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AN EVALUATION AND COMPARISON OF THE ARMY'S ACQUISITION PLANS FOR TWO TACTICAL COMMAND CONTROL AND COMMUNICATIONS SYSTEMS: MOBILE SUBSCRIBER EQUIPMENT AND SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM

by

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This thesis evaluates the Acquisition Plans of two US Army Command, Control and Communications (C3) Systems: Mobile Subscriber Equipment (MSE) and the Single Channel Ground and Airborne Radio System (SINCGARS), both of which are components of the Army Tactical Command and Control System (ATCCS). The study examines the defense acquisition process through the comparison of the Acquisition Plans and lessons Learned for these two programs, and determines if there is an optimal strategy for the Army to use when acquiring tactical C3 systems. An analysis of thestrengths and weaknesses of the two Acquisition Plans, and an evaluation of the similarities and differences of the two programs, concludes that the MSE Acquisition Plan proved more successful than its SINCGARS counterpart because of its Non-Developmental Item approach. This study recommends maximum use of the NDI strategy for acquiring C3 systems whenever possible.

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An Evaluation and Comparison of the Army's Acquisition Plans for Two Tactical Command, Control and Communications Systems: Mobile Subscriber Equipment and Single Channel Ground and Airborne Radio System

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ABSTRACT

This thesis evaluates the Acquisition Plans of two US Army Command, Control and Communications (C3) systems: Mobile Subscriber Equipment (MSE) and the Single Channel Ground and Airborne Radio System (SINCGARS), both of which are components of the Army Tactical Command and Control System (ATCCS). The study examines the defense acquisition process through the comparison of the Acquisition Plans and lessons learned for these two programs, and determines if there is an optimal strategy for the Army to use when acquiring tactical C3 systems. An analysis of the strengths and weaknesses of the two Acquisition Plans, and an evaluation of the similarities and differences of the two programs, concludes that the MSE Acquisition Plan proved more successful than its SINCGARS counterpart because of its Non-Developmental Item approach. This study recommends maximum use of the NDI strategy for acquiring C3 systems whenever possible.

TABLE OF CONTENTS

I. INTRODUCTION

A. PURPOSE

This thesis evaluates, compares and contrasts the acquisition plans of two United States Army Command, Control and Communications (C3) systems. The systems studied are the Mobile Subscriber Equipment (MSE) and the Single Channel Ground and Airborne Radio System (SINCGARS), which are two key components of the Army Command and Control System (ACCS).

"The defense acquisition process has received a great deal of attention over the last few years, and it is expected to be an ongoing topic in the next Congress. Therefore, now is a particularly good time to review defense acquisition, especially as the new Congress and the new Administration convene." [Ref. 1:p. 21]

This thesis examines the defense acquisition process through the comparison of the acquisition plans for two C3 systems that have been in the headlines due to contract delivery slippage, contractor failure to meet reliability requirements and other problems, as well as specific successes.

B. RESEARCH QUESTIONS

1. Primary Research Question

Based on a comparison of the acquisition plans and lessons learned from these two programs, is there an optimal strategy for the Army to use when acquiring tactical Command, Control and Communications systems?

2. Secondary Research Questions

a. How are the acquisition plans for these two programs alike and how do they differ?

b. What are the strengths and weaknesses of each of the two acquisition plans?

c. Did either acquisition plan succeed more than the other? If so why, and if not, then why not?

C. SCOPE

The scope of this thesis includes general descriptions of the systems being compared, allowing for only as much technical specificity as is necessary to compare the acquisition plans. The acquisition plans are described in detail, with concentration on successes and failures that occurred after the plans were implemented. Similarities and differences are studied and conclusions drawn.

D. STUDY ORGANIZATION AND METHODOLOGY

1. Background Information

First, the researchers gathered background information on the defense acquisition process from the various regulations and instructions which govern the process. Next, the Army Command and Control System (ACCS) was briefly studied; however, the research effort focuses on analysis of SINCGARS and MSE, two of the key programs which impact on the success or failure of ACCS. A query to the Defense Logistics Studies Information Exchange provided a wealth of additional source material. Chapters II and III are written based on the background data provided from the above sources.

2. Acquisition Plans

The Program Managers' offices were primary sources for specific programmatic information. The SINCGARS and MSE program offices provided the acquisition plans and subsequent documentation for their respective programs, which were then measured against the standard process outlined by Department of Defense (DOD) guidelines and directives such as the DOD Directive Number 5000 series (see Bibliography) and the Defense Systems Management College's "Acquisition Strategy Guide" [Ref 4]. Close study of the acquisition plans themselves established an audit trail for subsequent activities, so that specific successes or failures could be traced to individual decisions or omissions by the respective program office. For example, the acquisition strategies are assessed against the criteria of realism, stability, flexibility, resource balance, and control of program risk. Concurrences or deviations from these DOD standards were noted and evaluated.

Next the plans were weighed against their ultimate outcomes, to determine in a general qualitative manner the relative success or failure of the programs in terms of their established goals for cost, schedule and performance. For example, timeline slippages are traced to the source, whether caused by the contractor or government. Likewise, comparison of initial risk assessments with subsequest actions revealed inconsistencies and shortsightedness in some instances. Performance parameters such as mean time betweeen failure (MTBF) and interoperability were compared to original program goals. In this manner the programs were judged against their own standards.

Comparison of these programs to both DOD standards and their own expectations lent additional objectivity and balance to the study. Chapters IV and V contain this composite analysis for SINCGARS and MSE respectively.

3. Conclusions

Finally, Chapter VI compares and contrasts the two programs head-to-head. It includes the perspectives of many previous researchers, summarizes the key points from the preceding chapters, and answers the primary and subsidiary research questions.

II. THE DEFENSE ACQUISITION PROCESS

A. THE DEFENSE ACQUISITION PROCESS

"The U. S. Department of Defense (DOD) is by far the largest and most complex business organization in the world. It operates more than fifty-four hundred installations world wide and executes more than fifteen million contracts per year (more than sixty thousand per day). It also develops and produces the most sought-after weapons and equipment in the free world." [Ref. 2:p. 5] With budget reductions imminent, direction is clear to make the Defense acquisition process as effective and efficient as possible.

1. Acquisition Management Objectives

Department of Defense personnel hold the responsibility of appropriately managing the acquisition process to obtain weapons systems that meet the mission need, are delivered on time, and are procured within cost constraints. This is accomplished through setting and meeting major system acquisition management objectives that are designed to discipline the acquisition process. [Ref. 3:p. 4]

a. Mission Need

Systems should fulfill a mission need and do so effectively and reliably.

b. Competitive Concepts

When acquiring systems, different concepts should be explored and competition used to develop those concepts.

c. Trade-offs

Cost, schedule, and performance should be examined and trade-offs among the three should be constantly evaluated throughout the acquisition process.

d. *Test and Evaluation*

Independent test and evaluation should be conducted to ensure acceptable systems are acquired.

e. *Resource Planning*

Successful acquisition planning and appropriate resource management should take place.

f. *Tailored Acquisition Strategies*

Acquisition strategies should be tailored to specific programs to meet unique requirements.

g. *Life-cycle Costs*

Costs should be monitored throughout the life cycle of the system.

2. Stages of the Acquisition Process

The acquisition process consists of two basic stages: development and production. Each of these is further broken down into several decision points (milestones) and acquisition phases, each of which will be discussed in this chapter. Comparatively, in terms of management and decision making, the second of these stages is quite simple, encompassing no more than the physical production of the system. The development stage includes the complexity of all the necessary steps taken before production begins.

