United States General Accounting Office

GAO

Report to the Chairman of the Subcommittee on Defense, Committee on Appropriations, House of Representatives

November 1999

DEFENSE COMPUTERS

U.S. Space Command's Management of Its Year 2000 Operational Testing

GAO/AIMD-00-30

Contents

Abbreviations

DOD	Department of Defense
JCS	Joint Chiefs of Staff
OPEVAL	operational evaluation
SPACECOM	U.S. Space Command
Y2K	Year 2000

GAO
Accountability * Integrity * Reliability

United States General Accounting Office
Washington, D.C. 20548

Accounting and Information
Management Division

B-282546

November 15, 1999

The Honorable Jerry Lewis
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

Complete and thorough end-to-end testing is essential to provide reasonable assurance that new or modified systems used to collectively support a core business function or mission operation will not jeopardize an organization's ability to deliver products and services as a result of the Year 2000 (Y2K) computing problem. This is especially true for the Department of Defense (DOD) because it relies on a complex and broad array of interconnected computer systems—including weapons, command and control, satellite, inventory management, transportation management, health, financial, personnel and payment systems—to carryout its military operations and supporting business functions.

At your request, we reviewed DOD's management of various Year 2000-related end-to-end testing activities. As part of our efforts, we assessed the U.S. Space Command's management of its end-to-end test of space control systems essential to major theater war (one of 16 operational evaluations for the command) and determined what the results of this test show with respect to operational risks and readiness.[1] We briefed Space Command officials on our findings on October 1, 1999, and made a recommendation to correct the management weaknesses that we found. Space Command immediately acted to address our recommendation. We then briefed your office on our findings and Space Command's actions to address our recommendation on November 1, 1999. The purpose of this letter is to summarize our briefing to your office. The briefing slides that we presented to your office are in appendix I, and the objectives, scope, and methodology of our review are detailed in appendix II. Space Command provided oral comments on our briefing slides, and we have incorporated them as appropriate. We performed our audit work from March through

[1]DOD refers to its combatant commands' end-to-end tests as operational evaluations.

October 1999 in accordance with generally accepted government auditing standards.

Results in Brief

Year 2000 end-to-end testing is an essential component of an effective Year 2000 testing program since Y2K-related problems can affect so many of the systems owned and operated by an entity as well as systems belonging to business partners and infrastructure providers. Moreover, to be effective, end-to-end testing should be approached in a structured and disciplined fashion. Both the Joint Chiefs of Staff (JCS) guidance to its combatant commands on managing Year 2000 operational evaluations,[2] (the term JCS uses to refer to Year 2000 end-to-end testing) and our Year 2000 test guidance[3] define a number of key management controls to employ when planning, executing, analyzing, and reporting on such test and evaluation events.

We found that Space Command's space control operational evaluation satisfied 16 of 21 of the key processes prescribed by JCS guidance. For example, the Command established a Y2K task force to guide the evaluation effort, which included satellite/system specialists, test and evaluation experts, system analysts, military component and service representatives, and public affairs representatives. Further, the Command performed a rehearsal before conducting the evaluation to ensure that all critical systems and interfaces were operating correctly and that all staff knew their roles and responsibilities.

In response to our concerns, Space Command has taken positive actions to address the remaining five key processes. Three of the key processes were addressed during the course of our review and two were addressed in response to a recommendation we made at our briefing. During the course of our review, Space Command began ensuring that contingency plans were in place for its mission-critical systems, which it had not done before conducting the space control operational evaluation. Also, after we found that configuration management procedures were not always followed

[2] *Joint Staff Year 2000 Operational Evaluation Guide*, Version 3.0, April 1, 1999.

[3] *Year 2000 Computing Crisis: A Testing Guide* (GAO/AIMD-10.1.21, issued as an exposure draft in June 1998; issued in final in November 1998).

while executing the evaluation,[4] Space Command initiated an effort to ensure that such procedures are followed in future evaluations. In addition, during our review, the Command amended its report to discuss its decision to exclude six communications systems from the evaluation and whether this adversely impacted the ability to draw conclusions about mission readiness.

At the time of our October 1, 1999, briefing, Space Command still needed to address two partially satisfied key processes, which included (1) not documenting whether test cases for most intelligence systems met performance exit criteria and (2) not ensuring that 1 of 29 systems included in the evaluation was Y2K compliant. We therefore recommended that Space Command amend its final report to JCS to recognize the uncertainties and risks associated with its failure to take these steps and the actions underway or planned to address these uncertainties and risks. Without taking these steps, Space Command could not adequately know the Year 2000 readiness of critical tasks—collecting surveillance and intelligence data to disseminate warning messages—associated with conducting the space control mission. Because Space Command has subsequently amended its final report and plans to ensure that these weaknesses are not repeated in a November operational evaluation of its intelligence mission, we are not making further recommendations at this time.

Background

Space Command's mission is to provide direct support to combatant commanders and military forces through the use of space-based satellites and other technologies needed for navigation, surveillance and reconnaissance, communications, environmental and attack warnings during war and peacetime operations. To perform this mission, Space Command relies on a wide array of information technology systems, including command and control systems, geographically dispersed radar sites, satellites, communications networks, and intelligence systems.

In August 1998, the Secretary of Defense directed JCS to require its combatant commands, including Space Command, to plan, execute,

[4]Configuration management involves establishing product baselines and systematically controlling changes made to those baselines. Without an effective configuration management process, organizations can lose control of the software product, potentially produce and use inconsistent product versions, and create operational problems.

analyze, and report on a series of simulated Year 2000 operational evaluations. The evaluations, which were to assess whether DOD can continue to perform critical military operations in a Year 2000 environment, are one of three DOD end-to-end testing efforts.[5]

The purpose of end-to-end testing is to verify that a defined set of interrelated systems, which collectively support an organizational core business area or function, interoperate as intended in an operational environment (either actual or simulated). These interrelated systems include not only those owned and managed by an organization, but also the external systems with which they interface or that otherwise support the business area or function. The combatant commands' core business areas or functions are referred to as "thin lines."

