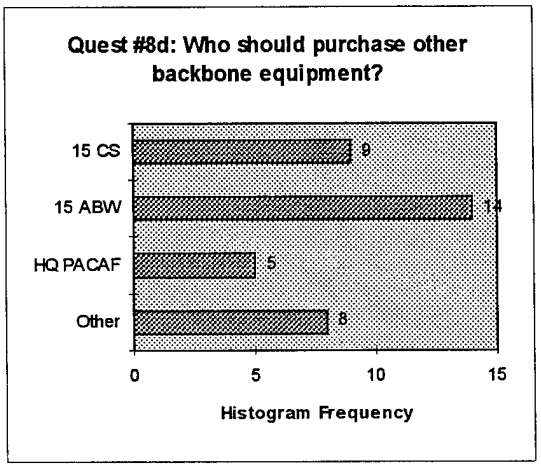
1: 15 CS
2, 5, or 6: total cost divided among user units, HQ USAF funded, or other
3: 15 ABW funded
4: HQ PACAF funded

Figure 3: Questionnaire responses concerning who should purchase central controllers.

Figure 3 shows that 42 percent of respondents feel the central controller purchase costs should be paid for through 15 ABW funds. The other 52 percent of respondents were divided into three smaller groups. Three questionnaire responses, 2, 5, and 6, were grouped into the Other category to meet the chi-square test criteria. Table 5 shows that there is no significant difference of opinions, based upon the respondent's position.

Chapter II showed that relevant AFIs provided guidance which was primarily general in nature.

Finding: Survey respondents feel central controller purchase costs should be paid for through 15 ABW funds.



Other: total cost divided among user units, HQ USAF funded, or other

Figure 4: Questionnaire responses concerning who should purchase other backbone equipment.

Table 6: Chi-square analysis of question 8d.

	1	3	4	2, 5, or 6	TOTALS
CC, PACAF	2	5	2	2	11
	2.75	4.28	1.53	2.44444	
LMR	2	5	1	3	11
	2.75	4.28	1.53	2.44444	
FIN, OTHER	5	4	2	3	14
	3.5	5.44	1.94	3.11111	
TOTALS	9	14	5	8	36
CHI^2 = 2.22	alpha = .05				
Crit Value	12.59				
Accept null					

1: 15 CS
2, 5, or 6: total cost divided among user units, HQ USAF funded, or other
3: 15 ABW funded
4: HQ PACAF funded

Figure 4 shows that 39 percent of respondents feel the backbone equipment purchase costs should be paid for by 15 ABW funds. Three questionnaire responses, 2, 5, and 6, were grouped into the Other category to meet the chi-square test criteria. Table 6 shows that there is no significant difference of opinions, based upon the respondent's position.

Chapter II showed that relevant AFIs provided guidance which was primarily general in nature.

Finding: Survey respondents feel backbone equipment purchase costs should be paid for through 15 ABW funds.

The above findings considered who should purchase equipment items for the new system. Survey question number three asked respondents whether they would like to have additional capabilities or features with their LMR.

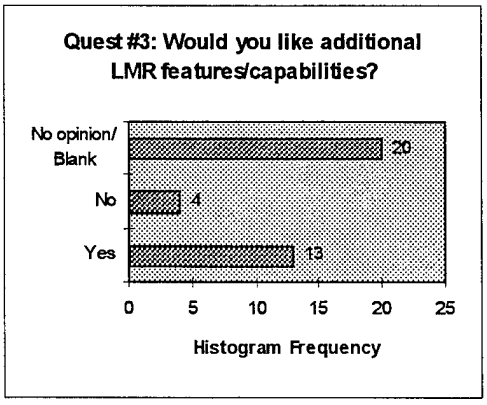


Figure 5: Questionnaire responses concerning the respondents' desire to have additional LMR features/capabilities.

Table 7: Chi-square analysis of question 3.

	1	2	3	TOTALS
CC, PACAF	5	1	6	12
	4.216	1.3	6.5	
LMR	6	1	4	11
	3.865	1.2	5.9	
FIN, OTHER	2	2	10	14
	4.919	1.5	7.6	
TOTALS	13	4	20	37
CHI^2 =	4.77	alpha =	.05	
Crit Value	9.49			
Accept null				

1: Yes
2: No
3: No opinion

Figure 5 shows that 54 percent of respondents have no opinion concerning this issue. However, 35 percent of respondents would like additional LMR features or capabilities. Table 7 shows that there is no significant difference of opinion, based upon the respondent's position.

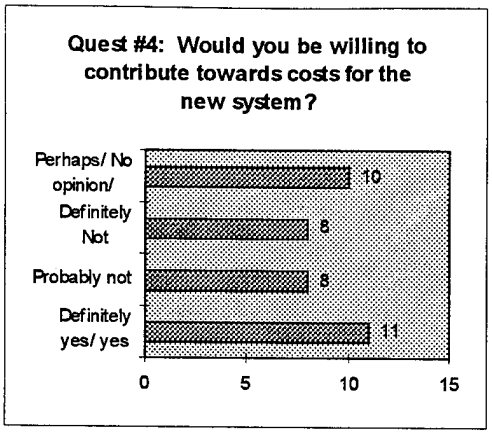


Figure 6: Questionnaire responses concerning respondents' willingness to contribute towards the payments for the new LMR system.

These responses were compared to the responses to survey question number four. This question asked whether the respondents would be willing to pay for enhancements to the LMR network (i.e. the new trunked LMR system). Figure 6 shows that 30 percent of respondents feel they would be willing to pay for the new trunked LMR system. However, 43 percent of respondents feel they either probably or definitely would not be willing to contribute towards the costs for the new system. The Perhaps, No Opinion, and blank responses were combined, as well as the Definitely yes and Yes responses to meet the chi-square test criteria. Table 8 shows there is no significant difference of opinion based upon the respondent's position.

Table 8: Chi-square analysis of question 4.

	1	2	3, 4 or blank	5 or 6	TOTALS
CC, PACAF	2	2	2	6	12
	2.595	2.59	3.24324324	3.568	
LMR	2	2	3	4	11
	2.378	2.38	2.97297297	3.27	
FIN, OTHER	4	4	5	1	14
	3.027	3.03	3.78378378	4.162	
TOTALS	8	8	10	11	37
CHI^2 =	6.11	alpha =	.05		
Crit Value	12.59				
Accept null					

1: Definitely Not
2: Probably Not
3, 4, or blank: No opinion, Perhaps, or no response
5 or 6: Yes or Definitely yes

Finding: Survey respondents are divided on the issue of paying for the new LMR system, even though 35 percent of respondents indicated they would like to have additional features with their LMR.

Survey question number eleven sought the respondents' opinions concerning whether tenant units should have more financial responsibility than 15 ABW units for the trunking system. Figure 7 shows that respondents feel tenant units should have slightly more financial responsibility than 15 ABW units for the new system. Table 9 shows that there is no significant difference of opinions, based upon the respondent's position.

Finding: Respondents feel tenant units should have slightly more financial responsibility for the trunking system.

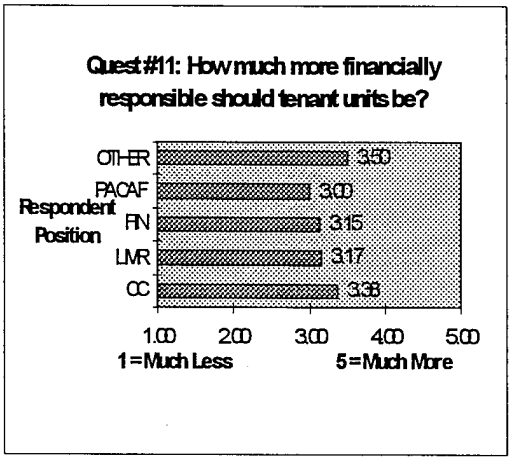


Figure 7: Questionnaire responses concerning whether tenant units should have more financial responsibility than 15 ABW units for the new system.

Table 9: ANOVA test of question 11.

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
CC	8	27	3.375	0.553571		
LMR	9	28.5	3.166667	1.5		
FIN	6	18.9	3.15	0.135		
PACAF	3	9	3	0		
OTHER	4	14	3.5	1		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.6947	4	0.17367	0.218883	0.925389789	2.7587059
Within Groups	19.55	25	0.782			
Total	20.245	29				Accept Null

Survey question number ten sought the respondent's opinions concerning whether or not tenant units should pay a monthly fee for using the trunking system. The responses, shown in Figure 8 and categorized by respondent

position, show that all groups of respondents feel tenant units should pay a monthly fee for using the trunking system. Table 10 shows the ANOVA test performed on the data, indicating there was no significant difference of opinions, based upon the respondent's position.

Finding: The respondents feel tenant units should pay a monthly fee for using the trunking system.

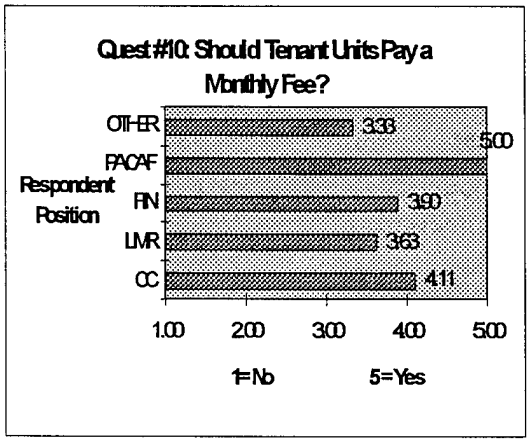


Figure 8: Questionnaire responses concerning whether tenant units should pay a monthly fee for using the new system.

Table 10: ANOVA test of question 10.

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
CC	9	37	4.111111	1.611111		
LMR	11	39.9	3.627273	2.648182		
FIN	8	31.2	3.9	2.308571		
PACAF	3	15	5	0		
OTHER	6	20	3.333333	3.466667		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	6.737	4	1.68426	0.739683	0.571932312	2.666436131
Within Groups	72.86	32	2.277001			
Total	79.6	36				Accept Null

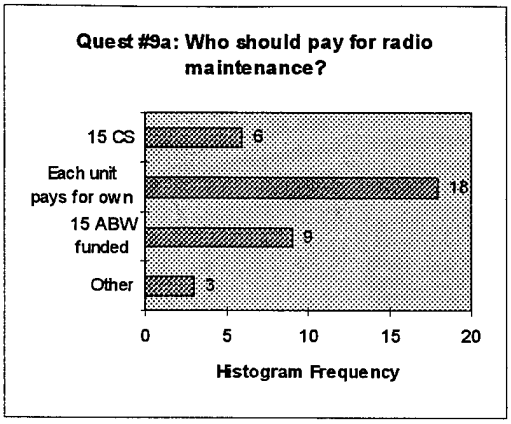
B. How can payment responsibility for equipment purchases be justified? Table 11 shows the information provided by each source concerning who should be responsible for purchasing each of the equipment items.

Table 11: Information provided by the questionnaire, relevant AFIs, and the 59th Signal Battalion concerning who should pay for the listed equipment items.

Equipment Item	Questionnaire	AFIs	59th Signal Battalion
Radios	Unit pays for own	Not specific	Unit pays for own
Repeaters	Wing funded	Not specific	Wing funded
Central Controllers	Wing funded	Not specific	Wing funded
Backbone Equipment	Wing funded	Not specific	Wing funded

Finding: Due to the lack of specific guidance provided in the AFIs, Table 11 should justify the actions of the 15 CS when determining who should pay for the various equipment items.

C. Who should pay for maintenance costs (includes radios, terminals, repeaters, and backbone equipment)? Chapter II discussed information from the relevant literature concerning this issue. The AFIs did not state who was responsible for paying the LMR maintenance costs. LMR services for tenant units were handled through support agreements with the 15 ABW. New support agreements have not been developed with the tenant units to handle services for the new trunking system. The following figures and tables show the questionnaire responses for each category of equipment as a histogram and as a chi-square analysis. The findings which follow each equipment category must be considered in conjunction with the information shown in Figures 7 and 8, and Tables 9 and 10, which show the respondents felt tenant units should have slightly more financial responsibility than 15 ABW units, and that tenant units should pay a monthly fee for using the system.



Other: HQ PACAF, HQ USAF, and other

Figure 9: Questionnaire responses concerning who should pay for radio maintenance.

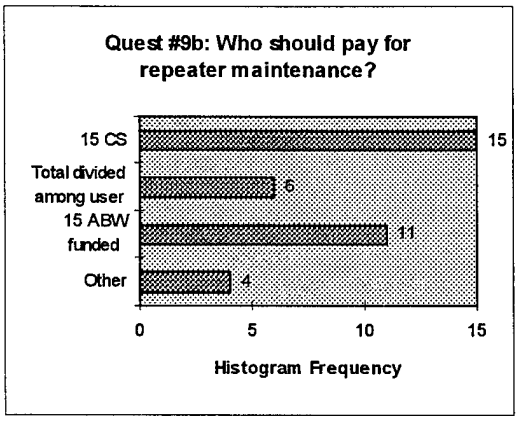
Table 12: Chi-square test of question 9a.

	1	2	3	Other	TOTALS
CC, PACAF	1	8	2	0	11
	1.83	5.5	2.75	0.917	
LMR	1	4	4	2	11
	1.83	5.5	2.75	0.917	
FIN, OTHER	4	6	3	1	14
	2.33	7	3.5	1.167	
TOTALS	6	18	9	3	36
CHI^2=	6.7	alpha =	.05		
Crit Value	12.6				
Accept null					

1: 15 CS
2: each unit pays for their own maintenance costs
3: 15 ABW funded
Other: HQ PACAF, HQ USAF, and other

Figure 9 shows that 50 percent of respondents feel each unit should pay for their own radio maintenance costs. The other 50 percent of respondents were divided into three smaller groups. Three question response options, 4, 5, and 6, were grouped into the Other category to satisfy chi-square test criteria. Table 12 shows that there is no significant difference of opinions between the respondents, based upon their position. As stated in Chapter II, radio maintenance has been covered under the 15 CS maintenance contract with Motorola. All 15 ABW units could use this contract without charge to the unit; tenant units were handled with support agreements.

Finding: Respondents feel that radio maintenance should be funded by each unit.



Other: HQ PACAF, HQ USAF, and other

Figure 10: Questionnaire responses concerning who should pay for repeater maintenance.

Table 13: Chi-square test of question 9b.

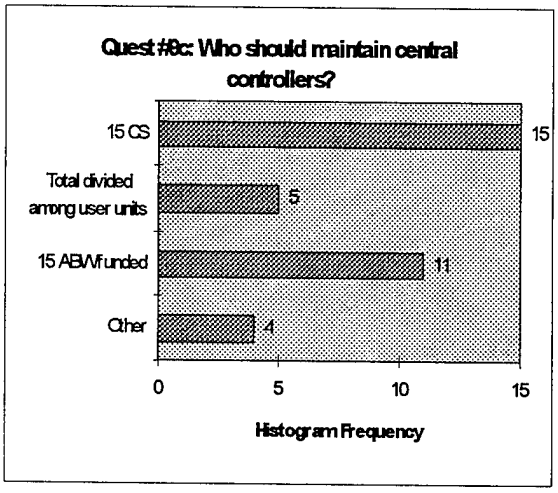
	1	2	3	Other	TOTALS
CC, PACAF	4	3	4	0	11
	4.58	1.83	3.36	1.222	
LMR	3	2	4	2	11
	4.58	1.83	3.36	1.222	
FIN, OTHER	8	1	3	2	14
	5.83	2.33	4.28	1.556	
TOTALS	15	6	11	4	36
CHI^2 =	5.41	alpha =	.05		
Crit Value	12.6				
Accept null					

1: 15 CS
2: total cost divided among the user units
3: 15 ABW funded
Other: HQ PACAF, HQ USAF, and other

Figure 10 shows that 42 percent of respondents feel that repeater maintenance costs should be paid for by the 15 CS. However, 31 percent of respondents felt that these costs should be paid for with 15 ABW funds. The other 27 percent of respondents were divided into two smaller groups. Three question response options, 4, 5, and 6, were grouped into the Other category to satisfy chi-square test criteria. Table 13 shows that there is no significant difference of opinions, based upon the respondent's position. Chapter II showed that relevant AFIs provided guidance which was primarily general in nature.

Finding: Repeater maintenance costs should be paid for by either 15 CS or 15 ABW funds.

Figure 11 shows that 50 percent of respondents feel the central controller maintenance costs should be paid for by the 15 CS. Three question response options, 4, 5, and 6, were grouped into the Other category to satisfy chi-square test criteria. Table 14 shows that there is no significant difference of opinions, based upon the respondent's position. Chapter II showed that relevant AFIs provided guidance which was primarily general in nature. **Finding**: Central controller maintenance costs should be paid for by the 15 CS.



Other: HQ PACAF, HQ USAF, and other

Table 14: Chi-square test of question 9c.

	1	2	3	Other	TOTALS
CC, PACAF	4	3	2	1	10
	4.29	1.43	3.14	1.143	
LMR	4	1	4	2	11
	4.71	1.57	3.46	1.257	
FIN, OTHER	7	1	5	1	14
	6	2	4.4	1.6	
TOTALS	15	5	11	4	35
CHI^2 = 3.99	alpha = .05				
Crit Value	12.6				
Accept null					

1: 15 CS
2: total cost divided among the user units
3: 15 ABW funded
Other: HQ PACAF, HQ USAF, and other

Figure 11: Questionnaire responses concerning who should pay for central controller maintenance.

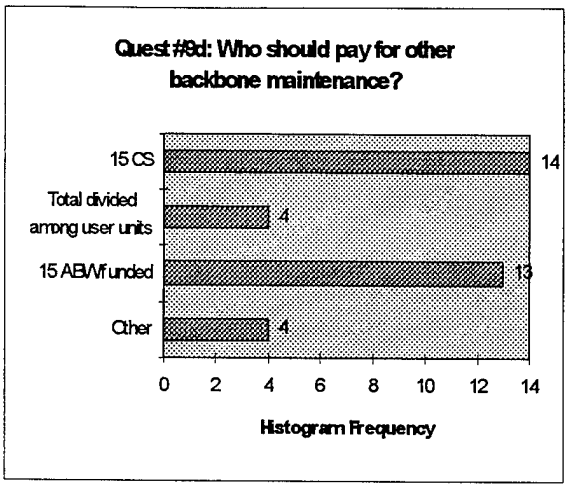


Table 15: Chi-square test of question 9d.

	1	2	3	Other	TOTALS
CC, PACAF	4	2	4	0	10
	4	1.14	3.71	1.143	
LMR	3	1	4	3	11
	4.4	1.26	4.09	1.257	
FIN, OTHER	7	1	5	1	14
	5.6	1.6	5.2	1.6	
TOTALS	14	4	13	4	35
CHI^2 =	5.53	alpha =	.05		
Crit Value	12.6				
Accept null					

Other: HQ PACAF, HQ USAF, and other

1: 15 CS
2: total cost divided among the user units
3: 15 ABW funded
Other: HQ PACAF, HQ USAF, and other

Figure 12: Questionnaire responses concerning who should pay for other backbone equipment maintenance.

Figure 12 shows that 40 percent of respondents feel the backbone equipment maintenance costs should be paid for by the 15 CS and 37 percent feel it should be paid for through 15 ABW funds (there was only a one-person difference). The other 23 percent of respondents were divided into two smaller groups. Three question response options, 4, 5, and 6, were grouped into the Other category to satisfy chi-square test criteria. Table 15 shows that there is no significant difference of opinions, based upon the respondent's position. Chapter II showed that relevant AFIs provided guidance which was primarily general in nature.

Finding: Backbone equipment maintenance costs should be paid for by either the 15 CS or through 15 ABW funds. The 15 CS LMR maintenance contract with Motorola, which is funded by the 15 ABW, may be an ideal vehicle for paying these costs.

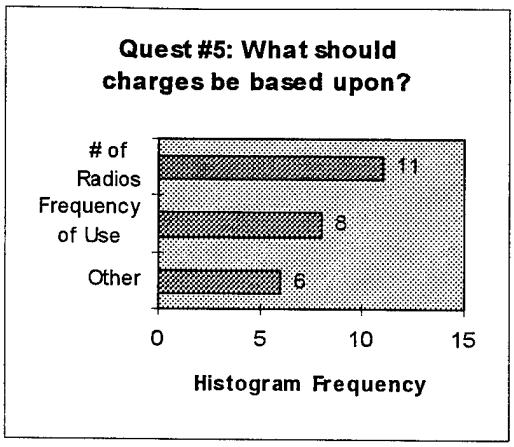
D. How can payment responsibility for equipment maintenance be justified? Table 16 shows the information provided by each source concerning who should be responsible for the maintenance costs for each equipment item.