The development stage encompasses three milestones and phases beginning with the identification of a threat or mission need, developing an acquisition strategy and obtaining a budget to support that strategy. Once the funds are obtained from Congress, work begins to find technical approaches to meet the need. This is accomplished by awarding competitive contracts to industry. The Government prepares a Statement of Work (SOW) based on an approved acquisition strategy, which is then transformed into a Request for Proposals (RFP) or Invitations for Bid (IFB) to attract interested contractors. The procurement process will be discussed further in Section C of this chapter. Contractor proposals are evaluated, and one or more contractors is/are awarded a contract. Under the terms of the contract/s, the contractor/s deliver/s the system to the government, who in turn performs testing and evaluation. [Ref. 2:p. 22]

3. Acquisition Milestone Process

As the acquisition process evolves, it moves from a paper description of a concept to actual hardware that will ultimately go into production. Contractors whose concepts are not feasible are eliminated during the developmental phases until a production contractor is ultimately chosen. There are four significant points at which key decisions are made during the acquisition process. [Ref. 2:p. 24]

a. Milestone 0 Decision

The first key decision (Concept Exploration and Definition) is made at the onset when the need has been identified in terms of the mission need. Once a system need has been identified, a military service must formally request program initiation at a Defense Acquisition Board (DAB) chaired by the Under Secretary of Defense for Acquisition (USD(A)). The service must also have requested and obtained funding prior to the DAB review.

b. Concept Exploration/Definition Phase

Approval at Milestone 0 authorizes the start of the Concept Exploration/Definition phase. An acquisition strategy is developed, and estimates and goals are defined in terms of cost, schedule and performance expectations. Various concepts are presented by contractors with the best concept/s chosen to continue further development.

c. Milestone I Decision

A second decision point (Concept Demonstration and Validation) is then scheduled for a DAB review to authorize the start of another phase known as Concept Demonstration and Validation. Alternative system design concepts are carefully screened and trade-offs on technical approaches are evaluated by the service. Concepts are demonstrated via advanced development models, simulation or other means, and those with the greatest potential and technical feasibility are chosen to move into the next acquisition phase.

d. Concept Demonstration/Validation Phase

During the Demonstration and Validation phase many administrative and technical concerns are addressed. Cost analyses, schedule estimates and performance criteria must be at an acceptable level. Engineering and technical requirements must prove to be obtainable, and trade-offs must be reviewed before the next milestone review is scheduled.

e. Milestone II Decision

The third key decision point (Full Scale Development) grants approval to build full scale weapon system models. The goal of this phase is to select a final prototype that is fully documented, tested and producible.

f. Full-Scale Development Phase

Competing systems and support subsystems are fully developed and tested and a winner chosen to go into production. The winning system must not only pass developmental and operational tests, but must be evaluated as affordable before a production decision is made.

g. Milestone III Decision

The final decision point is to produce the weapon system. This decision is one of the most important because it marks the end of Research and Development and defines the weapon system that is to meet the mission threat.

h. Full-Rate Production Phase

Once the DAB approves the start of production at Milestone III, the system is deployed and must be supported. Milestone III not only approves production, but ensures that logistics support has been well planned so that personnel are trained to operate and maintain the system once it is deployed.

i. Milestone IV and V Decisions

After several years, Milestones IV and V are scheduled to determine whether the system effectively meets the mission need, how the system should be improved to meet the threat or whether it should be completely replaced.

B. ACQUISITION STRATEGY

"Ideally, the acquisition strategy is structured at the outset of the program to provide an organized and consistent approach to meeting program objectives within known constraints." [Ref. 4:p. 3-1] The acquisition strategy is an overall plan to execute a program, and should be developed within ninety days of a Milestone 0 approval. The acquisition strategy establishes the program objectives in writing, gives the program direction, and lays out assumptions and alternatives. [Ref. 4:p. 3-1]

1. Acquisition Strategy Principles

In order to meet the program objectives the acquisition strategy must meet established principles: realism, stability, flexibility, resource balance, and controlled risk. [Ref. 5:p. 3-9]

a. Realism

Realism in the acquisition strategy implies that the program has attainable goals and objectives. If the strategy is not realistic, the program will likely incur problems. The shortfalls may be in terms of schedules, costs or even technical performance. Lack of realism in the acquisition strategy can easily foster program failure. The simplest way to accomplish realism is to research, study and understand the requirements and their constraints.

b. Stability

Acquisition strategy stability is promoted by disallowing negative circumstances to influence the program goals. If stability is not maintained and a single aspect of the program begins to falter, the entire program can come under scrutiny with all estimates and expectations becoming questionable. The stability characteristic is maintained in programs that are under complete control of their managers and no doubts about direction exist, programs that develop high-level support, and programs where lasting commitments have been made.

c. *Flexibility*

While stability is directed at restricting the changing of program objectives, it is recognized that certain changes are inevitable. The acquisition strategy must demonstrate the flexibility to allow for unforeseeable changes and setbacks. Lack of flexibility in the acquisition strategy can result in instability in the program. In order to achieve flexibility the program approach should evaluate the areas where change is likely and plan for possible changes.

d. *Resource Balance*

Resources are notably limited and must therefore be carefully managed. If all the requirements and goals within a program can receive an adequate portion of the dedicated money, time and people, then resource balance can be realized. Setting priorities and recognizing risks are instrumental in preserving resource balance.

e. *Controlled Risk*

In the acquisition strategy sense, risk incorporates four key elements: the probability of failure within a program; the cause of the failure; the ultimate effect of the failure; and the uncertainty associated with each of these. Controlled risk is the most critical principle of the acquisition strategy. All efforts in terms of the four previous principles should be made to minimize risk. Successful risk analysis and assessment result in controlling and minimizing risk.

2. Acquisition Strategy Structure

The formal structure of the acquisition strategy involves three specific areas of interest: strategic, technical and resource.

a. Strategic

The strategic concerns deal with the broad and comprehensive aspects of the acquisition strategy. Meeting the mission need, in terms of the national objectives and the security threat, is of concern at this level. The goals and objectives of the program and the prioritization of those are strategic issues, also. Time, money and technical constraints, as well as other critical program issues will be addressed at this point. Finally, market influences, primarily industrial but also political, are of strategic concern.

b. Technical

In the technical area, the concerns range from design to deployment with everything in between. Test and evaluation, reliability, supportability and maintainability procedures are set forth as technical concerns. Performance trade-offs are at issue, and training is addressed. The matters of production and subsequent deployment are of technical concern.

c. Resource

While the strategic and technical interests may deal broadly and abstractly with resources, this issue is crucial enough to stand alone. Resource concerns deal with managing time, money, personnel and facilities for the acquisition strategy and the program.

C. CONTRACTING PROCESS

"System acquisition process means the sequence of acquisition activities starting from the agency's reconciliation of its mission needs, with its capabilities, priorities and resources, and extending through the introduction of a system into operational use or the otherwise successful achievement of program objectives." [Ref. 3:p. 3] Contracting is part of the acquisition process but is one of the most important since it defines the terms and conditions in which contractors develop and produce weapon systems. During a typical acquisition there are several contracts awarded to help achieve the goals established for each acquisition phase. The contracting process normally incorporates the following sequence of activities:

- The Acquisition Plan
- Statement of Work
- Procurement Request
- Commerce Business Daily Synopsis
- Solicitation
- Technical Evaluation
- Cost Analysis
- Negotiations
- Contract Award
- Contract Administration
- Contract Modifications
- Completion or Termination

Each of these steps of the contracting process is discussed in some detail in the following sections.

1. The Acquisition Plan

While the acquisition strategy is a broad course of action developed to execute a program, it yields a decidedly precise Acquisition Plan which focuses on concrete specifics and lays out the contract strategy. Acquisition Plans are required for all programs with a development cost greater than two million dollars and a total production cost of fifteen million dollars or a production cost of five million dollars per year (FY80 dollars). [Ref 5:p. 8]

2. Statement of Work

The Statement of Work (SOW) prescribes the non-specification work to be performed by the contractor. Non-specification work is determined by stating the objectives, defining the scope and approach, providing background information, establishing a means for reporting and other tasks not covered in the technical documents. The SOW is the basis for source selection and the standard by which the contractor is judged once the contract is awarded.

3. Procurement Request

The procurement request (PR) is a funding document prepared by the program office. It also describes the services and quantities required under the terms of the contract.