The boundaries for end-to-end tests can vary depending on a given business function's system dependencies and criticality to the organizational mission. Therefore, in managing end-to-end test activities, it is important to analyze the interrelationships among core business functions and their supporting systems and the mission impact and risk of date-induced system failures and to use these analyses to define test boundaries. It is also important to work early and continually with functional partners to ensure that related end-to-end test activities are effectively coordinated and integrated. Table 1 summarizes key processes recommended by JCS'Year 2000 operational evaluation guidance, which is consistent with our Year 2000 test guide.

[5]In addition to conducting operational evaluations, the military services are conducting system integration testing, and the functional business areas, such as personnel and health affairs, are conducting functional end-to-end tests. Each of these end-to-end testing activities is discussed in detail in *Defense Computers: Management Controls Are Critical to Effective Year 2000 Testing* (GAO/AIMD-99-172, June 30, 1999).

Table 1: Summary of JCS Year 2000 Operational Evaluation Criteria

Planning	• Specify test assumptions and limitations
	• Establish a Year 2000 task force
	• Identify critical missions/tasks/systems
	• Verify that systems essential to mission are Year 2000 compliant
	• Develop an operational evaluation plan to guide event planning and execution
	• Identify and schedule support from other commands, DOD components, etc.
	• Determine relevant and necessary resources (e.g., funding, personnel, equipment, etc.)
	• Ensure approved Year 2000 contingency plans are prepared
	• Develop a risk management plan
	• Identify simulation needs and establish supporting testing environment
	• Develop data collection and analysis plan or approaches
Execution	• Conduct operational evaluation rehearsal
	• Follow configuration management policy
	• Perform baseline test for operational evaluation
	• Execute required Year 2000 date rollover tests
	• Collect and archive all Year 2000-relevant data and ensure that systems are reset to current day operations
Analysis	• Categorize, document, and report Year 2000 failures
	• Determine mission impact of Year 2000 failures
	• Ensure exit criteria are met
Reporting	• Prepare Year 2000 reports describing mission impact and readiness
	• Provide reports to JCS within required timeframes

Space Command has already completed 16 operational evaluations to assess its ability to manage and provide combatant support during a major theater war. These evaluations covered seven mission areas, including (1) integrated tactical warning and attack assessment, (2) space control, (3) force enhancement, (4) weather support, (5) command and control of space forces, (6) space operations support, and (7) space lift. The space control mission area provides (1) surveillance support to monitor, track, identify, and catalog all orbiting space objects for collision avoidance and (2) protection support to monitor, detect, assess, characterize, track, and issue warnings about threats, both natural and man-made, against United

States and allied space systems. The space control evaluation was executed between March 11 and March 25, 1999.

Space Command Implemented Most Important Management Processes During Its Space Control Evaluation

As noted in table 2 below, we found that, for its space control operational evaluation, Space Command satisfied the majority of the management process controls (16 of 21) specified in JCS' operational evaluation guidance.

Table 2: Summary of Space Command's Satisfaction of JCS Evaluation Criteria for the Space Control Evaluation

Phases	Number of primary evaluation criteria	Number of primary criteria satisfied
Planning	11	9
Execution	5	4
Analysis	3	2
Reporting	2	1
Total	**21**	**16**

Consistent with JCS guidance governing operational evaluation planning, Space Command established a Year 2000 task force, which included satellite/system specialists, test and evaluation experts, system analysts, military component and service representatives, and public affairs representatives. It identified 35 critical tasks that it needed to carry out the space control mission in support of a major theater war. Space Command also issued a directive to ensure testing resources would be made available for operational evaluations and earmarked about $8 million for operational evaluation activities—including the space control evaluation. Further, Space Command developed a test plan that documented participant roles and responsibilities, critical missions and tasks, test cases, and reporting requirements.

Space Command also took effective steps in executing, analyzing, and reporting on its evaluation. For instance, before executing the operational evaluation, Space Command performed a rehearsal to ensure that all critical systems and interfaces were operating correctly and that all staff knew their roles and responsibilities. Before resetting systems to current day operations, Space Command ensured that thin line systems were

assessed, master scenario events were performed and deviations were identified, and that all data needed to make an assessment of the command's ability to perform the space control mission were collected and archived.

Space Command Acted to Address Three Partially Satisfied Key Processes

Following its operational evaluation, Space Command took action to resolve three partially satisfied key processes. In doing so, it increased its assurance with respect to the Y2K readiness of space control critical tasks involving intelligence and communications systems.

First, before conducting its test, Space Command did not verify that contingency plans were in place for the 29 systems included in the evaluation. Instead, Space Command relied exclusively on system owners to do so. As noted in JCS testing guidance, contingency plans identify alternative systems or workaround procedures to use when performing a mission in the event of a system disruption. As such, JCS guidance states that it is essential that commands ensure that these plans are in place prior to executing the operational evaluation so that they can be invoked in the case of system failure. Subsequent to the evaluation, Space Command began verifying that contingency plans are in place for its mission-critical systems.

Second, while executing the evaluation, Space Command did not follow configuration management procedures. JCS guidance specifies that system configurations not be changed during testing unless authorized by the test director. During the space control evaluation, changes were made to one system after the baseline for the evaluation was established and without authorization from the test director. These changes contributed to a "hard" failure during testing. (Information on the nature of the system failure is classified).[6] After the evaluation, Space Command directed the 17th Test Squadron and intelligence unit to review this deviation and its impact on the command's ability to determine mission readiness. On September 30, 1999, the intelligence unit and 17th Test Squadron reported that the deviation did not materially affect mission readiness. To prevent similar problems in future evaluations, Space Command directed the 17th Test Squadron and intelligence unit to develop ways to improve testing

[6]A "hard" failure is a Y2K-related failure that results in an obvious adverse impact to the system. For example, the system shuts down, displays erroneous data, or performs other unexpected actions.

documentation and procedures with a special focus on ensuring that documentation standards, configuration management procedures, and baseline test requirements are followed.

