United States General Act ounting Office

Report to the Chairman, Committee on Armed Services, House of Representatives

### 1994

# TRIDEN I II



# Reductions to MK-6 Guidance System Inventor/Objectives May Be Possible





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GAO	United States General Accounting Office Washington, D.C. 20548	Accesion For	
	National Security and International Affairs Division	DTIC TAB	
	B-257417	By	
	July 6, 1994	Distribution /	
	The Honorable Ronald V. Dellums Chairman, Committee on Armed Services House of Representatives	Dist Avail and / or Special	
	Dear Mr. Chairman:	A-1	
	submarine's D-5 missile. Our review focuse basis for computing its total program inver systems and (2) the effect that a reduction would have on the overall reliability of the On April 29, 1994, we provided your office results of our review. This report summari information.	ed on determining (1) the Navy's ntory objective for the guidance in this inventory objective D-5 missile. preliminary information on the zes and supplements that	
Background	The Navy plans to have 10 Trident II subminishes are under construction. Each Trider missiles. Each D-5 missile is equipped with which is comprised of an inertial measurem assembly. The inertial measurement unit sorelays this data to the electronics assembly commands to the missile.	arines by the end of fiscal year ent II submarines and four at II submarine carries 24 D-5 a the MK-6 guidance system, ment unit and an electronics enses velocity and direction and y, which issues flight control	
	The Navy maintains spare MK-6 guidance systems onboard each submarine and in its logistics pipeline for test and maintenance purposes. The inventory objective is 570 inertial measurement units and 562 electronics assemblies. Through fiscal year 1994, the Navy had procured 525 inertial measurement units and 511 electronics assemblies. To meet its inventory objectives, the Navy plans to procure 45 additional inertial measurement units and 51 additional electronics assemblies before the guidance system acquisition program is completed. According to Navy officials, in fiscal year 1995 and beyond, \$318.2 million will be required to meet its guidance system inventory objectives. Appendix I provides additional information on the submarine-launched ballistic missile program and guidance system requirements.		



Results in Brief	The Navy's MK-6 guidance system inventory objectives are based on maintaining the D-5 missile system at the same high levels of readiness and reliability throughout the remaining 33 years of the Trident II program's life that were originally established between 1986 and 1987, during the Cold War era. To maintain these high readiness and reliability rates, the Navy calculated its program needs using methods that provided it with the highest number of MK-6 spares that might be needed at any time during the program.		
	The Navy carries six spare MK-6s onboard each patrolling submarine. Our analysis indicates that having three onboard spares would decrease the guidance system's operational readiness by only 3 percent (from 0.99979 to 0.96935) and having four onboard spares would result in only a 0.66-percent decrease (from 0.99979 to 0.99318). These decreases in MK-6 guidance system operational readiness would have a minimal effect on the overall D-5 missile system's operational readiness and reliability levels. A slight reduction in current operational readiness and reliability rates to levels that would allow for three onboard MK-6 spares would save approximately \$159 million. Reductions allowing for four onboard MK-6 spares would save approximately \$106 million. In addition, depending on the magnitude of inventory reductions, current readiness and reliability levels may be reduced for only a few years around the time that program needs are expected to be at their highest. In view of the break up of the Warsaw Pact and the Soviet Union, which ended the Cold War era, Trident missile and guidance system operational experience to date, the current budget environment, and the millions of dollars that could be saved if fewer MK-6s had to be procured, we believe the Department of Defense should consider whether slight reductions in readiness and reliability are acceptable.		
Navy's Calculation of Program Needs	The Navy calculated its Trident II MK-6 guidance system inventory objectives by projecting the number of electronics assemblies and inertial measurement units required to maintain the readiness and reliability goals, established during the 1986-1987 time frame, through the years when program needs are expected to peak <sup>1</sup> and through the remainder of the program's currently projected 38-year life (1990 through 2027). Navy officials told us that it is difficult to predict spares requirements for the program's life through the year 2027. Performance data are available for only 3 percent of the Trident II program's projected life, the Navy has no		
	<sup>1</sup> The Navy expects peak requirements to occur in the year 2018, when eight submarines are deployed and two others are being overhauled and refueled.		

experience maintaining a submarine-launched ballistic missile program for more than 20 years, unforeseen engineering challenges could arise, and the world threat could change. Despite these planning challenges requiring decisionmakers to make many assumptions about the future, all systems must be procured in the next few years to maintain continuous production.