4. Commerce Business Daily Synopsis

At this point the government normally places a synopsis in the Commerce Business Daily (CBD), a Department of Commerce publication to attract contractor competition. It is a marketing technique required by the Competition in Contracting Act of 1984 whenever a competitive procurement is expected to exceed $25K or when a sole source contract is estimated to be $10K or greater. The purpose of synopsizing a potential sole source procurement is to attract possible competition. The CBD synopsis is a brief one to two paragraph description of a Federal Government requirement. Interested contractors may then contact buying activities and request a complete description of the government's requirements. The government provides that information in a solicitation package known as a Request for Proposals (RFP) or Invitation for Bid (IFB).

5. Solicitation

The two methods of contracting are sealed bid or negotiation. The procedure for solicitation process differs depending on the complexity of the procurement and cost information available to the government.

a. Sealed Bid

The sealed bid method is used primarily for recurring items when there is more than one competitor and discussion with the vendors is not necessary. The government issues an IFB solicitation and allows enough time for prospective firms to prepare and submit their sealed bids. At a specified date and time the government opens the bids and awards the contract to the lowest qualified bidder. This award is based on price-related factors alone. [Ref. 6:p. 233]

b. Negotiation

The negotiation method is used when discussion, oral or written, is desired and necessary. Therefore, it is the most common method used for major systems acquisition. For this method the government issues a Request for Proposals (RFP) solicitation describing the requirement including source selection criteria. Interested and qualified firms then submit their proposals for review and selection. [Ref. 6:p. 232]

6. Technical Evaluation

In the case of sealed bids, little, if any, technical evaluation is required. All qualified bidders must meet the minimum technical requirements. However, a technical evaluation will be conducted when a negotiation is required. Criteria may include such factors as design approach, system engineering experience, management ability, and technical capability of the vendor.

7. Cost/Price Analysis

Cost analysis is accomplished on each proposal. Cost analysis is a detailed review of material, labor, and overhead costs and is used as a basis for negotiating with contractors.

Price analysis is simply looking at the bottom line without a thorough review of how that bottom line was reached. It is used when sealed bidding is the procurement method chosen. Price analysis techniques include comparing contractor proposal prices with each other, and comparing them to earlier similar proposals and catalog prices.

8. Negotiations

Negotiation involves all of the terms and conditions of a contract including cost. While both the government and the potential contractor strive to optimize their own position during the negotiations, they also attempt to obtain a mutually acceptable agreement on requirements for performance, schedule and cost.

9. Contract Award

a. Selection

Under the sealed bid method of contracting a responsible low bid usually results in a contract award. If the contract is negotiated, the selection is based on a formal process for major weapon systems. The Secretary of a military service normally appoints a Source Selection Authority (SSA), a Source Selection Advisory Council (SSAC) and a Source Selection Evaluation Board (SSEB) to accomplish this task. The SSEB evaluates the technical and cost merit of each proposal (technical evaluation and negotiations are addressed in steps 7 and 8 above) and submits a report to the SSAC, who assigns predetermined weights and recommends a selection to the SSA. "The SSA then selects the winning contractor or contractors based on (1) comparative evaluations of proposals, (2) costs, (3) risk assessment, (4) past performance, (5) contractual considerations, and (6) surveys of contractor capabilities." [Ref. 2:p. 30]

b. Contract Types

At the most basic level, there are two types of contracts: fixed-price and cost-reimbursement. The amount of risk the government calculates into the program determines which type of contract is used. These basic types are further defined and categorized.

(1) Fixed-Price

A fixed-price contract entails the delivery of the items by the contractor for the specified price or less. This may hold risk for the contractor but not necessarily for the government. Fixed-price contracts include the following:

- Firm fixed price

- Fixed price with economic adjustment
- Fixed price incentive firm target
- Fixed price level of effort

The above fixed-price contracts are simply different versions designed to incentivize contractors' cost ceilings. If they meet or beat these ceilings, additional profit may be awarded based on a predetermined formula in the contract.

(2) Cost-Reimbursement

Cost-reimbursement, or cost-plus, contracts involve the contractor planning to provide the product or service for an estimated amount, plus a fee. The basis for payment is contingent on the allowability of cost applied to the task at hand. If the government accepts the costs as allowable and allocable, the contractor is paid along with some profit (fee). Based on this definition, the government assumes all financial risk, but this is necessary when systems are being developed for the first time with functional specifications, unknown designs and technical risks that are difficult to price out in advance of contract award. Types of cost-plus contracts include the following:

- Cost plus fixed fee
- Cost plus incentive fee
- Cost plus award fee

10. Contract Administration

Contract administration and monitoring are performed both technically and administratively. The monitoring will involve written reports, formal and informal meetings and ongoing observation of the contractor's progress. Constant and persistent monitoring may preclude long term contractor deficiencies.

11. Contract Modifications

Modifications to a contract are often required. Unfortunately, circumstances change, and the need to modify may come on the part of the government or contractor, depending on change in requirements or change in deliverables. In most cases, modifications require renegotiation to establish a fair and reasonable price for the task the contractor is to accomplish.

12. Completion or Termination

Finally, a contract will end in one of two ways: completion or termination. Completion means successful delivery of the finished product. In the case of termination it can be for convenience of the government because the item/s is/are no longer required or because the contractor defaulted on some term or condition within the contract.

D. CONCLUSION

This chapter has provided a broad description of the defense acquisition process, acquisition strategy development and the contracting process. Relative terms and concepts have been introduced to establish a working basis. In Chapters IV and V these concepts will be applied to discuss and evaluate the Army's Acquisition Plans for SINCGARS and MSE.

III. THE ARMY COMMAND AND CONTROL SYSTEM

A. INTRODUCTION

Single Channel Ground and Airborne Radio System (SINCGARS) and Mobile Subscriber System (MSE) are two of the key communications elements for the Army Command and Control System (ACCS). The purpose of this chapter is to briefly define ACCS, to describe and discuss its subsystems, and to introduce it as background material before analyzing the acquisitions of MSE and SINCGARS.

B. THE ARMY COMMAND AND CONTROL SYSTEM

With the growing importance of effective Command, Control, Communications and Intelligence (C3I), the Army has taken great efforts to establish automated programs to meet these expanding needs. "The concept of the Army Command and Control System (ACCS), as the umbrella for the computer network is known, is considered to be sound by members of Congress and its investigative arm, the General Accounting Office." [Ref. 7:p. 9] In order to manage these growing programs, the Army has assigned a Program Executive Officer (PEO) for Command and Control (C2) systems to oversee the management of the battlefield C2 subsystems. A PEO for Communications systems has also been established with several Program Managers (PM's) subordinate to him, two of which are the PM for SINCGARS and the PM for MSE.

1. Components of ACCS

The means by which Army commanders employ and sustain forces in a theater of operations includes the facilities, equipment, communications, procedures, and personnel.

The ACCS is comprised of various systems located at different echelons. At echelons corps and below, ACCS' subordinate system is the Army Tactical Command and Control System (ATCCS). This system is in turn made up of the following subsystems:

- The Maneuver Control System
- Forward Area Air Defense Command, Control and Intelligence
- The All Source Analysis System
- The Combat Service Support Control System
- The Advanced Field Artillery Tactical Data System

These battlefield systems control the Army's five Battlefield Functional Areas (BFA's): maneuver, air defense, intelligence, combat service support and fire support. These are automated systems in various stages of development, with differing demands on communications networks. The key is that they must be successfully linked together for the Army to function as a synchronized entity on the battlefield.

2. Communications for ACCS/ATCCS

Communications support requirements for the above BFA's fall into the following three broad categories:

- Real-time data distribution
- Combat net radio
- Area switching communication

These networks bind the BFA's together, and provide the overall command and control connectivity. Figure 1 below depicts this relationship.