Third, in reporting on the evaluation, Space Command did not specify how its exclusion of six communications systems from the test impacted its ability to draw conclusions about mission readiness. When planning the evaluation, Space Command concluded that it would not include six communications systems in the evaluation due to resource constraints or because the systems were to be included in a future evaluation. As a result, Space Command assumed that communications systems would be available to perform critical tasks and disseminate time-sensitive warnings to combatant commanders. While Space Command communicated this assumption to JCS in its operational evaluation plan, it did not report on how this scope limitation could adversely affect its ability to draw conclusions about mission readiness. Instead, Space Command reported to JCS that critical space control tasks could be performed across the calendar and leap year dates with no significant impact on its mission readiness. Space Command has since ensured that omitted communications systems were included in other Year 2000 end-to-end testing or operational evaluation events and disclosed this limitation in its final report on the evaluation.

Space Command Is Acting to Address Recommendation Made at the Briefing

At the time of our October 1, 1999, briefing, Space Command had not yet addressed two partially satisfied key processes. First, in planning the evaluation, Space Command did not ensure that one intelligence system to be tested was certified as compliant. Rather, it only verified that the software application relevant to the evaluation was compliant. Year 2000 compliance of an application in isolation is of very limited value unless the system platform that it runs on, as well as other applications operating on the system, is compliant. As such, both JCS guidance and GAO's end-to-end test guidance define system, not application, compliance as a precondition to end-to-end testing.

Second, Space Command did not document whether intelligence systems met system performance exit criteria for all test cases. Specifically, the command was supposed to show whether it could process a predetermined number of transactions within specific time constraints. While command officials contend that this was done, only one-fifth of the transactions for intelligence critical tasks were documented. Space Command officials

stated that it was too time-consuming for operators to print screens for these tasks during the evaluation.

At our briefing, we recommended that Space Command amend its final report to JCS to recognize the (1) uncertainties and risks associated with its failure to fully satisfy these criteria and (2) the actions it had underway or planned to address these uncertainties and risks. Space Command agreed with this recommendation. It plans to amend its final report to disclose these limitations and to pursue an alternative data collection strategy for its planned November 1999 operational evaluation of its intelligence mission in order to verify that intelligence systems/tasks fully meet performance criteria.

Conclusion

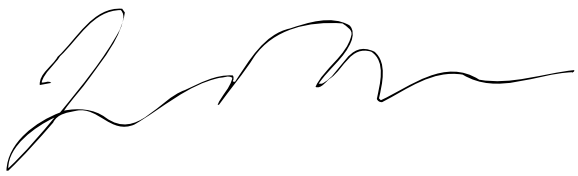
By acting swiftly to address our recommendation, made during the October 1, 1999, briefing, Space Command has demonstrated its commitment to improving management controls over Year 2000 testing activities and the effectiveness and value of its operational evaluation as well as mitigated the risks associated with being able to operate effectively in the Year 2000. Further, it has ensured that DOD managers have complete and reliable information to use in making informed military decisions. As a result, Space Command has satisfied the intent of our recommendation, and we are not making any further recommendations at this time.

We are sending copies of this report to Representative John P. Murtha, Ranking Minority Member, Subcommittee on Defense, House Appropriations Committee; Senator John Warner, Chairman, and Senator Carl Levin, Ranking Minority Member, Senate Committee on Armed Services; Senator Ted Stevens, Chairman, and Senator Daniel Inouye, Ranking Minority Member, Subcommittee on Defense, Senate Committee on Appropriations; and Representative Floyd Spence, Chairman, and Ike Skelton, Ranking Minority Member, House Committee on Armed Services.

We are also sending copies to the Honorable John Koskinen, Chair of the President's Year 2000 Conversion Council; the Honorable William Cohen, Secretary of Defense; the Honorable John Hamre, Deputy Secretary of Defense; General Henry Shelton, Chairman of the Joint Chiefs of Staff; Arthur Money, Assistant Secretary of Defense for Command, Control, Communications, and Intelligence; and the Honorable Jacob Lew, Director, Office of Management and Budget. Copies will also be made available to others upon request.

Should you or your staff have any questions concerning this report, please contact me at (202) 512-6240. I can also be reached by e-mail at *brockj.aimd@gao.gov*. Other points of contact and key contributors to this report are listed in appendix III.

Sincerely yours,



Jack L. Brock, Jr.
Director, Governmentwide and Defense
Information Systems

Briefing on Results of GAO Review of SPACECOM Space Control Y2K OPEVAL

Results of GAO Review of SPACECOM Space Control Y2K OPEVAL

House Appropriations Committee

November 1, 1999

1

Introduction

- In August 1998, the Secretary of Defense directed the Commanders-in-Chief (CINC), who are responsible for Defense's unified combatant commands, to plan, execute, and report on a series of simulated Year 2000 operational evaluations (Y2K OPEVALs).

- The CINC Y2K OPEVALs are one of three Defense Y2K end-to-end test and evaluation efforts. GAO's Y2K Test Guide advocates end-to-end testing, which is testing performed to verify that a defined set of interrelated systems (i.e., systems that collectively support an organizational core business function or operation) interoperate as intended in a Y2K environment.

  The CINC core business functions/operations are referred to as "thin lines." The "thin lines" consist of critical tasks, as well as systems that perform critical tasks.

