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BY THE COMPTROLLER GENERAL

Report To The Chairman Committee On Government Operations House Of Representatives

OF THE UNITED STATES

RELEASED

NORAD's Missile Warning System: What Went Wrong?

The importance and criticality of the North American Air Defense Command's (NORAD's) computer system have recently been emphasized when false missile warning messages were generated and the Nation's nuclear retaliatory forces alerted.

The Air Force began a computer upgrade program for NORAD computers in 1968 which is expected to reach initial operational capability in November 1981. Due to poor management causing program delays and the attempt to adapt inadequate computers to the NORAD mission, the system falls short of meeting the requirements of the growing missile warning mission.

NORAD will replace these computers by the late 1980s, but it needs to do more to improve management and warning capability.

MASAD-81-30
MAY 15, 1981

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

B-203028

The Honorable Jack Brooks
Chairman, Committee on
Government Operations
House of Representatives

Dear Mr. Chairman:

As you requested on December 16, 1980, we are reporting on our review of recent missile warning system failures at the North American Air Defense Command (NORAD). You were concerned about these failures and asked what corrective actions were needed to ensure that they not recur. Also, you were concerned over the possibility that the acquisition process for automatic data processing equipment was related to those missile warning system failures.

Due to the time constraints, we concentrated our efforts at NORAD Headquarters at Colorado Springs, Colorado. We were able to draw heavily on our own information collected over the past three reviews of NORAD. We also obtained official documents and official NORAD positions on recent failures and planned upgrades.

As you requested, we have not obtained agency comments on this report and unless you publicly announce its contents earlier, no further distribution of this report will be made until 30 days from the date of the report. At that time we will make copies available to the Secretary of Defense and to others on request.

Sincerely yours,

Milton J. Socolar

Acting Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE COMMITTEE ON
GOVERNMENT OPERATIONS
HOUSE OF REPRESENTATIVES

NORAD'S MISSILE WARNING SYSTEM: WHAT WENT WRONG?

D I G E S T

The North American Air Defense Command (NORAD) provides missile attack warning for the North American Continent. (See p. 1.)

The NORAD Combat Operations Center computers, which do the missile warning processing, have been involved in an automatic data processing system upgrade program since becoming operational in 1966. This 427M upgrade program, which is not yet completed, has been subject to schedule delays, cost growth, and insufficient mission performance capabilities which have been the subject of three GAO reports since 1978. These reports have described the critical need for an overall missile warning and space surveillance system and plan and a need for uniform and independent sources of electrical power. These needs are still unmet. Moreover, recent false missile warning messages sent out by the 427M system computers not only attracted adverse publicity but nearly caused an international crisis. (See pp. 2 to 4.)

GAO evaluated (1) the extent, if any, of the relationship of computer acquisition policies, directives, or procedures implementing the legal requirements of Public Law 89-306 (Brooks Act) to the 427M system problems, (2) actions taken to correct missile warning system failures, and (3) what remains to be done and if that effort is hindered in anyway by computer acquisition policies, directives, or procedures. (See p. 4.)

GAO could document no such relationship of the acquisition policies, directives, or procedures to 427M system problems. As GAO reported in 1978 (LCD-78-117), fragmented management and the use of standard Worldwide Military Command and Control System computers that were insufficient for NORAD requirements were the causes of 427M problems. (See pp. 6 to 14.) In response to recent GAO reports, NORAD has instituted significant changes in its acquisition management of computer resources and has planned further improvements.

Most significant of the actions taken or planned are:

--Consolidation of all NORAD computer acquisition management under the Commander in Chief of NORAD. (See p. 8.)

--Development of an overall integrated missile warning system architecture to provide the basis for time-phased, competitive acquisition of the NORAD computer system replacement scheduled to be operational in 1988. (See pp. 16 and 17.)

--Planned interim upgrade of inadequate 427M system computers for the communication segment to extend the life of the 427M system until the planned replacement system is operational in 1988. (See p. 16.)

--Establishment of a planning group to prepare a space surveillance architecture that should provide the basis for competitive procurement of space surveillance processors expected to be operational about 1986. (See pp. 16 and 17.)

--Development of plans to provide stable, reliable electrical power for the Cheyenne Mountain Complex missile warning computers. Besides improving availability of the computers, it should improve overall system reliability. (See p. 16.)

One further action is still needed. NORAD should be released from any requirements to use Worldwide Military Command and Control System equipment and software because it is not adequate to satisfy NORAD's requirements. (See p. 17.)

NORAD has taken the following actions to correct the problems that led to recent missile warning failures.

--A software development and testing facility was constructed in Colorado Springs that allows the development and testing of all software at an offsite facility removed from the operational missile warning system in the Cheyenne Mountain Complex. This should prevent errors such as that of November 9, 1979, when test data was inadvertently injected into the operational missile warning system. (See p. 13.)

--Missile warning transmission procedures, line check message formats, and outgoing message

error checking changes should prevent false alerts such as those of June 3 and 6, 1980. (See pp. 13 and 14.)

With specific attention to what remains to be done and the impact of the procurement process on those efforts, GAO examined documentation on the 427M system interim upgrades and the planned follow-on replacement systems. GAO could not identify any potential hinderance to their acquisition from the current computer acquisition laws, policies, or implementing regulations. (See p. 14.)

GAO found that NORAD is proceeding in a logical, reasoned manner toward 427M system interim upgrades for the mid-1980s and follow-on replacement in the late 1980s. (See pp. 15 to 17.)

Two delegations of procurement authority have been granted by the Administrator of General Services for the interim upgrades--to build the offsite test facility and to replace the inadequate communication systems processor. (See pp. 15 and 16.)