Table 16: Information provided by the questionnaire, relevant AFIs, and another unit concerning who should be responsible for paying for maintenance on various equipment items.

Equipment Item	Questionnaire	AFIs	59th Signal Battalion
Radios	Unit pays for own	Not specific	Unit pays for own
Repeaters	15 CS	Not specific	Wing funded
Central Controllers	15 CS	Not specific	Wing funded
Backbone Equipment	15 CS / Wing funded	Not specific	Wing funded

Finding: Due to the lack of specific guidance provided in the AFIs, Table 16 should justify the actions of the 15 CS when determining who should pay for maintenance on the various equipment items.

E. Should costs be based upon equipment ownership, system usage, geographic coverage needed, assigned features, or some other parameter?



Other: Geographic coverage required, and other

Figure 13: Questionnaire responses concerning what should charges to users of the LMR system be based upon.

Table 17: Chi-square test of question 5.

	1	2	3 or 4	TOTALS
CC, PACAF	3	4	1	8
	3.52	2.56	1.92	
LMR	4	3	3	10
	4.4	3.2	2.4	
FIN, OTHER	4	1	2	7
	3.08	2.24	1.68	
TOTALS	11	8	6	25
CHI^2 =	2.55	alpha =	.05	
Crit Value	9.49			
Accept null				

1: Number of radios owned by organization
2: Frequency of LMR use
3, 4: Geographic coverage required and other

Figure 13 shows that 44 percent of respondents feel charges should be based upon the number of radios each organization owns. Thirty-two percent of respondents feel charges should be based upon the frequency of system use by each unit. The other 24 percent of respondents who answered the question either selected response option 3 or provided their own criteria (see Appendix J). Question response options 3 and 4 were combined to satisfy chi-square test criteria. Table 17 shows that there is no significant difference of opinions, based upon the respondent's position. Chapter II showed that the 59th Signal battalion is considering charging units based upon the number of radios each unit owns. This should result in charges which are understandable, predictable, and fairly consistent;

qualities mentioned in Chapter II as being desirable of any successful cost allocation system.

Finding: Any charges to units for system use, other than telephone calls, should be based upon the number of radios owned by the unit.

F. If costs are based on assigned features, how can the cost per feature be determined?

Table 18 lists pricing data for several Motorola trunking equipment items. The MBX is needed for access to the telephone interconnect feature. The other items listed are shared items, and are used by the system controllers to operate, monitor, and manage the system.

Table 18: Prices for several Motorola trunking equipment items.

Equipment Item	Price
MBX	$78,000
SIMS II	$100,000
SmartNet System Watch II	$6,280

The Genesis Group software and hardware packages, identified in Chapter II, may also provide useful tools to determine telephone interconnect cost data and develop billing reports. Local phone calls will not incur any direct charges. However, since this feature does consume a significant amount more of frequency resource than a radio call, the 15 CS may want to consider billing for these calls. This is especially true if the system is producing many busies (i.e. other users are refused access to the system due to a lack of channel space) when this feature is being used.

Finding: Charges for telephone interconnect calls may be determined with the cost data in Table 18. This data may be used in conjunction with the Genesis software to generate billing reports.

G. What are the current policies toward paying for LMR equipment within the 15 ABW and HQ PACAF? Chapter II contained a discussion of current policies concerning this issue. This data is shown in Table 19.

Table 19: Current policies concerning paying for LMR equipment within the 15 ABW.

	Radios	Repeaters	Other Backbone Equipment
15 ABW units	Unit funded/Contract maintained	15 ABW funded/Contract maintained	15 ABW funded/Contract maintained
Tenant Units	Unit funded and maintained	Unit funded and maintained	Unit funded and maintained

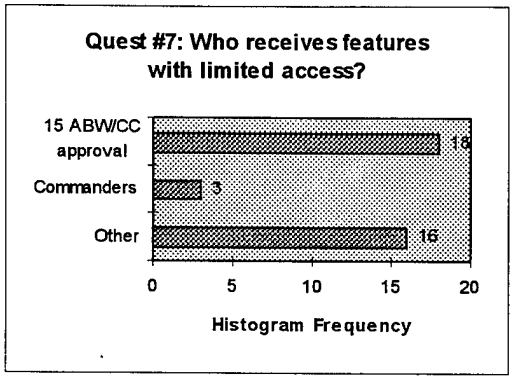
Finding: Table 19 displays the current policies towards paying for LMR equipment within the 15 ABW. These policies may be changed with the implementation of the trunking system.

Managing Trunking System Operations: Investigative Questions

A. What should the procedures be to request, approve, and assign features to individuals? This question was answered in Chapter II. The data presented showed that individuals should follow the current requirements processing procedures detailed in Appendix F.

B. How will the information regarding who has which features be maintained? This data was included in Chapter II as a discussion of how Motorola's trunking systems maintain feature data (i.e. use the SIMS II terminal and the SMARTNET II controller).

C. What criteria will be used to determine who gets access to features with limited accessibility (i.e. telephone interconnect)? The questionnaire responses, shown in Figure 14 as a histogram, show that 49 percent of respondents feel the 15 ABW CC should approve access to these features. However, 43 percent of respondents provided a response not listed on the questionnaire (shown in Appendix J). Sixty-nine percent of these 'Other' responses focused on requiring some sort of approval process to gain access to these features (i.e. CSRB, based on demonstrated need, mission requirements). The responses concerning demonstrated need and mission requirements would most likely be brought before some approval individual or board. Question response options 4 and 5 were combined to satisfy the chi-square test criteria. None of the respondents chose response option 1, assign features based upon rank. Table 20 shows that there is no significant difference of opinions, based upon the respondent's position.



Other: anybody who says they need it and other responses

Figure 14: Questionnaire responses concerning who should receive features with limited access.

Table 20: Chi-square analysis of question 7.

	2	3	4 or 5	TOTALS
CC, PACAF	1	5	6	12
	1	5.8	5.19	
LMR	1	8	2	11
	1	5.4	4.76	
FIN, OTHER	1	5	8	14
	1	6.8	6.05	
TOTALS	3	18	16	37
CHI^2 =	4.26		alpha =05	
Crit Value	9.49			
Accept null				

2: only commanders
3: only those approved by 15 ABW/CC
4, 5: anybody who says they need it and other responses

Chapter II discussed that the 59th Signal Battalion has given these types of features to primarily unit commanders and personnel dealing with safety issues (i.e. medical personnel). The 59th Signal Battalion delegates the approval authority to the equivalent of the 15 CS commander.

Finding: The questionnaire responses and actions of the 59th Signal Battalion show that some approval process should be developed to assign these types of features. Features should not be assigned to personnel based on some generic criteria (i.e. unit commander). The ultimate authority could be either the 15 ABW CC or the 15 CS commander.

D. What should the procedures be to request, assign, and reassign personnel to talkgroups? This information was presented in Chapter II as a discussion concerning how the 15 CS LMR manager sets up talkgroup assignments. Based on the findings, talkgroups will initially be setup with each conventional network getting its own talkgroup. Once the system is operational, system users should follow the requirements processing procedures detailed in Appendix F to request any talkgroup changes.

E. How will the information regarding who is assigned to which talkgroups be maintained? This data was included in Chapter II as a discussion of how Motorola's trunking systems maintain talkgroup assignment data. The finding was that the SIMS II terminal and the SMARTNET SystemWatch II controller will maintain talkgroup assignment data.

F. Which system reports will be used? Chapter II discussed the trunking system data which may be extracted from the Motorola equipment for use in report generation. The survey respondents were asked their opinion concerning the usefulness to them of several of the system statistics. The questionnaire responses, shown in Figure 15, show that the two key statistics respondents wish to see are organization phone calls and the cost for those calls. Tables 21 - 25 show that there is no significant difference of opinions, based upon the respondent's position.

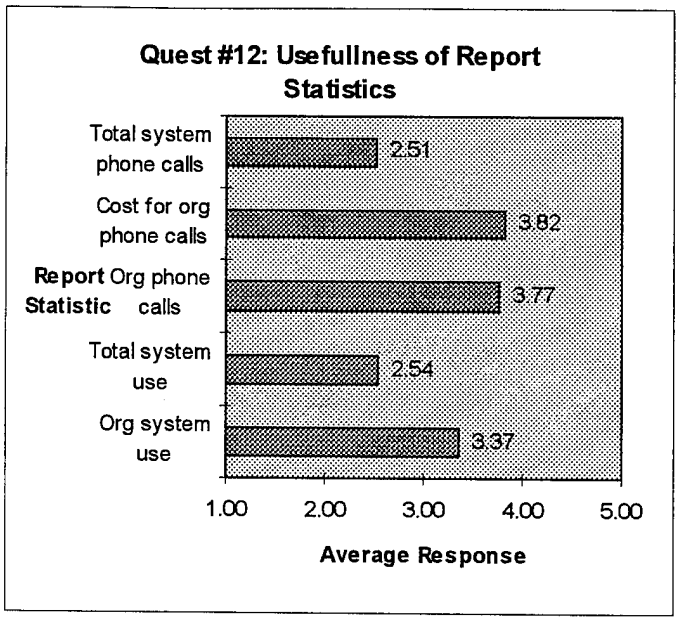


Figure 15: Questionnaire responses concerning which report statistics users would like to see in reports sent to them.

Table 21: ANOVA test on question 12a. Respondents rate the usefulness of the organization system use report statistic.

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
CC	9	30	3.333333	2.25		
LMR	11	39.7	3.609091	1.996909		
FIN	8	30	3.75	1.357143		
PACAF	2	9	4.5	0.5		
OTHER	5	12	2.4	1.8		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	8.8383	4	2.209584	1.201534	0.33059492	2.689631629
Within Groups	55.169	30	1.83897			
Total	64.007	34				Accept Null

Table 22: ANOVA test on question 12b. Respondents rate the usefulness of the total system use report statistic.

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
CC	9	18	2	1.5		
LMR	11	29.4	2.672727	2.410182		
FIN	8	23	2.875	1.839286		
PACAF	2	9	4.5	0.5		
OTHER	5	12	2.4	1.8		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	11.319	4	2.829653	1.497783	0.22780954	2.689631629
Within Groups	56.677	30	1.889227			
Total	67.995	34				**Accept Null**

Table 23: ANOVA test on question 12c. Respondents rate the usefulness of the organization phone calls report statistic.

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
CC	9	34	3.777778	1.694444		
LMR	11	44.8	4.072727	1.296182		
FIN	8	32.7	4.0875	1.175536		
PACAF	2	8	4	0		
OTHER	5	15	3	1		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4.6996	4	1.174898	0.909689	0.47092032	2.689631629
Within Groups	38.746	30	1.291537			
Total	43.446	34				**Accept Null**

Table 24: ANOVA test on question 12d. Respondents rate the usefulness of the cost for organization phone calls report statistic.

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
CC	9	37	4.111111	0.861111		
LMR	11	42.9	3.9	1.69		
FIN	8	32.2	4.025	1.090714		
PACAF	2	9	4.5	0.5		
OTHER	5	15	3	1		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	5.2915	4	1.322885	1.10474	0.37247663	2.689631629
Within Groups	35.924	30	1.197463			
Total	41.215	34				**Accept Null**

Table 25: ANOVA test on question 12e. Respondents rate the usefulness of the total system phone calls report statistic..

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
CC	9	21	2.333333	1.5		
LMR	11	32.2	2.927273	2.266182		
FIN	8	21.2	2.65	1.437143		
PACAF	2	7	3.5	0.5		
OTHER	5	12	2.4	2.3		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3.4936	4	0.873403	0.481463	0.74910023	2.689631629
Within Groups	54.422	30	1.814061			
Total	57.915	34				**Accept Null**

Chapter II showed that the 59th Signal Battalion has found the following statistics to be useful in their reports: queue times and system busies (both deal with total system use), organization phone calls, and total system phone calls. Table 26 displays the categories of report information along with the respondent's and the 59th Signal Battalion's opinions concerning their usefulness. The number indicates the average response; 1 meaning hardly ever useful and 5 meaning extremely useful.

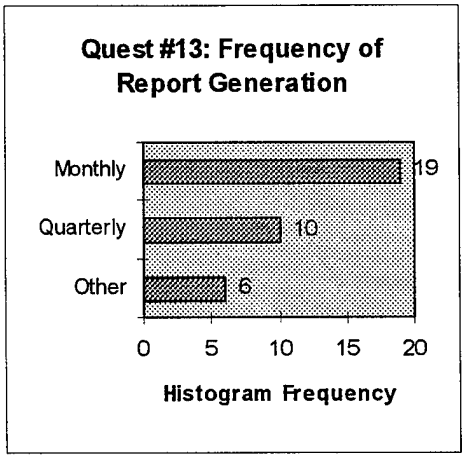
Table 26: Information concerning which report statistics may be useful to both survey respondents and the 59th Signal Battalion.

	Organization System Use	Total System Use	Organization Phone Calls	Cost for Organization Phone Calls	Total System Phone Calls
Survey Respondents Opinions	3.37	2.54	3.77	3.82	2.51
59th Signal Battalion	No	Yes	Yes	No	Yes

Finding: Although the 59th Signal Battalion did not mention the cost for the organization phone calls statistic as being very useful, the survey respondents felt this was the most useful statistic of those presented in the questionnaire. However, all responses are relatively evenly rated. Management of the 15 CS should consider all of the above statistics when determining which items to include in their system reports sent to units.

G. How often should the reports be generated? The questionnaire responses, shown in Figure 16 as a histogram, show that 53 percent of respondents feel they would like to receive the reports monthly. The other 47 percent of respondents were divided into 2 smaller groups. Four question response options, 1, 2, 5, and 6, were combined into the

Other category to meet chi-square test criteria. Table 27 shows that there is no significant difference of opinions based upon the respondent's position.



Other: weekly, twice per month, annually, and never

Figure 16: Questionnaire responses concerning how often respondents would like to see system reports sent to them.

Table 27: Chi-square analysis of question 13.

	3	4	Other	TOTALS
CC, PACAF	7	3	1	11
	5.9714	3.1	1.89	
LMR	6	4	1	11
	5.9714	3.1	1.89	
FIN, OTHER	6	3	4	13
	7.0571	3.7	2.23	
TOTALS	19	10	6	35
CHI^2 =	2.953	alpha =	0	
Crit Value	9.49			
Accept null				

3: monthly
4: quarterly
Other: weekly, twice per month, annually, and never

Chapter 2 discussed that the 59th Signal Battalion produced their system reports monthly.

Finding: The majority of respondents surveyed would like to see reports concerning system use on a monthly basis. This is in agreement with the frequency used by the 59th Signal Battalion.

H. What will be done with the information in the reports? This data was presented in Chapter II as a discussion of 15 CS management's ideas and the 15 CS LMR manager's ideas on this issue in comparison with what the 59th Signal Battalion has done with the information contained in the reports.

Finding: The information contained in the reports will be used to examine system usage, redistribute talkgroup assignments based on system loading factors, validate frequency requirements, and contain costs.

Summary of the Chapter

This chapter analyzed the data collected with the questionnaire and, where appropriate, compared the results to data identified in Chapter II. The questionnaire data for each investigative question was shown both as a histogram and as a comparison of responses, based upon the respondent's position. An appropriate statistical tool, either chi-square or analysis of variance, was used to determine if there was a significant difference of opinions, depending upon the respondent's position. Following the analysis was a brief interpretation of the results, indicated for each investigative question as a finding.

Chapter V

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The findings developed in Chapters II and IV provided answers to the paper's investigative and measurement questions that will provide the recommendations to answer the management question: How can the 15 CS manage the installation and operation of the new trunked LMR system?

Research Question: How can the 15 CS manage the financial responsibilities associated with the trunked LMR system?

Investigative Question: Who should pay for equipment purchases (includes radios, terminals, repeaters, and backbone equipment)?

Findings from Chapter II:

> Finding: The AFIs do not indicate who the appropriate authority is from whom funding for the LMR resources will come. Should the 15 CS decide to charge users for LMR services, 15 CS management must consider the charges which each unit has typically been responsible for in the past, and their sensitivity to changes to those charges.
>
> Finding: Both 15 ABW and tenant units have typically purchased their own radios in the past.
>
> Finding: The U.S. Army's 59th Signal Battalion in Alaska used wing-level funds to purchase the LMR equipment which would be shared among all system users (i.e. repeaters, central controllers, and backbone equipment).

Findings from Chapter IV:

> Finding: Respondents felt that each unit should purchase their own radios.

Finding: Respondents felt that the 15 ABW should purchase all repeaters, central controllers, and other backbone equipment.

Based on these findings it is apparent that the survey respondents agreed to continue their previous practices concerning LMR equipment purchases. These findings are also consistent with the information contained in relevant AFIs. The 59th Signal Battalion follows the purchasing guidelines indicated by the survey respondents as being desirable (i.e. purchase with wing-level funds).

Conclusion: All units should purchase their own radios, and the 15 ABW should purchase all other LMR equipment.

Recommendation: A memorandum of understanding should be developed between the 15 CS, 15 ABW, and all system users stating that all units will purchase their own radios and the 15 ABW will fund for the initial purchase of all other LMR equipment.

Investigative Question: How can payment responsibility for equipment purchases be justified?

Findings from Chapter II:

Finding: The 15 CS must determine how new units may be added to the system and the financial responsibility of all units using the system.

Finding: Any new agreements involving the reimbursement for charges related to the trunking system must be very specific in stating who is responsible for which specific charges.

Finding from Chapter IV:

Finding: Table 11 from Chapter IV, shown below, shows information provided by the questionnaire, AFIs, and the 59th Signal Battalion concerning who should pay for the various LMR equipment items.

Table 11: Information provided by the questionnaire, relevant AFIs, and the 59th Signal Battalion concerning who should pay for the listed equipment items.

Equipment Item	Questionnaire	AFIs	59th Signal Battalion
Radios	Unit pays for own	Not specific	Unit pays for own
Repeaters	Wing funded	Not specific	Wing funded
Central Controllers	Wing funded	Not specific	Wing funded
Backbone Equipment	Wing funded	Not specific	Wing funded

Previous practices by the 15 ABW, the questionnaire, and the 59th Signal Battalion all agree that radios should be purchased by each unit. Each source also indicated that other trunking equipment should be purchased through wing-level funds. The AFIs provide no guidance which contradicts these practices. Agreements must be developed which specifically state how new units may be added to the trunked LMR system and the financial responsibility each unit will incur.

Conclusion: The previous practices of the 15 ABW, the opinions revealed through the questionnaire, the actions of the 59th Signal Battalion, and the lack of specific guidance in the AFIs should justify the actions of the 15 CS when determining who should pay for the trunked LMR equipment.

Recommendation: The 15 CS should develop a memorandum of understanding which specifically states who is responsible for which specific charges. New units who are added to the system will then be able to determine which charges they will be responsible for.

Investigative Question: Who should pay for maintenance costs (includes radios, terminals, repeaters, and backbone equipment)?

Findings from Chapter II:

> Finding: The 59th Signal Battalion, which operates a trunked LMR system in Alaska, currently splits the backbone equipment maintenance costs evenly between the Army and the Air Force. Negotiations began in February 1995 to consider changing this practice and basing charges on the number of radios owned.
>
> Finding: The AFIs do not indicate who the appropriate authority is from whom funding for the LMR system maintenance will come. Should the 15 CS decide to charge users for LMR services, 15 CS management must consider the charges which each unit has typically been responsible for in the past, and their sensitivity to changes in those charges.
>
> Finding: Any new agreements involving the reimbursement for charges related to the trunking system must be very specific in stating who is responsible for which specific charges.

Findings from Chapter IV:

> Finding: Respondents felt that radio maintenance should be funded by each unit. Respondents felt that funding for repeater, central controller, and other backbone equipment maintenance should come from the 15 CS or the 15 ABW. The 15 CS LMR maintenance contract with Motorola, which is funded by the 15 ABW, may be an ideal vehicle for paying these costs.
>
> Finding: Respondents felt that tenant units should have slightly more financial responsibility than 15 ABW units for the trunking system.
>
> Finding: Respondents felt that tenant units should pay a monthly fee for using the trunking system.