The Navy's calculations included MK-6s (1) in missiles onboard deployed submarines; (2) already expended in missile test firings and planned to be expended in test firings through the life of the program;<sup>2</sup> (3) carried onboard submarines as spares and spares kept at the Strategic Weapons Facility; (4) used by contractors, designers, technicians, and shipyards for test purposes; (5) in the repair pipeline; and (6) discarded because they were no longer repairable. The Navy used past program experience, statistical analyses, and engineering judgment to develop its inventory objectives. The Navy's projected MK-6 guidance system needs are shown in table 1.

<sup>&</sup>lt;sup>3</sup>Missile test firings include the Commander in Chief Evaluation Test (CET) program of 28 initial missile flight tests, the Follow-on CET (FCET) program in which 6 missiles are flight tested each program year, and Demonstration and Shakedown Operation (DASO) tests that are conducted when submarines are commissioned or complete a major overhaul.

#### Table 1: Projected MK-6 Guidance System Needs at Program Peak

Requirements in the year 2018 (8 deployed submarines)	Electronics assemblies	inertial measurement units
In missiles onboard submarines (24 per vessel)	192	192
Spare systems onboard submarines (6 per vessel)	48	48
Expended in missile test firings (CETs, FCETs, and DASOs)	201	201
Used for production acceptance testing (1 per contractor per production year)	17	17
Strategic Weapons Facility (needed to replace faulty systems on submarines returning from patrol)	12	12
Electronic assemblies used to test inertial measurement units at the contractor, the design agent, and other test sites (inertial measurement units are not required for testing electronics assemblies)	10	0
Used by shipyards to test submarine systems after construction or overhaul (no longer tactical assets)	10	10
Repair pipeline (undergoing repair, safety level, and in transit between the Strategic Weapons Facility and the repair facility)	43	61
Nonrepairable (estimated at about 1 per program year based on MK-5 experience)	29	29
Total	562	570

### Fewer Than Six Spares May Be Sufficient Onboard Submarines

The Navy calculated that each patrolling submarine must carry six spare MK-6 guidance systems to ensure that there is essentially a 100-percent probability that all missiles' guidance systems will be operationally ready if called upon for launch. Operational readiness is the prime element of overall system reliability<sup>3</sup> as the missile's performance is inconsequential if it is not first operationally ready. Our calculations show that current operational readiness goals can be met with four onboard spares and minimum weapon system reliability goals can be met with three. Our review indicates that fewer than six spares would be sufficient onboard Trident II submarines for the following reasons:

• Weapons system reliability requirements, established between 1986 and 1987 during the Cold War era, need to be re-evaluated in light of the current world environment.

<sup>&</sup>lt;sup>3</sup>Overall weapon system reliability is dependent on the level of operational readiness, launch, and flight reliability achieved for a number of the weapon's subsystems, including, but not limited to, guidance, missile performance, fire control, navigation, and ship support.

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	Department of Defense stated that as a result of this assessment, the number of spare MK-6 guidance systems ultimately procured might be reduced. The Department's comments are included in their entirety in appendix III.
Scope and Methodology	In performing our review, we interviewed officials and reviewed documents at the U.S. Strategic Command, Omaha, Nebraska; the Department of Defense's Office of Strategic Forces and Operations; the Navy's Submarine Warfare Division; Strategic Systems Program Office, Arlington, Virginia; Submarine Force, U.S. Atlantic Fleet, Norfolk, Virginia; and the Strategic Systems Office, Submarine Force, U.S. Pacific Fleet, Pearl Harbor, Hawaii. We performed our review from January through May 1994 in accordance with generally accepted government auditing standards.
	Unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days after its issue date. At that time, we will send copies to the appropriate congressional committees and the Secretaries of Defense and the Navy. We will also make copies available to others on request.
	Please contact me at (202) 512-4841 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix IV.
	Sincerely yours,
	Amis J. Godizues
	Louis J. Rodrigues Director, Systems Development

and Production Issues

GAO/NSIAD-94-192 Trident II

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#### **Abbreviations**

CET	Commander in Chief Evaluation Test
DASO	Demonstration and Shakedown Operation
FCET	Follow-on Commander in Chief Evaluation Test