These upgrades will allow the 427M to support NORAD requirements until the whole system can be replaced. NORAD should complete overall missile warning system and space surveillance system plans in about 2 years. (See p. 17.)

A recent Senate Armed Services Committee report suggested the possibility of a delegation of procurement authority making the replacement of the 427M system more timely and effective. Because the recent upgrades have removed time criticality and requirements will not be formally identified for 2 years, any such delegation appears unwarranted now. (See pp. 18 to 20.)

GAO recommends that the Secretary of Defense:

--Assist and support current NORAD 427M system replacement planning and creation of overall missile warning and space surveillance system architectures.

--Assist and support NORAD plans for providing stable, reliable electrical power for the Cheyenne Mountain Complex computers.

--Curtail further consideration of additional delegation of procurement authority for NORAD

until such time that the system architectures are completed, and then only if some critical need has been validated.

--Take action to exempt NORAD from Joint Chiefs of Staff directions to use standardized Worldwide Military Command and Control System computers and allow acquisition of systems that are based upon actual NORAD mission requirements. GAO suggests, however, that these NORAD systems be required to maintain interface compatibility with the Worldwide Military Command and Control System. (See pp. 20 and 21.)

GAO did not obtain official comments on this report. However, GAO discussed these matters with Defense officials and their comments were considered in the preparation of this report. (See p. 5.)

Contents

ABBREVIATIONS

ADCOM	Aerospace Defense Command
CSS	Communications System Segment
DOD	Department of Defense
GAO	General Accounting Office
GSA	General Services Administration

ABBREVIATIONS

JCS	Joint Chiefs of Staff
NORAD	North American Air Defense Command
NCS	NORAD Computer System
OMB	Office of Management and Budget
SCC	Space Computational Center
WWMCCS	Worldwide Military Command and Control System

CHAPTER 1

INTRODUCTION

NORTH AMERICAN AIR DEFENSE COMMAND'S ORGANIZATION AND MISSION

The North American Air Defense Command (NORAD) is a binational partnership between the United States and Canada. The Commander in Chief of NORAD is also the Commander of the U.S. component, the Aerospace Defense Command (ADCOM). Canadian forces are from the Canadian Forces Air Defence Group, headquartered at North Bay, Ontario. The senior representative of the Canadian Forces is Vice Commander in Chief of NORAD. The Commander of NORAD reports to the Joint Chiefs of Staff (JCS) as representing the Specified Command, ADCOM. As the Commander of Aerospace Defense Center he reports directly to the Chief of Staff of the Air Force.

The NORAD mission is to provide

--tactical warning and attack assessment of bomber or ballistic missile attack on North America;

--space surveillance, tracking, and cataloging of all human-made objects in space;

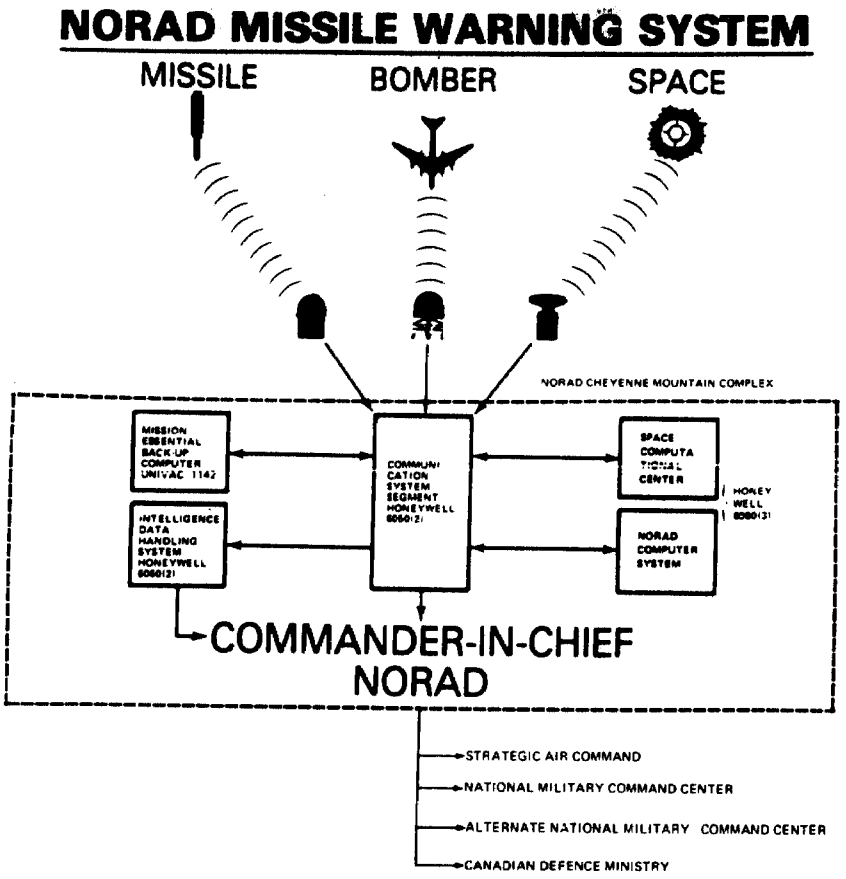
--peacetime surveillance, detection, and identification of aircraft; and

--operational control of U.S. and Canadian Air Defence Forces.

Also, NORAD has the responsibility to JCS to provide worldwide detection of missile launches and nuclear events. This includes the Pacific area and Europe, as well as the area adjacent to the North American Continent.

To accomplish this, NORAD exercises operational control of the detection and communications systems and operates and maintains the analytical systems in the NORAD Cheyenne Mountain Complex that provide the National Command Authorities and Commander in Chief of the Strategic Air Command with real-time missile warning messages and NORAD confidence assessments. New NORAD requirements are to provide satellite attack warning and verification for all U.S. satellites and support the Space Shuttle missions.

