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

April 2003

MILITARY READINESS

DOD Needs a Clear and Defined Process for Setting Aircraft Availability Goals in the New Security Environment

GAO-03-300

April 2003

GAO Accountability • Integrity • Reliability

Highlights

Highlights of GAO-03-300, a report to the Chairman, Subcommittee on Readiness, Committee on Armed Services, House of Representatives

MILITARY READINESS

DOD Needs a Clear and Defined Process for Setting Aircraft Availability Goals in the New Security Environment

Why GAO Did This Study

The attacks on 9/11/2001 show that threats to U.S. security can now come from any number of terrorist groups, at any number of locations, and in wholly unexpected ways. As a result, the Department of Defense (DOD) is shifting to a new defense strategy focused on dealing with uncertainty by acting quickly across a wide range of combat conditions. One key ingredient of the new strategy is the availability of aircraft to carry out their missions. Key measures of availability include the percentage of time an aircraft can perform at least one or all of its assigned missions, termed the "mission capable" (MC) and "full mission capable" (FMC) rates, respectively.

At the Subcommittee's request, GAO examined whether key DOD aircraft have been able to meet MC and FMC goals in recent years, and DOD's process for setting aircraft availability goals.

What GAO Recommends

GAO recommends that DOD review the current goals to ensure that they have a valid basis and are appropriate to the new defense strategy, and revise its instructions to ensure that such measures are based on a clearly defined and documented process and objective methodology. DOD concurred or partially concurred with all of GAO's recommendations and outlined planned actions to address them.

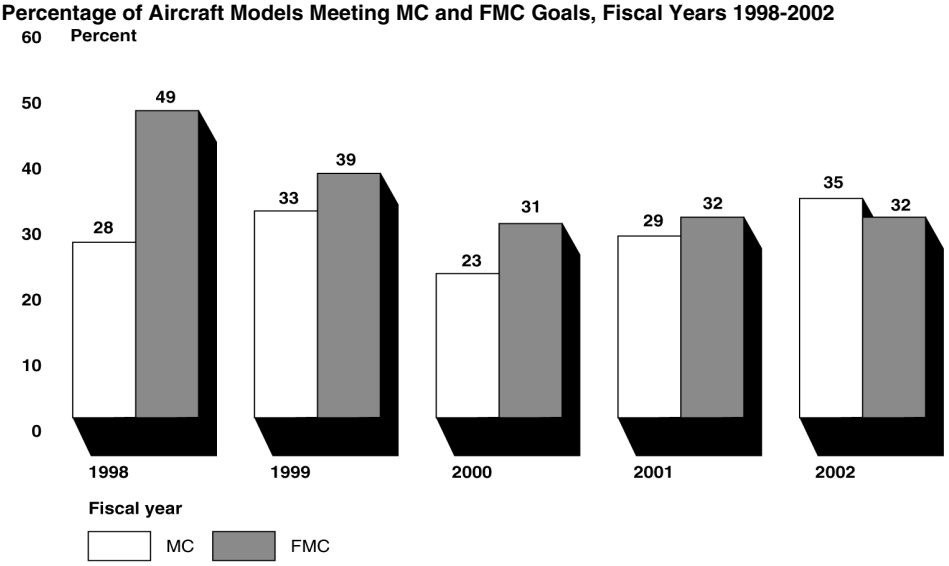
www.gao.gov/cgi-bin/getrpt?GAO-03-300.

To view the full report, including the scope and methodology, click on the link above. For more information, contact Neal Curtin at (757) 552-8100 or Curtinn@gao.gov.

What GAO Found

Less than one-half of the 49 key active-duty aircraft models that GAO reviewed met their MC or FMC goals during fiscal years 1998-2002. The levels of mission capability varied by military service and type of aircraft, and the levels at which the goals were set also varied widely, even among the same type of aircraft. However, the MC and FMC goals for each model changed little over time. Since 1998, only 11 of 49 aircraft models (22 percent) experienced a change to their goals. Seven of the changes were to raise the goals to higher levels. Difficulties in meeting the goals are caused by a complex combination of logistical and operational factors.

Percentage of Aircraft Models Meeting MC and FMC Goals, Fiscal Years 1998-2002



Sources: Military services (data), GAO (presentation).