The repeaters, central controllers, and other backbone equipment will be shared among all units using the new system. Therefore, it seems logical that funding for maintenance for these items should come from the 15 ABW, the central funding source responsible for supporting each unit. Since the 15 ABW is not funded to support tenant units, tenant units should be asked to fund for some portion of the system. Survey respondents agreed

that tenant units should be slightly more financially responsible for the new system than non-tenant units. The respondents also felt that tenant units should pay a monthly fee for using the system. This payment structure may be implemented to cover the maintenance costs for the system. Since the current host-tenant support agreements are not adequate to handle the new system, the agreements must be changed. New agreements must be very specific in stating who is responsible for which specific charges. The agreements must also stress the importance of the trunking system to all system users, thus encouraging the tenant units to support the funding agreements.

Conclusions: All units, tenant and non-tenant, must agree to the new payment structure implemented to fund for maintenance for the trunked LMR system. It is critical that the payment structure be understandable to all users and consistent.

Recommendation: The 15 CS should enter into negotiations with the tenant units to develop new support agreements which specifically state who is responsible for which specific charges.

Investigative Question: How can payment responsibility for equipment maintenance be justified?

Findings from Chapter II

Finding: The 59th Signal Battalion, which operates a trunked LMR system in Alaska, currently splits the backbone equipment maintenance costs evenly between the Army and the Air Force. Negotiations began in February 1995 to consider changing this practice and basing charges on the number of radios owned.

Finding: The AFIs do not indicate who the appropriate authority is from whom funding for the LMR system maintenance will come. Should the 15 CS decide to charge users for LMR services, 15 CS management must consider the charges

which each unit has typically been responsible for in the past, and their sensitivity to changes in those charges.

Finding: Any new agreements involving the reimbursement for charges related to the trunking system must be very specific in stating who is responsible for which specific charges.

Findings from Chapter IV:

Finding: Respondents felt that radio maintenance should be funded by each unit. Respondents felt that funding for repeater, central controller, and other backbone equipment maintenance should come from the 15 CS or the 15 ABW. The 15 CS LMR maintenance contract with Motorola, which is funded by the 15 ABW, may be an ideal vehicle for paying these costs.

Finding: Respondents felt that tenant units should have slightly more financial responsibility than 15 ABW units for the trunking system.

Finding: Respondents felt that tenant units should pay a monthly fee for using the trunking system.

When attempting to justify its actions, the 15 CS should turn to current AFIs and what other organizations have done to handle similar circumstances. They may also attempt to ascertain the opinions of those personnel who would be affected by their decisions (i.e. the users of the trunked LMR system). As indicated in the above findings, the information gathered from each source contain the same funding source for paying for LMR equipment maintenance. Previous practices by the 15 ABW, the questionnaire, and the 59th Signal Battalion all agree that radios should be maintained by each unit. The 59th Signal Battalion uses wing-level funding to pay for other system equipment maintenance. When respondents indicated that they felt the 15 CS should pay for other system equipment maintenance, they may have been thinking that the Motorola maintenance contract should be used, which is handled through the 15 CS. This contract is funded through the 15 ABW (i.e. wing-level funds). The AFIs provide no guidance which

contradicts these practices. Agreements must be developed which specifically state how new units may be added to the trunked LMR system and the financial responsibility each unit will incur.

Conclusion: The previous practices of the 15 ABW, the opinions revealed through the questionnaire, the actions of the 59th Signal Battalion, and the lack of specific guidance in the AFIs should justify the actions of the 15 CS when determining who should pay for the trunked LMR equipment maintenance costs.

Recommendation: The 15 CS should develop a memorandum of understanding which specifically states who is responsible for which specific charges. New units who are added to the system will then be able to determine which charges they will be responsible for.

Investigative Question: Should costs be based upon equipment ownership, system usage, geographic coverage needed, assigned features, or some other parameter?

Findings from Chapter II:

Finding: The 59th Signal Battalion currently splits the charges evenly between the Army and the Air Force. However, they are considering basing the charges on the number of radios owned.

Finding: The 15 CS should attempt to develop charging procedures which are equitable, understandable, and repeatable.

Finding: Any billing statements and system reports generated should be sent to those personnel responsible for controlling costs.

Finding from Chapter IV:

Finding: Respondents felt that any charges to units for system use, other than telephone calls, should be based upon the number of radios owned.

The 59th Signal Battalion currently splits the backbone equipment maintenance costs evenly between the Army and the Air Force. However, they have discovered that such procedures may not be equitable (i.e. the Air Force may have many more radios and users than the Army). They are considering basing the charges on the number of radios owned. This should result in charges which are more equitable, understandable, and certainly repeatable, characteristics which are desirable in a chargeback system. Survey respondents agreed that charges should be based on the number of radios owned.

Conclusions: Charging units based on the number of radios owned should result in cost allocations which are understandable, equitable, and repeatable. This form of chargeback should also provide a fairly consistent funding source, given that the number of radios owned by each unit does not decrease substantially.

Recommendations: The 15 CS should charge user units based upon the number of radios owned. The 15 CS must also ensure that these charges are understandable, auditable, and repeatable, qualities mentioned in Chapter II as being desirable of any cost allocation system. The 15 CS should send the billing statements and reports to those individuals who are responsible for controlling costs (i.e. unit commanders).

Investigative Question: If costs are based on assigned features, how can the cost per feature be determined?

Findings from Chapter II:

Finding: Any billing statement sent to user units must be clear, understandable, and predictable for both recurring and non-recurring charges.

Finding: EzBill+ may be used to determine costs and generate bills to system users.

Finding: The cost data shown in Table 2 may be used in the development of a cost allocation formula to charge user units.

Table 2: Trunking Equipment Prices

Equipment Item	Cost	Already Purchased
MBX (Telephone Interconnect Equip.)	**$78,000**	**No**
SMARTNET SystemWatch II Terminal software (includes 1 RF modem and 1 radio)	**$6,280**	**Yes**
SIMS II Terminal software (includes 2 RF modems and 2 radios)	**$100,000**	**No**

The Genesis Group provides several software packages which assist system users in managing their trunked LMR system. The software is capable of producing system activity reports and billing statements. However, the SMARTNET SystemWatch II terminal, which the 15 CS currently uses, is capable of performing these functions. Additionally, the SIMS II terminal, which the 15 CS is scheduled to purchase in July 1995, is also capable of performing these functions. Cost data for several backbone equipment items was presented in Table 2. These costs may be used in the development of a cost allocation formula. The formula may then be used in conjunction with the 15 CS' SystemWatch II terminal and, once purchased, the SIMS II terminal to generate billing statements.

Conclusions: The SMARTNET SystemWatch II and the SIMS II terminals may be adequate to perform the report and billing functions to be used by the 15 CS. Should the 15 CS find these equipment items not adequate to meet their report and billing needs, the software products developed by The Genesis Group may be able to meet their needs.

Recommendations: The 15 CS should use the SystemWatch II terminal and, once purchased, the SIMS II terminal to generate their reports and billing statements. Should the 15 CS find these items do not meet their needs, the 15 CS may consider purchasing the EzBill+ product from The Genesis Group.

Investigative Question: What are the current policies toward paying for LMR equipment within the 15 ABW?

Findings from Chapter II:

Finding: The 15 CS has historically been responsible for providing communications and computer equipment and services to members of the 15 ABW and HQ PACAF personnel.

Finding: LMR support for tenant units has generally been handled through host-tenant support agreements. These agreements will not be adequate to handle the shared equipment items to be utilized with the trunked LMR system

Finding: Tenant units have historically been financially responsible for their own LMR equipment.

Current agreements concerning LMR support for tenant units involve systems which are generally owned and used solely by the tenant units. However, since the trunked LMR system involves backbone equipment items which will be shared among all system users, tenant and non-tenant, the current agreements are not adequate.

Conclusion: The current host-tenant support agreements concerning LMR support are not adequate to handle the new trunked LMR system

Recommendation: The 15 CS should enter into negotiations with the tenant units to develop new agreements which will adequately handle the change in support which will be required with the new trunked LMR system.

Research Question: How can the 15 CS manage the trunking system operations?

Investigative Question: What should the procedures be to request, approve, and assign features to individuals?

Finding from Chapter II:

Finding: The 15 ABW C4 Requirements Management Guide and AFI 33-103, provide the necessary steps to request LMR services (i.e. feature assignment).

Although the new trunking system operates differently than the conventional LMR networks currently in use, they still are C4 systems. Therefore, users should be required to follow the procedures already developed to process C4 requirements.

Conclusion: The 15 ABW C4 Requirements Management Guide and AFI 33-103 provide procedures which may be used to process LMR feature requests for the trunked LMR system.

Recommendation: The 15 CS should require all users to follow the procedures outlined in the above documents when processing feature requests.

Investigative Question: How will the information regarding who has which features be maintained?

Finding from Chapter II:

> Finding: The SMARTNET SystemWatch II terminal may be used to monitor, control, and change talkgroup and feature assignment data for individual radios, talkgroups, and system-wide. The SIMS II terminal is also capable of performing these functions.
>
> Recommendation: The 15 CS should use the SMARTNET SystemWatch II and, once purchased, the SIMS II terminal to maintain feature assignment data.

Investigative Question: What criteria will be used to determine who gets access to features with limited accessibility (i.e. telephone interconnect)?

Finding from Chapter II:

> Finding: The 59th Signal Battalion uses the following criteria to determine who gets access to the telephone interconnect feature: safety, unit commanders, need for off-post communications, and consideration of other means of communication available.

Findings from Chapter IV:

> Finding: Respondents felt that some sort of approval process should be developed to assign these types of features.
>
> Finding: Features should not be assigned to personnel based on some generic criteria (i.e. unit commander).
>
> Finding: The approval authority could be either the 15 ABW/CC or the 15 CS commander.

When system users make a telephone interconnect call, they tie up significantly more frequency resources than a normal radio call would consume. Therefore, when these types of calls are placed, other users may be preempted from using the system. The 15 CS must carefully consider which users are given access to this feature. For the trunked LMR system managed by the 59th Signal Battalion, the post signal commander (i.e. 15 CS

commander equivalent) has been given the authority to grant access to this feature. The criteria used to grant access (shown in the above findings) have worked well for the 59th Signal Battalion. Survey respondents were divided on the issue of who should grant access to this feature and what the criteria for access should be. However, most respondents felt there should be some sort of approval process (i.e. CSRB, based on demonstrated need, mission requirements) before access is granted. It makes sense that the feature not be given to any user who requests it. Additionally, the authority to grant access to this feature should be placed with an individual who has the ability to judge both the overall system and operational impact of users using this feature.

Conclusion: The 15 CS must exercise caution and sound judgment when determining who receives access to the telephone interconnect feature.

Recommendations: The 15 CS commander should be given the authority to grant users access to the telephone interconnect feature. The 15 CS commander should use the following criteria when considering granting a user access: safety, commander, need for off-post communication, and consideration of other means of communication available.

Investigative Question: What should the procedures be to request, assign, and reassign personnel to talkgroups?

Findings from Chapter II:

Finding: The 59th Signal Battalion initially set up their talkgroups by giving each conventional network its own talkgroup. Network managers recommended that once the system is operational, the LMR managers from each unit discuss their functional requirements (i.e. who their personnel need to talk to) in order to optimize the system configuration.

Finding: The 15 CS LMR manager stated that each conventional network will initially be given its own talkgroup. Once the system is operational, LMR managers will determine if there is a more efficient method of designing the talkgroup assignments.

Finding: Users should follow the requirements processing procedures outlined in AFI 33-103 and the 15 ABW C4 Requirements Management Guide when requesting any talkgroup changes.

Giving each conventional network its own talkgroup is certainly the simplest method of transferring users to the new LMR system. Users will have to become accustomed to the new system. Any further initial changes or disruptions to their LMR service (i.e. initially designing talkgroups in a configuration other than what users are currently using) would most likely complicate the transfer from the conventional LMR system to the trunked system. However, it does make sense to relook at the talkgroup configurations once users are comfortable with operating on the new system. One of the primary advantages of the trunked system is the ability to talk to any individual or group on the system. Users may have a valid operational requirement to talk to others outside of their current talkgroup. If this occurs frequently, LMR managers may want to consider redesigning the talkgroup configurations. Additionally, since requesting talkgroup changes is a C4 request, the guidelines outlined in AFI 33-103 and the 15 ABW C4 Requirements Management Guide should be followed.

Conclusions: Giving each conventional network its own talkgroup seems to be the simplest method of initially transferring users to the trunked LMR system. This will result in a talkgroup configuration which may not be the most efficient, considering the users' operational needs and the trunking equipment capacity.

Recommendations: The 15 CS should initially give each conventional network its own talkgroup. Once the transfer is complete and users become familiar with operating on the new system, the 15 CS LMR manager should get together with the unit LMR managers to determine if the current talkgroup configuration is indeed the most appropriate, considering each unit's operational requirements. Users should follow the guidelines outlined in AFI 33-103 and the 15 ABW C4 Requirements Management Guide to request any talkgroup assignment changes.

Investigative Question: How will the information regarding who is assigned to which talkgroups be maintained?

Finding from Chapter II:

Finding: The SMARTNET SystemWatch II terminal may be used to monitor, control, and change talkgroup and feature assignment data for individual radios, talkgroups, and system-wide. The SIMS II terminal is also capable of performing these functions.

Recommendation: The 15 CS should use the SystemWatch II terminal and, once purchased, the SIMS II terminal to maintain talkgroup assignment data.

Investigative Question: Which system reports will be used?

Findings from Chapter II:

Finding: The 59th Signal Battalion has found the following system report statistics to be useful: number of calls processed, system peak and low periods, queue times, and telephone interconnect versus dispatch times.

Finding: The plan developed by the National Library of Australia (Appendix H) may be useful to the 15 CS while developing their procedures to manage the report generation function of the trunking system.

Finding: The statistics which the 15 CS decides to use in their reports must be understandable to their customers and repeatable.

Finding from Chapter IV:

Finding: Respondents felt the cost for organization phone calls statistic would be the most useful to them. They also felt that the organization system use and the organization phone calls statistics would be useful.

It seems that the report information which would be useful to the system managers may be slightly different than the data which the user units would find useful. This is demonstrated by the difference of report information used by the 59th Signal Battalion, which does not send the reports to the user units, and the respondents' choices for system statistics. Users want to see information concerning system use by their own organization. Whereas, the system managers should be more concerned with system-wide activity, reviewing system statistics similar to those used by the 59th Signal Battalion.

Conclusion: User units want to see system statistics which reflect system use by their own organization. System managers should be concerned with system-wide activity.

Recommendation: The 15 CS should generate system activity reports showing organization phone calls, the cost for those phone calls, and the effect those calls had on other system activity (i.e. did the phone calls cause any system busies?). These reports should be sent to the user units. The 15 CS should generate another report showing these same statistics in addition to the number of calls processed, the peak and low periods of system activity, queue times, and telephone interconnect versus dispatch times. This report will not be sent to user units.

Investigative Question: How often should the reports be generated?

Finding from Chapter II:

> Finding: The 59th Signal Battalion generates their system activity reports at least monthly.

Finding from Chapter IV:

> Finding: The majority of respondents surveyed would like to see reports concerning system use on a monthly basis.

It would seem that the reports sent to the user units should be used to monitor system use by that particular organization. Unit personnel could look for any trends and attempt to flag any system misuse. Monthly report generation has worked well for the 59th Signal Battalion. This frequency allows the user units to monitor their own system activity frequently enough to monitor any trends which may be developing and to flag system misuse before it could possibly get out of hand.

> Conclusion: Report generation on a monthly basis seems to be reasonable, given that it has worked well for another organization and that it should allow the user units to adequately monitor their own system activity.
>
> Recommendation: The 15 CS should generate the reports indicated in the previous investigative question on a monthly basis.

Investigative Question: What will be done with the information in the reports?

Findings from Chapter II:

> Finding: The report information generated by the 59th Signal Battalion is used to monitor system activity, educate system users, and monitor any possible system misuse. The 15 CS commander and LMR manager indicated the same uses for the report information, in addition to validating frequency requirements, contain costs, and redistribute talkgroup assignments based on system loading factors.

It does not seem logical to generate system activity reports and then do nothing with the reports. The reports should be used to improve the operational effectiveness of the trunked LMR system (i.e. extract the most efficient and effective use possible with the resources at hand). Educating the system users is a large part of achieving this goal. Users must be aware of how to properly use the system as well as the periods when the system is most heavily loaded (i.e. the times when users may not be able to acquire a channel to communicate). This user education may help to keep users from getting frustrated while learning to use the new system.

Conclusion: Using the report information to educate users and achieve the most effective and efficient use of the trunked LMR system should be a primary purpose of using the report information.

Recommendation: The 15 CS LMR manager should use the report information to compare with previous activity (i.e. the month before), educate system users (i.e. tell them when peak and low periods are), watch for any possible system misuse, validate frequency requirements, and redistribute talkgroup assignments based on system loading factors.

Limitations

Although trunked LMR systems are not new, Air Force units have just recently began to use them. During the study, it was necessary to examine Department of Defense (DOD) units, in addition to commercial companies, since most DOD units are not in the business to make money, whereas many commercial companies are. This aspect would

affect the financial considerations of this study. As a result, the number of units which could be researched for this study was limited.

Future Research

As more DOD units install trunked LMR systems, and as units who already are using the systems become more experienced with managing them, a greater body of knowledge will become available to assist those who are not familiar with managing a trunked LMR system. These units should be examined to determine if there are any other practices which have proven beneficial or detrimental to the successful operation and management of a trunked LMR system.

Many DOD agencies are moving towards the fee-for-service operating mode. If this trend becomes more widespread and is adopted by units on Hickam AFB, the 15 CS must reconsider the financial aspects examined in this study. The development of a fair, understandable, and repeatable cost allocation formula would become even more critical with the onset of fee-for-service, since all users would be charged for using the trunked LMR system.

Summary of the Chapter

The conclusions and recommendations provided should be helpful to the 15 CS in the development of plans, procedures and policies to manage the installation and operation of the trunked LMR system. Information obtained from the 59th Signal Battalion has been extremely useful in the development of recommendations to the 15 CS. The questionnaire

data was also useful to obtain the opinions of Hickam personnel concerning the issues addressed in this study. Further study in the area of financial management may be necessary should the 15 ABW adopt a fee-for-service operating mode. The 15 CS must take steps to address the financial and operational issues discussed in this study, which have answered the management question: How can the 15 CS manage the installation and operation of the new trunked LMR system? These issues are critical to the successful implementation of a new UHF trunked LMR system.