The NORAD command post is in the underground Cheyenne Mountain Complex in Colorado. Missile warning information gathered from a worldwide network of sensors is processed on the 427M system computers and warning messages are distributed to U.S. and Canadian command posts as depicted in the following diagram.



THE 427M COMPUTER SYSTEM

In 1966 the NORAD Cheyenne Mountain Complex became operational. NORAD immediately began planning an improved data processing system to meet the NORAD mission needs of the 1980s. This was the 427M Computer Improvement Program. The basic objective of the program was to enhance NORAD's mission effectiveness by providing greater and more reliable information processing capabilities than could be accomplished with the older equipment. Basically, the 427M system was divided into three major segments; (1) the Communication System Segment (CSS), (2) the NORAD Computer System (NCS), and (3) the Space Computational Center (SCC).

CSS

CSS provides essential communications support for NORAD Headquarters. It interfaces with all external facilities and sensors serving or served by NORAD as well as internal circuits. CSS provides complete message processing, formatting, line code conversions, and routing of messages. Due to critical availability requirements, one of the two computers processes live data while the other runs in a backup mode. Since it controls all communications, CSS is the single most critical element of the 427M system.

NCS

NCS provides central command and control information for NORAD for the aerospace defense of North America. Its highly time-sensitive mission essential functions include the receipt, processing, display, and output of missile warning data; nuclear detonation reports; aircraft surveillance and warning; and weapons and sensor systems status. Its less time-sensitive functions include logistics, personnel, airfield data, and environmental support.

SCC

NORAD is the focal point for integrated U.S. and Canadian activities which detect and track all humanmade satellites in space. This includes the entire satellite life cycle; launch, orbit injection, normal tracking, maneuver, decay, orbital decay, and impact prediction. Also, SCC maintains the official United Nations inventory of all humanmade orbiting satellites. The development of satellite attack warning requirements and the support for the employment of space defense weapons and the Space Shuttle have also added to the SCC mission.

RECENT MISSILE WARNING SYSTEM FAILURES

If the NORAD Commander determines there is the possibility of a threat, a threat assessment conference involving senior military officials is convened to determine the nature of the threat. Threat assessment conferences have been called on the following occasions:

--On October 3, 1979, a Submarine-Launched Ballistic Missile radar (Mt. Hebo) picked up a low orbit rocket body that was close to decay and generated a false launch and impact report.

--On November 9, 1979, false indications of a mass raid were caused by inadvertent introduction of simulated data into NCS.

--On March 15, 1980, four Submarine-Launched Ballistic Missiles were launched from the Kuril Islands as part of Soviet troop training. One of the launches had a flight path whose combined azimuth and trajectory appeared to project an impact point in the United States. Such a range of possibilities is called a threat fan.

--On June 3, 1980, false attack indications were caused by a faulty component in a communications processor computer.

--On June 6, 1980, false attack indications were again caused by the faulty component during operational testing.

The Mt. Hebo radar which caused the March 15 false alert is no longer operational having been replaced by the Pave Paws radar at Beale Air Force Base, California. The erroneous indications of launches could occur again because no system can be built to cover all exceptions. The November 9, 1979, and June 3 and 6, 1980, type failures were preventable, and NORAD's actions to do so are covered in the next chapter.

PRIOR REPORTS

This is the fourth report on the NORAD Missile Warning System. In our previous reports, 1/ we recommended that (1) the management of computer acquisition be centralized in NORAD, (2) planning begin for replacement of the 427M computers, (3) the Cheyenne Mountain power system be improved, and (4) NORAD be exempted from JCS' direction to use standardized Worldwide Military Command and Control System (WWMCCS) hardware and software which we found inadequate for NORAD requirements.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our objective was to independently review the recent missile warning system failures at NORAD and their relationship to the computer acquisition process. Specifically, we were to assess (1) the extent, if any, of the relationship of computer acquisition procedures to 427M system problems, (2) actions taken to correct missile warning system failures, and (3) what remains to be done and if that effort is hindered in anyway by the acquisition process. We did not assess the effect of the recent Paper Work Reduction Act of 1980 (Public Law 96-511) on the computer acquisition process in the Air Force. Policies and directives implementing Public Law 96-511 would be formulated at the Office of Management and Budget (OMB) and General Services Administration (GSA) offices in Washington, D.C. Due to time constraints, we did not analyze the acquisition process further than necessary to determine its relationship to NORAD's 427M systems computer development problems or to recent missile warning system failures.

Also, our review of the procurement policies and regulations of OMB, GSA, the Secretary of Defense, JCS, and the Secretary of the Air Force was limited to those applicable to computer system acquisition by NORAD. We addressed the acquisition process at

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1/We have issued three reports since September 1978: "NORAD Information Processing Improvement Program--Will It Enhance Mission Capability?" (LCD-78-117, Sept. 21, 1978); Letter Report to Congressman Ken Kramer regarding NORAD/ADCOM Reorganization (LCD-79-119, June 25, 1979); and "Review of Department of Defense Strategic Missile Warning Systems" (NORAD-SECRET) (C-LCD-80-3, Mar. 17, 1980).

NORAD relative to the Air Force regulations that directly control their acquisition process.

We reviewed documents previously obtained in our reviews of NORAD, recent planning documents obtained during this review, and official NORAD statements in response to questions submitted to the Command.

We used the results of our review of these documents to arrive at our assessment of the relationship of acquisition to NORAD computer system problems. We relied on recent analyses in NORAD documentation regarding the adequacy of NORAD's interim upgrades to the 427M system.