Despite their importance, DOD does not have a clear and defined process for setting aircraft availability goals. The goal-setting process is largely undefined and undocumented, and there is widespread uncertainty among the military services over how the goals were established, who is responsible for setting them, and the continuing adequacy of MC and FMC goals as measures of aircraft availability. Uncertainty and the lack of documentation in setting the goals ultimately obscures basic perceptions of readiness and operational effectiveness, undermines congressional confidence in the basis for DOD's funding requests, and brings into question the appropriateness of those goals to the new defense strategy. DOD guidance does not define the availability goals that the services must establish or require any objective methodology for setting them. Nor does it require the services to identify one office as the coordinating agent for goal setting or to document the basis for the goals chosen. DOD officials told GAO that the guidance has not been updated since 1990 to reflect the new security environment of increased deployments and other changes since the end of the Cold War.

Contents

Abbreviations

DOD	Department of Defense
FMC	full mission capable
GAO	General Accounting Office
MC	mission capable

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Accountability * Integrity * Reliability

United States General Accounting Office
Washington, DC 20548

April 7, 2003

The Honorable Joel Hefley
Chairman
Subcommittee on Readiness
Committee on Armed Services
House of Representatives

Dear Mr. Chairman:

The terrorist attacks on September 11, 2001, clearly demonstrated that the U.S. security landscape has changed. The familiar Cold War threats of large-scale wars between nation states in predictable areas such as the Koreas and the Middle East have been joined by a broad array of new threats characterized by surprise and uncertainty. Attacks on U.S. security can now come from any number of terrorist groups such as al Qaeda, in any number of locations, and in wholly unexpected ways. As a result of the changed security environment, the Department of Defense (DOD) has rethought defense strategy and is shifting to a "capabilities-based" approach focused on contending with uncertainty by enhancing its ability to act quickly and decisively across a wide range of combat conditions and locations.

One key ingredient of the new strategy is the availability of aircraft to carry out their assigned missions. DOD requires each military service to establish availability goals for aircraft and other major weapon systems, and measures of the degree to which those goals are met.[1] Key measures include the percentage of time that an aircraft can perform at least one or all of its assigned missions, termed the "mission capable" (MC) and "full mission capable" (FMC) rates, respectively. MC and FMC goals and rates are fundamental indicators of readiness expectations. They are also used by DOD as indicators of maintenance and supply effectiveness and are made available to the Congress for its general oversight of DOD. Moreover, the level at which the goals are set also influences large amounts of military spending for aircraft procurements, spare parts inventories, and other resources needed to meet the goals. However, our recent reports have identified problems in meeting MC goals among

[1]See Department of Defense Instruction 3110.5, Materiel Condition Reporting for Mission-Essential Systems and Equipment, Sept. 14, 1990.

certain aircraft. For example, we reported in June 2000 that many of the cargo aircraft needed to meet wartime airlift requirements were not meeting MC goals.[2]

Concerned that the new capabilities-based strategy may be difficult to carry out if aircraft are experiencing problems in meeting existing availability goals, you requested that we examine DOD's structure for establishing MC and FMC goals for aircraft in the Air Force, Army, Navy, and Marine Corps. This report addresses (1) whether key active-duty aircraft have been able to meet existing MC and FMC goals, (2) the causes of any difficulties in meeting those goals, and (3) whether DOD has a clear and defined process for setting aircraft availability goals. We performed our review from February through November 2002 in accordance with generally accepted government auditing standards. Appendix II describes the scope and methodology of our work.

Results in Brief

Less than one-half of DOD's key active-duty aircraft models have met their MC and FMC goals since 1998.[3] For example, during fiscal years 1998-2002, only 23-35 percent of the 49 aircraft models we reviewed were able to meet their MC goals. Similarly, some 31-49 percent of the models met their FMC goals during the same period. In most cases, the actual rates were at least 5 percentage points below the goals. The level of mission capability varied by military service and by type of aircraft. The Army and Air Force had the highest average MC rates, at 77-83 percent over the past 5 years; followed by the Marines, at about 71-75 percent; and the Navy, at 61-67 percent. Rates have increased slightly since fiscal year 2001 in all services except the Navy. Average MC rates were the highest for helicopters, at 76-80 percent; followed by cargo aircraft and tankers, at 75-79 percent; fighter/attack aircraft, at 75-77 percent; bombers, at 64-69 percent; and electronic command/control aircraft, at 60-67 percent. Average FMC rates followed similar rank order patterns. The level at which the goals were set showed little consistency, varying widely even among the same type of

[2]See U.S. General Accounting Office, *Military Readiness: Air Transport Capability Falls Short of Requirements*, GAO/NSIAD-00-135 (Washington, D.C.: June 22, 2000).