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Objectives

- At the request of the Chairman, House Appropriations Committee, Defense Subcommittee, GAO is reviewing selected OPEVALs to determine:

  (1) if the OPEVAL was planned, executed, and documented in accordance with DOD guidelines, and

  (2) what the OPEVAL results indicated concerning readiness and risks.

- The OPEVALS reviewed by GAO included those conducted by Space and Transportation Commands and were selected in collaboration with the Defense Inspector General (IG) to ensure:
  - appropriate coverage of all CINC OPEVALs, and
  - no duplication of effort.

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Scope and Methodology

This briefing addresses the Space Command OPEVAL for Space Control. To satisfy objective (1), we

- reviewed the OPEVAL plan, testing documents/records, and test results/reports;
- interviewed Space Command officials responsible for Y2K OPEVAL planning, execution, and reporting tasks; and
- compared Space Command's planning, execution, analysis, and reporting actions with Defense OPEVAL guidance.

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Scope and Methodology

- To satisfy objective (2), we
  - reviewed Space Command's OPEVAL results, 7-and 30-day reports, and system problem tracking reports and
  - interviewed Space Command officials and analysts responsible for developing OPEVAL assessment methodologies, interpreting evaluation metrics, and ensuring that evaluation exit criteria were met.
- On October 1, 1999, we briefed Space Command leadership on the results of our review and made a recommendation to address our findings. In agreeing to our recommendation, Space Command has taken action to address weaknesses identified during the review and plans to amend its final OPEVAL report accordingly.
- We performed our work from March 1999 through October 1999 in accordance with generally accepted government auditing standards.

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Background

DOD OPEVAL Overview

- To assist the CINCs in planning, documenting, executing, analyzing, and reporting OPEVALs, the Joint Staff issued OPEVAL guidance. The guidance is divided into phases:
  - planning,
  - execution,
  - analysis, and
  - reporting
- The OPEVAL guidance is consistent with GAO's end-to-end testing guidance and DOD's Y2K management plan.

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Background

Space Command OPEVAL Events' Status

- Space Command is responsible for providing continuous and real-time (1) warnings of air or space attacks against North America and (2) space control, surveillance, communications, and intelligence support to military operations worldwide.

- To fulfill its missions, Space Command depends heavily on information systems and technology, including satellites, geographically dispersed radars/sensors, ground relay terminals/stations, and communication networks.

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Background

- Space Command identified 7 “thin lines” (missions) to be operationally evaluated: (1) Integrated Tactical Warning and Attack Assessment, (2) Space Control, (3) Force Enhancement, (4) Weather Support, (5) Command and Control (C2) of Space Forces, (6) Space Operations Support, and (7) Space Lift.
- For the 7 “thin lines”, Space Command identified 92 critical tasks[1] and 86 supporting systems.
- The following table describes the status of Space Command’s 16 OPEVALs and the Chairman’s Contingency Assessment (CCA).

[1] The number does not include critical tasks for the first two OPEVALS because critical tasks were not identified in reports for the first two OPEVALS.

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Background

Evaluation Events	"Thin Line"	Schedule	Results
OPEVAL – North American Aerospace Defense Command (NORAD)	Integrated Tactical Warning and Attack Assessment (ITWAA)	December 2-4, 1998	Reported mission ready 0 "soft"[1] failures 0 "hard" [2] failures
OPEVAL – NORAD	ITWAA	February 16-28, 1999	Reported mission ready 2 "soft" failures 1 "hard" failure
OPEVAL	Space Control	March 15-25, 1999	Reported mission ready 2 "soft"[1] failures 3 "hard"[2] failures
OPEVAL – Central Command	Command and Control (C2) – Space Forces	April 6-12, 1999	Reported mission ready 1 "soft"[1] failure 0 "hard"[2] failures

[1]A "soft" failure is a Y2K-related failure that is not immediately discernable. The effect may be cumulative and require several hours, days, or longer to manifest itself.
[2]A "hard" failure is a Y2K-related failure that results in an obvious adverse impact to the system. For example, the system shuts down, erroneous data is displayed, or unexpected actions occur.
[3] Information classified by the Department of Defense.

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Background

Evaluation Events	"Thin Line"	Schedule	Results
OPEVAL – Central Command	Global Positioning System - Space Support/Space Force Enhancement	April 23-May 1, 1999	Reported mission ready 0 "soft" failures 0 "hard" failures
OPEVAL – Central Command	Theater Ballistic Missile Warning (TBMW) – Space Support/Space Force Enhancement	April 22-30, 1999	Reported mission ready 0 "soft" failures 1 "hard" failure
OPEVAL – Central Command	Space Support/ Satellite Control	May 1-2 & May 10-11, 1999	Reported mission ready 3 "soft"[1] failures 0 "hard"[2] failures
OPEVAL – Central Command	Terrestrial Weather - Space Support/ Space Force Enhancement	May 10-17, 1999	Reported mission ready 1 "soft"[1] failure 0 "hard"[2] failures

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Background

Evaluation Events	"Thin Line"	Schedule	Results
OPEVAL	Communications – Space Operations Support	June 9-15, 1999	Reported mission ready 0 "soft"[1] failures 0 "hard"[2] failures
CCA[4]	Intelligence, Surveillance, & Reconnaissance	June 14-18,1999	Classified[3]
OPEVAL	Space Weather	June 19-July 14, 1999	Reported mission ready 0 "soft"[1] failures 0 "hard"[2] failures
OPEVAL – Central Command	TBMW – C2 Space Forces	July 15-31, 1999	Reported mission ready 0 "soft" failures 1 "hard" failure
OPEVAL – Central Command	Communications – Space Force Enhancement	July 27, 1999	Reported mission ready 1 "soft" failure 0 "hard failures

[4]The CCA was designed to evaluate the ability of unified commands to perform missions in an environment degraded by Y2K failures.