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Appendix A

NET # / NET NAME	NET MANAGER / ALTERNATE	PHONE / PHONE	ORGANIZATION
01 MED NET	Bill Wilso Miss Tanaka	449-5308 449-5308	15 MDG/SGSLF
02 CAMS MAINT "A"	SSgt Carter TSgt Martin	448-9255 449-1017	15 ABW/OCM
03 MOTOR POOL/TAXI	SSgt Speakman	449-0494	15 ABW/LGTO
04 PRIME BEEF	SSgt Marsch TSgt Newhouse	449-2095 449-7102	15 CES/DEO
05 CIVIL ENGINEERING	Tsgt Pottinger	449-2189	15 CES/DEMRP
06 CAMS MAINT "B"	SSgt Carter	448-9255	15 ABW/OCM
07 BASE OPS/RAMP CONTROL	SSgt Carter	448-9255	15 ABW/OCM
08 HICKAM SP/LE	TSgt Hammock SRA Roach	449-5881 449-5881	15 ABW/SPTLA
09 BELLOWS SP	TSgt Burns	259-5955	DET 1, 15 ABW/SPOE
11 MAC MAINT "A"	Msgt Rosa Sgt Quintana	449-5280 449-7572	635/LGC
12 MAC MAINT "B"	TSgt Balangue	449-6843 449-6863	619 MS
13 CAMS MAINT "C"	SSgt Carter	448-9255	15 ABW/OCM
14 SAC MAINT	SSgt Goodlove	449-2052	HQ PACAF AOS/PCOT

15	MSgt Legget	656-1320	15 CS/OL-B
WHEELER HIROCC	MSgt Hayashi	656-1320	
16	MSgt Schultz	668-7774	15 CS/SCLR
PALEHUA OBSERVATORY			
18	SA Mientek	449-1680	AFOSI, DET 1818
OSI	SA Joy		
19	SSgt Carter	448-9255	15 ABW/OCM
GROUND CONTROL (HON)			
20	Mr Mohica	449-2092	15 ABW/SCOJM
MARS	Sgt Noyola-Hudson	449-3109	
21	SSgt Burch	449-1181	635 AMSS/TRO
AMC ATOC		449-2906	
22	MSgt Herb	449-0093	15 ABW/LGX
MOBILITY CONTROL			
23	TSgt Tauyan	448-0506	15 ABW/LGTX
TRANSPORTATION MOB.			
24	SRA Nottleman	449-2509	15 ABW/LGSF
POL	SSgt Flirt	449-7939	
25	CMSgt Errecart	449-5117	HQ PACAF/IG
PACAF IG	Maj Compton	449-5117	
26			
ECMC			
27			25TH ASOS/DOG
25TH LIASON SQ	Sgt Quintana	656-1572	
28	TSgt Arthur	449-6863	15 CS/SCOUJL
NASA			
29	CMSgt Uhrig	449-1221	203 MXS/MAMC
203 ARS ANG	SSgt Pratt	449-1177	
30	TSgt Thompson	449-6450	15 AMDS/SGPRO
AEROMEDICAL EVACUATION			

32	TSgt Ryan	637-7310	DET 6,2 STG/DC
KAENA POINT TRACKING			
37	TSgt Arthur	449-6863	15 CS/SCOUJL
BASE PAGING SYSTEM			
41	TSgt Arthur	449-6863	15 CS/SCOUJL
HICKAM COMMANDER			
42	Mr Coughlin	449-6391	15 ABW/DEF
HICKAM FIRE/CRASH			
45	SRA Scott	656-2183	15 MXS/LGMW
WHEELER MUNITIONS		656-2183	
48	Mr Ellis	449-5213	15 CES/CEXD
AIR BASE OPERABILITY		449-2398	
49	TSgt Askin	449-6253	15 CES/EOD
EOD	MSgt Auld	449-6253	
50	TSgt Arthur	449-6863	15 CS/SCOUJL
COMMUNICATIONS			

Appendix B

Trunking System Feature Listing

Full interoperability for all units

All subscriber equipment reprogrammable within band

Ability to add new nets to system without new frequencies

Wide/narrow band capable

Digital capable

Dynamic regrouping

Secure voice operation

Individual private call

Call about (paging)

Group call

System wide call

Scan

Queuing

Callback

Radio inhibit (remote shutdown)

Private telephone interconnect

Configuration, security, and account management

Automatic site registration and deregistration

Zone trunking

Comprehensive airtime use statistics

Comprehensive telephone interconnect records/stats

System Watch

(this list was obtained from the 15 CS LMR manager)

Appendix C

BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE INSTRUCTION 33-101
30 JUNE 1994

Communications

COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTER SYSTEMS MANAGEMENT GUIDANCE AND RESPONSIBILITIES

This instruction implements Air Force Policy Directive (AFPD) 33-1, *Air Force Command, Control, Communications, and Computer (C4) Systems*. It provides management procedures for commanders to ensure availability, interoperability, and maintainability of C4 systems in support of mission readiness and war fighting capability. This instruction covers general guidance and procedures for effective and efficient management of C4 systems throughout their life-cycle. Find specific C4 systems guidance and procedures in other Air Force 33-series publications. Guidance on requirements processing and acquisition of C4 systems costing $5 million or more, involving development, or specifically selected by Headquarters United States Air Force (HQ USAF) is found in Air Force Instruction (AFI) 10-601, *Mission Needs and Operational Requirements Guidance and Procedures* (formerly AFR 57-1) Department of Defense (DoD) Instruction 5000.2/Air Force Supplement 1, *Defense Acquisition Management Policies and Procedures*, February 23, 1991, with Change 1, and the Air Force 63-series publications. Refer recommended changes and conflicts between this and other publications, using Air Force (AF) Form 847, **Recommendation for Change of Publication**, through channels, to Headquarters, Air Force Command, Control, Communications and Computer Agency (HQ AFC4A)/Policy and Procedures Branch (HQ AFC4A/XPXP), 203 West Losey Street, Room 1065, Scott AFB IL 62225-5224. See attachment 1 for abbreviations, acronyms, and terms used in this instruction.

SUMMARY OF CHANGES

This is the first publication of AFI 33-101. It replaces Air Force Regulations (AFR) 700-1, 28 February 1989; 700-5, 1 March 1989; AFR 700-9, Volumes I and II, 15 March 1985; and 700-12, 28 May 1987. It eliminates the requirement for a Communications System Requirements Board and lists management responsibilities, authorities, and actions necessary for project implementation.

1. Responsibilities and Authorities.

1.1. Headquarters United States Air Force (HQ USAF)/Deputy Chief of Staff, Command, Control, Communications, and Computers (HQ USAF/SC) will develop Air Force doctrine and policy for C4 systems. This includes strategic planning, programming, management, security, and use of C4 systems that are a part of or exempt from the information resources management (IRM) program. HQ USAF/SC manages the IRM Review Program for the Designated Senior Official (DSO) for Information Management, Assistant Secretary of the Air Force (SAF) for Acquisition (SAF/AQ), including consolidation of information management issues provided by the Assistant SAF Office of the Administrative Assistant (SAF/AA) and SAF/AQ (DoD Instruction 7740.3, *Information Resources Management (IRM) Review Program*, February 7, 1989). HQ USAF/SC advises the Air Force DSO, SAF/AQ, on C4 systems resource acquisition policy. HQ USAF/SC:

- Develops and coordinates the Air Force position on C4 systems policy and procedures. Represents Air Force interests to the Assistant Secretary of Defense (Command, Control, Communications and Intelligence [C3I]) in matters concerning C4 systems). Also provides liaison with other DoD components that develop policies that affect DoD and Air Force C4 systems.
- Ensures effective and efficient management of Air Force C4 systems worldwide and provides management oversight for fielded Air Force C4 systems. Approves or disapprove exception requests and recommends approval or disapproval to the Air Force Acquisition Executive (SAF/AQK) on waiver requests to United States Air Force (USAF)

Supersedes AFRs 700-1, 28 February 1989; 700-5, 1 March 1989; Certified by: HQ USAF/SC (Lt General Carl G. O'Berry)
700-9 (Volumes 1 & 2), 15 March 1985; and 700-12, 28 May 1987 Pages: 12/Distribution: F
OPR: HQ AFC4A/XPXP (CMSgt Victor S.Tidball)

programming language policy (DoD Instruction 5000.2/Air Force Supplement 1). Resolves disagreements on noncompliance with the planning and architectural guidance between major commands (MAJCOM) or functional managers.

- Coordinates with SAF/AQ and HQ Air Force Materiel Command (AFMC) on standards developed as part of the mission critical computer resources standardization area. Serves as the Air Force representative to the Standards Coordinating Committee (SCC). Implements and monitors United States Air Force (USAF) policy for software work force development and software technology and transition to include: the development, execution and maintenance of the Air Force Software Management Plan, and continuous Air Force-wide software engineering process improvement.
- Serves as the Air Force executive agent for the Defense Information Systems Network.
- Manages Air Force specialty codes (AFSC) 33VX, 3VXXX, 33XX and 3CXXX officer and enlisted career fields.
- Serves as Air Force senior representative for visual information (VI).

1.2. HQ Air Force functional managers chair their own functional requirements boards (AFI 33-103, *Requirements Development and Processing* [formerly AFR 700-3]). They prepare and process requirements documents for Air Force-wide C4 systems that support their areas. They will:

- Prepare and annually update a functional area Strategic Automated Information System (AIS) Plan as part of their Functional Area Plans.
- Provide their Strategic AIS plan to MAJCOM functional managers for inclusion in the MAJCOM Mission Area Plans.
- Prepare, coordinate, validate, and approve operational requirements documents.
- Validate and coordinate program management directives.
- Develop and maintain C4 architectures.
- Perform operational C4 systems reviews of fielded C4 systems at least once every 3 years in conjunction with the using or affected MAJCOMs.
- Review all Air Force systems directly supporting the functional area.
- Develop and maintain standard data elements needed to support their functional area and share data with other functional areas. (DoD Directive 8320.1, *DoD Data Administration*, September 26, 1991, and AFI 33-110, *Air Force Data Administration Program* [formerly AFR 4-29])

1.3. **Major Command Responsibilities.** The MAJCOM commander will designate a C4 Systems Officer (CSO) and a single staff element for overall management of C4 systems. The CSO provides technical advice to the commander. In conjunction with the HQ USAF functional managers, the MAJCOM CSO will perform operational C4 systems reviews for fielded C4 systems at least once every 3 years and will review all MAJCOM and Air Force systems when assigned management oversight. The CSO will develop a process to review and validate MAJCOM requirements (AFI 33-103).

1.3.1. The CSO and C4 staff element will:

- Develop MAJCOM C4 systems plans and architectures.
- Program and budget for engineering, installation, operation, and maintenance of MAJCOM-unique and Air Force-wide C4 systems.
- Establish a MAJCOM C4 systems integration function to model and maintain current architecture.
- Establish a system to redistribute excess software and hardware within the MAJCOM to meet MAJCOM needs and report the excess not redistributed to the Air Force reuse administrator, 7th Communications Group/GADE, Pentagon, Washington DC, (AFI 33-112, *Automatic Data Processing Equipment (ADPE) Management* and DoD Manual 7950.1, *Defense Automation Resource Management Manual*, September 1988).
- Appoint a MAJCOM frequency manager to manage the MAJCOM frequency program AFI 33-118, *Radio Frequency Spectrum Management*.
- Appoint a MAJCOM Visual Information manager (*AFI 33-117, Visual Information (VI) Management* [formerly AFR 700-32, Volumes 1 through 8].
- Identify and collect new C4 requirements and incorporate into the MAJCOM template and base C4 systems blueprints, as necessary.
- Coordinate planned C4 requirements with the MAJCOM Systems Telecommunications Engineering Manager (STEM-C).

- Serve as the Air Force lead command and Air Force-wide systems manager for assigned C4 systems.
- Approve subordinate base C4 systems blueprints.
- Appoint a MAJCOM ADP Equipment Control Officer.
- Appoint MAJCOM primary and alternate focal points to review and comment on draft standards; develop and represent MAJCOM positions on standards-related issues; identify, document and forward standards-related problems to HQ AFC4A, Directorate of Interoperability and Technology (HQ AFC4A/TN) for action; and assist with the development of standards when requested by HQ AFC4A.

1.3.2. MAJCOM functional managers will ensure that functional area strategic AIS planning is included in the MAJCOM Mission Area Plans.

1.3.3. MAJCOMs implement DoD Directive 3222.5 (C), *Electromagnetic Compatibility (EMC) Management Program for SIGINT Sites (U)*, April 22, 1987, and DoD Instruction 7920.5, *Management of End User Computing (EUC)*, March 1, 1989.

1.4. **In addition to other MAJCOM responsibilities, HQ AFMC will:**

- Provide specific C4 common-user Air Force-wide systems and services, and will support these systems throughout their life-cycle.
- Engineer and install communications, computer, weather and air traffic control and landing systems.
- Maintain C4 Systems Installation Records according to AFI 21-404, *Command, Control, Communications, and Computer (C4) Systems Installation Records* (formerly AFR 700-28).
- Provide System Telecommunications Engineering Managers (STEM) for each MAJCOM and base.
- Serve as Air Force focal point for development and maintenance of base C4 systems blueprints.

1.5. HQ AFC4A will:

- Provide architectural support to the MAJCOMs as outlined in AFI 33-102, *Command, Control, Communications, Computers, and Intelligence (C4I) Capabilities Planning Procedures* (formerly AFR 700-2).
- Perform network management functions oversight for Air Force common-user systems and manage the Air Force leased long-haul telecommunications budget.
- Serve as the HQ USAF/SC office of primary responsibility for assigned Air Force C4 publications and templates.
- Serve as the Air Force focal point for guidance on and maintenance of C4 Systems Installation Records (CSIR), including publishing procedures required for creating and maintaining CSIRs (AFI 21-404).
- Serve as the Air Force executive agent for C4 systems security (AFPD 33-2, *C4 Systems Security*).
- Assist in functional management of AFSC 3CXXX and 3VXXX enlisted specialties.
- Direct and manage the standards functions detailed in AFI 60-101, *Standardization* [formerly AFR 73-1] for Data Communications Protocol Standards (DCPS), Information Standards and Technology , Information Processing Standards for Computers, and the Telecommunications Systems Standards standardization management areas.
- Develop and represent the Air Force position on standards issues to the Joint Telecommunication Standards Steering Group, the DCPS Technical Management Panel, the Information Processing Steering Group (IPSG), and the Interoperability and Integration Panel.
- Serve as the alternate Air Force representative to the SCC.
- Serve as the Air Force executive agent for managing and integrating VI systems and technology.

1.6. **HQ Air Force Frequency Management Agency.** Serves as the Air Force executive agent for managing Air Force use of the radio frequency spectrum as detailed in AFI 33-118.

1.7. **Air Combat Camera Service will:**

- Manage the Air Force combat camera program and resources to include readiness training for all Air Force combat camera forces.
- Operate the Air Force Media Center and the DoD Motion Media Records Center.
- Manage the Air Force audiovisual production program.
- Provide advisory services, as requested, for base VI activities, to include maintaining a model performance work statement for use in contracting for VI products and services.

1.8. **Air Force ADP Reuse Administrator (7CG/GADE.) Will:**

- Report all excess automated data processing equipment (ADPE) to the Defense Automation Resources Information Center.
- Process all requests for equipment declared excess.

1.9. **Commanders at all levels.**

- Plan for and manage C4 systems under their control.
- Ensure the supporting CSO reviews all operations plans (OPLAN) involving C4 resources or activities.

1.9.1. **Wing commanders Will:**

- Appoint a base CSO to serve as the single focal point for the installation's C4 systems needs and as the accountable officer for base ADPE.
- Serve as the base-level approval authority for the base C4 Systems Blueprint, Blueprint Phase Implementation Directive, and requirements documents submitted for implementation of C4 systems.

1.9.2. Commanders of tenant activities, with large quantities of C4 systems, appoint a CSO to serve as their single focal point and accountable officer for their activities C4 systems. Host-tenant support agreements will include specific responsibilities of the tenant and base CSOs.

1.10. **Base CSOs Will:**

- Ensure elements of the base C4 environment and infrastructure continue to satisfy customers mission needs, including mobile C4 assets.
- Manage the base-level infrastructure, host systems and tenant systems as defined in host-tenant support agreements, and establish a base C4 systems integration function.
- Plan the evolution of C4 systems supporting the base user's missions; ensure war, support, and contingency planning are accomplished for C4 requirements.
- Develop C4 annexes to base OPLANs and coordinate on tenant OPLANs involving C4 resources or activities.
- Identify and collect C4 systems infrastructure requirements and incorporate into the base C4 Systems Blueprint, as necessary.
- Coordinate C4 plans and requirements with the base's STEM (STEM-B) to ensure incorporation into the base C4 Systems Blueprint, which serves as the base's comprehensive C4 systems planning and implementation document.
- Coordinate STEM-B visits with base-level functional area managers.
- Perform base-level coordination of the C4 Systems Blueprint with the host wing and other tenant units.
- May serve as the base-level approval authority for the base C4 Systems Blueprint, BPID and requirements documents submitted for implementation of C4 systems. A wing commander approved BPID authorizes expenditure of resources up to the total estimate provided on the BPID (see AFI 33-103 and AFI 33-104, *C4 Systems Base Level Planning and Implementation* [formerly AFR 700-4] for processing instructions).
- Serve as the overall interface with the STEM-B to establish priorities and render decisions concerning the base C4 infrastructure.
- Manage C4 systems projects (AFI 33-104).
- Maintain a master file of CSIRs for base-supported C4 systems or facilities.
- Prevent or minimize electromagnetic interference and electromagnetic radiation hazards.
- Manage the base frequency management program (AFI 33-118).
- Establish a focal point for determining base-level C4 training requirements and provide for customer training.
- Account for all ADPE in the base ADPE inventory.
- Appoint a Base Visual Information Manager (BVIM) to manage base VI activities (AFI 33-117). The BVIM will establish clearly defined local controls to ensure visual information resources are used for official purposes and are managed in the most effective and efficient manner. The BVIM will coordinate on host and tenant unit VI supply and equipment requests, as required, before base supply processes them.

1.11 **STEM Responsibilities:**

1.11.1 MAJCOM STEM (STEM-C) will:

- Serve as a C4 systems technical advisor to the MAJCOM commander and CSO
- Assist MAJCOM in developing C4I target architecture.
- Provide MAJCOM information to support POM submittals.
- Interface between MAJCOM and STEM-Bs in development of base C4 systems blueprints.

- Assist MAJCOM in developing standard configurations for implementation of base C4 infrastructure.
- Review all the MAJCOMs bases C4 systems blueprints and coordinate approval through the MAJCOM.
- Develop an overall MAJCOM C4 Systems Blueprint.

1.11.2 **STEM-B will:**

- Coordinate with the host base CSO, tenants and all functional area managers at the base to determine plans that will impact the base C4 infrastructure.
- Serve the wing commander and CSO as a C4 system's technical advisor.
- Develop, update, and maintain the base C4 Systems Blueprint.
- Develop BPIDs, as requested, to further define the requirements, provide initial and certified technical solutions, and provide the cost estimate to implement the requirement.
- Review all C4 requirements that have a C4 infrastructure impact.

1.12. **C4 Systems Managers.**

- Manage the system upon transfer from the acquisition program manager.
- Baseline system resources and make changes as modifications are approved.
- Develop and publish system procedures and guidance required to manage, operate, and maintain configuration control of the system. (DoD Instruction 5000.2, Part 9)
- Distribute software changes and hardware upgrades ensuring oversight activities are informed. For Air Force-wide systems, inform the Air Force functional manager, HQ AFC4A, and operating commands.
- Conduct systems reviews at least annually, to ensure the system meets reliability, maintainability, performance and security standards, and continues to meet mission requirements.

1.13. **Users of C4 Equipment and Systems.** Users must protect and conserve the C4 equipment and systems they use. They also will comply with federal laws and statutes that apply to using software, equipment, and systems.

2. General Guidance.

2.1. Commanders plan, acquire, operate, and maintain C4 systems consistent with Air Force and MAJCOM plans, architectures, templates, and C4 systems blueprints. They develop and maintain their C4 plans and architectures according to AFI 33-102, the Air Force 33-2XX-series publications, and Air Force Pamphlet 700-50 (Volume 1, Air Force Communications-Computer Systems Architecture Overview; Volume 2, Deployable Communications-Computer Systems Architecture Overview; Volume 4, Local Information Transfer; Volume 5, Long Haul Information Transfer; Volume 6, Integrated Systems Control; and Volume 7, Air Force Communications-Computer Systems Architecture Software Architecture). Commanders manage C4 systems according to life-cycle management policy in DoD Directive 8120.1, *Life-cycle Management (LCM) of Automated Information Systems (AISs)*, January 14, 1993; DoD Instruction 8120.2, *Automated Information System (AIS) Life-Cycle Management (LCM) Process, Review, and Milestone Approval Procedures*, January 14, 1993; and appropriate DoD 5000-series publications. They manage information and data according to appropriate information management policies (Air Force 37-series publications and AFI 33-110).

2.2. All levels of command ensure C4 systems compatibility and interoperability with those of other communities where operational requirements dictate. Satisfy compatibility and interoperability requirements before a system is fielded, and maintain them throughout the life of each system (DoD Directive 4630.5, *Compatibility, Interoperability, and Integration of Command, Control, Communications, and Intelligence (C3I) Systems*, November 12, 1992.

2.3. Use specific terminology or contractual clauses in Air Force acquisition documents and certified technical solutions to ensure compliance with mandatory C4 systems standards. The Defense Information Systems Agency (DISA) Technical Reference Model provides guidance on which standards apply to a specific acquisition. Use MIL-STD-188-100 series for acquisition of C4 equipment requiring research and development.

2.4. Air Force Engineering and Installation (EI) standards establish guidelines for uniformity of project engineering and installation practices. Standardize C4 facilities, using preferred items of equipment.