ARMY TACTICAL COMMAND AND CONTROL SYSTEM

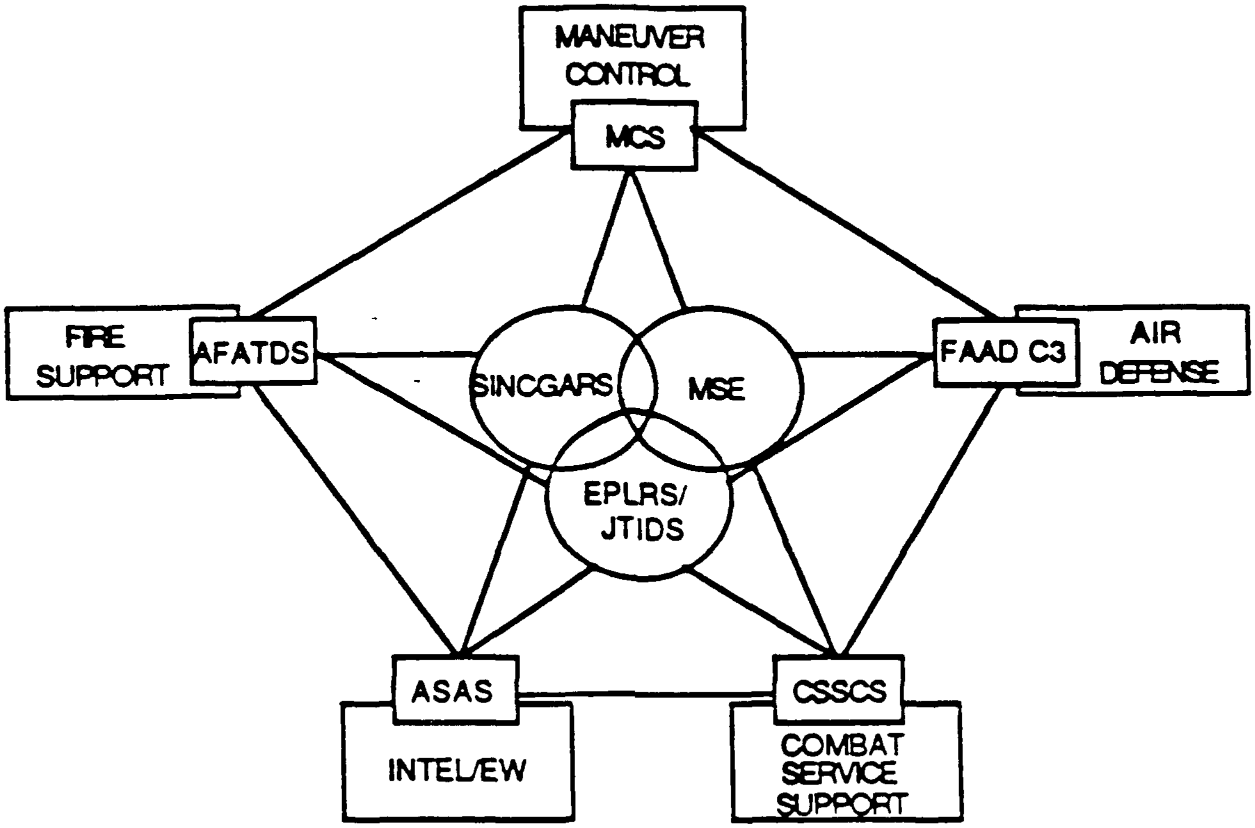

FIGURE 1 [Ref. 8]

The real-time data distribution requirement will be satisfied by the Joint Tactical Information Distribution System and Enhanced Position Location Reporting System (JTIDS/EPLRS). These systems are not scheduled for fielding until Fiscal Years 92/93 and are not addressed in this study. Single Channel Ground and Airborne Radio System will be used as the combat net radio and is the focus of Chapter IV of this thesis. Chapter V covers Mobile Subscriber Equipment, which will function as the area common user switched communication system.

C. CONCLUSION

The Army Tactical Command and Control System is composed of several automated subsystems which require sophisticated communications support. This support entails three things: data transport, voice (radio), and voice (telephone) capabilities. Data transport will not be addressed in this thesis, since fielding of this capability remains in the indeterminate future. Voice communications, radio and telephone, are provided at the tactical level by SINCGARS and MSE. These two systems, currently being fielded, are the focus of this study. We will address the acquisition of SINCGARS in the next chapter.

IV. ANALYSIS OF THE ACQUISITION PLAN FOR SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM

A. OVERVIEW OF SINCGARS

As indicated in Chapter III, Single Channel Ground and Airborne Radio System (SINCGARS) is designed to satisfy the Army's requirement for a combat net radio system in the Army Tactical Command and Control System.

1. System Description

The SINCGARS concept uses Very High Frequency-Frequency Modulation (VHF-FM) spread spectrum to transmit and receive voice, data, and record traffic and is available in manpack, vehicular and aircraft configurations. It is designed for NATO interoperability and nuclear survivability. By using an Electronic Counter-Counter Measure (ECCM) device, SINCGARS operates in a hostile Electronic Warfare (EW) environment and prevents enemy jamming and interception. The device uses a frequency hopping technique where the signal quickly hops across the entire frequency range at about one hundred times per second. The SINCGARS equipment replaces current equipment one-for-one.

2. Background and History

A Milestone 0 decision was made in December 1974. The Required Operational Capability (ROC) document was approved by the Department of the Army (DA), and in January 1975 a Deputy Chief of Staff for Operations (DCSOPS) task force set out to explore and define the concept. Thus Concept Exploration/Definition began. The recommended approaches for ECCM that resulted were slow frequency hopping and fast frequency hopping.

In February 1976 the Milestone I decision was made to award contracts for exploring both of these methods. Since the Vice Chief of Staff, Army (VCSA) wanted to shorten the delivery schedule, the SINCGARS program next moved from advance development, skipping Milestone II (Full-Scale Development), directly into production, with a significantly truncated engineering development phase. This strategy substantially increased program schedule risk. Contracts were awarded in April 1978 to Cincinnati Electronics, International Telephone and Telegraph/Aerospace Optical Division (ITT/AOD) and Rockwell-Collins, and Phase III was set in motion. The Cincinnati-Electronics and ITT/AOD production contracts were Cost Plus Incentive Fee (CPIF) for the slow frequency hopping devices and the Rockwell-Collins was Cost Plus Fixed Fee (CPFF) for fast frequency hopping techniques.

In 1980 funding problems began. A financial shortfall was identified and limits were placed on the developing contractors. Delays resulted, contracts were modified and cost ceilings were established. This was immediately followed by an Under Secretary of the Army request to reexamine the two frequency hopping approaches. A Milestone II decision to discontinue development of the fast frequency hopping concept was made in December 1981, and the Army was to concentrate on the slow frequency hopping method to speed up the development process.

A Milestone IIIa decision, Low Rate Initial Production (LRIP), was made in September 1983. After nine years of development, the system had not yet been completely developed and tested. Finally, a Milestone III decision, Full-Rate Production (FRP), was granted in December 1983 when ITT/AOD was awarded a single year production contract with yearly options for the ground radio. A similar contract for the airborne radio was awarded to ITT/AOD in May 1985.

Production testing almost immediately identified serious problems with the system. Test failures resulted in a lengthened test phase and production delays. Reliability was the central issue. Progress payments to ITT/AOD were stopped in November 1985, and alternatives were examined. In 1986 nine different vendors' products were tested using a Non-Developmental Item (NDI) approach to replace the ITT/AOD development failures, but none could meet the reliability requirements. Meanwhile, ITT/AOD established a Test, Analyze and Fix (TAAF) process to redesign the problem radios. In 1987 ITT/AOD corrected failures and claimed to have improved reliability. The Army resumed progress payments in May 1987.

In January 1988, two and a half years after the contract was awarded, the ITT/AOD radios successfully completed testing, were accepted, and delivery and Follow-on Test and Evaluation (FOT&E) began. Successful FOT&E was accomplished in May 1988. Meanwhile, permission had been granted in 1987 to seek a second source for the SINCGARS frequency hopping radio, because new requirements for Air Force and Marine versions were too numerous for a single contractor. General Dynamics received a second source contract in July 1988. The version was not required to be internally identical but had to prove compatibility in form, fit and function.

SINCGARS fielding began in July 1988, thirteen and a half years after the need was identified.