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Background

Evaluation Events	"Thin Line"	Schedule	Results
OPEVAL	Space Lift	July 22, 1999	Reported mission ready 0 "soft" failures 0 "hard" failures
OPEVAL	Space Lift	July 27, 1999	Reported mission ready 0 "soft" failures 0 "hard" failures
OPEVAL	Space Lift	August 2-6, 1999	Reported mission ready 0 "soft" failures 0 "hard" failures
OPEVAL	Space Lift	September 1-3, 1999	Reported mission ready 0 "soft" failures 0 "hard" failures

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Background

Space Control OPEVAL

- The Space Control "thin line" includes providing (1) surveillance support to monitor, track, identify, and catalog all orbiting space objects for collision avoidance and (2) protection support to monitor, detect, assess, characterize, track, and issue warnings about threats, both natural and man-made, against U.S. and allied space systems.

- The Space Control OPEVAL was conducted in collaboration with other DOD organizations, including Air Force, Army, and Navy Space Commands. It was intended to test real-world Space Control operations in a Y2K environment.

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Background

- The Space Control "thin line" included 50 systems supporting 35 critical tasks. The OPEVAL involved 29 of these systems.
- The Space Control OPEVAL was completed between March 11-25, 1999 and included these test execution events:
  - Rehearsal: March 11, 1999.
  - Baseline: March 20, 1999.
  - Surveillance/Intelligence Testing: March 15-19, 1999.
  - Protection Testing: March 22-25, 1999.
- The test environment consisted of desktop computers; geographically dispersed ground radar sites; and partitioned IBM mainframes.

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Background

- The required calendar and leap year events (September 8, 1999 to September 9, 1999; December 31, 1999 to January 1, 2000; February 28, 2000 to February 29, 2000; and February 29, 2000 to March 1, 2000) were assessed as part of the OPEVAL.

- The Space Control OPEVAL assessed 46 date dependent functions in 29 systems using these dates.

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Background

Space Control Critical Tasks	Thin Line Systems
1. Maintain the current space environment database	Navy Fence; Millstone; Thule; TOS; Altair; MPDS; IDHS; SPADOC; CMP; CFE-R; ICIG; NUIS; AMHS
2. Space Surveillance Network tasking	MPDS; SPADOC; CMP
3. Observation control/tasking analysis	MPDS; SPADOC; CMP
4. Observation Processing	SPADOC
5. Element Set Updates	SPADOC
6. Transmit Field Element Sets	SPADOC
7. Cross-tag/lost satellite/unknown observation processing	SPADOC
8. Launch processing	SPADOC

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Background

Space Control Critical Tasks	Thin Line Systems
9. Maneuver Processing	SPADOC
10. Manual Piece Separation Processing	SPADOC
11. Collision Avoidance	SPADOC
12. Decay Processing/re-entry assessment	SPADOC
13. Break-up Processing	SPADOC
14. Monitor and report status of all sensor sites	MPDS; SPADOC; CMP
15. Manage sensor coverage	MPDS; SPADOC; CMP
16. Perform event-related up-channel reporting	MPDS; SPADOC; CMP

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Background

Space Control Critical Tasks	Thin Line Systems
17. Perform extended collection/surveillance against foreign satellites to characterize status and performance parameters as well as support the foreign space order of battle	Navy Fence, Millstone, Thule, TOS, Altair; MPDS; IDHS; SPADOC; CMP; CFE-R; ICIG; NUIS; AMHS; OSAS; SDB; SMAT; SMPAS
18. Monitor the space situation and collect and correlate data on potential and actual hostile activities against U.S. and designated allied space systems.	Navy Fence, Millstone, Thule, TOS, Altair; MPDS; IDHS; SPADOC; CMP; CFE-R; ICIG; NUIS; AMHS; SDB; SATRAN
19. Assess data and determine intent	SPADOC; AMHS; NUIS; OSAS; SDB; SMAT; SMPAS
20. Inform the National Military Command Center of impending, current, and completed hostile space activity	MPDS; SPADOC; CMP
21. Characterize the results of a space attack	SPADOC

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Background

Space Control Critical Tasks	Thin Line Systems
22. Provide designated authorities with situation reports	MPDS; SPADOC; CMP
23. Provide technical support as required	MPDS; SPADOC; CMP
24. Provide assistance to routine peacetime space operations	MPDS; SPADOC; CMP
25. Provide warning and assessment messages	MPDS; SPADOC; CMP
26. Provide countermeasure coordination/status	MPDS; SPADOC; CMP
27. Inform space system owner/operators and other designated authorities of selected countermeasures	MPDS; SPADOC; CMP

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Space Control Critical Tasks	Thin Line Systems
28. Evaluate countermeasure effectiveness	SPADOC
29. Assist in planning for further countermeasures	SPADOC
30. Inform National Military Command Center and other appropriate elements of the results of countermeasure implementation	MPDS; SPADOC; CMP
31. Maintain current documentation of world-wide counter space capabilities	SPADOC; CFE-R; ICIG; NUIS; SDB; SMPAS; OSAS; SMAT
32. Receive taskings (sensors)	Navy Fence; Millstone; Thule; TOS; Altair; MPDS; CMP
33. Schedule tracks (sensors)	Navy Fence; Millstone; Thule; TOS; Altair
34. Conduct tracks (sensors)	Navy Fence; Millstone; Thule; TOS; Altair
35. Transmit track data (sensors)	Navy Fence; Millstone; Thule; TOS; Altair; MPDS; IDHS

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Results of GAO Review

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Planning

Defense Test Criteria	Result
Specify test assumptions and limitations	Satisfied
Establish a Y2K task force and assign responsibilities	Satisfied
Identify critical missions/tasks/systems	Satisfied
Verify systems essential to mission are Y2K compliant/certified	Partially Satisfied
Develop OPEVAL plan to guide event planning and execution	Satisfied
Identify and schedule CINC/Allied/Component/Agency support	Satisfied
Determine relevant and necessary resources (e.g., funding, personnel, equipment, etc.)	Satisfied
Ensure approved Y2K contingency plans are prepared	Partially Satisfied
Develop risk management plan	Satisfied
Identify simulation needs and establish supporting environment	Satisfied
Develop data collection and analysis plan or approaches	Satisfied

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Findings: Planning

Criteria: In planning for the OPEVAL, CINCs are to define assumptions concerning the readiness of systems and the ability to evaluate systems in light of real-world limitations.