2.5. Requirements specifications will call for relational database management systems where database management services are needed (Federal Information Processing Standards [FIPS] 127, *Database Language SQL*). New computer systems will specify the X-Windows (Massachusetts Institute of Technology) user interface documented

in FIPS 158, *X Window System Version 11, Release 5* except MS DOS systems.

2.6. Document Air Force automated information systems according to DoD-STD-7935A, or the Data Item Descriptions associated with DoD-STD-2167A(MIL-STD-498).

2.7. Provide adequate security for all C4 systems, to protect the information they process and the availability of the system.

2.8. To provide for life-cycle management of C4 systems, base-level CSOs and HQ AFMC develop and maintain CSIRs for all Air Force-owned, organic or contractor maintained, fixed-plant, C4 systems (AFI 21-404). The supporting CSO provides the single point of contact for C4 maintenance whether performed by contract, DoD civilian, or active-duty military resources.

2.9. Consolidate visual information (VI) activities at headquarters and base level. Control and authorize Air Force VI activities through issuance of a Defense Visual Information Activity Number (DVIAN) (AFI 33-117). MAJCOMs will inform HQ USAF/SCMV of additions, changes or deletions to the DVIAN database.

2.10 The Base C4 Systems Blueprint, developed and maintained by the STEM-B in coordination with the base CSO, serves as part of the base's C4 planning, and may be used as a basis for requirements development and implementation. All requirements that impact the infrastructure will be coordinated with the STEM-B to maintain the integrity of the C4 Systems Blueprint. BPIDs may direct implementation of a portion of the C4 Systems Blueprint and authorize expenditure of resources.

3. C4 Systems Planning.

3.1. AFI 33-102 describes a management process for developing C4I architectures and plans. It provides general guidance in applying policy, standards, and resources to develop and maintain strategic planning for C4I systems. All C4 systems developed for use as defined by CJCSI 6212.01, *Compatibility, Interoperability, and Integration of Command, Control, Communications, Computers, and Intelligence Systems*, for use in joint operations, must be certified as "interoperable" with systems with which they have a requirement to exchange information.

3.2 Functional area offices survey their area of responsibility and then create functional and physical models to lay the foundation for developing C4I systems plans and architectures. Develop strategic plans and ensure inclusion of supporting C4I systems in Mission Area Plans

3.3 Include C4 systems security in all planning (AFPD 33-2).

3.4 Include communications services prewiring for all construction projects according to AFPD 32-80, *Facility Design and Construction*, and current HQ USAF Engineering Technical Letters on prewiring.

3.5 Include information management public law issues in all planning (i.e., records management, Privacy Act, Freedom of Information Act, The Paperwork Reduction Act, reports control and information collection control).

4. C4 Systems Requirements Development. This instruction and AFI 33-103 cover requirements for a new system or modification of an existing system with an expected implementation cost of less than $5 million and requiring no research and development. Process requirements costing $5 million or more, involving development, or specifically selected by HQ USAF according to AFI 10-601 and manage these requirements under Air Force 63-series directives.

4.1. Tenant units on Air Force installations will coordinate with the supporting CSO to determine the impact of their required systems on the base infrastructure. The CSO and tenant organizations may negotiate a list of C4 requirements that do not require CSO coordination. Tenant units requiring support from the host CSO submit requirements according to local procedures.

4.2. Requirements impacting the base infrastructure will be reviewed by the STEM-B. Technical solutions for these requirements must be certified by the STEM-B and incorporated into the base C4 Systems Blueprint.

4.3. **Requirements Implementation Approval.** After the CSO provides a certified technical solution, allocation of resources by the appropriate authority constitutes approval for implementation.

5. C4 Systems Implementation.

5.1. CSOs must manage C4 project implementation to deliver a product on time that fulfills the requirement and is supportable throughout its life-cycle. They must make sure project acquisition conforms to the law as reflected in the Federal Acquisition Regulation, the Federal Information Resources Management Regulation, the DoD and Air Force FAR Supplements, Air Force Acquisition Circulars, and other applicable DoD and Air Force guidance. They ensure the use of competitive procurement practices to obtain resources at the

lowest cost and offering the best value to the Air Force over the C4 system life-cycle for all projects. They must plan projects under a phased, life-cycle oriented approach to implementing, operating, and supporting the C4 system.

5.2. **The Implementing Activity Commander Will:**

- Designate a single C4 system project manager to head each project.
- Act as the project decision authority, and oversee project accomplishments, actual cost, and progress.
- Reuse excess ADP hardware and software where possible.
- Reuse or adapt for use Air Force-owned software listed in the Computer System Authorization Dictionary (CSAD) for C4 system projects to satisfy requirements whenever economically possible.
- List all Air Force-developed software requiring over 80 man-hours to develop, or contracted software costing over $5,000, in the CSAD.
- Use DoD and Air Force C4 infrastructure support contracts whenever possible.

5.3. Based on technical requirements, MAJCOM CSOs may grant waivers for the purchase of C4 resources from other than mandatory-use Air Force Infrastructure Support Contracts. Each waiver request must demonstrate why the user requirement cannot be satisfied by the mandatory use contracts.

5.4 The CSO:

- Or program manager will order, receive, and accept centrally managed national stock numbered resources and supplies according to AFM 67-1, *USAF Supply Manual*.
- Or program manager will order all C4 equipment, to include hardware and software, through base supply or the supporting procurement office. The contracting office will obligate funds only for those C4 systems or resources identified in the certified technical solution or required for maintenance. When a CSO or program management office orders C4 resources for distribution to other bases, they must notify the CSO and user at the receiving base prior to ordering the resources.
- Will receive computer equipment from the carrier and ensure the equipment is accounted for in the Information Processing Management System (IPMS). The CSO or user is responsible for government acceptance of the equipment.
- Coordinates with the STEM-B for development of the BPIDs and other project implementing directives.

5.5 The using organization is responsible for installation of computer equipment and software unless it has made previous arrangements (such as vendor installation or CSO installation). The CSO and the using organization plan and execute installation requirements. When a computer system will process classified information, users must contact the base TEMPEST manager for specific TEMPEST installation requirements.

6. C4 Systems Operation and Support.

6.1. The IPMS is the official Air Force record of ADP equipment inventory, transactions and status. Units are authorized to have the equipment listed in IPMS. The CSO will account for all computer equipment and that software which costs $5,000 or more on IMPS. Inventory all items annually.

6.2. The Air Force Equipment Management System (AFEMS) is the official inventory and account for communications, electronics, and other equipment centrally managed by HQ AFMC. The CSO will assist C4 systems users to account for their C4 systems assets.

6.3. Commanders at all levels will consolidate C4 systems to maximize resource effectiveness and reduce costs where mission requirements do not require redundancy.

6.4. The C4 systems program manager reviews systems support and service contracts annually. When systems or components require modernization to ensure cost-effective mission accomplishment, the system manager will initiate the required programming and acquisition actions. Reviews will include:

- Determination of contractor performance.
- Cost and mission effectiveness.
- Essentiality of services.
- Identification of critical functions for contingency operations.

6.5. The Air Force provides telephone service for official use only. The Air Force will offer service to unofficial users only in an emergency or when an installation cannot reasonably obtain commercial service for its unofficial needs.

6.6. **Computer Systems** (AFI 33-112 and AFI 33-113, *Telecommunication Center (TCC) and Data Processing Center (DPC) Management* [formerly AFR 700-7]). Activities or individuals will use only

Air Force-owned or licensed software. Individuals using commercial-off-the-shelf software must ensure they are using legally-acquired software and are not violating copyright laws nor other contractual agreements. Air Force activities will use DoD and service-owned software and share Air Force-owned software when possible.

6.7. **Bulletin Boards.** Activities may establish or subscribe to Electronic Bulletin Boards to satisfy approved requirements. The unit commander must approve the use of non-Federal Government electronic bulletin boards.

6.8. **Small Computers.** Using organizations will operate and support their small computers during peacetime, contingencies, deployments, and wartime. Plans and tests will exercise operations, logistics, and security support requirements. Plans must be tested periodically and modified as necessary.

6.9. **Combat Communications Assets.** These assets support peacetime contingencies for up to 120 days. Users request combat communications support from the unit's parent MAJCOM according to AFI 10-414, *Requesting Combat Communications Resources* (formerly AFR 55-28).

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DCS/Command, Control, Communications, and Computers

1 Attachment
Glossary of References, Abbreviations, Acronyms, and Terms

Appendix D

BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE INSTRUCTION 33-103
24 JUNE 1994

Communications

REQUIREMENTS DEVELOPMENT AND PROCESSING

This instruction implements Air Force Policy Directive (AFPD) 33-1, Command, Control, Communications, and Computer (C4) Systems and Department of Defense (DoD) Directive 8120.1, *Life-Cycle Management (LCM) of Automated Information Systems (AISs)*, January 14, 1993. It details a process to streamline the development of and response to C4 systems requirements. It also provides an overright procedure to maintain the integrity of the process. The process identifies C4 systems requirements, develops certified technical solutions, and obtains C4 resources for non-developmental C4 systems with an expected life-cycle cost of less than $5 million. Those systems expected to cost $5 million or more, involve development, or require an interface to support the joint war fighter must follow procedures outlined in AFPD 10-6, *Mission Needs and Operational Requirements Use Agreements* (formerly AFR 57-1), and Air Force Instruction (AFI) 10-601, *Mission Needs and Operational Requirements Guidance and Procedures* (formerly AFR 56-1). Modifications to Air Force logistically supported systems and equipment must follow procedures in DoD Manual (DoDM) 5000.2/Air Force Supplement 1 *Defense Acquisition Management Documentation and Reports*, February 1991, with Change 1. Submit recommended changes, questions, and notification of conflicts between this and other publications to Headquarters, Air Force Command, Control, Communications, and Computer Agency, Policy and Procedures Branch, (HQ AFC4A/XPXP), 203 W. Losey Street, Room 1020, Scott AFB IL 62225-5219. The glossary of references, abbreviations, acronyms, and terms are at attachment 1.

SUMMARY OF CHANGES

This instruction revises AFR 700-3, 30 November 1984, and makes AF Form 3215 optional.

1. The C4 Systems Requirements Process. The C4 systems requirement's process enables users and C4 managers to obtain new C4 capabilities.

2. Responsibilities.

2.1. The requesting organization identifies C4 systems requirements and allocates resources.

2.2. The C4 systems officer (CSO) assists C4 systems users to identify C4 needs and develops, obtains, and implements certified technical solutions for user requirements (AFI 33-104, *C4 Systems Long Range Planning* [formerly AFR 700-4]).

2.3. Each major command (MAJCOM) and other organizations involved determine the documentation requirements at each step of the process.

3. Identifying C4 Systems Requirements. The requesting organization identifies C4 requirements that cannot be met with a non material solution. Requirements arise from a deficiency in an existing operational capability, from a need for a new capability, or from an opportunity to replace or modernize an existing system with improved technology when operationally and economically practical.

Supersedes AFR 700-3, 30 November 1984
OPR: HQ AFC4A/XPXP (Capt McGarry)

Certified by: HQ USAF/SC (Lt General Carl G. O'Berry)
Pages: 8/Distribtion: F

3.1. Modification and Upgrade. A modification changes a system (whether for safety, to correct a deficiency, or improve performance, reliability, availability, and maintainability) still being produced under the original acquisition program. An upgrade changes a system that is out of production. Upgrades to C4 systems with an acquisition cost of $5 million or more require a Mission Need Statement (MNS) except those C4 systems and equipment with centralized AFMC logistics support (ground communications-electronics and space electronics equipment/systems) which will adhere to DoDI 5000.2/Air Force Supplement 1, *Defense Acquisition Policies and Procedures*, February 23, 1991, with Change 1. All permanent upgrades require a MNS for entry into the formal requirements and acquisition process with the exception of:

- Upgrades under $10 million in total estimated costs (current year dollars).
- Temporary and approved safety upgrades (as defined by DoDI 5000.2/AF Sup 1).

These exceptions will use the AF Form 1067, Modification Proposal, instead of a MNS.

3.2. The requesting organization identifies requirements for C4 systems in functional terms, including all applicable operational parameters and interfaces. Use of the AF Form 3215, C4 Systems Requirements Document, is optional. The organization may include special requirements, such as accommodations for handicapped users, deployment, special operating conditions, manpower, training, and maintenance. Organizations document deficiencies and include them in the base and MAJCOM C4 system planning efforts such as the C4 Systems Blueprint (see AFIs 33-102, *C4 Systems Long Range Planning* [formerly AFR 700-2] and 33-104). The processes for developing requirements and for planning are interdependent. The servicing C4 organization assists the requesting organization in performing a process review and analysis of its information and data-management requirements. (AFI 33-104 describes methodologies for this analysis.)

3.3. The requesting organization provides the supporting CSO with:

- Point of contact in requesting organization. The organization must provide the name, office symbol, and telephone number of an individual who can provide additional information about the request.
- Description of mission deficiency or need. This description expresses the need in functional terms. The organization must clearly indicate "what" rather than "how."
- Authorizing official. The MAJCOM or wing commander defines this authority. Before processing requirements above MAJCOM level, the base and MAJCOM CSO must endorse the requirement.
- Service need date. Identify when the requesting organization needs a solution, factoring in specific need and availability of funds.

3.4. The requesting organization coordinates with the MAJCOM Information Management office regarding legal requirements that relate to automated records, Privacy Act, Freedom of Information Act issues, and reporting requirements.

4. Developing the Certified Technical Solution. This process begins when the requesting organization gives the supporting CSO a C4 systems requirement. The CSO makes a preliminary review, checks the base C4 Systems Blueprint for possible impact on existing solutions, and devises or obtains an initial technical solution, including a cost estimate, applying MAJCOM, local directives, and applicable architectures. The requesting organization then must decide if it wants to pursue a certified technical solution. If it does, it prepares and submits a request for a certified technical solution to the CSO (see attachment 2). The CSO gives the requesting organization the name of the assigned action officer and the control number and follows up periodically to discuss current requirement status.

4.1. To make sure C4 system configurations properly integrate with local, Air Force, and DoD C4 systems architectures, the CSO consults the appropriate systems telecommunications engineering manager (STEM). The STEM serves MAJCOM, wing commanders, and CSOs as the C4 engineering technical advisors. The STEM-B for the base and the STEM-C for the MAJCOM define and clarify C4 systems requirements, assist in developing initial and certified technical solutions and costing. STEMs use guidance outlined in Chairman of the Joint Chiefs of Staff Instruction 6212.01, *Compatibility, Interoperability, and Integration of Command, Control, Communications, Computers, and Intelligence Systems*. The CSO uses two methods to develop or obtain certified technical solutions.

4.1.1. The CSO will expedite the development of local solutions to routine requirements. Such routine

requirements include telephone moves, ordering standard Air Force-configuration personal computers, or procuring low-cost software that is commercially available and compatible with locally recognized standards. For low-cost requirements, the CSO must keep review and oversight to an absolute minimum.

4.1.2. The CSO may also ask the Headquarters Communications Systems Center (HQ CSC) or Standard Systems Center (SSC) to provide technical assistance for complicated user requirements. Use the format for *Request for Technical Solutions* described in Attachment 2. Send the request for both HQ CSC and SSC to the servicing STEM-B for coordination between the two organizations. For organizations without a STEM, send the request to HQ CSC/XPC, 4029 Hilltop Road, Suite 200, Tinker AFB OK 73145-6343. *NOTE: Whenever possible, electronically send the requirement.* The servicing STEM will provide the initial technical solution and cost estimate within 30 days of receipt to the requester and supporting CSO.

4.2. When the C4 systems requirement involves communications security (COMSEC), the CSO contacts the unit or MAJCOM COMSEC officer for guidance. To get additional assistance in developing the COMSEC portion of the technical solution, forward the requirement to HQ AFCSC/LMM, 250 Hall Boulevard, Suite 311, San Antonio TX 78243-7056, through the servicing STEM. If a STEM is not assigned, send the request to HQ CSC/XPC.

4.3. If the C4 systems requirement impacts Air Force-wide or DoD C4 systems resources, the organization developing the technical solution coordinates with the lead command or designated systems advocate before returning the solution to the requesting organization.

4.3.1. For simple solutions, the organization contacts the lead command or designated advocate by telephone. The lead command representative or designated advocate may then be able to provide guidance and concurrence.

4.3.2. For more complex solutions or when a lead command or designated advocate determines a review is necessary, the organization must forward the requirements documents (via electronic means, if possible) to the lead command or designated advocate for coordination and concurrence. The organization must also forward requirements affecting these systems and those requiring support for centralized computer processing to the servicing regional processing center for action.

4.3.3. The lead command or designated advocate will concur with the solution or provide an alternative, and then return the document to the organization developing the technical solution.

4.4. The CSO develops or obtains a certified technical solution, clearly listing all cost data required for implementation; provides a cost estimate, including investment and recurring costs; assess alternative solutions; and makes every effort to consolidate similar C4 systems requirements. The CSO's certified technical solution includes the following information:

4.4.1. Certified Technical Solution and Alternatives. The solution summarizes the recommended courses of action to meet the need and make sure it complies with downward-directed architectures and standards. It describes alternatives considered, if applicable, and includes any supporting information.

4.4.2. The Recommended Procurement Method. This may include purchase, lease, or a combination. Procurements involving lease of hardware, software, services, or telecommunications require a lease-versus-purchase analysis.

4.4.3. The Procurement Strategy for Obtaining Bids. For information on procurement methods and strategies (and before actual procurement), go to your base or MAJCOM-level procurement office for advice.

4.4.4. COMSEC. When involved, the CSO obtains the mission, design, and series codes from the MAJCOM.

4.4.5. Estimated System Life. This is an estimate in years of the useful life expectancy of the system. The CSO may use it in any lease-versus-purchase analysis and in determining the alternative with the lowest overall financing cost. If an established life-cycle was not provided by the manufacturer nor AFMC, use 10 years.

4.4.6. Cost Data. Includes:

- C4 hardware and software.
- Contractual services.
- Personnel.
- Training.
- System and equipment operation and maintenance costs.
- Facilities or facility modification

The CSO indicates all investment and recurring costs and considers other costs as well, such as site preparation, utilities, and consumables.

4.4.7. Lead Command or Designated Advocate Review. This indicates the name, rank, title, date, and concurrence of the lead command representative

or designated advocate.

4.5. Projects with expected investment costs greater than $1 million require an economic analysis to determine the most cost-effective alternative for satisfying a requirement. (AFI 65-501, *Economic Analysis and Program Evaluation* [formerly AFR 173-15]; AFMAN 65-506, *Economic Analysis and Program Evaluation*).

4.6. When developing a certified technical solution, the CSO considers the required operational date (Can you implement the solution in time?) and uses available resources when possible. The CSO considers investment and recurring costs as well as maintainability, maintenance support, and required facilities. The solution must meet Air Force C4 systems specifications for architecture, integration, and standards. C4 systems security considerations include TEMPEST, COMSEC, and computer security (AFPD 33-2, *C4 Systems Security* [formerly AFR 56-1]). The CSO considers the system's impact on the base infrastructure, infrastructure support contracts, MAJCOM and area functional C4 systems plans, and mobility requirements. Other items the CSO should consider are training, manpower impact, safety, and mission capability.

4.7. The CSO tracks the status of the requirement and provides a periodic status report to the requesting organization according to MAJCOM or local procedures.

5. Allocating Resources. After accepting the CSO-provided certified technical solution, the requesting organization, with assistance from the CSO, follows established local, MAJCOM, and Air Force procedures to obtain resources (such as money, manpower, and facilities) to implement the technical solution. See AFI 65-601, Volume 1, *US Air Force Budget Policies and Procedures* (formerly AFR 172-1, Volume 1 and AFR 172-8), and AFI 38-204, *Air Force Manpower Programming* (formerly AFR 21-1, Volume 2) for budgeting and manpower instructions.

6. Implementing the Requirement. Implementation begins when the requesting organization provides necessary funds and other resources. The CSO, with the input of the requesting organization, decides how to implement the requirement. The CSO makes sure that the proper type of funds (3080 or 3400) are used. AFI 33-104 outlines these base-level and MAJCOM procedures.