B. THE ACQUISITION PLAN

The SINCGARS Acquisition Plan was released in November 1982. This section discusses the following elements of the Acquisition Plan:

- Program Funding

- Program Risk
- Integrated Logistic Support Planning Concept
- Application of Design to Cost
- Test and Evaluation Approach

1. Program Funding

In the November 1982 Acquisition Plan, planned funding for SINCGARS was broken out into Research and Development (R & D) and production for the fiscal years (FY) through FY86 as indicated in Table 1 [Ref. 9:p. 5]. The Selected Acquisition Report (SAR) dated December 1988 updated and summarized the estimates as shown in Table 2 [Ref. 10:p. 6]. While the Acquisition Plan only estimates costs out to FY86 for a total of $582.6 million, the SAR extends the estimates through FY03.

PLANNED FUNDING FOR SINCGARS (1982)

(dollars in millions)

	FY81& PRIOR	FY82	FY83	FY84	FY85	FY86
R & D	5.3	15.3	14.1	11.4	4.0	2.6
PRODUCTION	-	-	19.8	51.3	139.4	259.4

TABLE 1

UPDATED FUNDING ESTIMATES FOR SINCGARS (1988)

(dollars in millions)

	FY89& PRIOR	FY90	FY91	FY92-FY03	TOTAL
R & D	162.7	11.9	1.4	25.9	201.9
PROCMNT	629.1	350.0	347.5	4303.1	5629.7
TOTAL	791.8	361.9	348.9	4329.0	5831.6

TABLE 2

2. Program Risk

Program risk in the Acquisition Plan is defined through the three categories of technical, cost and schedule.

a. Technical Risk

The overall technical risk was considered moderate in the 1982 Acquisition Plan with many positive aspects in the advance development phase. However, the positive aspects dealt primarily with planning and administrative issues. A number of "areas of appreciable risk" were also identified, and these dealt with the more technical features. The deficiencies ranged from necessary design changes to technical packaging. The Acquisition Plan recognized that the "packaging approach could have an adverse effect on system reliability."

b. Cost Risk

Cost risk was considered low based on the support received for the program, which included support for possible future changes.

c. Schedule Risk

Not surprisingly, the schedule risk was high. The need to field SINCGARS quickly, the decision to shorten the schedule, and thus defer the engineering development phase, and the increased production rate were recognized as potential problems that could only exacerbate this risk. In light of the initial assessment of schedule risk as high, these subsequent programmatic decisions were questionable and ultimately proved detrimental.

3. Integrated Logistic Support Planning Concept

Planning for logistic support was addressed in great detail. An Integrated Logistic Support (ILS) management team was established in the early program stages and support from the necessary organizations was gained. Among other items the concept included design, test, personnel and safety elements. Maintenance planning went to the level of indicating who would maintain which items and where. Supply support addressed the fielding of equipment, delivery of spares and regular reporting. The plan established training standards, devices and teams. Ultimately, the ILS planning concept was extremely thorough, though it did not anticipate the subsequent second source production. Fortunately, the second contractor was required to support the original umbrella ILS plan.

4. Test and Evaluation Approach

A specialized test program was developed to replace the standard prescribed testing procedures that were waived by Department of the Army. The customized test included three elements.

a. Limited Development and Operational Testing

The first phase of testing (Limited Development and Operational Testing) included reliability, maintainability and physical quality standards. This testing would determine how different SINCGARS was from current equipment.

b. Maturity Development and Operational Testing

Maturity testing would test the specific contractor's equipment in terms of reliability, maintainability and supportability.

c. Production Acceptance Testing

Finally, the production acceptance testing was more comprehensive and tested the actual technical mechanism of the system and equipment.

C. ACQUISITION/PROCUREMENT APPROACH

The procurement approach was addressed in the November 1982 SINCGARS Acquisition Plan. Quite naturally, negotiation method was used with the government soliciting through a Request For Proposals. The proposed sources were the same firms who were currently working under government contract on the development of the system: Cincinnati Electronics and ITT/AOD.

1. Contract Type

While the contracts for development of the methods of frequency hopping were cost-reimbursement types, specifically CPIF and CPFF, the type of contract for production was a Firm Fixed Price (FFP) contract. FFP contracts place total responsibility for cost, schedule and technical requirements on the supplier. The Acquisition Plan called for a four-year multiyear contract to be awarded to a prime contractor, while the government would reserve the option to award a second source contract and require the prime contractor to provide instruction to the second source on how to manufacture the equipment. However, in December 1983 a single year FFP contract with three option years was awarded to ITT/AOD, and no second source was initially sought. General Dynamics was awarded a second source contract in July 1988 with the government providing the contractor with form, fit and function specifications.

2. Alternative Approaches Considered

An alternative procurement approach was considered in the Acquisition Plan. The alternative approach called for a five-year multiyear contract to be awarded in FY83 and then another three-year multiyear contract awarded in FY86 to a second source. This alternative was not selected due to the quick production requirements and the desire to eventually select a second source if required.

3. Milestone for Procurement Cycle

The November 1982 Acquisition Plan optimistically called for a contract award by June 1983. The actual December 1983 award missed this milestone, but only barely. The SINCGARS program was on track up to this point.

D. TECHNICAL AND SECURITY ISSUES

1. Performance

The technical performance of SINCGARS is impressive, especially regarding interoperability, reliability, and flexibility.

a. Interoperability

The SINCGARS family of manpack, vehicular, and airborne radios must be interoperable with a wide variety of systems. In single channel mode it must be able to interface with NATO systems. It must be used with TACFIRE (tactical automated fire control), Patriot, Chaparral and SHORAD (short range air defense) weapons systems. It must interface with facsimile data systems, various communications security (COMSEC) devices, and radio-wire interface units. These interoperability requirements were solved by ITT through an ingenious design based on different internal modules, as well as different mode capabilities.

b. Reliability

As discussed previously in this chapter, reliability problems have plagued SINCGARS. In 1986 it failed to meet the Army's standard of 1250 hours for mean time between failure (MTBF). After restructuring the program, ITT achieved an MTBF of 1700 hours. This reliability greatly exceeds that of the current family of FM voice radios and will significantly decrease maintenance costs during the life-cycle of the system.

c. *Flexibility*

The heart of the SINCGARS family is a basic five watt transmitter/receiver unit. Its amplifier or battery case fits in all current standard mounting assemblies, so the manpack radio can be easily converted into a vehicular-mounted or airborne system. This convertibility extends to the Air Force and Marine Corps versions.

2. Security

Increased survivability and security are achieved by SINCGARS through its frequency hopping and communications security features.

a. *Frequency Hopping*

Frequency hopping is an electronic counter-counter measure (ECCM) that provides a great degree of protection from enemy surveillance and jamming. Its hop rate of greater than 100 hops per second can be set among any of 2320 channels, spreading the spectrum of the emitted signal across a wide bandwidth. The pre-arranged sequence of hops can be loaded either directly into the front of the radio via cable or it can be electronically received.

b. *Communications Security*

Communications security capability is provided by the standard KY-57/TSEC or VINSON equipment. This equipment has proved reliable and sustainable, and will not require any new training. A version with an integrated COMSEC module is also planned.

E. FIELDING FACTORS

With production already begun at ITT and General Dynamics expected to begin second source low rate initial production (LRIP) in 1991, the total procurement of SINCGARS was expected to run to around 300,000 radios at a total cost of around five billion dollars. But initial fielding in Texas and Korea revealed several additional problems with the radio. The most important one was the discovery of possible radio frequency interference between SINCGARS and MSE components. The problem has recently been corrected.

This, coupled with MSE fielding at Fort Hood, necessitated changing the fielding schedule of SINCGARS. With current budgetary restrictions and force structure changes imminent, the total procurement of SINCGARS may fall to as few as 185,000 units for the Army and Marine Corps. [Ref. 11:p. 31] The Army desires to make cuts, if any, at the end of the production schedule, not to slow down the established production rate.