Finding: Space Command identified real-world considerations and system readiness limitations during Y2K planning meetings. These limitations were disclosed in the OPEVAL Plan and to the JCS. Specifically, Space Command reported that 29 of the 50 “thin line” systems would be included and 21 would be excluded from the OPEVAL due to resource constraints, or because they would be tested in other OPEVALs. Six of the 21 excluded systems were communications systems that were to be tested in a future OPEVAL.

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Findings: Planning

Criteria: A CINC Y2K Task Force composed of knowledgeable Y2K, test, and systems experts should be formed to establish the base for all Y2K planning, coordination, execution, and reporting.

Finding: Consistent with the defined scope of the OPEVAL, Space Command established a Y2K Task Force and it defined roles and responsibilities with milestones for each member. Members of the task force included satellite/system specialists, test and evaluation experts, system analysts, and public affair specialists from the Command's Operations, Intelligence, Planning, and Public Affairs units. They also included Air Force's Operational Test and Evaluation Center (AFOTEC) and 17th Test Squadron, military service, and NASA representatives.

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Findings: Planning

Criteria: CINCs need to analyze critical missions to determine the most critical missions and identify the critical tasks supporting each critical mission. In addition, the minimum number of integrated automated information platforms/systems required to perform each critical task or critical mission must be identified (the “thin line”).

Finding: Consistent with the defined scope of the OPEVAL, Space Command identified 35 critical tasks that needed to be evaluated to determine mission readiness in a Y2K environment. In addition, Space Command identified a total of 29 “thin line” systems to support these tasks.

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Findings: Planning

Criteria: Ensure that mission-critical "thin line" systems are certified Y2K compliant.

Finding: Consistent with the defined scope of the OPEVAL, Space Command verified that 28 of 29 mission-critical, "thin line" systems to be included in the OPEVAL were certified Y2K compliant. The 29th system was not certified as compliant, but was nevertheless included in the OPEVAL rather than invoking the system's contingency plan because, according to Space Command officials, they verified that the application on the system relevant to the OPEVAL was compliant. This is contrary to JCS guidance and GAO's end-to-end test guidance, which defines system (not application) compliance as a precondition to end-to-end testing. In short, Y2K compliance of an application in isolation is of very limited value unless the system platform that it runs on, and the other applications running on the system that it interoperates with, are also compliant.

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Finding: Planning

Finding: At the time of our October 1, 1999, briefing, Space Command had not addressed this concern. We therefore recommended that this deviation be disclosed in the final OPEVAL report. Space Command officials agreed with our recommendation that the final report disclose this information and now plans to revise the final report. Additionally, Space Command stated that the system is scheduled to be compliant in November 1999 and to be included in its November 1999 operational evaluation of the intelligence mission area.

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Findings: Planning

Criteria: The Y2K task force should document how the OPEVAL will be conducted, data will be gathered and analyzed, and how reports will be formatted.

Finding: Space Command developed an exercise directive and test plan for the OPEVAL to:

- ensure that mechanisms for evaluating critical dates and contingency plans for mission-critical systems are executed.
- document participant roles and responsibilities.
- link critical missions, critical tasks, architectures, test cases, and data elements.
- report Y2K OPEVAL results.

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Findings: Planning

Criteria: When preparing for a Y2K OPEVAL, determine the extent of participation of other CINCs, allies, components, and agencies and coordinate their participation in the event.

Finding: Consistent with the defined scope of the OPEVAL, Space Command identified, coordinated, and scheduled the OPEVAL with Y2K Task Force members from the Command's Operations, Intelligence, Planning, and Public Affairs units. They also coordinated activities with Air Force's Operational Test and Evaluation Center (AFOTEC), 17th Test Squadron, and Air Force, Army, and Navy Space Commands, and NASA.

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Findings: Planning

Criteria: The necessary resources (funding, personnel, training, equipment, time frames, and external organization support) should be identified and included in the plan.

Finding: In November 1998, Space Command issued a directive to ensure testing resources would be made available for Y2K OPEVALS. About $8 million was earmarked for OPEVAL activities, including the Space Control OPEVAL. Space Command also coordinated the evaluation scenario and scripts with all OPEVAL participants, acquired the systems hardware and software to simulate space control events, and scheduled 37 test and operator personnel to help execute the OPEVAL.

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Findings: Planning

Criteria: To ensure that Y2K exercise objectives are met, it is essential to have contingency plans in place prior to executing the OPEVAL.

Finding 1: Space Command's approach to determining whether contingency plans were in place prior to executing the OPEVAL was to rely exclusively on system owners to ensure that this criterion was met. Space Command did not take steps to verify this criterion. Space Command has since initiated a review of about 50 contingency plans.

Finding 2: During the OPEVAL, operators successfully performed mission tasks in response to the 3 "hard" system failures by invoking workarounds.

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Findings: Planning

Criteria: CINC-unique risk management plans should be developed to identify and mitigate system-related risks before they adversely impact mission execution.

Finding: Space Command identified OPEVAL risks and strategies for managing these risks in its Space Control OPEVAL Plan. For example, the Plan recognizes the risks associated with confusing OPEVAL sensor observations with real-world observations. To mitigate these risks, Space Command's Plan provides strategies for isolating systems' execution of OPEVAL tasks/functions from real-world system operations by electronic partitioning.