We closely analyzed other Senate and Air Force reports on recent NORAD missile warning system failures to ensure that the data we collected was accurate and consistent with that collected by other reviewers.

We were requested by the chairman of the House Committee on Government Operations not to seek official comments on this report. However, we discussed these matters with Defense officials and their comments were considered in the preparation of the report.

CHAPTER 2

RELATIONSHIP OF NORAD COMPUTER PROBLEMS TO THE ACQUISITION PROCESS

Problems in the 427M system development program are in two basic areas. One area relates to the implementation of the system and the other with recent false missile warning alerts. As reported in 1978, the implementation delays were due to fragmented management and the 1970 Air Force and JCS' direction to use standard command and control system hardware and software that did not fully meet NORAD requirements. Recent missile warning system failures were related to procedural errors and software design problems. We could find no evidence linking the acquisition process to either of these problem areas.

PROBLEMS WITH THE 427M SYSTEM AND CAUSES

In our 1978 report, "NORAD's Information Processing Improvement Program--Will It Enhance Mission Capability" (LCD-78-117, Sept. 21, 1978), we reported that the delays in implementation of the 427M system at NORAD were due to

--fragmented management that created inadequate contract control and

--mandatory use of WWMCCS equipment and software that were inadequate for NORAD's mission requirements.

Fragmented management

The successful development of any system depends on well organized and disciplined management control of resources. There were eight contractors and four Air Force contract control offices involved; only one was located at NORAD. Their 1975 responsibilities are depicted in the following chart.

Fragmentation of Contract Responsibilities
After Management Reorganization in 1975 of
427M Development Program at NORAD

Responsibility for contract	System project task	Involved contractors
Electronic Systems Division	Systems specifications	MITRE Corporation and in-house resources
	Systems integration	MITRE Corporation and in-house resources
	CSS software	Ford Aerospace Comm. Corp. and Systems Dev. Corp.
	Consoles	Raytheon Corp.
	Interface processors	Data General Corp.
NORAD	NCS software	In-house resources, Ford Aerospace Dev. Corp., Systems Dev. Corp., and GSA Service Contract
	SCC software	In-house resources, Ford Aerospace Comm. Co., Systems Dev. Corp., GSA service contract, and Kaman Industries
JCS (through Air Force Systems Command)	NCS hardware	Honeywell Corp.
	SCC hardware	Honeywell Corp.
Air Force Space Division	Displays	Ford Aerospace Comm. Corp.
Ford Aerospace Comm. Corp.	CSS hardware	Honeywell Corp.

This fragmented 427M system management structure prohibited an organized, disciplined approach to control the development program.

In September 1969 the Air Force Systems Command was given overall 427M system development program responsibility. A 427M program office was established at the Command's Electronic Systems Division at Hanscom Air Force Base, Massachusetts. Contractural management problems began to occur. On three occasions the Commander of NORAD requested, without success, that the program office or program manager be located in Colorado Springs, Colorado, near the Cheyenne Mountain Complex to provide closer management of the contractors.

An effort to improve program management was again made in March 1975 when NORAD and the Electronic Systems Division agreed to move program management to Colorado Springs. However, contract management remained at the Electronic Systems Division in Massachusetts. Contract coordination problems and schedule slippages continued.

In April 1977, at the request of the NORAD Commander, an Air Force Independent Review Group reviewed the 427M system development program. They reported that the management organization for the program had been severely fragmented since its restructuring in March 1975. Attempts to tie the separately developed segments into a system were inadequate. The Independent Review Group recommended one central contracting manager. This was not acted upon. The Electronic Systems Division rejected the proposal and separately controlled their system projects performed by its contractors.

As development of the 427M program proceeded after the 1975 reorganization of contractors, the fragmented management affected the contracting arrangements and control which contributed to development problems. For example, as a result of assuming responsibility for system engineering, integration, and test efforts in June 1977, NORAD signed a sole-source contract with Ford Aerospace Communications Corporation, which in effect duplicated one signed between Electronic Systems Division and the same corporation.

The Defense Contract Administration Service raised objections to this contracting procedure, citing not only the difficulty in substantiating contractor charges but also the problem of enforcing contractor compliance. We found both of these factors contributed to prolonging the development cycle. This situation existed until September 1979 when NORAD assumed all remaining contractual responsibility. All contracts have been managed by NORAD since that time. NORAD has obtained experienced acquisition personnel to provide more expertise for this function.

Use of inadequate hardware and software

In 1978 we cited the problems associated with NORAD's use of standard WWMCCS equipment and software which did not have sufficient capacity for NORAD's mission requirements. We found that (1) as a result of insufficient computer capacity, 49 specific missile warning system requirements had to be deferred until some unspecified future date and (2) the MITRE Corporation had projected processing capacity limitations of the computers used. These problems were related to the 1970 joint decision by the Air Force and JCS that NORAD use standard WWMCCS computers and software.

Similar problems existed in the SCC segment. When NORAD first stated its SCC processing requirements, it projected a need for a large-scale scientific computer to meet those requirements. In spite of NORAD protests, the Air Force and JCS concurred that NORAD would use the same type computer (Honeywell 6080) for SCC as used for the Command and Control System. As originally planned, all space objects were to be tracked with high accuracy algorithms; however, due to the limited capabilities of the standard WWMCCS equipment, less accurate algorithms are used to track most of the 4,000 plus objects in space. We recommended in our 1978 report, LCD-78-117, that NORAD begin to plan a replacement for SCC.

An Air Force Systems Command review group reported that their requirements and procedures for maintaining Command and Control System standardized hardware and software had created problems for the 427M system because it was not designed for handling real-time applications. Consequently, the Air Force, software development contractors, and other users had to write more complex software subroutines to meet NORAD real-time response requirements than would otherwise be necessary.