### Submarine-Launched Ballistic Missile Program and Its Changing Guidance System Requirements

Submarine-Launched Ballistic Missile Program	Throughout the Cold War, the submarine-launched ballistic missile program provided a nuclear deterrence. Successive generations of submarines, missiles, and guidance systems, including the Polaris, Poseidon, Trident I, and Trident II systems, provided improved accuracy, range, survivability, and destructive power.		
	Despite the end of the Cold War, submarine-launched ballistic missile patrols continue. The Department of Defense contends that the primary threat that must be deterred continues to be the destructive capability of Russian strategic forces, and that the United States must maintain its nuclear forces to deter the full scope of threats to the United States and its allies.		
	The current submarine-launched ballistic missile program consists of eight Trident I submarines carrying C-4 missiles equipped with MK-5 guidance systems and six Trident II submarines carrying D-5 missiles equipped with MK-6 guidance systems. Four more Trident II submarines will enter the fleet by 1997. Currently, the Navy has no plans to develop systems to eventually replace the Trident IIs, which entered the fleet in 1989 and will be maintained until the year 2027 when the last Trident II is expected to be retired.		
	While on patrol, Trident submarines sustain the survivability of their ballistic missiles by remaining undetected. Opportunities for detection are minimized by virtually excluding outgoing communication and remaining submerged. Surfacing for medical emergencies or compelling humanitarian reasons, such as attending to a death in the family, are permitted.		
Program Changes Reduce Guidance System Inventory Objectives	In its fiscal year 1994 budget plans, the Navy reduced its D-5 missile and MK-6 guidance system inventory objectives, when a decision to backfit the Trident I fleet with Trident II missiles and guidance systems was postponed. In its fiscal year 1995 plans, inventory objectives were reduced further. These recent reductions are primarily the result of (1) the anticipated cancellation of the submarines' first scheduled overhaul and, therefore, a reduction in total program Demonstration and Shakedown Operations flight tests (plans had called for one overhaul after 12 years of operation and a second, to replace the nuclear core, after 20 years); (2) a decrease in the number of electronics assemblies reserved for use by repair, design, and test facilities inspecting inertial measurement units; and		

(3) a decrease in the number of inertial measurement units forecast to be in the repair pipeline.

Table I.1 reflects changes in the Navy's Trident II inventory objectives since fiscal year 1993.

#### Table I.1: Changes in Trident II Inventory Objectives

- Fiscal year		Inventory objectives	
	D-5 missiles	MK-6 electronics assemblies	MK-6 inertial measurement units
1993	779	892	940
1994	428	596	620
1995	389	562	570

Table I.2 shows the Navy's plans for reaching its guidance system inventory objectives.

#### Table I.2: Guidance System Procurement Plans

	Electronics assemblies	inertial measurement units
Delivered as of December 1993	383	386
Procured through fiscal year 1994, but not yet delivered	128	139
Procurement plans for fiscal year 1995	30	30
Procurement plans for fiscal year 1996 and beyond <sup>a</sup>	21	15
Inventory objectives	562	570

"The President's fiscal year 1995 budget did not include advanced procurement funding for a fiscal year 1996 guidance system buy, because the Navy is contemplating a new procurement strategy aimed at preserving the industrial base. It has not completed procurement plans for fiscal year 1996 and beyond.