[3]We focused our report on fiscal years 1998-2002 because the Navy and Marine Corps changed their reporting system in 1998 and were unable to provide data separated by service for previous years. (The Marine Corps is a separate service under the Department of the Navy and follows Navy regulations governing MC and FMC goals and performance measures.). Appendix I provides MC and FMC data for all services, including Army and Air Force data back to fiscal year 1991.

aircraft. For example, MC goals for the bombers and fighters in our review ranged from 50 to 80 percent and 65 to 83 percent, respectively. While the level at which the goals were set showed little consistency, MC and FMC goals have changed little over time. Since 1998, only 11 of 49 aircraft models (22 percent) experienced a change to their goals. Seven of these changes were to raise the goals.

Difficulties in meeting the goals are caused by a combination of interrelated logistical and operational factors, with no dominating single problem. For example, depending upon the missions and capabilities it was designed to provide, each aircraft can be inherently complex and prone to failure or be simple and easy to maintain and available more often. Complex aircraft require well-trained and experienced maintenance personnel. However, service officials frequently cited shortages of such personnel as a key cause of difficulties in meeting MC goals, and we have cited this as a major problem area for years. Age and overuse of the aircraft were cited as key factors as well. While age may affect MC rates, we found no statistical evidence that age alone explains the difficulties in meeting the MC goals. MC rates are also undermined by spare parts shortages. Such shortages may be particularly troublesome for older aircraft as they near the end of their projected life and spare parts inventories are reduced. We have previously reported on problems with spare parts shortages, and DOD is taking steps to increase the inventories of some parts.[4] Finally, perceived low funding levels and the way that maintenance systems are structured were also viewed as keys to low MC rates. For example, increases in the use of centralized depot-level maintenance were cited as a cause of maintenance delay and lowered MC rates. We have raised concerns for years that DOD's downsizing of its depot infrastructure and workforce was done without sound strategic planning and that investments in facilities, equipment, and personnel have not been sufficient to ensure the long-term viability of the depots.

DOD does not have a clear and defined process for setting aircraft availability goals. DOD's goal-setting process is largely undefined and undocumented, and there is widespread uncertainty among the services over how the goals were established and who is responsible for setting them. Furthermore, the services have basic questions about the adequacy

[4]See U.S. General Accounting Office, *Air Force Depot Maintenance: Management Improvements Needed for Backlog of Funded Contract Maintenance Work*, GAO-02-623 (Washington, D.C.; June 20, 2002).

of those goals as measures of aircraft availability. Uncertainty and the lack of documentation in setting MC and FMC goals ultimately obscures basic perceptions of readiness and operational effectiveness, undermines congressional confidence in the basis for funding requests, and brings into question the appropriateness of those goals to the new defense strategy. For example, the services could not explain and document how the original MC and FMC goals were set for any of the aircraft in our review. Navy and Air Force officials believed that the goals were generally based on analyses of historical performance rates of similar aircraft and/or subjective judgment. Moreover, in many cases, the services identified multiple offices as being responsible for setting the goals. But when contacted, each believed that the other was responsible. Some officials questioned which goals—the MC goals, the FMC goals, or some other goal—were the right ones to use in the new security environment. For example, a new measure of aircraft availability is being developed for the new Joint Strike Fighter, and MC and FMC goals are not being used. DOD's instruction provides little or no guidance on these and other key issues.[5] For example, it requires the services to establish availability goals but does not define which goals should be established, even though it specifically requires the services to collect condition status information on MC, FMC, and other availability measures. The instruction also provides no standardized methodology for setting goals, requiring only that they include estimates of maximum aircraft performance, assuming peacetime usage levels and full funding of logistical support systems. Nor does it require the services to identify the pros and cons of setting the goals at different levels and the guiding principles used to make those decisions. Finally, it does not require the services to identify one office as the coordinating agent for goal setting or to document the basis for the goals chosen. DOD officials told us that the instruction has not been updated since 1990 to reflect the new security environment of increased deployments and other changes since the end of the Cold War.