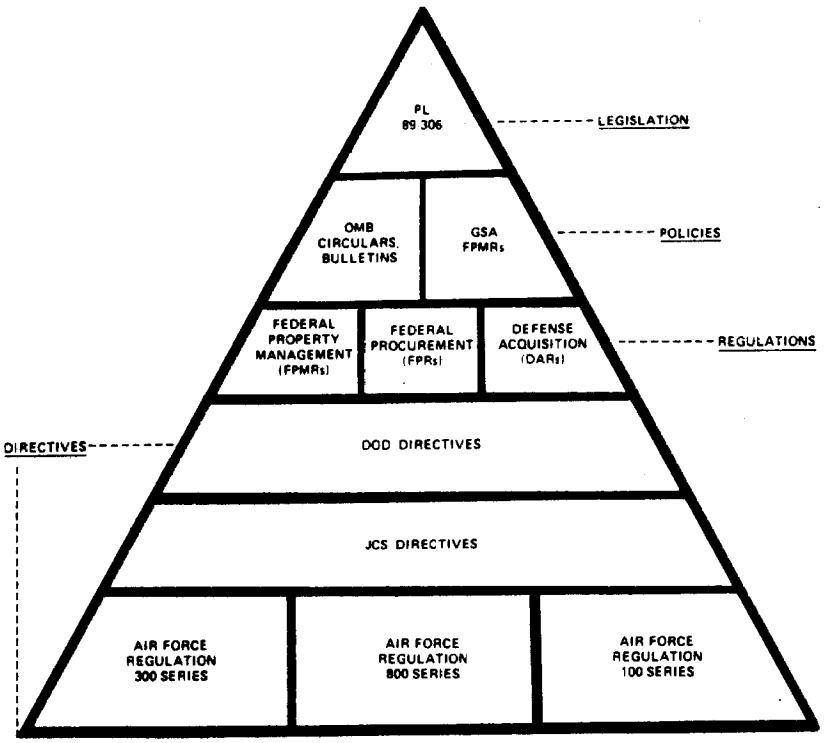
In 1978 we reported that unlike the CSS software that was developed by a contractor, the NCS and SCC software development programs were being accomplished in-house by military and civilian personnel. The problem of making the command and control system standard software perform in a real-time, online environment had placed a burden of nearly $3 million annually on NORAD's in-house software development effort. This amounted to nearly 25 percent of its total software resource allocation. The burden of this unprogramed effort forced them to limit 427M system software development to the remaining available programed funds. In some cases, the inability to respond to new requirements resulted in the postponement of the ability to satisfy certain requirements until some future date.

THE ACQUISITION PROCESS

The development, acquisition, modification, and testing of missile warning systems and subsystems involves many organizations in several Air Force commands, various acquisition strategies, and many millions of dollars. Factors involved in these acquisitions include the command acquiring the computer system, the regulatory authority for the acquisition, the roles of the participating organizations, and other applicable procedures and factors.

Public Law 89-306 (the 1965 Brooks Act), prescribes procedures for acquiring computers for Federal agencies. Under this law, the acquisition process for computers is governed by a hierarchy of policies and directives which, for NORAD, are promulgated in the Air Force 100, 300, and 800 series of regulations, as depicted in the following chart.

NORAD ACQUISITION LEGISLATION, POLICIES, REGULATIONS, AND DIRECTIVES (note a)



OMB Policies: A-11, A-71, A-76, A-94, A-108, A-109, 60-6, 70-9, 77-3
GSA Policies: FPMR 101-36.2, 36.2, 36.3, 36.4, 36.5, 36.7, 36.9, 36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.17, 36.47
DOD Directives: 5100.1, 5100.30, 5100.40
JCS Directives: JCS Pub. 17
USAF Directives: 100 series, 300 series, 800 series
In addition, NORAD is in the process of preparing its own computer acquisition directives

a/This chart was prepared by NORAD.

The Air Force 100, 300, and 800 series of regulations for computer acquisition are generally applied as follows:

--Air Force 100 deals with communications processors.

--Air Force 300 deals with general purpose, commercially available computers.

--Air Force 800 deals with specialized computers normally associated with weapons and command and control systems.

Acquisition methods specified in Air Force 300 and 800 series have been and are being used to acquire NORAD computers. Generally, a new acquisition is made under the 800 series, then the 300 series is used for subsequent upgrades.

The Air Force 800 computer acquisition method generally has longer management and planning leadtimes than the Air Force 300 and is useful for computer acquisitions with large integration requirements. The Air Force 800 method was originally intended to be used for the 427M program. This appeared appropriate due to the large size of the system and the major software development and integration effort involved. The 427M system now consists of 84 computers and over 10 million software instructions.

However, neither of the above methods of acquisition was used because, as previously discussed, NORAD was directed to use standard WWMCCS hardware and software in lieu of a separate system acquisition.

THE ACQUISITION PROCESS AND 427M DEVELOPMENT DELAYS

The 427M system's initial operational capability which was originally scheduled for 1976 is now scheduled for November 1981, a 5-year slippage. As previously discussed, the delays associated with the 427M system development stemmed from a fragmented management structure and the direction to use equipment and software that did not meet NORAD requirements. We could find no documentary evidence showing any relationship of the acquisition procedures themselves to the delays we found.

The acquisition and implementation time required for competitive upgrades of typical computer systems has been documented by NORAD to be about 64 months. We compared this typical time frame to that required for the 427M. It should be noted that the 427M acquisition phase was completed in the normal 34-month period. However, as shown below, the implementation phase is significantly longer than the normal period. Total 427M time frame will be 155 months if the initial operational capability is reached in November 1981.