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Findings: Planning

Criteria: CINCs should (1) determine if simulations or manual data input will be needed during the execution of the OPEVAL, and, if needed, (2) ensure that an environment which can support the simulation is planned for and acquired.

Finding: Within the defined scope of the OPEVAL, Space Command identified the simulations needed and manual data inputs required for testing and ensured that data injection methodologies were included in the OPEVAL Plan and master scenario events list (MSEL). For example, Space Command used simulated scenarios to perform satellite orbital changes for tracking and cataloging purposes.

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Findings: Planning

Criteria: A plan should be prepared to help coordinate and synchronize all OPEVAL data collection and assessment activities.

Finding: Consistent with the specified scope of the OPEVAL, Space Command developed a data collection and analysis plan that included (1) specific actions that should be accomplished by the OPEVAL participants prior to the start of and at the completion of each OPEVAL, (2) ground rules for collecting and documenting mission-critical system outputs, and (3) direction on reviewing the critical tasks executed during the OPEVAL and determining the performance of the mission-critical "thin line" systems.

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Execution

Defense Test Criteria	Result
Conduct OPEVAL rehearsal	Satisfied
Follow configuration management policies	Partially Satisfied
Perform baseline test for OPEVAL	Satisfied
Execute required Y2K date rollover tests	Satisfied
Collect and archive all Y2K-relevant data and ensure that systems are reset to current day operations	Satisfied

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Findings: Execution

Criteria: Prior to executing the Y2K OPEVAL, a rehearsal should be conducted to ensure that all critical systems and interfaces identified in the system architecture are operating correctly and that OPEVAL staff know their roles and responsibilities.

Finding: Space Command performed a rehearsal/test readiness review on March 11, 1999. The rehearsal was used to (1) validate that the test readiness review requirements, (2) verify data collection and analysis methodologies, (3) confirm the baseline configuration for testing, and (4) ensure OPEVAL staff practiced their roles and responsibilities.

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Findings: Execution

Criteria: The configurations of systems and architecture established for OPEVAL testing should not be changed unless authorized by the test director.

Finding: Changes were made to one system in the test environment after the baseline for the OPEVAL was established and without authorization from the test director. These changes contributed to one "hard" system failure identified during the OPEVAL. (Information on the nature of the system failure is classified.) Space Command has since reinforced the need to strictly follow configuration management policies during OPEVALS and tasked the 17th Test Squadron and intelligence unit to develop ways to better ensure that configuration management over test baselines is enforced.

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Findings: Execution

Criteria: A baseline Y2K test should be executed to establish expected results data that will be used to compare to output data captured during the Y2K date rollover tests and to help establish whether or not a failure is Y2K-related.

Finding: Space Command conducted a baseline Y2K test on March 20, 1999. However, this test only covered the critical tasks associated with space surveillance and protection and did not include intelligence tasks because officials stated that baseline testing duplicated rehearsal activities. This position is contrary to JCS guidance. According to JCS guidance, the purpose of the rehearsal is to provide operators with an opportunity to practice their responsibilities. In contrast, the baseline test is to execute the master scenario events list under operational conditions to establish expected outputs against which OPEVAL results can be compared. Clearly, these two execution requirements, because they serve different purposes, differ in terms of content, depth, and scope, and thus are not duplicative.

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Findings: Execution

Finding: Space Command officials acknowledge the differences between test rehearsals and baseline tests, but explained that the rehearsal for intelligence systems was expanded to satisfy baseline testing requirements, including using the same quality and quantity of data planned for the baseline test. To verify this, we reviewed information subsequently provided by the test directorate and found that it showed a level of testing rigor for these systems that went beyond that normally required of a test rehearsal. We also verified that baseline test results were documented during the rehearsal. SPACECOM officials have disclosed this deviation and its impact in its amended OPEVAL report.

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Findings: Execution

Criteria: Mission-critical "thin line" systems should be executed using normal operating procedures, and a seamless continuity of operations during critical Y2K date rollovers should be observed.

Finding: For the Space Control OPEVAL, 29 systems were tested and 3 experienced "hard" failures. According to Space Command officials, it was not necessary to invoke contingency plans for these failures because operators were able to perform workarounds to complete mission tasks. For 2 of the 3 "hard" failures, these workarounds were included in OPEVAL documentation; however, for the third "hard" failure, OPEVAL documentation was not prepared. According to Space Command officials, in all 3 cases, operations were not disrupted and tasks were completed seamlessly and continually.

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Findings: Execution

Criteria: Ensure that all data needed to conduct the evaluation for the Y2K case has been captured prior to resetting the system to current day operations requirements.

Finding: Prior to resetting the systems to present day operational conditions, Space Command determined that (1) the 29 “thin-line” systems were assessed, (2) the master scenario events were performed and deviations were identified, and (3) all data needed to make an assessment of Space Command’s ability to perform the defined “thin line” were collected and archived.

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Analysis

Defense Test Criteria	Result
Categorize, document, and report failures	Satisfied
Determine mission impact of Y2K failures	Satisfied
Ensure Y2K OPEVAL exit criteria are met	Partially Satisfied

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Findings: Analysis

Criteria: All failures are to be identified and properly categorized as either “hard” or “soft” failures and should be documented and reported in accordance with the data collection and analysis plan.

Finding: Space Command identified 5 Y2K failures during the Space Control OPEVAL and categorized 3 as “hard” and 2 as “soft” failures. All system failures were documented in accordance with DOD Y2K requirements and reported to the Joint Staff Y2K office. Examples of the “hard” failures include a system that did not display messages during and after the leap year rollover and a system that did not automatically list file names for operators in a viewer window.

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Findings: Analysis

Criteria: Determine the impact of a failure on the accomplishment of a critical mission.