### Our Analysis of the Navy's Rationale for Onboard Spare Requirements

According to Navy officials, underway replenishment of guidance systems is impractical; therefore, submarines on patrol must carry adequate spare guidance systems. Navy officials told us that returning to the Strategic Weapons Facility to receive additional spares or continuing to patrol with a reduced number of operational missiles could reduce target coverage. The submarine's crew does not have the technical expertise or equipment to repair the units onboard. When either a faulty electronics assembly or inertial measurement unit is identified it is removed and replaced. All guidance system repairs are done on shore by contractors.

The number of spare MK-6 guidance systems needed onboard a patrolling submarine was calculated based on the average number of inertial measurement unit failures per patrol, per quarter, over the past 2 years. Navy officials chose this method, claiming that it (1) weights all patrols equally regardless of length, (2) provides a conservative figure, and (3) has proven successful in estimating spares for prior programs such as the Trident I. The Navy's guidance system operational readiness goal is to have adequate spares available 99.9 percent of the time. The Navy also included a 99-percent confidence level factor in its calculations because, according to Navy officials, it provided a higher, more conservative result that helps ensure that sufficient spares will be available even in the event of unforeseen future system problems. Based on this methodology, the Navy calculated that six spare guidance systems are required on each submarine.

We requested that the Navy use the methodology described above to calculate the guidance system's operational readiness levels that could be achieved with incremental reductions to the number of spare MK-6 guidance systems onboard the submarines. The results of these computations are shown in table II.1.

Number of MK-6 spares carried	Probability of having sufficient spare MK-6s (operational readiness levels)
6	0.99979
5	0.99872
4	0.99318
3	0.96935
2	0.88740
1	0.67602
0	0.31253

Table IL1: Guidance System Operational Readiness Levels Achieved With Six or Fewer Onboard Spares

	Appendix II Our Analysis of the Navy's Estimate for Onboard Spare Requirements
	The Navy's guidance system operational readiness goal is also a factor in ensuring that the overall weapon system maintains a specific reliability rate. The Navy committed to maintaining an overall weapon system reliability level in 1987, during the Trident II program's milestone III review. Navy officials told us that to ensure that this overall weapon system reliability level is maintained, all subsystems, including guidance systems, are required to achieve very high levels of individual readiness and reliability resulting in a total system reliability rate 5 percent higher than the minimum rate agreed to at the milestone III review. This higher
	<ul> <li>goal can only be achieved if the guidance system's operational readiness level is maintained at essentially 100 percent.</li> <li>Navy officials acknowledged that the results of their guidance system failure rate analysis would be more accurate if more data were available, but given the newness of the program and because procurement must be completed in the next few years, this analysis at least provides an estimate for planning purposes. However, it should be noted that even though this data was taken from a small population size, the Navy used it to calculate the guidance system's operational readiness level with extreme precision. For example, as shown in table II.1, a difference in the guidance system's operational readiness level of 0.001 is considered significant enough to justify six onboard spares rather than five.</li> </ul>
Trident I Patrols Experienced Few Failures	The Navy is using the same method for estimating Trident II onboard MK-6 spares that it used to estimate Trident I onboard MK-5 spares. According to Navy officials, this method has been successful as no Trident patrol has ever had more failures than it has had spares. However, this method often provided patrols at least twice as many spare guidance systems as were ever actually needed. Onboard spare requirements for Trident I submarines have ranged from six at the beginning of the program to a current requirement for four. Onboard requirements for Poseidon submarines carrying Trident I missiles have ranged from six to three depending on the reliability of the system and availability of spares. However, of the 647 combined Trident I patrols (Trident I and Poseidon submarines carrying Trident I missiles), 643 patrols had 2 or fewer failures, 3 patrols had 3 failures, and only 1 patrol had 4 failures.

### Appendix II Our Analysis of the Navy's Rationale for Ouboard Spare Requirements

### Savings Resulting From Lower Onboard Spare Requirements

Table II.2 provides cost savings resulting from inventory reductions based on changes to onboard spare requirements.