NORAD acquisition steps	Months typically required	Total	Months allotted for 427M	Total
Acquisition:				
Data automation requirement submission	0	0	0	0
Air Force Director of Automation approval	3	3	3.5	3.5
Secretary of Air Force Office approval	1	4	0	3.5
Program Plans and Directives	4	8	3.0	6.5
Specifications Developed	8	16	14.0	20.5
Request for proposal	3	19	1.0	21.5
Receive proposals	5	24	5.0	26.5
Evaluation of proposals/ negotiation with vendors	8	32	5.5	32.0
Procurement approval	1	33	1.0	33.0
Award contract	1	34	1.0	34.0
Implementation:				
Begin site preparation, software development	0	34	2.0	36.0
Site preparation completed	10	44	22.0	58.0
Equipment delivered/ accepted	2	46	2.0	60.0
Software conversion completed (equipment operational capability for 427M)	12	58	69.0	129.0
Complete testing (initial operational capability)	6	64	26.0	a/155.0

a/Initial operational capability for the 427M system is scheduled for November 1981.

NORAD's system acquisition has been termed unsuccessful by the Inspector General of the Air Force in his September 1980 report "Special Management Review of USAF Support to the Tactical Warning/Attack Assessment System." In his discussion of systems acquisition in general and NORAD's acquisitions specifically, he reaffirmed our 1978 findings that the 427M system upgrade program was $80 to $100 million over cost and over 3 years late. Further, he stated:

> "It must be noted that the criteria used in this report (accuracy of initial schedule and cost estimates, final performance of the system) to determine the success or failure of system acquisitions are not as objective as they might appear. For instance, acceptable cost growth is subjective. In the final analysis, the overriding criterion for determining the success of a program is whether the final product

meets the needs of the user. By this criterion, only two of the seven sensors and two Command Centers acquisition programs researched in this report can be considered as failures, the FSS-7 and the 427M. No primary cause was found for the failure of the FSS-7s to perform satisfactorily. As indicated by the GAO and the 1977 Independent Review Group, 427M acquisition problems were primarily due to fragmented management authority and the directed use of WWMCCS computers. The size and complexity of the program also contributed to the difficulties."

THE ACQUISITION PROCESS AND RECENT FAILURES

There were basically two problems related to the much publicized recent NORAD Missile Warning System failures, neither of which were related to the acquisition process. The events of November 9, 1979, and June 3 and 6, 1980, typify these problems.

On November 9, 1979, test scenario data was inadvertently fed into the online missile warning computers which generated false alerts. Subsequently, an offsite test facility was installed at a cost of $16 million to prevent recurrence of this problem. The offsite test facility is a functional equivalent of the 427M system in the Cheyenne Mountain Complex. These computers were leased from Honeywell and some equipment purchased from Ford Aerospace Communications Corporation on a delegation of procurement authority. The implementation of this offsite test facility allows software development and testing, especially stress testing of software, to be performed outside the online missile warning system. Since testing is no longer performed on the live 427M system, this type of false alert should not recur.

On June 3 and 6, 1980, missile warning system failures occurred when a faulty component in the communications system began writing numbers into blank spaces in the missile warning messages sent out live to various command posts. The blank spaces during an attack indicate the number of attacking missiles and usually contained zeros, but in this case the erroneous numbers generated by the computer indicated a mass attack. These messages were used for communications line testing. As a result of this failure, NORAD took these pertinent steps:

--First, NORAD added computer programs that have the effect of tracing a message through the entire message preparation phase to ensure that the transmission accurately reflects that which is input through the message system.

--Second, a display was added in the NORAD command post which shows what is being transmitted to the other command posts. All outgoing warning messages are now released by the Commander in Chief of NORAD.

--Third, the test messages being transmitted from NORAD to the other command posts for communication line checks have been changed in format from blank warning messages to standard communications test messages.

CONCLUSIONS

Our analysis of prior reports and available documentation of the 427M system acquisition and delay problems shows that the time delays experienced in the 427M program have occurred basically in the implementation phase rather than acquisition phase. We found no documentation supporting any relationship to the acquisition process. We could identify no specific statute, policy, regulation, or directive that caused warning failures. As discussed above, these failures were related to operational procedural errors and insufficient software checks on outgoing missile warning messages. For this reason, we concluded that the acquisition process had nothing to do with errors resulting from faulty procedures and software programing.

Regarding the fragmented management previously reported, NORAD centralized acquisition management of computer resources and obtained experienced acquisition personnel to provide more expertise for this function.

CHAPTER 3

PLANNED SYSTEM IMPROVEMENTS AND THE IMPACT OF ACQUISITION ON THESE EFFORTS

In response to our recent reports and to upgrade inadequate mission capabilities inherent in the 427M system, NORAD is planning a complete missile warning and space surveillance computer systems replacement. Based on the missile warning system and space surveillance architectures that NORAD is preparing, this replacement is expected to be completed in the 1986-88 time frame.

To meet mission requirements until the current systems can be replaced, NORAD has planned an interim upgrade of CSS of the 427M system and has built a separate software development and testing facility. This offsite test facility was necessary for the 427M system development to reach initial operational capability in November 1981.

With regard to an acquisition strategy for NORAD's total system replacement, we believe that competitive acquisition is warranted at this time. There is no time criticality to justify exemption to competitive acquisition, and the requirements for the new systems will not be adequately articulated for another 2 years.

NORAD PLANS FOR TOTAL SYSTEM REPLACEMENT

In our 1978 report (LCD-78-117) we recommended that the entire 427M system be replaced with modern, state-of-the-art computers and adequate software. NORAD is now planning to do the following:

--Develop a system based on a new architecture for CSS using distributed processing techniques. This real-time message processing system would first augment, then replace the existing CSS. This system would begin taking over CSS functions in 1988.