7. Prescribed Forms. This instruction prescribes the AF Form 3215 for optional use.

CARL G. O'BERRY, Lt General, USAF
DCS/ Command, Control, Communications, and Computers

2 Attachments
1. Glossary of References, Abbreviations, Acronyms, and Terms
2. Request for Technical Solution

Appendix E

BY ORDER OF THE SECRETARY OF THE AIR FORCE

SEE HOLDOVER SUPS

AIR FORCE INSTRUCTION 33-106
3 JUNE 1994

Communications

MANAGING HIGH FREQUENCY RADIOS, LAND MOBILE RADIOS, AND THE MILITARY-AFFILIATE RADIO SYSTEM

This instruction implements Air Force Policy Directive (AFPD) 33-1, *Command, Control, Communications, and Computer (C4) Systems*; Defense Information Systems Agency (DISA) Circular 310-70-79, *Mystic Star Network Management Manual and Users Guide*, and Public Law 99-500, *Paperwork Reduction Reauthorization Act of 1986*, 18 October 1986; and Department of Defense (DoD) Directive 4650.2, *Military-Affiliate Radio System (MARS)*, January 17, 1986, with Change 1. It identifies responsibilities to implement and support the Air Force high frequency (HF), land mobile radios (LMR), and Military-Affiliate Radio System (MARS). Refer technical questions concerning LMRs to Headquarters Air Force Command, Control, Communications, and Computer Agency (HQ AFC4A), Voice Systems Support (HQ AFC4A/SYVW). Refer questions concerning HF and MARS to HQ AFC4A, Directorate of Systems and Procedures, Radio Systems Branch (HQ AFC4A/SYXR), 203 West Losey Street, Room 3065, Scott AFB IL 62225-5234. Send recommended changes and conflicts between this and other publications on AF Form 847, **Recommendation for Change of Publication,** to HQ AFC4A, Policy and Procedures Branch (HQ AFC4A/XPXP), 203 West Losey Street, Room 1065, Scott AFB IL 62225-5224. For a listing of references, abbreviations, and acronyms, see attachment 1.

SUMMARY OF CHANGES

This is the initial publication of Air Force Instruction (AFI) 33-106. It reorganizes the management practices for HF systems, LMRs, and MARS.

Section A--Managing High Frequency Systems

1. United States Air Force High Frequency. All agencies identified in this section coordinate HF requirements and solutions so that radio systems and networks actively support the users.

1.1. Headquarters United States Air Force (HQ USAF), C2 Combat Integration Requirements (HQ USAF/XORS), identifies, defines, and confirms United States Air Force (USAF) HF requirements.

1.2. HQ USAF, Infrastructure Division (HQ USAF/SCMI), directs the development, operation, and maintenance of USAF HF systems and networks.

1.3. **HQ AFC4A/SYXR:**

1.3.1. Develops USAF HF architecture, standards, policies, and procedures.

1.3.2. Recommends, analyzes, and approves systems operations and maintenance support methods.

1.3.3. Identifies, reviews, and tracks all USAF HF requirements.

1.3.4. Facilitates global and regional networking solutions.

2. The Global High Frequency System. This system consists of 15 HF stations around the world providing worldwide communications to all DoD ground agencies and aircraft. The system supports:

- Command and control, special purpose, and contingency air-ground-air communications. Neither the system nor individual stations are dedicated to any service, command, or other activity.
- Authorized users according to established traffic precedence.

Supersedes AFRs 700-17, 15 November 1988 and 700-18, 15 December 1988.
OPR: HQ AFC4A/SYXR (Capt Sandy Lawrence)

Certified by: HQ USAF/SC (Lt General Carl G. O'Berry)
Pages: 8/Distribution: F

2.1. **The Global HF System Manager, HQ FC4A/SYXR:**
.1.1. Establishes a single set of Air Force procedures for Global HF system operations.
2.1.2. Reviews and implements major command (MAJCOM)-level recommendations for changes to the Air Force Global HF system procedures.
2.1.3. Coordinates mission requirements with system users.
2.1.4. Answers requests for intercommand and interservice special communications support.
2.1.5. Evaluates Global HF system network performance.
2.1.6. Accompanies MAJCOM HF managers on staff visits to evaluate operations, equipment use, and system integrity.
2.2. MAJCOM HF managers within the Air Combat Command, Air Mobility Command, Air Force Materiel Command, Pacific Air Forces, United States Air Forces in Europe, and Air Force Space Command:
2.2.1. Oversee operations of assets under their control.
2.2.2. Match employees and equipment to job requirements.
2.2.3. Evaluate training, operations, and equipment use.
2.2.4. Coordinate publication creation and production.
2.2.4.1. Track each publication through production and report its status to the systems manager.

MYSTIC STAR System.
.1. MYSTIC STAR is a worldwide communications system, operated and maintained by elements of the USAF, United States Army, and United States Navy, under the control of DISA/DITT:

- Consists of satellite and HF networks.
- Supports presidential, special air, very important person , and command airborne missions.

3.2. **The MYSTIC STAR HF Network Consists of:**

- A single master net control station (MNCS) at Andrews AFB, Maryland .
- Interstation and intersite circuits
- Relay and auxiliary communications subsystems.

3.2.1. The network provides worldwide communications by directly controlling radio equipment located at global HF system stations.
3.3. **HQ AFC4A/SYXR:**
3.3.1. Oversees the MYSTIC STAR network.
3.3.2. Develops system architecture, network policy, and guidelines.
3.3.3. Coordinates on all MAJCOM-level supplements pertaining to established policies and procedures.
3.4. **The Technical Manager (Ops-Tech Manager) for MYSTIC STAR:**
3.4.1. Operates from the 89th Communications Group Office of Technical Management) at Andrews AFB, Maryland.
3.4.2. Manages the MYSTIC STAR network.
3.4.3. Evaluates system facilities.
3.4.4. Assesses network performance.
3.4.5. Compares performance trends to established standards.
3.4.6. Recommends improvements to criteria, documentation, or performance.
3.4.7. Works with personnel on all plans for operating, maintaining, managing, controlling, and configuring the network.
3.4.8. Recommends budgets for network operations.
3.4.9. Reports the operational status, performance status, or limitations of the network to HQ AFC4A/SYXR and DISA.
3.4.10. Responds directly to DISA and Air Force requirements.
3.4.11. Implements plans and special system configurations.
3.5. **The Commander, 89th Communications Group, Andrews AFB, Maryland:**
3.5.1. Manages, operates, and evaluates the MNCS according to DISA Circular 310-70-79.
3.5.2. Gives status updates on the network to the MYSTIC STAR system manager.

Section B—Managing Land Mobile Radios and Cellular Telephones

4. Managing Land Mobile Radios. LMRs include base support radios, pagers, cellular telephones and combat deployable radios. *NOTE:* This instruction doesn't apply to alarm monitor and control systems, citizens-band radios, and low-power systems.
4.1. The functional manager (HQ USAF/SCMI) and the Air Force focal point (HQ AFC4A/SYVW) supply direction and guidance to MAJCOM and base or unit LMR managers.
4.2. The Air National Guard Readiness Center (ANGRC/SCOS) provides guidance to Air National Guard (ANG) units.
4.3. MAJCOMs must appoint LMR managers.
4.4. MAJCOM LMR managers:
4.4.1. Ensure all subordinate LMR managers use the current version of the LMR Management Information System (MIS) according to P.L. 99-500.
4.4.2. Process requirements for LMRs. (Air Force Instruction {AFI} 33-103, *Requirements Development and Processing* {formerly AFR 700-3}).
4.4.3. Include LMR needs in contingency deployment planning (AFI 10-404, *Base Support Planning* {formerly AFR 28-31}).
4.4.4. Direct training for all subordinate LMR managers according to Qualification Training Package (QTP) 300XO-210W, *Base Land Mobile Radio (LMR) Management. EXCEPTION:* While the National Guard Bureau strongly advocates the use of Air Force Job Qualification Standards or Air Force Qualification Training Packages as a viable training aid, their use for

ANG units is not a mandatory requirement. (AFI 36-2233, *Air Force On-the-Job Training Products for Communications-Electronics Enlisted Specialty Training* {formerly AFR 50-65})

4.4.5. Ensure an authorized frequency is assigned to all equipment before purchase. (AFI 33-118, *Radio Frequency Spectrum Management* {formerly AFR 700-14})

4.4.6. Develop an economic analysis if requesting organic, or blue-suit, maintenance. (AFI 65-501, *Economic Analysis and Program Evaluation for Resource Management* {formerly AFR 173-15})

4.4.7. Develop operational procedures for using intrinsically safe LMRs in hazardous environments in conjunction with MAJCOM safety staffs.

4.4.8. Ensure all subordinate LMR managers and LMR quality assurance evaluators receive the awareness briefings on the controlled cryptologic item (CCI) and communications security (COMSEC).

4.4.9. Ensure all subordinate LMR managers verify LMRs are declassified before giving them to contract maintenance for repair.

4.5. **MIS users:**

4.5.1. When using the MIS, comply with DOD Directives 5200.28, *Security Requirements for Automated Information Systems (AISs), March 21, 1988;* and 8120.1, *Life-Cycle Management (LCM) of Automated Information Systems (AISs)*, January 14, 1993; DOD Instruction 7920.5, *Management of End User Computing (EUC)*, March 1, 1989; Military Standard (MIL-STD) 973, *Configuration Management*; DOD Instruction 5000.2/Air Force Supplement 1, *Defense Acquisition Management Policies and Procedures*, February 23, 1991, with Change 1; AFIs 33-202, *The Air Force Computer Security Program* (formerly AFSSI 5100); 33-104, *Base-Level Planning and Implementation Management (formerly AFR 700-4);* 33-112, *Computers and Automatic Data Processing Equipment (ADPE) Management (formerly AFRs 700-6 and 700-26);* and Air Force manuals (AFM) 171-100 volume 6, *Development and Documentation of Automated Data Systems (ADS) - Small Computer*, and 171-110 volume 5, *OS-1100 System Security Procedures and Responsibilities: PQ210/JX Technical Information Manual.*

4.6. **Unit or Base LMR Managers:**

4.6.1. Immediately report any suspected unauthorized MIS changes to the MAJCOM LMR manager.

4.6.2. Maintain LMR continuity folders as shown in attachment 2 of this instruction.

4.6.3. Use National Security Agency (NSA)-approved devices for LMRs requiring COMSEC or data encryption according to standards of the National Institute for Standards and Technology (NIST) and Federal Information Processing Standard (FIPS) Publication 140-1, *Security Requirements for Cryptographic Modules.*

4.6.4. Use NSA/NIST-approved Type I COMSEC devices with a valid United States Government equipment identification (USGEID) endorsement number to secure classified traffic.

4.6.5. Use NSA/NIST-approved Type II COMSEC equipment with a valid USGEID endorsement number to protect unclassified information relating to national security.

4.6.6. Send requests for exceptions to HQ AFC4A/SYSC/SYVW, 203 West Losey Street, Room 2040, Scott AFB IL 62225-5234. *NOTE:* ANG units submit waiver requests through ANGRC/SCOS, 3500 Fetchet Ave, Andrews AFB, Maryland 20331-5157.

4.6.7. Use only keying material produced by NSA and accounted for and distributed in the COMSEC material control system.

4.6.8. Establish needs for data encryption standard keying materials at least 45 days before you need them. (AFKAG-2, *Air Force COMSEC Accounting Manual,* and appropriate Air Force 33-series publications.)

4.6.9. Maintain COMSEC-equipped LMRs according to AFSAL/National Telecommunications Information System Security Instruction (NTISSI) 3005, *Safeguarding and Control of Data Encryption Standard (DES) Equipment and Associated Unclassified Communications Security Aids.*

4.6.9.1. Ensure personnel who maintain COMSEC-equipped LMRs:

- Have United States citizenship.
- Attend a CCI briefing.
- Receive COMSEC awareness training.

5. Managing Cellular Telephones.

5.1. **HQ USAF, MAJCOM, and Base Cellular Telephone Managers:**

5.1.1. Manage cellular telephone assets according to directives and guidelines governing management of LMRs.

5.1.2. Acquire cellular telephones and service according to MAJCOM procedures for requesting and approving mobile communications requirements.

5.1.3. Get approval for cellular telephones that could solve a mobile communications requirement by:

- Having the base command, control, communications, and computer (C4) systems officer (CSO) analyze the economic impact for each requirement (AFI 65-501).
- Processing separately any requests for cellular telephones that can process classified or sensitive information (AFI 33-103).

5.1.4. The base cellular telephone manager maintains Government-owned assets.

5.1.5. MAJCOM cellular telephone managers determine whether to issue cellular telephones and establish procedures for approving variances from Table of

Allowance 660. *NOTE:* ANG units use subdivision hertz tandards.

.2. Telephone control officers pay cellular telephone bills following the guidance in AFI 33-111, *Telephone Systems Management* (formerly AFR 700-8, Volumes 1, 2, and 3*)*.

5.3. The base cellular telephone manager revalidates all cellular telephones annually to determine whether the need for them still exits.

Section C–Managing the Military-Affiliate Radio System

6. The MARS Mission. For a full statement, refer to DOD Directive 4650.2.

6.1. **Using MARS Provides:**

- Worldwide emergency communications that support survival, recovery, and reconstitution plans.
- Fixed and mobile communications that support the disaster preparedness program (AFI 32-4001, *Disaster Preparedness Planning and Operations* {formerly AFR 355-1}).
- Point-to-point record data and voice communications that support contingency plans and personnel morale and welfare.

6.2. **MARS Consists of Military and Affiliate Organizational Elements:**

- The military element includes military MARS facilities and operating personnel.
- The affiliate element consists of amateur radio operators and their stations. This element augments military capabilities and provides a volunteer reserve of stations and trained radio operators that support military communications.

7. Responsibilities:

7.1. The Deputy Chief of Staff, Command, Control, Communications and Computers (HQ USAF/SC), develops MARS policy and provides overall guidance for the MARS program.

7.2. **The Chief, USAF MARS (HQ AFC4A/SYXR):**

7.2.1. Manages the MARS program for HQ USAF.

7.2.2. Issues operating publications to MARS stations.

7.2.3. Represents HQ USAF on the DoD Joint MARS Chiefs Panel, amateur radio conventions, and MARS conferences.

7.2.4. Coordinates with MARS Chiefs from other services on matters requiring joint-service resolutions.

7.2.5. Coordinates With **MAJCOMs:**

- To determine emergency and contingency communications requirements.
- To answer MARS frequency requests.

7.2.6. Sends valid frequency requests to the Air Force Frequency Management Agency.

7.2.7. Develops and publishes guidelines and management procedures (including those for emergency operations) for MARS operations.

7.2.8. Assigns and manages MARS frequencies using AF Form 3662, **MARS Repeater Application and Registration** (AFI 33-118).

7.2.9. Establishes a management structure to administer the affiliate organization and control network operations using AF Forms 3661, **MARS Personnel Action Notification,** and 3665, **Military Affiliate Radio System Certificate of Appointment.**

7.2.10. Appoints region and state MARS directors and other key affiliate officials.

7.2.11. Manages excess and surplus government property acquired for use in MARS through the MARS accountable officer.

7.2.12. Responds to applications for MARS membership and issues AF Form 3666, **Military Affiliate Radio System (MARS) Station Certificate** and AF Form 3666-A, **MARS Station License.**

7.2.13. Serves as Air Force liaison for amateur radio.

7.2.14. Controls and issues DD Form 2350, **DOD Military Affiliate Radio System (MARS) Disaster Support Identification Card.**

7.2.15. Budgets for postage stamps for MARS regions.

7.2.16. Approves DD Form 630, **Department of Defense Application for Membership in Military Affiliate Radio System (MARS),** which authorizes military MARS station operations.

7.2.17. Approves auxiliary stations along with the host command.

7.2.18. Authorizes the affiliate to operate a MARS station by approving DD Form 630.

7.2.19. Terminates affiliates who bring discredit upon themselves or MARS, or who fail to:

- Abide by the publications and rules governing MARS.
- Complete required MARS training.
- Maintain minimum quarterly participation on established MARS radio nets as instructed by published management guidelines. Use AF Form 3664, **MARS Net Continuity Log,** to record quarterly participation.
- Maintain a current Federal Communications Commission amateur radio license.
- Notify appropriate authorities of a change of address.

7.2.19.1. Terminated affiliates must wait 2 years before requesting reinstatement in the MARS program; affiliates voluntarily resigning must wait 1 year before requesting reinstatement. Members terminated for extreme cause (e.g., conduct unbecoming), must wait a minimum of 5 years before requesting reinstatement in any of the military services' MARS programs.

7.2.19.2. Waivers of termination of affiliates may be granted for extenuating circumstances on a case-by-case basis.
7.2.20. Grants periods of inactive status to MARS affiliates on a case-by-case basis.
7.2.21. Establishes procedures for MARS affiliates to access the government telephone systems.
7.3. **MAJCOM CSOs:**
7.3.1. Appoint a command MARS director.
7.3.2. Identify MARS support requirements when formulating command contingency and disaster plans.
7.3.3. Appoint installation MARS directors even if the installation has no MARS station.
7.3.4. Notify Chief, USAF MARS, of all appointments.
7.3.5. Authorize personnel for full-time MARS stations.
NOTE: Don't authorize personnel for standby stations.
7.4 The installation MARS director administers the local MARS program.
7.5. **MARS Affiliates:**
7.5.1. Comply with publications governing MARS operations.
7.5.2. Submit frequency requests through the Chief, USAF MARS.
7.6. MARS accountable officers process AF Form 3660, **USAF MARS EquipmentRequest**, and DD Form 1348-1, **DoD Single Line Item Release/Receipt Document.**
7.7. MARS officials use AF Form 3663, **MARS Monitoring Report**, to ensure frequency compliance.
7.8. Use AF Form 427, **Military Affiliate Radio System Message, to process messages.**

8. Military MARS Stations. These stations consist of funded (active) and unfunded (standby) base MARS stations. MAJCOMs and bases should support military MARS stations in the same manner as other Air Force C4 facilities. The base unit of assignment oversees equipment maintenance.

9. Auxiliary MARS Stations. Establish auxiliary MARS stations for special missions such as United States Air Force Reserve, ANG, Civil Air Patrol, and base morale, welfare, and recreation.

10. Eligibility for Affiliate Membership.

10.1. Refer to DOD Directive 4650.2 for eligibility requirements for affiliate membership.
10.2. Request affiliate membership on DD Form 630 through the state MARS director.

11. Training. Refer to the MARS operating directives for training guidelines.

12. Operating Directives. Follow MARS operating directives in conjunction with allied communications publications.

13. Support to Civil Agencies.
13.1. Refer to the National Military Command System, National Emergency Communications Plan (Secret) for MARS support guidelines for civil agencies.
13.2. Refer to AFPD 32-40, *Disaster Preparedness*, for support guidelines for civil agencies near military installations.

14. MARS Mobile Communications Stations. Installation Commanders:
14.1. Determine the requirements for a MARS mobile communications station.
14.2. May establish a MARS support team of local affiliates for contingency requirements.

15. Storage and Shipment of MARS Equipment.
15.1. An active duty, military MARS member may ship or store MARS equipment at government expense. (See Joint Travel Regulations.)

16. Government Telephones. MARS affiliate officials may use Government telephone systems for official business.

17. Official Mail. MARS affiliates may use official mail to conduct official MARS business (according to AFI 37-125, *Official Mail, Small Parcel and Distribution Management* {formerly AFR 4-50}).

18. Forms Prescribed. This instruction prescribes AF Forms 427, 1501, 1501A, 3660, 3661, 3662, 3663, 3664, 3665; and 3666; and DD Forms 630 and 2350.

CARL G. O'BERRY, Lt General, USAF
DCS/Command, Control,
Communications and Computers

2 Attachments
1. Glossary of References, Abbreviations and Acronyms
2. Land Mobile Radio Continuity Folder

Appendix F

15 ABW

Command, Control, Communications, and Computer (C4) Systems

Requirements Management Guide

1 JAN 94

FOREWORD

15 ABW and associate unit members,

Over the last couple of years we have witnessed tremendous changes in the telecommunications arena. Computers are becoming faster and more powerful, electronic key systems are becoming the norm, and fiber optic cables are allowing us to transmit a tremendous amount of data at a much faster rate. These technological advances are allowing us to more effectively utilize and manage an ever increasing amount of information. The proliferation of voice, data, and multi-media communications equipment has quite literally forced us to change the way we do business. These changes are not without new challenges. Shrinking budgets and manpower reductions require an increased emphasis on how we plan for the future to more efficiently use our diminishing resources. In an era of rapid and dynamic change, we must try to anticipate change rather than react to it. Accordingly, I have directed our communications staff to take a hard look at how we plan for and process our communications requirements. This guide outlines the procedures we will be using.