#### Table II.2: Potential Savings From Reduced Onboard MK-6 Spares and Inventory Objectives

Number of onboard sparse	Reduction in guidence sets from current inventory for 2018 program peak*	Total number of systems still planned		Systems required in fiscal year 1995 under spare reduction options <sup>b</sup>		Systems required in fiscal year 1996 and out years under spare reduction options <sup>e</sup>		
		Electronics assemblies	inertial measurement units	Electronics assemblies	Inertial measurement units	Electronics assemblies	inertial measurement units	Potential savings <sup>d</sup>
6	0	51	45	30	30	21	15	\$0
5	8	43	37	30	30	13	7	53.0
4	16	35	29	30	29	5	0	106.1
3	24	27	21	27	21	0	0	159.1
2	32	19	13	19	13	0	0	212.2
1	40	11	5	11	5	0	0	265.2
0	48	3	0	3	0	0	0	318.2

\*A guidance set includes one electronics assembly and one inertial measurement unit. Eight submarines will be deployed in the year 2018.

<sup>b</sup>Funding for 30 electronics assemblies and 30 inertial measurement units has been requested.

°Procurement of 21 electronics assemblies and 15 inertial measurement units is planned.

<sup>d</sup>Based on fiscal year 1995 budget figures of \$6.63 million per guidance set (total cost, less advance procurement in prior years.)

#### Appendix III

# **Comments From the Department of Defense**



during the lifetime of the Trident submarines and Trident II missiles (which could be as long as 40 years), it is necessary to ensure that enough guidance sets are produced now to meet that contingency. The DoD does concur with the GAO recommendation that a study should be performed to determine whether the current TRIDENT II weapon system readiness goals remain appropriate in light of the changes that have taken place in the world political composition and threat capability. As a result of that assessment, the number of on-board spare MK-6 guidance systems ultimately procured might be reduced. However, it is unlikely that the results of that review will change the quantity of MK-6 guidance systems to be procured in FY 1995, as called for by the FY 1995 President's Budget aubmission. A one-third reduction in the number of on-board spares from six to four would reduce the total inventory objective by 20, which is essentially the quantity programmed to be procured in FY 1996 and beyond (as displayed in Appendix II of the GAO draft report). The DoD will complete this study after the Nuclear Posture Review submarine-launched ballistic missile force structure determination, in time to support the FY 1996 budget submission. The detailed DoD comments on the draft report findings and recommendations are provided in the enclosure. Suggested technical changes were separately provided to the GAO staff. The DoD appreciates the opportunity to comment on the GAO draft report. Sincerely, Sung Robel George R. Schneiter Director. Strategic and Space Systems Enclosure

GAO DRAFT REPORT - DATED JUNE 3, 19	994
(GAO CODE 707025 - OSD CASE 9700)	
"TRIDENT II: SPARE MK-4 GUIDANCE SYS	TEMS
FOR MISSILES CAN BE REDUCED"	
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DEPARTMENT OF DEFENSE COMMEN	TS
FINDING A: The Nevy Calculation of Program Needs. The GA	O reported that the Navy
MK-6 guidance system inventory objectives are based on maintaining the	he same high level of
reactness and reliability throughout the remaining 33 years of the TRID	PEINI II program ble-
which was originally established during the Cold War. Ine GAU object high readinates and reliability rates the Navy calculated its processor and	ven mat, to manifiam (AOS)
might reasoning it with the highest number of MK-6 sources that might he need	ded at any time during the
program.	
The GAO explained that the Navy calculated its TRIDENT II MK-6 g	uidance system inventory
objectives by projecting the number of electronics assemblies and inerti	al measurement units
required to maintain Cold War readiness and reliability goals through th	he years when program
needs are expected to peak. The GAO noted that the Navy calculation	s included MK-6s (1) in
missiles onboard deployed submarines, (2) expended in missile test firin	ngs to date, (3) carried
onboard submarines as spares and spares kept at the Strategic Weapon	s Facility, (4) used by
Contractors, designers, technicians, and supports for test purposes, (5) (6) discarded because they were no longer renairable	in the repair pipelane, and
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The GAO further reported that the Navy expected peak requirements to	o occur in the year 2018,
when eight submarines would be deployed, with two others being over	hauled and refueled. The
GAO reported that, according to Navy officials, it is difficult to predict	spares requirements for
he life of the program through the year 2027. The GAO pointed out the	hat performance data are
waitable for only 3 percent of the TRIDENT II program projected life	and observed that the
Navy has no experience maintaining a submarine-launched ballistic miss	sue program for more than
20 years. Inc UAO pointed out uniforescen engineering challenges could change. The GAO further pointed out that densite such a	and arise and/or the world
uncar cours change. The GAO further pointed out that, despite such p	all everence must he
procured during the pext few years to maintain continuous production	(pp. 2-4/GAO Draft
Report)	(Ph. a. a. o. to pier
DoD RESPONSE: Partially concur. The DoD does not concur with	h the GAO use of the term
"Cold War." Whatever the current relationship with nations of the forr	mer Soviet Union, the
requirements for guidance sets were based on the capabilities of the the	en Soviet Union strategic
nuclear forces between 1986 and 1987, and not the decades long politic	cal relationship known as
the "Cold War.	
	Enclosure