F. STRENGTHS AND WEAKNESSES OF THE SINCGARS ACQUISITION PLAN

1. Strengths

An analysis of the SINCGARS Acquisition Plan reveals the following strengths: replacing a family of radios in total, aggressive program management through use of contractual incentives, and seeking a second production source. Many acquisitions of communications equipment fail because individual components are upgraded while others are not. This generally overtaxes the technical capabilities of the older equipment while underutilizing the attributes of the new. SINCGARS replaces virtually all of the tactical VHF/FM radios in the Army. New Air Force and Marine Corps radios are also variants of this family. This insures satisfaction of various performance parameters such as interoperability and adaptability, and helps guarantee uniform reliability and maintainability considerations.

When early reliability requirements were not met, the Army's decision to stop progress payments to ITT forced the company to develop a Test, Analyze and Fix (TAAF) process. As of November 1985, ITT "began to bear all costs of the program." [Ref. 12:p. 44]

Concerned that the Army might quickly turn towards the new Non-Developmental Item (NDI) method and find an alternate source, ITT was prompted to act quickly to solve the technical problems. Forty-five million dollars of its own budget and eighteen months later, ITT had solved the reliability problems and the Army resumed payments. [Ref. 12:p. 45] The Army and industry had also gained valuable experience in the search for an NDI solution, which would subsequently pay off when second source selection was approved. General Dynamics was quickly able to meet form, fit, and function requirements.

The second source selection also proved beneficial. It naturally provided competitive incentives to the original prime contractor since contract renewals became contingent on its performance relative to another firm. Additionally, new requirements for the system from the Air Force and the Marine Corps would have severely tested one company's production capability.

Thus, the Army's decision to replace the entire family of VHF/FM radios and its aggressive program management were definite strengths of the program. Because of these, fielding began in July 1988, thirteen years after the mission need was identified. This is an average length of time for so comprehensive a DOD procurement, and is especially good in light of the problems that beset the program.

2. Weaknesses

The weaknesses of the program can be traced to the aggressive attempt to force SINCGARS into production without adequate engineering development. Both the contractor and the Army had agreed that it could be done. Perhaps if this acquisition phase had been completed as originally planned, later problems might not have occurred. As Graf said, "Moving directly from the advanced development to high rate production required the application of extensive production engineering support to finalize the SINCGARS design." [Ref. 13:p. 43] That translates to time and money lost.

As discussed in Chapter II, program managers must always balance tradeoffs between cost, schedule, and performance. In this case, the decision to speed up the schedule caused a temporary degradation of performance and ultimately added to cost. The original acquisition plan had recognized the appreciable technical and schedule risks. Unfortunately, these predictions proved accurate.

G. CONCLUSION

In summary, the acquisition of SINCGARS has been troublesome, with significant schedule and performance problems. The decision to bypass the engineering development phase had long term negative effects on the program. Facing moderate technical risk and relatively state-of-the-art technology, engineering development should not have been sacrificed to improve its delivery schedule. In the end it did not work, and SINCGARS viability is still questionable, though it possesses many impressive performance characteristics. Hopefully, valuable lessons were learned, or costly mistakes will be repeated. Systems engineering simply cannot be ignored.

V. ANALYSIS OF THE ACQUISITION PLAN FOR MOBILE SUBSCRIBER EQUIPMENT

A. OVERVIEW OF MSE

Mobile Subscriber Equipment (MSE) is the Army's revolutionary solution to the need for replacing twenty year old equipment and to provide the area switching communications system for the Army Tactical Command and Control System.

1. System Description

Mobile Subscriber Equipment is an automatic, digital switching system that provides secure voice, high-volume data and facsimile transmission to both mobile and stationary users on the battlefield. It has single- and multi-channel capability and is interoperable with North Atlantic Treaty Organization systems. With MSE a large portion of the wire and cable on the battlefield is eliminated.

The concept is based on a system used in the French and Belgian Armies that was developed by Thompson-CSF. That system is known as RITA (Reseau Integre de Transmission Automatique) and was fielded initially in 1981. [Ref. 14:p. 36]

2. Background and History

In October 1979 a Joint Operational Requirement was approved for MSE, and by January 1980 the Mission Element Need Statement was approved by the Office of the Secretary of Defense (OSD), thus providing a Milestone 0 approval to start the Concept Exploration/Definition Phase. Initially, there was great effort expended to implement a cooperative development program with the Federal Republic of Germany. However, after a year of unsuccessful negotiations, the Office of the Secretary of Defense decided to proceed as a U.S. unilateral program in January 1981.

For the next year and a half, the Concept Exploration/Definition Phase required a constant revalidation of the need for MSE and redefinition of user requirements. Numerous meetings were held at the General Officer level with the same goal continuously surfacing: MSE should meet the users' minimum essential needs. In August 1982 the direction was given to explore the two concepts of procuring an existing system from a foreign source or allowing American industry to produce an MSE system.

Based on the Army's experience with RITA, the decision was made to procure off-the-shelf equipment using a Non-Developmental Item (NDI) approach, buying from both U.S. and foreign sources. This strategy was based on the premise that most of the development phase could be eliminated, thus bypassing Milestones I and II.

In May 1983 the Acquisition Plan was approved for implementation. It called for awarding a production contract by April 1984. However, in July 1983, based on an Army Chief of Staff review, the decision was made to change the role MSE would have on the battlefield and expand its area of deployment. These changes necessitated a rewrite of the Acquisition Plan, which was finalized in June 1984. The revised Acquisition Plan then set a goal of awarding a production contract by May 1985.

A solicitation was issued in July 1984, and proposals from GTE and Rockwell/Collins were received in October 1984. After lengthy negotiations, the contract was finally awarded to GTE in December 1985. Finally, six years into the program, production began.

Meanwhile, "in 1985, MSE was declared exempt from Gramm-Rudman-Hollings budget controls. This put MSE on par with SDI (Strategic Defense Initiative) and other high-priority programs which enjoy some degree of protection from budget cuts." [Ref. 15:p. 66] Therefore, the acquisition strategy seemed to be on course.

Fielding of MSE began in February 1988, eight years after the need was first identified, but less then two and a half years after the contract was awarded. In retrospect, the success of this program can be attributed to the off-the-shelf, NDI approach, combined with budget support gained by the Gramm-Rudman-Hollings exemption.

B. THE ACQUISITION PLAN

As stated in the previous section, the original Acquisition Plan approved in 1983 was rewritten in June 1984. The cover letter requesting approval of the June 1984 acquisition plan states that this version "is an update of an acquisition plan previously approved." Discussion and analysis of the two plans follows.

1. Program Funding

While the original acquisition plan addressed MSE to support only the level of corps area communications and totaled $633.1 million over a four year period, the updated acquisition plan required fielding into the division as well as corps area and was broken out as indicated in Table 3. [Ref. 16:p. 3]

PLANNED FUNDING FOR MSE (1986)

(dollars in millions)

	FY85	FY85	FY87	FY88	FY89	FY90	TOTAL
CONTRACT RQMNTS	104.4	371.2	645.5	847.4	798.6	1022.2	3789.3
INITIAL RPR PARTS	4.2	81.0	113.6	69.1	162.9	79.2	510.0
GOV'T IN-HOUSE SPT	1.4	1.4	1.5	1.5	1.6	1.7	9.1
TOTAL	110.0	453.6	760.6	918.0	963.1	1103.1	4308.4

TABLE 3

2. Program Risk

The original acquisition plan determined the technical, schedule and cost risks to be moderate due to the possible complexity of assuring that MSE would properly interface with other tactical communication systems on the battlefield. In the revised acquisition plan, which entailed including support to the division area, the problem of corps/division interface was eliminated, and the technical, schedule and cost risks were categorized as low.

3. Integrated Logistic Support Planning Concept

Since the MSE procurement involved a system that basically already existed, the Integrated Logistic Support (ILS) planning concentrated on utilizing support features that were already in-place. The concept required the winning contractor to include ILS planning in his proposal, to guarantee spares, and to provide software support to the system.