--Replace NCS with a modern state-of-the-art computer system to provide faster and more effective missile warning processing. The NCS will have to be able to handle multiple real-time tasks to meet NORAD's dynamic missile warning mission requirements. This new system is expected to reach full operational capability in 1988.

--Replace SCC with computers having inherent real-time scientific capability. This new capability is required to support satellite attack warning, deep space, and Space Shuttle missions. This new system is expected to be fully operational in 1986.

ACTIONS NECESSARY TO FACILITATE TOTAL 427M SYSTEM REPLACEMENT

CSS interim upgrade

NORAD is currently taking certain actions to facilitate the cost-effective replacement of the 427M system. One urgent need is the interim upgrade of the Honeywell computers in CSS. An interim upgrade of the CSS Honeywell 6050 computers to Honeywell 6060s is planned to ensure a near term capability to meet current and projected mission requirements until a suitable replacement for CSS can be defined, developed, and installed. This planned upgrade is intended to provide adequate performance, maintainability, and reliability until 1987. NORAD was granted a delegation of procurement authority in December 1980 to acquire the necessary equipment on an expedited basis. The upgrade involves acquisition of two Honeywell 6060 computers under an existing WWMCCS contract. This is a sole-source procurement of specific source of supply and model.

Power system reliability improvements

As we have reported previously, there is an urgent requirement to provide an uninterruptible power supply to protect critical mission processing computers in the Cheyenne Mountain Complex. Also, other power reliability problems exist.

In September 1980 a team from the Air Force Engineering and Services Center at Tyndall Air Force Base, Florida, examined the operation of the Cheyenne Mountain Complex powerplant and the electrical distribution system supporting the complex. This team made several recommendations for improving the power system, one of these being the installation of an uninterruptible power supply. NORAD has engaged a local architect-engineering firm to define the Cheyenne Mountain Complex power requirements. One aspect of this effort is to define the exact size and configuration of an uninterruptible power system.

The Commander of NORAD said that he has included a request for funding in the fiscal year 1982 budget to begin upgrading the power system.

Missile warning and space surveillance architecture plans

Our 1978 NORAD report pointed out the need for improved overall computer system planning at NORAD and recommended that the Secretary of the Air Force start a redesign of the entire NORAD Missile Warning System. We also recommended that a steering committee be established to assess problems with current and future system developments and monitor corrective actions taken. As proposed, this group would be accountable for the proper execution of the design effort.

There are currently two systems' architecture planning efforts underway at NORAD, one for missile warning and one for space surveillance. These planning efforts are coordinated and carried out under two new groups. Both are preparing architecture plans that will eventually be merged by the Director of the Communications Electronics and Computer Resources into an overall NORAD system architecture.

As discussed in the previous chapter, NORAD acquisition of computers and associated software should be based on realistic mission requirements, rather than based on a specified system capability irrespective of actual requirements. Our 1978 report recommended that NORAD be exempted from mandatory use of standard WWMCCS computers which have proven to be inadequate for NORAD's requirements. However, we were informed by the Commander of NORAD that this exemption has not been granted. JCS has final responsibility over these command and control systems. Failure to exempt NORAD from this requirement could adversely affect NORAD's architectural planning efforts and create another 427M-type system. However, this does not mean an exemption from the competitive acquisition process.

The Commander of NORAD said that the architecture for missile warning would be capable of supporting the competitive acquisition of computers in another 2 years. The NORAD computer acquisition plan for fiscal years 1983 through 1987 shows the following phased acquisition plans for 427M system replacement computers.

NORAD 427M Computer System Replacement Plans

Computer acquisition milestone	Interim CSS upgrade	1983-87 time frame computer systems replacements planned		
		CSS	NCS	SCC
	(quarter/year)			
Data automation requirement submission	3/80	3/81	4/82	3/81
Requirement approval	4/80	1/82	4/83	2/82
Delegation of authority issued	1/81	-	-	-
Start software development	-	(a)	2/84	3/82
Purchase equipment	2/81	(a)	1/85	1/83
Installation	3/81	(a)	2/85	2/83
Initial operational capability	3/81	3/85	3/87	3/85
Full operational capability	3/81	3/86	1/88	1/86
Life estimated	3/87	b/3/98	b/1/98	b/1/96

a/The CSS replacement will go through a concept definition/validation phase that could not be accurately estimated presently.

b/Based on our estimate of 10 to 15 years life for new equipment of this type.

DELEGATION OF PROCUREMENT AUTHORITY AS AN ACQUISITION STRATEGY

DOD currently submits agency procurement requests to GSA to obtain authorizations to procure computer equipment and services. Public Law 89-306 allows the Administrator of GSA to delegate such procurement authority when the Administrator determines it is necessary for the economy and efficiency of operations or when such action is essential to national defense or security. The Administrator requires documentary evidence that the agency requesting the delegation has complied with all regulations applicable to that procurement. Frequently, requests for delegations of procurement authority are sought for exemption from the requirement to use the competitive acquisition process. When a delegation is granted under these circumstances, the requesting agency is allowed to procure equipment in a negotiated, sole-source manner.

DOD has been criticized in our recent reports and by some members of the Senate Armed Services Committee for failure to actively use the competitive acquisition process. The Assistant Secretary of the Air Force for Financial Management recently criticized Air Force computer acquisition program managers for failure to adequately plan their computer acquisitions such that competitive procurement could be employed. The Air Force Director of Computer Resources stated that such failure to plan was destroying the credibility of Air Force acquisition management capabilities and that he would carefully scrutinize any further requests for delegation of procurement authority.