Now on pp. 2-3.

See comment 1.

![](_page_18_Picture_1.jpeg)

Page 18

Now on pp. 4-5.

![](_page_19_Picture_1.jpeg)

![](_page_20_Picture_1.jpeg)

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iee comment 1.	<b>DeD RESPONSE:</b> Concur. Two clarifications, however, are required. First, the draft report inaccurately describes the need for the patrolling submarine to remain fully undetected and its modus operandi for doing so. While on patrol, TRIDENT submarines sustain the survivability of their ballistic missiles by remaining undetected by both U.S. and foreign assets. Opportunities for detection are minimized by virtually excluding outgoing communications and remaining submerged. (Surfacing for medical emergencies or connelling humanitarian reasons, such as attending to a death in the family, is permitted.)
See comment 1.	Second, the GAO description as to why the U.S. must maintain its nuclear deterrent is not accurate. The United States must maintain its nuclear weapons to deter the full scope of threats to the United States, its allies, and its forces overseas. The most important threat that must be deterred today remains the immense destructive capabilities of the Russian strategic forces. Although the change in government has led to an improved political relationship between the United States and Russia, the threat posed by the capabilities of current and projected Russian strategic nuclear forces has not diminished. Russia continues to maintain and modernize its strategic offensive forces, and those forces continue to be capable of threatening the survival of the United States.
Now on pp. 10-11.	• FINDING D: Program Changes Reduce Guidance System Inventory objectives. The GAO reported that, in the FY 1994 Navy budget plans, the Navy reduced its D-5 missile and the MK-6 guidance system inventory objectives, when a decision to backfit the TRIDENT I fleet with TRIDENT II missiles and guidance systems was postponed. The GAO reported that, in the FY 1995 Navy plans, inventory objectives were reduced further. The GAO observed that those recent reductions are primarily the result of (I) the anticipated cancellation of the first scheduled overhaul of the submarines and, therefore, a reduction in total program demonstration and shakedown operations flight tests, (2) a decrease in the number of electronics assemblies reserved for use by repair, design, and test facilities inspecting inertial measurement units, and (3) a decrease in the number of inertial measurement units forecast to be in the repair pipeline. (p. 10/GAO Draft Report) DeD RESPONSE: Concur.
	• FINDING E: Analysis of The Navy Rationale For Onboard Spare Requirements. The GAO reported that, according to Navy officials, submarines on patrol must carry adequate spare guidance systems, because (1) surfacing to receive spare systems would increase the vulnerability of the weapon system, and (2) because the submarine crew does not have the technical expertise or equipment to repair the units onboard. The GAO also reported that, when either a faulty electronics assembly or inertial measurement unit is identified, it is removed and replaced. The GAO learned that all guidance system repairs are done on shore by contractors. The GAO found that the number of spare MK-6 guidance systems needed onboard a patrolling submarine was calculated based on the average number of inertial measurement unit failures per patrol, per quarter, over the past 2 years. The GAO also learned Navy officials chose that method because it (1) weighted all patrols equally, regardless of length, (2) provided a conservative figure,
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	and (3) had proven successful in estimating spares for prior programs such as the TRIDENT J. The GAO reported that the Navy guidance system operational readiness goal is to have adequate spares available 99.9 percent of the time. In addition, the GAO reported that the Navy also included a 99-percent confidence level factor in its calculations because, according to Navy officials, it provided a more conservative result and helped ensure that sufficient spares would be availableeven in the event of unforesseen future system problems. The GAO concluded that, based on the described methodology, the Navy calculated six spare guidance systems are required on each submarine.