Finding: Space Command determined that all 5 Y2K failures had no significant impact on its ability to perform the Space Control mission.

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Findings: Analysis

Criteria: JCS defined 9 exit criteria that OPEVAL results should be measured to ensure that critical tasks and missions can be performed in a Y2K environment.

Finding 1: Space Command measured its OPEVAL performance against the 9 Joint Staff exit criteria and concluded that the Space Control mission can be successfully performed in a Y2K environment.

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Findings: Analysis

Finding 2: Space Command did not document that all the measures of performance established as exit criteria for intelligence critical tasks/systems were achieved. Measures of performance are used to determine whether specified system functions are performed within established time frames. Space Command's measures of performance for the critical tasks in its Space Control OPEVAL included predetermined numbers of transactions to be executed and time constraints within which transactions are to be executed.

However, Space Command only documented a portion of the predetermined number of transactions specified in the OPEVAL Plan for intelligence critical tasks. According to intelligence officials, all predefined transactions were executed successfully but only one-fifth were documented because it was too time-consuming to print screens during testing. In the absence of the requisite test results documentation, we could not validate this claim.

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Findings: Analysis

Finding 3: At the time of our briefing, Space Command had not addressed this concern. We therefore recommended that the final report be revised to reflect this deviation and to describe the actions being taken to mitigate the resulting risks. Space Command officials have since agreed that some alternative measure should have been taken to document all test results and thus ensure the OPEVAL's integrity was not compromised. The officials have also agreed to our recommendation and plan to revise the final OPEVAL report to reflect this deviation and to ensure that the November 1999 operational evaluation of its intelligence mission area provides for fully documenting test results.

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Reporting

Defense Test Criteria	Result
Prepare Y2K reports describing mission impact and readiness	Partially Satisfied
Provide reports to Joint Staff J7 within required time frames	Satisfied

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Findings: Reporting

Criteria: CINCs are to prepare Y2K reports describing mission impact and readiness.

Finding 1: Space Command provided Y2K reports to the Joint Staff which concluded that all critical tasks supporting Space Control can be performed with no significant impact on readiness caused by potential Y2K failures.

Finding 2: Space Command officials stated that the reports were completed as required. However, the reports did not fully describe the limitations in the scope of the OPEVAL and testing deviations (i.e., the omission of 6 key communications systems, the noncompliant system involved in the OPEVAL, configuration changes made to a system after the baseline was established for the OPEVAL, and the failure to fully document that

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Findings: Reporting

established performance criteria for intelligence tasks/systems were satisfied) or the extent to which these limitations and deviations affected the command's ability to draw unqualified conclusions about Space Control mission readiness.

Finding 3: Since completing the Space Control OPEVAL, Space Command provided documentation that showed the 6 communications systems were included in other OPEVAL or end-to-end tests. Also, Space Command has recently agreed to revise its 30-day report to disclose testing deviations involving the use of a noncompliant system in the OPEVAL, the failure to follow configuration management procedures, and the failure to fully document intelligence tasks/systems test results.

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Findings: Reporting

Criteria: A preliminary report is required within 7 calendar days after the completion of the OPEVAL and a final report is required within 30 calendar days. Both reports are to be provided to Joint Staff.

Finding: Space Command completed the 7- and 30-day reports for the Space Control OPEVAL and provided them to Joint Staff.

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Conclusions

- Space Command satisfied many of the Defense OPEVAL requirements for its defined Space Control "thin line."

- However, key steps that are vital to (1) ensuring that only compliant systems or system contingency plans are used in the OPEVAL, (2) fully disclosing deviations from planned performance measures and the impact of doing so, and (3) accurately reporting mission readiness in light of OPEVAL scope limitations were not fully satisfied. As a result, the Y2K readiness of Space Control critical tasks involving intelligence and communications systems was not known with sufficient surety to support Space Command's March 1999 unqualified conclusion of mission readiness in a Y2K environment.

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Conclusions

- Since then, Space Command has taken steps to fill voids in its understanding of Space Control mission readiness by ensuring that omitted communications systems were included in other Y2K end-to-end testing or OPEVAL events. It has also taken additional action to improve testing procedures and documentation requirements and has agreed to address our recommendation for revising its final OPEVAL report to reflect deviations with regard to the performance and verification of intelligence systems' Y2K compliance. Moreover, Space Command has acted to ensure that its planned November 1999 operational evaluation provides for fully documenting test results. Therefore, we are not making any further recommendations at this time.

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Objectives, Scope, and Methodology

At the request of the Chairman, House Appropriations Committee, Subcommittee on Defense, we selected the Space Command Space Control evaluation for review to determine (1) if the evaluation was planned, executed, and documented in accordance with DOD guidelines, and (2) what the evaluation results indicated concerning readiness and risks. This operational evaluation was selected in collaboration with the Defense Inspector General to ensure appropriate coverage of all combatant command operational evaluations and no duplication of effort.

To satisfy our first objective, we reviewed the evaluation plan, testing documentation and records, and test results and associated reports. We also interviewed Space Command officials responsible for Year 2000 operational evaluation planning, execution, and reporting tasks. Further, we examined the century date rollover testing documents for the operational evaluation and compared Space Command's operational evaluation planning, execution, analysis, and reporting actions against JCS operational evaluation guidance and our Year 2000 testing guide.

To satisfy the second objective, we reviewed Space Command's operational evaluation results, including its 7- and 30-day reports and system problem tracking reports. We also interviewed Space Command officials and analysts responsible for developing operational evaluation assessment methodologies, interpreting evaluation metrics, and ensuring that evaluation exit criteria were met.

On October 1, 1999, we briefed Space Command leadership on the results of our review. Space Command provided oral comments on our briefing slides, and we have incorporated them as appropriate. We performed our work from March through October 1999 in accordance with generally accepted government auditing standards.

GAO Contact and Staff Acknowledgements

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