4. Test and Evaluation Approach

The test and evaluation approach for MSE required that all systems proposed meet the performance requirements, and the offered proposals include a suggested test plan for the system. This test plan would then become an item for negotiation, and once agreed upon, would be included in the winner's contract as a binding part of the contract. Training and Doctrine concepts would also be tested upon delivery of the system.

C. ACQUISITION/PROCUREMENT APPROACH

As stated previously, using an NDI acquisition strategy meant eliminating most of the development stage, including major Milestone decisions and formal acquisition phases. That saves a great deal of time and money. The practicality of this approach was based upon the large number of firms, foreign and domestic, that already had such systems in production. Approximately ten suppliers were identified as qualified to submit proposals.

1. Contract Type

Competitive negotiations were utilized to award a Firm Fixed Price (FFP) contract to a team led by GTE as prime contractor in December 1985. More than thirty other subcontractors, including Thomson-CSF of France, Raytheon and RCA were involved in the effort. The FFP contract was awarded with five yearly priced option years; option year three has been implemented.

2. Alternative Approach Considered

Although alternatives were addressed in the acquisition plan, clear reasons for their dismissal were given, and no alternative approaches were seriously considered. NDI was the approach that was selected early on, and was a significant program driver.

3. Milestone for Procurement Cycle

The original March 1983 acquisition plan established a desired April 1984 contract award date; however, when the need arose to rewrite the acquisition plan, the estimated contract award date was necessarily shifted. The revised date was May 1985, but negotiations scheduled for February to April 1985 went longer than expected and moved the actual contract award date to December 1985.

D. TECHNICAL AND SECURITY ISSUES

1. Switching Equipment

Since the system replaces all corps and division assets, interface problems between automatic switchboards are eliminated. Forty-two switches comprise the corps network, providing a robust and survivable system capable of fast, flexible reconfiguration. Typically, software programs supporting networks of computers are not flexible and are costly to change, but systems and software management issues were resolved early on by sending teams of eventual network managers to France to learn and observe RITA in operation. [Ref. 17:pp. 18-21]

The flood-search call routing employed by these switchboards greatly increases the chances of reaching the called party, even should the network become partially degraded. This network advances the tactical army from the analog to the digital world, with commensurate increases in capability, efficiency, and speed. Near state-of-the-art technology is employed. The switches are made by GTE as downsized variants of their AN/TTC-39 digital circuit switch and their AN/TTC-41 unit level circuit switch.

2. Transmission Equipment

With more numerous nodes per area, the radio links between them are shorter. This allows lower power requirements and increases survivability by reducing chances of detection. It also allows closer proximity to command posts with lower profile antennas. The down-the-hill radio links eliminate long, time-consuming cable runs. The super high frequency (SHF) and ultra high frequency (UHF) radios used also provide greater channelization and better signal-to-noise ratios (SNR). GTE subcontracted these to Ericsson for the down-the-hill microwave radios and to Canadian Marconi for the UHF line-of-sight (LOS).

3. Subscriber Equipment

a. Digital Subscriber Voice Terminal (DSVT)

The DSVT provides encrypted digital voice to the tactical army. It also possesses a data port capable of up to 16 kilobits per second (kbps) transmission. The voice quality is excellent.

b. Mobile Subscriber Radio Terminal (MSRT)

The MSRT gives the tactical commander state-of-the-art cellular phone technology, with encryption for added security. This mobile secure radio-telephone is a DSVT connected to a very high frequency (VHF) radio. The data port also functions as above. The radio is from the RITA system.

c. Lightweight Digital Facsimile (LDF)

A ruggedized version of the office telecommunications facsimile, the LDF allows hard copy transfer across the battlefield. Though not state-of-the-art, it provides quick and broad dissemination of black and white orders and operations plans. Magnavox makes this machine.

4. Communications Security (COMSEC)

The issue of COMSEC is undoubtedly complicated by MSE. The network secures virtually all links. Complicated problems require complex solutions. Approved by the National Security Agency (NSA) the system electronically transfers keying information, greatly reducing the problems of paper material handling and destruction. The devices used were already in production, either in existing U.S. systems or as part of RITA. The systems control was also derived from the French.

5. Summary

In conclusion, MSE incorporates many near state-of-the-art communications technologies from diverse sources to provide a robust, survivable, mobile, reconfigurable network with a large array of sophisticated subscriber services. Many subcontractors provide equipment already in production and battlefield tested. Technically, the system vastly exceeds its predecessor. While the system has increased in complexity, security is guaranteed throughout the network.

E. FIELDING FACTORS

1. Timetable

The overall timetable from concept development to initial operational capability has been extremely short for so large a Department of Defense procurement. These typically average eleven to twenty years. [Ref. 2:p. 29] In contrast, MSE was first fielded in the spring of 1988, barely eight years from acceptance of mission need. Considering that this system replaces virtually every item in a corps signal brigade or a division signal battalion, this is even more impressive. But timetables that tight require comprehensive planning.

The Material Fielding Plan (MFP) is the document used by the Army to provide the gaining unit with all the information required to successfully prepare and field the new equipment. Generally, the MFP for MSE was extremely successful. It utilized a new concept called Total Package Material Fielding (TPMF) which provides for the inclusion of initial stockages of repair parts and Test Measurement and Diagnostic Equipment (TMDE) along with the end items. It also incorporated the unit-by-unit concept. Others have adequately addressed MFP deficiencies discovered during initial fielding at Fort Hood [Ref. 18:p. 64]. These problems included difficulty with the fielding schedule, warranty provisions, the maintenance support chain, establishment of a contingency signal support company, and test and evaluation. The program office and GTE have worked closely together to correct these problems. But, in general, the MFP for MSE has been successfully implemented in initial fieldings and has contributed to meeting the aggressive schedule.

The fielding schedule itself is extremely compressed. A typical division fielding schedule was eighteen weeks, and the first fielding was very close to that target. However, such compression has contractual ramifications and implications for readiness and training.

2. Contract Incentives

Since GTE is awarded contract extensions based on exercising yearly options, evidence of solid systems engineering and integration was required. The feedback loop for fixing problems identified during training and operational test and evaluation was extremely rapid. With obligations to myriad subcontractors under the FFP contract, GTE could ill afford time delays and aggressively solved problems as they occurred. This has significantly smoothed the fielding process. Subsequently, GTE was rewarded for this with contracts for systems control packages and packet switching product improvements. These substantial follow-on contracts provided ample incentive for success. This has proved a successful management technique.

3. Readiness and Training Impacts

Since the Army is fielding MSE a corps at a time, concerns about readiness for operational contingency missions were raised. Potential adverse effects were mitigated by unit-by-unit fielding and by establishing provisional organizations to provide necessary command and control interfaces during fielding. This is typified by the contingency signal support company mentioned earlier [Ref. 18:p. 79]. The compressed timetable also guaranteed minimal operational downtime. Since much of the equipment is similar to current inventory items, operator training has been fairly straightforward. Advance training of leaders and managers also contributed to rapid transition. In general, potentially adverse readiness and training impacts have been minimized.

4. Summary

In conclusion, the fielding of MSE has proceeded with very few delays. Numerous factors contribute to this success, but the combination of contractual incentives and unit-by-unit fielding has proved most instrumental. The extremely compressed timetable has been met by thorough planning and aggressive execution.

F. STRENGTHS AND WEAKNESSES OF THE MSE ACQUISITION PLAN

1. Strengths

Analysis of the acquisition of MSE reveals the following strengths: overall Army support, the NDI approach, and contractual incentives. The successes so far can be attributed to the commitment, active involvement, and support of senior Army officials. The exemption from budget control considerations previously mentioned was one example. The decision to purchase enough to field to the entire Army was another. Such support for a communications system is indeed rare.

The NDI approach saved the expense of much bureaucratic review and early milestone decisions by eliminating most of the development phase. Since development is frequently the most lengthy phase of a program, that decision alone has saved a great deal of time and money. Considering the current budget situation, MSE might not have been had the conventional process been followed.

Contractual incentives have clearly contributed to the success. With an FFP contract, GTE benefits from rapid fielding with few time delays. The Army benefits from having quick resolution to identified problems. GTE has also been rewarded for good work by the award of follow on contracts.