Planning for your command, control, communications and computer (C4) systems requirements demands a continual focus on the future. I ask each of you to take a hard look at your functional areas. I encourage you to work with our C4 systems planning personnel to develop a coordinated approach to satisfying our current and future communications needs and gain effective results through efficient use of our resources. Finally, as this is our initial effort, your feedback would help.

DWIGHT M. KEALOHA, Brig Gen, USAF
Commander
15th Air Base Wing

Command, Control, Communications, and Computer (C4) Systems Requirements Management Guide

This guide establishes policies and procedures for identifying, developing and processing C4 systems requirements. It defines administrative responsibilities associated with processing C4 requirements and establishes the Hickam AFB C4 Systems Board. This instruction applies to all organizations on Hickam AFB and associate organizations requiring C4 services from the 15 ABW.

Table of Contents

1. GENERAL. Effective management of C4 systems requires a constant focus on architectural planning and integration procedures. Coordination between customers, supplier organizations, and approval authorities is critical to achieving an effective C4 systems capability. This instruction is intended to serve as a guide for ensuring coordinated management of the existing C4 systems architecture and effective integration of new C4 requirements.

2. C4 SYSTEMS PLANNING. C4 systems planning focuses on mission requirements and provides broad goals, objectives, and strategies for developing future capabilities. The process requires continual interaction between customers and suppliers; full understanding of the peacetime and wartime mission; and an objective review of C4 systems capabilities. Identification of C4 systems shortfalls begins with the base level customer.

a. Each organization will appoint a Unit Communications-Computer Systems Officer (UCO), who will actively participate in planning organizational C4 systems needs and must be aware of C4 systems capabilities and limitations.

(1) Each UCO will work directly with the Communicaitons-Computer Systems Officer (CSO [15 CS/CC or designated representative]) to overcome any identified shortfalls. The UCOs will represent their organization and must stay informed of all C4 systems upgrades, installations, removals, etc..

(2) The UCO will act as the single organizational POC for all new C4 requirements (telephones, computers, software, etc.).

(3) Each UCO will attend periodic Base Level Review meetings conducted by the CSO. The Base Level Review will serve as a forum for interaction between customers and supplier organizations. It is intended to educate our customers on the existing C4 infrastructure and assist them in developing a more robust C4 systems capability.

b. The CSO will assist UCOs in overcoming any identified organizational communications shortfalls. The CSO will provide consultation services and assist in the development of new requirements. The CSO will also ensure planned systems effectively integrate into the existing C4 architecture.

(1) The CSO will host a periodic Base Level Review. The Base Level Review will focus on outlining the current and planned C4 architecture. The review should educate the customer and assist them in identifying organizational communications shortfalls. This review will be conducted as often as possible but at least semiannually. It should afford the opportunity for suppliers and customers to become familiar with their respective organizational structures and missions. Follow-on contacts ensure continuous rapport and a team approach to satisfying organizational and base-wide requirements.

(2) The CSO will maintain all applicable Air Force and MAJCOM planning documents. These documents will be used to plan future base-level C4 systems and will be referred to when integrating base level requirements into the existing C4 architecture. 15 CS/SCX will familiarize each UCO on these documents.

3. C4 SYSTEMS REQUIREMENTS PROCESSING. Requirements originate from a deficiency in an existing operational capability, a need for a new capability, or an opportunity to replace or modernize an existing system. The process begins when the requesting organization determines they have a C4 requirement that cannot be met with a nonmaterial solution, such as a change in tactics, doctrine, organizational training, or operational procedures. The process includes; development of a certified technical solution; requirement approval; and resource procurement/ implementation. All requirements will be provided to 15 CS Customer Service Center for processing.

a. The requesting organization will:

(1) Identify and submit C4 systems requirements IAW the format outlined in attachment 1.

(2) Examine funding options before submission. NOTE: Lack of funding should not preclude submission of a valid requirement. Unfunded requirements will be processed for approval action and once approved, are valid for 2 years.

(3) Ensure the requirement is validated by the UCO prior to submission.

(4) Concur/nonconcur with the technical solution provided by the CSO. Technical solutions to requirements which have not been implemented after one year must be reevaluated to ensure they remain appropriate and within approved funding levels. NOTE: Implementation costs may not exceed a 15% increase from time of approval without being reviewed by the appropriate approval authority.

b. The CSO will:

(1) Assist in the development of customer requirements.

(2) Receive and enter the requirement into the Automated Requirements Tracking System (ARTS).

(3) Develop technical solutions for requirements or process the requirement for engineering technical support.

(4) Seek customer concurrence to technical solutions.

(5) Forward the requirement to the appropriate validation/approval level (CSO, C4 Systems Board, MAJCOM, etc.)

(6) Facilitate procurement of resources and implementation of the approved requirement.

(7) Ensure the customer is routinely informed of all actions regarding the processing of their requirement.

4. APPROVAL LEVELS. The CSO will ensure all requirements are validated/approved at the appropriate level. The various levels of approval are:

a. C4 SYSTEMS BOARD. The wing commander, or designated representative, has approval authority for all C4 systems requirements generated within the wing. Tenant requirements will be reviewed by the C4 systems board and approved, if appropriate. The only requirements that must be elevated above wing level for approval are: Air Force standard managed systems; PACAF managed systems; non-standard Automated Data Processing Equipment (ADPE) requirements; multi-base requirements; and high precedence circuits.

(1) The C4 Systems Board will be comprised of the following members:

(a) Voting members:

15 ABW/CC - Chairperson

15 Support Group/CC - Vice Chairperson

15 Logistics Group/CC

15 Operations Group/CC

15 Medical Group/CC

15 ABW Financial Management & Comptroller/FM

(b) Non-voting members:

15 Communications Squadron/CC (Tech Advisor)

15 Civil Engineering Squadron/CC

15 Supply Squadron/CC

15 Contracting Squadron/CC

15 Security Police/CC

619 Airlift Support Group/CC

15 ABW Manpower/MO

(2) C4 Systems Board members will:

(a) Convene as required, by the chairperson, to support C4 requirements.

(b) Approve/disapprove all C4 systems requirements forwarded by the CSO.

(c) Validate/disapprove requirements to be processed for MAJCOM approval.

(d) Review the Base Assessment/Blueprint and planning documents annually.

(e) The CSO will perform administrative functions for the C4 systems board. An agenda and minutes will be published for each C4 systems board.

(f) The requesting organization will attend the C4 systems board meeting to support and defend their requirement. If a representative is unable to attend, the requirement will be assessed on available information and the justification provided. If sufficient information is not available, the requirement will be disapproved or tabled until a representative can be present.

b. DELEGATED APPROVAL. The CSO is delegated the following authority:

(1) Approve/disapprove base-wide local area network and fiber optic connectivity requirements that are consistent with the base C4 systems blueprint/architecture.

(2) Approve/disapprove standard computer systems, software, and peripheral devices.

(3) Approve/disapprove standard pagers, land mobile radios (LMR) and cellular telephone requirements.

(4) Approve/disapprove standard telecommunications requirements. Key systems, switches, major relocations and requirements with recurring monthly charges greater than $5,000 must meet the C4 Systems Board.

(5) Validate technical solutions (including amendments) from Communications Systems Center (CSC) agencies (i.e. Det 1, 1845 EIG; 1845 EIG; Standard Systems Center, etc...)

(6) Sign project support agreements concurrence or nonconcurrence letters (including amendments) and AF Forms 1261.

NOTE: The CSO reserves the right to forward any/all requirements to the base C4 Systems Board for approval.

c. MAJOR COMMAND (MAJCOM) APPROVAL. The following types of requirements must be forwarded, after validation, to HQ PACAF/SCXP for approval processing:

(1) AIR FORCE STANDARD MANAGED SYSTEMS. These are C4 systems that are managed by an agency designated by HQ USAF/SC as the Standard Systems Manager (SAM). 15 CS/SCX will maintain a list of standard managed systems and the approving agency. The designated SAM is the approving authority for such systems.

(2) PACAF STANDARD MANAGED SYSTEMS. These are interbase C4 systems whose configuration at wing level must be controlled to ensure command wide compatibility. 15 CS/SCX will maintain a list of PACAF managed systems. HQ PACAF is the approving authority for such systems.

(3) NON-STANDARD ADPE REQUIREMENTS. These are C4 systems requirements which involve the acquisition of central processing units (CPUs) or total systems via other than standard Air Force requirements contracts. HQ PACAF is the approving authority for such systems.

(4) HIGH PRECEDENCE CIRCUITS. These are circuits (point-to-point or telephone) with a priority precedence or higher. HQ PACAF is the approving authority for such circuits.

(5) MULTI-BASE REQUIREMENTS. These are C4 requirements that affect more than one installation (example; request for a C4 systems for both Hickam and Elmendorf). These requirements should go straight to HQ PACAF/SCXP for management and do not require a Hickam requirements number.

d. OUT-OF-CYCLE REQUIREMENTS. High priority C4 system requirements that can't wait on the regularly scheduled C4 Systems Board will be handled as an out-of-cycle requirement. Out-of-cycle requirements will be processed as follows:

(1) The requestor will prepare a letter, signed by the organization commander, DCS or equivalent, stating why the requirement must be processed out-of-cycle. The letter will be addressed to 15 CS/CC and must accompany the requirements document (completed IAW Atch 1).

(2) The CSO will process the requirement and obtain the signatures of voting C4 Systems Board members.

5. MISCELLANEOUS C4 REQUIREMENTS. The following types of C4 requirements are routinely processed out-of-cycle and do not require formal approval. Requests must be coordinated through the 15 CS, Customer Service Center (449-2666).

a. SMALL COMPUTER MAINTENANCE. A local form is used to request maintenance action on small computers, peripheral devices, etc. Call-ins are accepted.

b. PUBLIC ADDRESS (PA) SUPPORT. A local form is used to request PA support for official military functions. Loaner equipment is also available upon request. Call-ins are accepted.

c. AUDIO/VISUAL SUPPORT. Submit an AF Form 833 for visual information support (includes photography, presentations, graphics services, and video duplication). Complete an AF Form 2017 to check out film/video library equipment and an AF Form 1297 to check out multi-image equipment.

d. TABLE OF ALLOWANCE (TA) ITEMS. C4 systems, which are authorized on an existing TA, do not require formal submission or approval. The requestor need only submit a completed AF Form 601, IAW applicable directives, for coordination. This procedure applies to procurement, transfer, and turn-in transactions.

SAMPLE C4 SYSTEMS REQUIREMENT FORMAT

1. CSRD NUMBER: Leave blank, this information will be completed by the CSO.

2. TITLE: Enter a brief descriptive subject or title that identifies the requirements.

3. NEED DATE: Date the requesting organization needs the solution implemented based on a specific need and funds availability.

4. PROCESS CLASSIFIED: Will the requested service/equipment be used to process classified information? If yes, choose a level; top secret, secret, or confidential.

5. PROCESS SENSITIVE UNCLASSIFIED: Will the requested service/ equipment be used to process sensitive unclassified information? This includes information subject to the Privacy Act and Freedom of Information Act. If "yes", identify the types of information processed.

6. REQUIREMENT: Describe the mission deficiency or need while avoiding the use of acronyms. A narrative, expressed in functional terms, describing what capability is needed, do NOT provide a shopping list of desired equipment in this section.

a. Requests for telephones, relocations, modifications, or removals must be accompanied by a floor plan. The floor plan must include the building/room number and the exact location of the affected equipment. A telephone matrix must be provided for major installations and reorganizations.

b. Networking requirements must identify the number of computers/printers that will be connected, a list of software that needs to run on the local area network, a list of existing equipment, and a floor plan of the area covering the computers and printers.

c. Computer hardware/software requirements must also include the ADPE account number. For software, include the serial number of the central processing unit the software will be installed in. If an ADPE account number has not been assigned, please so state.

d. If compatibility with an existing or proposed systems is required, state the name, type, and model of the system.

7. JUSTIFICATION: Explain why the capability described in the requirement block is needed. Justification should include who, what, when, where, why, and how the satisfaction of the requirement will improve mission capabilities and/or save funds or time.

8. IMPACT IF DISAPPROVED: Describe in brief narrative form the actual mission impact if the requirement is not fulfilled.

9. USER/POINT OF CONTACT: Requesting agency point of contact. Indicate the name, office symbol, and telephone number of an individual who can provide additional information about the requirement.

10. UNIT COMMUNICATIONS-COMPUTER SYSTEMS OFFICER (UCO). This block must contain his/her name, office symbol, phone number, and signature.

11. SUGGESTED TECHNICAL SOLUTION: This is not required, however, if you prefer a specific type of equipment, please include your request as an attachment. Also, if you already have the equipment and are looking for installation/connectivity only, please so state.

TERMS

AIR FORCE C4 SYSTEMS ARCHITECTURES

- The standards, protocols, etc. that shape the evolution of Air Force C4 systems. Compliance with these architectures during development, implementation, and/or modification of Air Force C4 systems is imperative to achieve desired integration and interoperability objectives.

AUTOMATED REQUIREMENTS TRACKING SYSTEM (ARTS)

- A database that allows chronological monitoring of a requirement from inception to completion. Requirements are entered into the system at the Customer Service Center and forwarded electronically to production work centers and/or the integration/architecture office. Customers will be routinely updated on the status of their requirements, but may also contact the CSC counter during normal duty hours for status of updates.

COMMUNICATIONS-COMPUTER SYSTEMS OFFICER (CSO)

- The supporting C4 systems officer at base level. The 15 CS/CC (or designated representative) is responsible for carrying out the responsibilities of the BCSO.

COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTER (C4) SYSTEMS

- Any combination of facilities, computer equipment, software, communications equipment, transmission media, procedures, people, and other resources used for the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information.

COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTER (C4) SYSTEMS BOARD

- A formal gathering of key personnel listed in this instruction who meet at least quarterly to review C4 requirements for validation or approval. 15 CS/SCX is the focal point for all requirements meeting the C4 Systems Board.

TERMS (cont.)

COMMUNICATIONS-COMPUTER SYSTEMS REQUIREMENTS DOCUMENT (CSRD)

- This may be the AF Form 3215, AF Form 601, a locally generated form, or paper that includes the information listed in Atch 1. A requirement is a statement identifying a C4 systems mission shortfall or system need. A C4 systems requirement occurs when an organization; cannot accomplish its current or new mission; has an opportunity to increase its operational efficiency; can cut operational costs because of advances in technologies; or has an opportunity to modernize an existing C4 system by applying newer technologies.

CUSTOMER SERVICE CENTER (CSC)

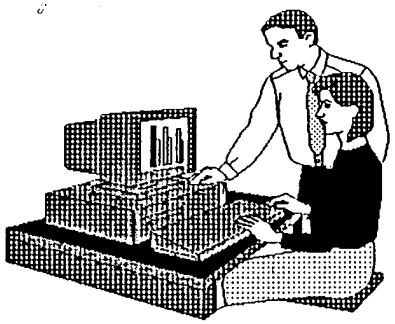
- A 15 CS office that is available as the base, single POC for all incoming requirements. After requirements are received, the CSC enters information into our requirements database, then staffed to the appropriate action office(s). The phone number for this office is 449-2666. Services include telecommunications actions, ADPE management, frequency management, LMR management, and audio/visual support.

TECHNICAL SOLUTION AND COSTING (TS&C)

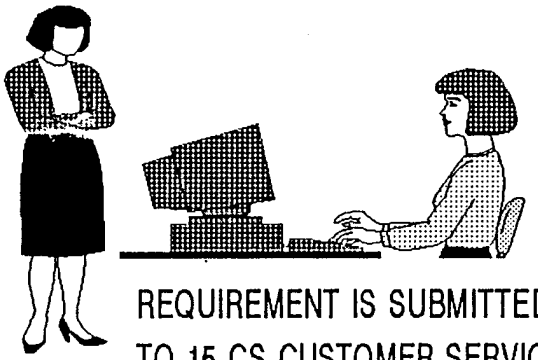
- A detailed description of the C4 systems solution which can be incorporated into, or will not impact, the base infrastructure and is compliant with downward directed architectures and standards. This includes recommended acquisition method and strategy, estimates a=of all one-time recurring costs and identification of manpower impact.

ACQUISITION FLOW PROCESS

CUSTOMER



COORDINATION WITH UCO TAKES PLACE



REQUIREMENT IS SUBMITTED TO 15 CS CUSTOMER SERVICE CENTER

APPROVAL

BC4SO

C4 SYS BOARD

HQ PACAF

INTERNAL TECH SOLUTION

EXTERNAL SOLUTION

15 CS/SCXPA

Architectures and Integration Office

Attachment 3

Appendix G

Characteristics of cost allocation systems:

Characteristics	Relevant System Components
Equitability	Unit of measure
	Nature of cost
	Rate negotiation
Repeatability	Data capture
	Frequency of changing:
	Rates
	Units of measure
	Resource cost composition
	Treatment of:
	Support and overhead cost
	Over- or under-recovery
Accuracy	Unit of measure
	Data capture
	Billing Format
Understandability	Unit of measure
	Billing format
Controllability	Unit of measure
	Nature of cost
	Billing adjustment
Economical	Unit of measure
	Data capture
	Billing mechanism
Meaningful	Billing resources

	Minimum charge
Forecastability	Unit of measure
	Nature of cost
Operational	Billing format
	Party billed
Appropriate	Billing format
	Unit of measure
Timely	Billing frequency

Taken from Quinlan (1989).

Appendix H

4.0 SYSTEM OUTPUTS

4.1 Output from the BIBDATA system will be produced in a number of forms. It will fall into the following broad groups:

- terminal output;
- output on magnetic media;
- output on hardcopy media.

4.2 Products to be provided will cover individual bibliographic records, authority files and shelf lists as well as a variety of system control information. The form of output will vary from product to product.

4.3 The following basic outputs will be provided by the system:

4.3.1 Terminal Output (VDU Display or Hardcopy):

- bibliographic data for individual records in short form;
- bibliographic data for individual records in full form;
- authority file entries for name, series and subject authority files;
- location information for a particular bibliographic record;
- system status, and general informatory messages.

4.3.2 Magnetic Media Output:

- individual bibliographic records in AUSMARC format;
- archive records in AUSMARC format;
- individual authority file records for name, series and subject authority file entries;
- catalogue card images.

4.3.3 Hardcopy Output:

- catalogue cards as required by users in a

limited range of format options options;

- authority file entries on catalogue cards

- library accessions list of recent additions

- Classified and Dictionary COM catalogues each in a standard format

- circulation control stationary

- location file on Computer Output Microfilm

4.4 The exact formats of the various output products will need to be determined. However bibliographic data records on magnetic tape will be in the AUSMARC format. Estimates of volumes for each class of magnetic media and hard-copy output are given in Appendix D.

4.5 Users will have the option of capturing output at their own location by use of a cassette interface on the terminal. Terminals will be basically visual display devices.

4.6 In the initial stages of the system, output will be produced in one of two places. It may be produced either at the central site or at the terminal itself. Products at:

4.6.1 Central Site:

- all hardcopy output;

- catalogue card output in print format form on magnetic media;

- AUSMARC records on magnetic media;

4.6.2 User Site:

- all terminal output;

- AUSMARC records on cassette magnetic media;

4.7 Output to magnetic media will be made according to system standards to be specified. These standards will define requirements or options in the areas of tape/cassette labels, tape densities and reel numbering for example.

4.8 It is envisaged that as system usage grows there will be a move toward production of system outputs at regional locations. This question is addressed in section 9 of this document.
7

4.9 User options. Users of the system will have the option of specifying the type of output they require and the medium on which it is to be produced. This facility will be implemented through a user profile which will contain data relating to the requirements of the individual institution. The profile may be changed at the users direction but the change will be made by central site operations staff. The information contained in the profile will indicate, for example, how many sets of catalogue cards are required for each request to produce cards, whether the user wishes to automatically receive an authority file set on first use of an authority file entry, and whether automatic updating of the authority file set is required if and when an entry used by that institution is changed in response to an authority file error report by that or any other institution.

4.10 Individual authority file records will be supplied on magnetic tape in AUSMARC format. Exact details of this format have yet to be determined.