w on pp. 12-13.	The GAO found that the Navy guidance system operational readiness goal is also a factor in ensuring that the overall weapon system maintains a specific reliability rate. The GAO reported that the Navy committed to maintaining an overall weapon system reliability level in 1987, during the TRIDENT II program milestone III review. The GAO reported that, according to Navy officials, to ensure the overall weapon system reliability level is maintained, all of the subsystems, including guidance systems, are required to achieve levels of individual readiness and reliability resulting in a total system reliability rate 5 percent higher than the minimum rate agreed to at the referenced Milestone III review. The GAO concluded that the higher goal can only be achieved if the operational readiness level of the guidance system is maintained at essentially 100 percent. The GAO also indicated the Navy acknowledged that the results of its guidance system failure rate analysis would be more credible if more data were available. The GAO observed, however, that given the newness of the program and because procurement must be completed in the next few years, the analysis at least provides (as one Navy official stated) a "ball park" figure for planning purposes. (pp. 12-14/GAO Draft Report)
	<b>DoD RESPONSE:</b> Partially concur. The GAO understates the adverse effects upon a ballistic missile submarine mission were it not to have adequate spares to replace failed guidance sets, which are critical components essential for missile launch. Specifically, submarines on patrol must carry adequate spare guidance systems, because surfacing to enter port to receive spare systems, which is tantamount to terminating patrol and lapsing target coverage, would increase the vulnerability of the weapon system and reduce strategic effectiveness. The submarine crew does not have the technical expertise or equipment to repair the units onboard, and underway replenishment of guidance units is impractical.
e comment 2.	The GAO description of the 99-percent confidence factor is vague where it refers to general conservatism. More correctly, it is an accepted statistical method to provide a degree of "insurance" to probability estimates where actual data are limited to a small fraction of the total population size. In the case at hand, predictions for more than 30 years into the future are being based on the first 3 percent of the system life performance data. Among other ambiguities, aging effects normally associated with precision equipment cannot yet be accounted for, making some degree of increased confidence appropriate.
	The GAO description of the "5 percent higher" is a misinterpretation of Milestone III estimated performance and threshold requirements. The estimated performance was actually 5 percent better than the threshold, and the subsystem reliability specifications were based on that higher estimate.
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<b>low on p. 13</b> .	<b>FINDING F: TRIDENT L Patrola Experience Few Failures</b> . The GAO reported that the Navy was using the same method for estimating TRIDENT II onboard MK-6 spares that it used to estimate TRIDENT I onboard MK-5 spares. The GAO reported that, according to Navy officials, that method had been successful, since no patrol has ever had more failures than it had spares. The GAO contended, however, that the method often provided patrols at least twice as many spare guidance systems as were ever actually needed. The GAO reported that onboard spare requirements for TRIDENT I submarines had ranged from six at the beginning of the program to a current requirement for four. The GAO also reported that onboard requirements for POSEIDON submarines carrying TRIDENT I missiles had ranged from six to three, depending on reliability of the system and the availability of spares. The GAO concluded that, of the 647 combined TRIDENT I patrols (TRIDENT I and POSEIDON submarines carrying TRIDENT I missiles), 643 patrols had two or fewer failures, three patrols had three failures, and only one natrol had four failures. (p. 14/GAO Draft Report)
	DeD RESPONSE: Partially concur. Although the data cited in the GAO Draft report on failures per TRIDENT I ballistic missile submarine patrol are accurate, the statement that "this method often provided patrols at least twice as many spares as needed" is both misleading and technically irrelevant. Currently, the TRIDENT I ballistic missile submarine carries four spares and has experienced a patrol in which all four spares were used. The weapons system operational readiness requirements are required to be met on every Fleet Ballistic Missile deterrent patrol. Therefore, whether or not a failure occurrence is once or multiple times is irrelevant from a logistics planning standpoint. From a statistical analysis perspective, a failure rate distribution similar to that actually experienced (i.e., few patrols with multiple failures) would be expected, given the high reliability requirements imposed.