2. Weaknesses

Examination of MSE's acquisition reveals few glaring deficiencies. Generally, the weaknesses of the MSE acquisition can be attributed to the breakneck speed of the process. Most of them have been mitigated in some way or another. The original acquisition plan was vague and soon discarded. The sole-source procurement through GTE brings hazards if the firm fails in its obligations; so far GTE has not. Some felt the acquisition involved the purchase of too much foreign equipment. The prime contractor is quick to point out that about 70 percent of the money is spent in America, generating approximately 75,000 jobs [Ref. 19:p. 120]. Another charge is that the equipment will likely obsolesce at approximately the same time, since it was all produced at once. However, generators and trucks age at different rates than electronics, so there should be no drastic sudden degradation. These weaknesses seem overshadowed by the positive aspects.

G. CONCLUSION

In summary, the acquisition of MSE, from its NDI approach to its Total Package Material Fielding, unit by unit, for the Total Army, can be characterized a success. Though the initial plan and purpose may not have been clear, and the contract negotiations lengthy, the Army apparently has succeeded in the acquisition of this critical C3 system. With aggressive program management, positive contractual incentives, and consistent Army support, MSE's acquisition has been extremely smooth and rapid.

VI. COMPARISON AND CONTRAST

A. SIMILARITIES

The acquisitions of Single Channel Ground and Airborne Radio System and Mobile Subscriber Equipment bear many surface resemblances. Both are large scope communications systems replacing decades-old analog equipment with updated, near state-of-the-art technologies. Both function in the tactical arena, where interoperability and maintenance are key drivers. Both support the commander on the ground with robust survivable communications. Both provide essentially a secure voice capability, with only limited data transmission utility. These technical likenesses lead one to question whether one acquisition strategy would be appropriate for both.

Programmatic similarities also abound. Both acquisitions represent major program expenditures measured in billions of dollars. Both systems are provided by major U.S. prime contractors with excellent business reputations in the commercial and defense arenas. Support for both acquisitions has come from not only the communications communities, but senior Army and defense department leadership as well. Electronics and automation innovations have transformed the battlefield, generating an information explosion and requiring vastly increased communications capability. With MSE and SINCGARS, more sufficient means has now been supplied to control and channel this information effectively and efficiently.

B. DIFFERENCES

In spite of the above similarities, these systems' acquisition paths could not have been more different. The procurement of MSE followed a non-developmental item approach;

SINCGARS was acquired using standard Department of Defense acquisition methods. Mobile Subscriber Equipment logically grew out of ongoing communication system upgrades, and it supported the new AirLand Battle doctrine of corps and division continuity. The acquisition of SINCGARS was a typical replacement, one for one, of aging, expensive-to-maintain equipment. The total army, active and reserve, will receive MSE; SINCGARS may only go to the active component.

Another difference lies in the level of application within the Army Tactical Command and Control System. In Chapter III, we examined the battlefield functional areas of maneuver control, intelligence and electronic warfare, fire support, air defense, and combat service support. The area common user support across those functional areas is provided by MSE; SINCGARS supplies the combat net radio access. Corps and division echelons rely most on MSE to provide the pipeline throughput for all functional areas. The primary users of SINCGARS are found at brigade, battalion and company level, where emphasis is primarily on maneuver control and fire support.

The off the shelf procurement of MSE allowed the planners to focus better on the systems engineering aspects of the entire network. For SINCGARS, the engineers had to continually redesign plug in modules to meet increasingly complicated performance requirements. With MSE, the limitations of the components were known up front, and the program managers were able to devote tremendous energy to complex fielding and support plans. The SINCGARS program constantly reacted to performance failures and changing specifications; even now it must respond to performance problems unforeseen by engineers.

Using the NDI approach, MSE was successfully fielded to major Army commands nine years from statement of need. This is substantially quicker than the average for DOD procurements. In contrast, SINCGARS began fielding more than 13 years from identification of the requirement. Timing and reputation frequently determine the survival of major defense acquisitions. With its accelerated program, MSE capitalized on large defense expenditures in the early eighties. The SINCGARS effort was hampered by fits and starts, and its production dollars may feel the knife of sharp budget reductions.

C. CONCLUSIONS

Analysis of the acquisitions of MSE and SINCGARS reveals two clear conclusions. First, command, control and communications systems should be procured as complete systems, with corresponding careful attention to systems engineering. This prevents an applique or band-aid approach. Second, when taking advantage of recent innovations in commercial communications technologies, the off-the-shelf or NDI approach allows industry the opportunity to select from the complete range of commercially available products, and integrate them into robust, survivable military systems.

Commercial communications systems are, after all, not that different from military communications systems. While there is no civilian adjunct to the Stealth fighter, ITT and GTE have been providing communications services to business customers similar to military communications services for a long time. In fact, the cellular phone was first designed for our mobile time-conscious businesspeople. Since that technology suited the concept of the mobile commander constantly assessing changing battlefield conditions, it made sense to tailor the civilian innovation to the military application.

Of course, SINCGARS' frequency hopping feature had no civilian precedent, so, initially, an NDI approach would have been impossible. However, the engineering development stage was, therefore, even more critical for exploring all the ramifications of this technological innovation. The detrimental impact of the decision to skip engineering development for SINCGARS has been described in Chapter IV. The lesson is apparent. The NDI approach lends itself well to the acquisition of generic C3 systems for the tactical military arena, as long as they do not involve integrating absolute cutting edge technology. We have seen the success of MSE's acquisition in Chapter V.

The bottom line is that NDI should be used for C3 systems whenever possible. Our study has examined the acquisitions of MSE and SINCGARS in the contexts of overall DOD procurement policy, Army Tactical Command and Control Systems goals, practical technical and security considerations, and fielding results. It has found that, while no one approach may suffice in all cases, military communications systems generally will benefit from an off-the-shelf procurement strategy. Most technical innovations for the civilian market have military applications. The NDI approach enables contractors to focus on accomplishing their primary goal: to provide satisfactory products to consumers at reasonable profits. The Army is then free to plan for the most effective introduction of these new technologies into its battlefield missions. This optimizes the strengths of both institutions, and allows each to concentrate on what it does best.

D. RESEARCH QUESTIONS

1. Secondary Research Questions

a. How are the acquisition plans for these two programs alike and how do they differ?

As pointed out in section A of this chapter, SINCGARS and MSE have many similarities. However, the differences provided in section B indicate that the Acquisition Plans were very dissimilar and resulted in a long, difficult acquisition process for SINCGARS, while the MSE acquisition went considerably smoother.

b. What are the strengths and weaknesses of each of the two acquisition plans?

Chapter IV explains the strengths and weaknesses of the SINCGARS Acquisition Plan with the most significant strength being the use of contractual incentives and the most detrimental weakness being the decision to begin production without adequate engineering development. This particular strength eventually aided in overcoming the results of this weakness.

The main strength of the MSE Acquisition Plan lies in the wise decision to use an NDI strategy, saving the precious resources of time and money, and, as Chapter V also states, the few "weaknesses seem overshadowed by the positive aspects."

c. Did either acquisition plan succeed more than the other? If so why, and if not, then why not?

Although neither program can even remotely be considered a failure, the Acquisition Plan for MSE provided a big success story for the program and the Army. This is attributed to the tremendous savings in time and money, while still yielding a high-performance C3 system through the NDI approach.

2. Primary Research Question

Based on a comparison of the acquisition plans and lessons learned from these two programs, is there an optimal strategy for the Army to use when acquiring tactical Command, Control and Communications systems?

The optimal strategy for the Army to use when acquiring C3 systems, whenever possible, is an NDI approach. Of course, as stated earlier in section C, many military needs cannot be filled by typical commercial marketplace technology. However, when the commercial technology is present, it should receive the highest consideration as a viable strategy. As pre-eminent Army Signal officer Lieutenant General Emmett Paige, Jr., put it, "In our business area, I believe that NDI--using commercial technology--is the way to go."

[Ref. 20:p. 74]

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