We were asked by the chairman of the House Committee on Government Operations to determine what corrective actions are still needed at NORAD to correct missile warning system problems. He mentioned a recent report that suggested a causal relationship between the NORAD problems and the acquisition process whereby that equipment was purchased.

That report, "Recent False Alerts from the Nation's Missile Attack Warning System," dated October 9, 1980, by the Senate Armed Services Committee, stated that the current computer acquisition process delayed DOD attempts to obtain better computer equipment. It suggested that a blanket delegation of procurement authority might enable NORAD to replace their computers quicker than using the competitive acquisition process. We reviewed NORAD's current phased replacement planning to determine if such an approach might be feasible.

Some Air Force acquisition managers feel that the current policies, directives, and regulations implementing the Public Law 89-306 are too cumbersome and time consuming. As we have demonstrated in our earlier chart of computer acquisition directives, it is indeed subject to numerous policies, directives, and regulations. (See p. 10.) This may in fact indicate a need for OMB, GSA, the Secretary of Defense, JCS, and the Secretaries of the services to take some action to streamline their paperwork

procedures. However, since a review of this large and complex structure was well beyond the purview of this review, we pursued this facet no further.

To ensure that the agencies requesting delegations of noncompetitive procurement authority have complied with all applicable regulations, the Administrator of GSA issued guidelines for the information that must be submitted for his consideration. The applicant must state

--the intended use or application of the equipment;

--the critical installation schedule or unique features and/or mandatory requirements dictated by the intended use that limit the acquisition to a single source of supply or a specific make and model;

--if noncompetitive, sole-source acquisition is planned, a statement that there is no other known source available;

--the existence of any patents or copyrights or other such limitations; and

--the practical factors that preclude the acquisition from competition.

Two of the above criteria for approving a delegation of procurement authority are not met by NORAD plans for replacement of the 427M system. First, there is no time criticality for the replacement program. The interim upgrade of CSS, the power system improvement, and the addition of the offsite software developmental facility will satisfy current time critical deficiencies and allow the follow-on replacement to proceed on a competitive time-phased schedule as planned. Second, and more important, NORAD could not apply for a delegation of procurement authority under the regular process since the missile warning and space surveillance architectures with associated requirements identification will not be completed for about 2 years. Since one requirement that must be met for a delegation is firm identification system requirements, NORAD could not use delegated procurement authority at this time.

CONCLUSIONS

In response to our recent reports, NORAD has instituted significant changes in its acquisition and management of computer resources. It is making excellent progress toward planning future improvements based on sound definition of requirements in overall missile warning system architectures. However, exemption from use of standard WWMCCS computers is still needed to preclude the recurrence of past problems of insufficient missile warning and space surveillance capabilities. Most significant of the actions taken or planned are:

--The development of an overall integrated missile warning system architecture. This should provide the basis for time-phased competitive acquisition of 427M system replacement computers. The new system is planned to be operational in 1988.

--Planned interim upgrade of the currently insufficient 427M computers for CSS to extend life of the 427M until the planned replacement system becomes operational in 1988.

--The establishment of a planning group to prepare a space surveillance architecture that should provide the basis for competitive procurement of space surveillance processors expected to be operational in 1986.

--The development of plans to provide stable, reliable electrical power for the Cheyenne Mountain Complex missile warning computers. Besides improving availability of the computers, it should improve overall system reliability.

As stated above, however, one further action is still needed. NORAD should be released from any requirement to use standardized WWMCCS computers and be allowed to acquire systems that are based on the unique NORAD mission requirements.

Regarding a possible hindrance to future acquisition other than the many implementing directives to be followed, we could not document any impingement on future acquisitions caused by Public Law 89-306. Two delegations of procurement authority have been granted to NORAD to build the offsite testing facility and to perform the interim upgrade on CSS. The question of a possible delegation of procurement authority for further acquisition of NORAD replacement computers is prevented by the current lack of any time criticality and the fact that it will be another year or two before requirements can be adequately identified to use such a means.

RECOMMENDATIONS

GAO recommends that the Secretary of Defense:

--Assist and support current NORAD 427M system replacement planning and creation of overall missile warning and space surveillance architectures.

--Assist and support NORAD plans for providing stable, reliable electrical power for the Cheyenne Mountain Complex computers.

--Curtail further consideration of additional delegation of procurement authority for NORAD until such time that the system architectures are completed, and then only if some critical need has been validated.

--Take action to exempt NORAD from JCS directions to use standardized WWMCCS computers and allow acquisition of systems that are based on actual NORAD mission requirements. We suggest, however, that these NORAD systems be required to maintain interface compatibility with WWMCCS.

APPENDIX I

NINETY-SIXTH CONGRESS

Congress of the United States

House of Representatives

COMMITTEE ON GOVERNMENT OPERATIONS
2157 Rayburn House Office Building
Washington, D.C. 20515

December 16, 1980

The Honorable Elmer B. Staats
Comptroller General of the United States
General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear General:

Within the past year there have been a series of computer failures at the North American Air Defense (NORAD) Command's strategic warning facility at Cheyenne Mountain, Colorado. The computer failure caused a false warning of a Soviet missile attack against the United States and U.S. strategic forces were unnecessarily placed on nuclear alert. These events are most alarming.

The acquisition process for ADP equipment was alluded to in a recent Senate report as one of the primary causes of these failures at NORAD. I am most disturbed by the mishaps at NORAD and the allegation that the ADP acquisition process contributed to them.

I request that the GAO review NORAD's acquisition and use of ADP and telecommunications to determine what corrective actions are needed by the Air Force and the central agencies to ensure that these failures do not recur. The resolution of the Air Force's problems at NORAD is critical to our national defense and I recommend that GAO immediately address this matter.

With best wishes, I am

Sincerely,

JACK BROOKS
Chairman

(954003)

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