	The methodology used to predict the inventory objective for the TRIDENT II MK-6 guidance system is based on the experience gained in previous Fleet Ballistic Missile programs. Specifically addressing the TRIDENT I experience, during the peak requirements period, an anomaly was discovered in the monitor drive module that supports the stellar sensor. That resulted in the systems being recalled from the fleet, reducing the available onboard spares. Daily asset management was required to ensure overall program requirements were met until the necessary upgrades were made to the spares inventory. That is an example of an unplanned development that the inventory projections must accommodate as systems age.
	RECOMMENDATIONS
ow on p. 5.	<b><u>RECOMMENDATION 1</u></b> : The GAO recommended that the Secretary of Defense consider whether some slight reductions in Cold War-based operational readiness and reliability goals are acceptable. (p. 7/GAO Draft Report)
e comment 1.	<b>DeD RESPONSE:</b> Partially concur. The DoD will initiate a study to determine whether reductions in <u>existing</u> operational readiness and reliability goals are acceptable. That study will be
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	completed in time to support the FY 1996 budget submission. The on-going DoD Nuclear Posture Review is reviewing the current strategic nuclear force structure. The Nuclear Posture Review is examining operational readiness and reliability goals as a part of determining the overall force structure. The Nuclear Posture Review is considering all force structure options to ensure that the DoD-proposed strategic force structure will provide the optimum balance of strategic readiness and deterrence versus cost. The determination by the Nuclear Posture Review on submarine-launched ballistic missile force structure is expected in time to support the FY 1995 budget cycle.
	Using the force structure determined by the Nuclear Posture Review as a prime input, the DoD will then decide whether the current TRIDENT II weapon system readiness goals remain appropriate in light of the changes that have taken place in the world political composition and threat capability since the disestablishment of the Warsaw Pact and the demise of the Soviet Union.
ow on p. 5.	<b><u>RECOMMENDATION 2</u></b> : The GAO recommended that, if the reductions identified in connection with Recommendation 1 are acceptable, the Secretary should reduce the number of additional MK-6 guidance systems to be procured. (p. 7/GAO Draft Report)
	<b>DoD RESPONSE:</b> Concur. As a result of the review of TRIDENT readiness and reliability discussed in the DoD response to Recommendation 1, the number of on-board spare MK-6 guidance systems ultimately procured may be reduced. However, it is unlikely that the results of the review will affect the quantity of MK-6 guidance systems procured in FY 1995, as reflected in the FY 1995 President's Budget submission. Even a one-third reduction in the number of on-board spares from six to four would reduce the total inventory objective by 20, which is the essentially the quantity remaining to be procured in FY 1996 and beyond (as displayed in Appendix II of the GAO draft report).
	It should be noted that the MK-6 guidance system has already experienced three failures on one patrol in a system that has been deployed only 4 years, and just 3 percent of the average operational hours to be experienced by the guidance systems on the ten TRIDENT II ballistic missile submarines over their 30-year life through FY 2027. A reduction below four on-board spares is extremely unlikely given that history. The GAO discussion of the possibility of a reduction to three spares reflects only the very small sample size and limited performance data available to date, with no allowance for future aging or other effects on guidance system performance.
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Appendix III Comments From the Department of Defense

GAO Comments	The following are GAO's comments on the Department of Defense's letter dated June 22, 1994.
	1. We have revised our report to include this information.
	2. We have addressed this comment in the report text.

#### Appendix IV

# **Major Contributors to This Report**

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