4.11 Output of statistical data. At regular intervals, probably weekly, each user of the system will receive a statistical summary of system resource usage for the period subject to analysis. This output will be on standard computer stationery. The information contained on these reports will be used as the basis for customer billing. The summary will be divided into two sections. One section will deal with the system activity of the individual user and will contain the following information:

- number of original catalogue records added;

- number of copy catalogue records added (i.e. the number of existing records to which a location symbol has been added);

- the percentage of copy cataloguing as related to total cataloguing;

- total cataloguing inputs to the system;

- elapsed time used (i.e. terminal connect time);

- number of successful retrievals by type of access;

- number of unsuccessful retrievals by type of access;

- number of authority file error reports issued;
- number of authority file screens accessed;
- number of messages from the terminals;
- number of messages to the terminals;
- number of disk access requests:
  - read;
  - write.
- number of catalogue cards produced;
- number of machine-readable records output:
  - on-line,
  - off-line.
  - number of validation errors detected by error class.

The second section will provide the same information but for the total system. This will give users the opportunity to compare their own usage of the system with the usage by the total user population and thus provide a guide for the purpose of operational tuning.

7.12 In addition to user statistical information there will be produced a number of outputs for the purposes of central site control. These control outputs are:

- system log of all system activity;
- authority file maintenance log;
- message log.

5.0 SYSTEM MANAGEMENT

5.1 System controls will encompass the following area:

- system access;
- editing and validation of original input data;
- monitoring and reporting on authority file usage;
- production of usage statistics.

5.2 System access.

5.2.1 Users will have access to the system via authorised identification procedures.

5.3 Edit and validation.

5.3.1 Machine edit and validation checks will be performed on all original input records.

5.4 Authority file monitoring and reporting.

5.4.1 The creation, use and maintenace of authority files will be monitored by an Authority File Control Group. This group will have the responsibility, with assistance from users, for the integrity of the information contained on the authority files. A mechanism for the submission of error reports to the Authority File Control Group by users will be provided in the system. The authority to change entries on the authority files will be vested solely in the Authority File Control Group. The entry of data to the authority file will be performed by users in the case of original cataloguing, providing no appropriate item already exists on the files. Users will not be permitted to change authority files directly or alter national agency authority file data where this represents first use of the record. Users must instead use the error reporting facilities provided. This does not preclude them from amending their own copy of the record prior to making an output request. All error reports will be acknowledged showing what action was taken in response to the report.

5.5 Usage statistics.

5.5.1 As a means of managing the system there will be required at least the following weekly statistics:

- message traffic by user through the telecommunication network;

- number of catalogue cards produced for each user and the number of line printer lines produced;

- the number of machine-readable records output by each user;

- the number of frames of COM output produced for each users;

- the number of lines of printed output, exclusive of catalogue card production, produced for each user;

- the number of records amended by each users;

- the number of records archived by each user;

- the number of original entry records from each user;

- the number of successful and unsuccessful retrieval requests for each user classified by:

  - ISBN search;

  - author/title search;

  - author search;

  - title keyword.

- systems use in terms of elapsed time;

- the number of input/output requests made;

- total number of records added to the data base in the period;

- the present size of the data base in terms of records;

- the number of locations added ;

- the number of validation errors detected by class of error;

- total number of authority file entries held;

- number of error reports received;

- number of error reports causing amendment.

5.5.2 In addition to these statistics, a print of all messages other than bibliographic messages, i.e. general information or query messages sent through the general message screen facility, will be held in hardcopy form for reference purposes. This message log will provide hardcopy data relating to the notification of system problems by users and will be used by the system maintenance group in applying corrections to the system.

5.5.3 A weekly report for each insitutional user will be produced and forwarded to the user site for statistical purposes. These reports will be produced on standard computer output stationery using a line printer (Refer Section 4.12).

Appendix I

19 December 1994

From: Capt Donald T. Carter

Subj: LMR Trunking System Survey

To: Survey Recipient

1. I am an Air Force Institute of Technology student pursuing a Masters of Science degree in Information Systems at Hawaii Pacific University. My master's thesis involves investigating several issues concerning the new trunked LMR system servicing Hickam AFB. The attached questionnaire seeks to determine your opinions on several issues. This questionnaire is being sent to the commander, LMR manager, and finance officer of each organization currently using an LMR managed by the 15 CS. It was also provided to HQ PACAF staffers responsible for developing LMR policies and procedures for the entire Command.

2. Your responses will be used strictly for academic purposes. However, 15 CS management will be advised of the results; they may take the responses into consideration during their trunking system implementation efforts.

3. This beleaguered grad student would greatly appreciate your taking a moment of your valuable time to complete the questionnaire; return it to 15 CS/CC by 10 Jan 95. To receive a copy of the research results, please complete the enclosed form and return it to 15 CS/CC in a separate distribution envelope. If you have any questions, please call me at 422-7963. Thanks for your assistance in advance.

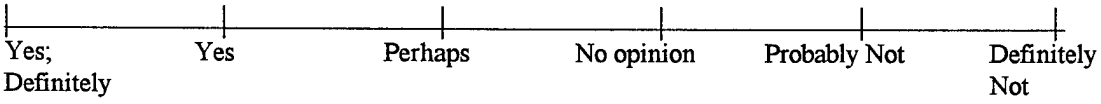
Donald T. Carter, Capt, USAF

1. The following best describes my position:
   (1) ☐ unit commander
   (2) ☐ LMR manager
   (3) ☐ unit finance/budget manager
   (4) ☐ HQ PACAF staff
   (5) ☐ other

2. The following best describes my unit:
   (1) ☐ 15 ABW unit
   (2) ☐ HQ PACAF
   (3) ☐ tenant unit
   (4) ☐ other

3. Are there any features you would like to see incorporated into the LMR network?
   (1) ☐ yes
   (2) ☐ no
   (3) ☐ no opinion

4. The current LMR system is going to be upgraded to a system which will provide greater interoperability and enhanced features. Would you be willing to contribute towards the purchase and support costs for the new system?



5. If so, do you think charges should be based on:
   (1) ☐ how many radios your organization has
   (2) ☐ how often you use your LMR
   (3) ☐ the geographic coverage you require (how far away from HAFB you need to be able to communicate)
   (4) ☐ other _____

6. If not, please check an appropriate reason:
   (1) ☐ 15 CS should be responsible for paying for all comm equipment and services
   (2) ☐ the increase in service/capabilities is not worth the extra cost to me
   (3) ☐ other _____

7. What should the criteria be to assign features with limited access (e.g., only a few users may have access to certain features like telephone interconnect)?

(1) ☐ rank
(2) ☐ only commanders
(3) ☐ only those approved by 15 ABW/CC
(4) ☐ anybody who says they need it
(5) ☐ other

8. Who do you think should be responsible for paying for the initial purchase of the following equipment items?

a. radios used by individual units:
(1) ☐ 15 CS
(2) ☐ each unit pays for their own
(3) ☐ 15 ABW funded
(4) ☐ HQ PACAF funded
(5) ☐ HQ USAF funded
(6) ☐ other

b. repeaters
(1) ☐ 15 CS
(2) ☐ total cost divided among the user units
(3) ☐ 15 ABW funded
(4) ☐ HQ PACAF funded
(5) ☐ HQ USAF funded
(6) ☐ other

c. central controllers
(1) ☐ 15 CS
(2) ☐ total cost divided among the user units
(3) ☐ 15 ABW funded
(4) ☐ HQ PACAF funded
(5) ☐ HQ USAF funded
(6) ☐ other

d. other backbone equipment
(1) ☐ 15 CS
(2) ☐ total cost divided among the user units
(3) ☐ 15 ABW funded
(4) ☐ HQ PACAF funded
(5) ☐ HQ USAF funded
(6) ☐ other

9. Who do you think should be responsible for paying for the maintenance and support costs for the following equipment items?

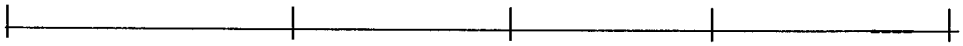
a. radios used by individual units
(1) ☐ 15 CS
(2) ☐ each unit pays for their own maintenance costs
(3) ☐ 15 ABW funded
(4) ☐ HQ PACAF funded
(5) ☐ HQ USAF funded
(6) ☐ other

b. repeaters
(1) ☐ 15 CS
(2) ☐ total cost divided among the user units
(3) ☐ 15 ABW funded
(4) ☐ HQ PACAF funded
(5) ☐ HQ USAF funded
(6) ☐ other

c. central controllers
(1) ☐ 15 CS
(2) ☐ total cost divided among the user units
(3) ☐ 15 ABW funded
(4) ☐ HQ PACAF funded
(5) ☐ HQ USAF funded
(6) ☐ other

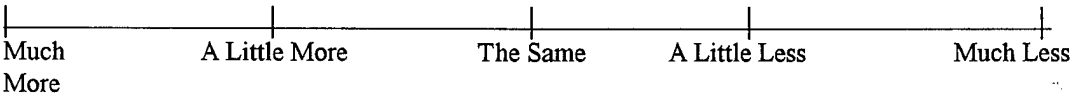
d. other backbone equipment
(1) ☐ 15 CS
(2) ☐ total cost divided among the user units
(3) ☐ 15 ABW funded
(4) ☐ HQ PACAF funded
(5) ☐ HQ USAF funded
(6) ☐ other

10. Do you think that tenant units (non-15 ABW units) should be responsible for paying a monthly fee for using the trunking system?



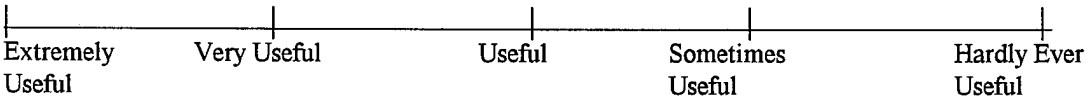
Yes; Definitely	Perhaps	No opinion	Probably Not	Definitely Not

11. If so, how much financial responsibility should the tenant units have when compared to 15 ABW units? *Much more* would mean you think that tenant units should be much more financially responsible for the trunking system.

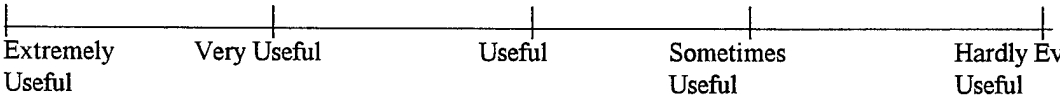


12. The new trunked LMR system will be capable of generating reports showing various system usage statistics. Please rate the following statistics concerning their usefulness to you (extremely useful means that you would really like to see this statistic in a report sent to you).

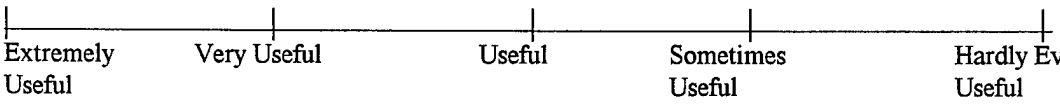
System use by your organization (total minutes of air time)



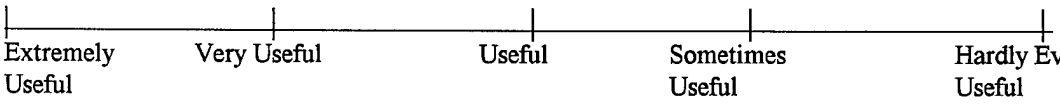
Total system use by all units (total minutes of air time)



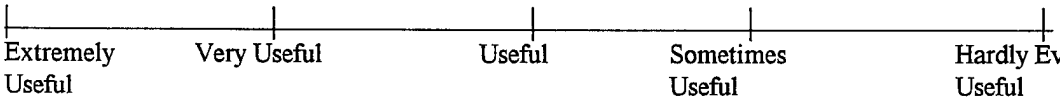
Phone calls by your organization



Cost for phone calls placed by your organization



Total phone calls by the system



13. How often would you like to see reports with these statistics sent to you?

(1) ☐ weekly
(2) ☐ twice per month
(3) ☐ monthly
(4) ☐ quarterly
(5) ☐ annually
(6) ☐ I don't want to see system reports

Appendix J

Response	Q #1	Q #2	Q #3	Q #4	Q #5	Q #6
1	1	3	1	5	2	
2	2	1	1	6	2	
3	2	1	1	5	3	
4	1	1		5	2	
5	3	1	3	4	2	
6	5	1	2	2		1
7	5	3	3	1		3
8	5	1	1	1		1
9	2	1		2	2	1
10	2	1	2	4	2	
11	5	1	3	1	4	1
12	1	1	1	1		2
13	3	1	3	1		3
14	1	1	1	1		3
15	3	3	3	2	1	1
16	2	1	1	6	1	3
17	5	3	3	4	3	
18	2	3	3	1		1
19	2	3	1	2	1	3
20	2	1	3	1	4	1
21	2	1	1	5	1	
22	1	3	3	2	1	2
23	5	3	2	2		3
24	3	1	3	3		
25	1	1	1	5		1
26	3	1	1	2		3
27	1	1		4	2	
28	1	1	2	6	4	
29	4	2	1	2	2	
30	3	1	3	4	1	
31	2	1	1	4	1	
32	1	1		5	1	
33	4	2	3			3
34	3	1	3	5	1	
35	3	3	3	4	1	
36	4	2	3	5	1	
37	2	1	3	4	4	3
37						
Mean						
Median						

#6 other
as tenant, cannot afford to allocate scarce resources to upgrade LMR system
PACAF should fund each base; each unit cannot absorb cost of base system
No unit can afford money for the trunk system. We need to find alternative ways of funding through wing
15 CS should pay a share of costs in order to encourage orgs to upgrade
The bulk of payment should be through 15th
Host tenant support agreements require the host to provide SP support. The SPs are the primary users of t
Purchase of radios should come out of 15 ABW account, considering the radios will be needed wing wide.
We are not users.
Shared cost all units.

Q #7	#7 other
5	based on demonstrated need
5	operational mission impact
4	
5	Group CC approval
3	
3	
5	mission requirements
4	
3	
3	
5	Approval process: establish criteria, not necessarily 15 ABW/CC approval
3	
5	CSRD decision
5	Those approved by the CSRB
5	
3	
5	Group CC approval
3	
2	
3	
3	
3	
5	Anyone with an operational need.
3	
5	CSRB process
3	
3	
5	CSRB approval
3	
5	
3	
2	
5	15 CS should determine
2	
3	
3	
3	

Q #8a	Q #8b	Q #8c	Q #8d	Q #9a	Q #9b	Q #9c
2	3	3	3	2	2	2
2	3	3	3	2	2	2
4	4	4	4	4	4	4
2	3	4	3	2	3	4
2	1	3	1	2	1	3
3	3	1	1	2	1	1
1	1	1	1	1	1	1
4	4	4	4	1	1	1
2	3	3	3	2	1	1
2	4	2	2	3	3	3
2	1	1	1	2	1	1
4	4	4	4	2	3	3
2	3	3	3	3	3	3
2	4	3	1	2	1	1
1	1	1	1	1	1	1
3	3	3	3	3	3	3
2	2	3	3	2	1	3
3	3	3	3	3	3	3
4	4	4	6	4	4	4
2	1	2	1	3	3	3
2	2	1	1	2	2	1
2	1	1	1	1	1	1
3	3	3	3	3	3	3
2	3	3	3	2	3	3
5	5	5	5	2	1	1
3	4	4	5	3	4	4
2	3	3	3	3	3	
2	6	6	6	2	2	2
2	3	3	3	2	1	1
5	1	1	2	5	5	1
3	3	3	3	2	1	1
4	4	4	4	3	3	3
2	4	4	4	1	1	1
2	2	2	2	2	2	2
3	3	3	3	2	2	2
2	5	5	6	1	1	1

Q #9d	Q #10	Q #11	Q #12a	Q #12b	Q #12c	Q #12d
3	4	4	4	1	5	5
2	5	3	5	5	5	5
4	2		4	4	4	4
3	5	3	3	1	5	5
1	4	3	4	3	4	4
1	5	3	4	4	4	4
1	4	3	3	3	2	2
1	5	5	1	1	3	3
1	5	3	3	3	5	4
3	3.9	2.5	3.9	1.2	3.9	3.9
1	4	3				
3	5	3	1	1	3	4
3	5	3	4	2	5	5
1	4	3	4	1	4	4
1	2.2		4	4	4	3.2
3	5	5	4.8	3.2	3.9	4
3	1		3	3	4	4
3	1		4	3	4	4
6	1	1	5	5	5	5
3	5	5	1	1	2	2
1	4	3	1	1	2	1
1	2		3	2	3	3
3	1		1	1	2	2
3	5	3	4	4	4	4
1	2	3	1	2	2	3
5	4	3	4	4	4	4
	5	3	4	4	2	3
2	5	3	5	2	5	5
1	5	3	5	5	4	5
3	5	3	4	4	5	5
1	3	3	4	2	5	5
3	5	5	5	4	5	5
	5	3				
1	5	3.9	5	1	5	5
2	1		1	1	1.7	2
2	5	3	4	4	4	4
6	5	3	4	1	5	5

Q #12e	Q #13
4	1
5	3
4	4
1	4
3	2
4	4
1	4
1	3
5	3
1.2	4
1	3
2	2
3	3
3.2	4
4.2	4
4	3
3	3
2.8	3
2	3
1	6
3	3
2	5
4	3
2	4
4	2
1	3
2	3
4	4
3	3
3	3
4	3
1	3
1	3
3	3
1	4

Appendix K

Glossary

Certified Technical Solution: "This detailed description of the C4 systems solution uses the base infrastructure and complies with downward-directed architectures and standards. It identifies recommended acquisition methods and strategies, estimates one-time and recurring costs, and identifies manpower impacts" (AFI 33-103, 1994, p. 6).

Channel Grant: When a user presses the PTT button on his or her radio, the radio transmits the request for service to the central controller over the control channel. "The controller assigns an available voice channel for use by the radio and tells the requesting radio which channel has been assigned" (SystemWatch II User's Guide, 1992, p. 1). This process is called a channel grant.

Control Channel: This is a dedicated frequency which is used whenever a user depresses the push-to-talk (PTT) button on the radio. A signal is sent over this control channel to the central controller indicating that this radio would like to transmit.

C4 Systems Officer (CSO): "Identifies the supporting C4 systems officer at all levels. At base-level, this is the commander of the communications unit responsible for carrying out base C4 systems responsibilities" (AFI 33-101, 1994, p. 11).

Database: A collection of interrelated data organized in such a way that it corresponds to the needs and structure of an organization and can be used by more than one person for more than one application. In this paper, *database* refers to the data identifying LMR users, talkgroups, talkgroup assignments, feature assignments, and system use statistics.

Dynamic Regrouping: Allows a dispatcher to reassign talkgroup units and radio features without action on the part of mobile or portable operators. Personnel who are not normally configured to talk to each other may be set up to talk to each other for emergency or special situations. This action may be performed from the SMARTNET Interface Management System (SIMS) II terminal and is carried out via the control channel. Dynamic regrouping is not available in SystemWatch.

Land Mobile Radio (LMR): A radio used to provide local transfer of information by portable, mobile, or base station radios and associated equipment.

Mobile Radio: A two-way, single-channel or multichannel radio mounted in a vehicle or capable of being carried by hand.

Push-to-Talk (PTT): "When a radio user makes a call, he or she must press a PTT button. A SystemWatch II operator can visually monitor any PTT activity in the trunking system" (SystemWatch II User's Guide, 1992, pp. E3-E4).

Repeater: A radio that retransmits all communications entering its receiver. Repeaters extend the communications range of the radio system by rebroadcasting (repeating) all transmissions.

Selective Radio Inhibit: If a mobile or portable is lost or stolen, a dispatcher can prohibit the radio from operating on the system using this feature. Once activated, the radio will no longer be able to transmit or receive.

Talkgroup: "A talkgroup is the primary level of organization of radios in a TYPE II radio system" (SystemWatch II User's Guide, 1992, p. E5).

Trunking: Pooling of frequency resources shared among users; users are not assigned a particular frequency; frequencies are shared and assigned using computerized radio technology. Offers clear, uninterrupted communications with highly efficient channel usage.

Type II: The new signaling structure for trunking systems. The original signaling structure for trunking systems was named TYPE I.