To ensure that aircraft availability goals are appropriate to the new defense strategy and consistent with a clear and defined process, we are recommending that DOD and the services (1) determine whether different types of goals are needed; (2) validate the basis for the existing goals; and (3) revise Instruction 3110.5 to clearly define the goals required to be established and their performance measures, establish a standard methodology with objective principles of analysis to be used by all

[5]See DOD Instruction 3110.5.

services in setting goals, and require each service to identify a focal point for the development and documentation of the goal setting process.

In comments on a draft of this report, DOD generally agreed with our recommendations. However, it believed that including the performance measures associated with the goals in Instruction 3110.5 would result in their being used as the primary measure of the overall state of materiel readiness. We agree that determinations of overall materiel readiness require consideration of a variety of factors beyond those identified in Instruction 3110.5. However, to avoid confusion and misunderstanding about basic aircraft performance, it is necessary to clearly identify the performance measures associated with the availability goals selected. This does not preclude the use of other metrics in broader assessments of materiel readiness. DOD also believed that the individual services, not the department, should be responsible for establishing their own detailed methodologies for goal setting because of the potential for variations in service environments and the types of goals used. We also agree that the services should have some leeway to accommodate differences between them. However, we continue to believe that all services should adhere to a standard set of overarching principles of analysis to safeguard objectivity and transparency in the goal-setting process. Such principles could be established in coordination with the services. The services could then develop detailed methodologies consistent with these principles but tailored to their own environments. For these reasons we made no change to our recommendations.

Background

DOD aircraft are used to perform a variety of different missions. However, for the purpose of this report, we have grouped them into five basic categories: (1) various models of fighter/attack aircraft, such as the F/A-18 Hornet, provide air superiority or close air support of ground forces; (2) bombers, such as the B-1 Lancer, provide long- and short-range delivery of heavy munitions; (3) electronic command and control aircraft, such as the E-3 Sentry, provide airspace and battlefield reconnaissance, command, and control services; (4) tankers and cargo aircraft, such as the KC-135 Stratotanker and the C-5 Galaxy, respectively, provide air refueling services and the ability to carry troops and equipment anywhere in the world; and (5) helicopters, with their ability to hover as well as conduct long- and short-range operations, are used for a variety of missions, including transportation of troops and equipment, air assault and

reconnaissance, and search and rescue operations. Our review included a total of 49 different aircraft models (over 5,600 individual aircraft in 2002) in these five categories.[6] These aircraft were considered by the services to be their key active-duty operational aircraft.[7] Table 1 lists these aircraft models, along with the military service using them, and their MC and FMC goals for fiscal year 2002.

Table 1: Key DOD Aircraft Models

2002 mission capable/full mission capable goals in percents					
Category	**Fighter/Attack aircraft**	**Bombers**	**Electronic command/control**	**Tankers/Cargo aircraft**	**Helicopters**
Aircraft	A-10 Thunderbolt	B-1 Lancer	E-3 Sentry	C-5 Galaxy	AH-64A Apache
Service	Air Force	Air Force	Air Force	Air Force	Army
Goal	82[a]/NA[b]	67[a]/NA[b]	85[a]/NA[b]	75[a]/45[b]	75[a]/70[b]
Aircraft	F-15 Eagle	B-2 Spirit	E-8 Joint Stars	C-17 Globemaster	AH-64D Apache
Service	Air Force	Air Force	Air Force	Air Force	Army
Goal	83[a]/NA[b]	50[a]/NA[b]	75[a]/NA[b]	88[a]/78[b]	75[a]/70[b]
Aircraft	F-15E Eagle	B-52 Stratofortress	RC-135 Rivet Joint	C-130 Hercules	UH-60A Black Hawk
Service	Air Force	Air Force	Air Force	Air Force	Army
Goal	81[a]/NA[b]	80[a]/NA[b]	75[a]/NA[b]	75[a]/48[b]	80[a]/75[b]
Aircraft	F-16 Fighting Falcon		U-2	C-141 Starlifter	UH-60L Black Hawk
Service	Air Force		Air Force	Air Force	Army
Goal	83[a]/NA[b]		85[a]/NA[b]	80[a]/59[b]	80[a]/75[b]
Aircraft	F-117 Nighthawk		S-3B Viking	KC-135 Stratotanker	CH-47D Chinook
Service	Air Force		Navy	Air Force	Army
Goal	80[a]/NA[b]		70[a]/54[b]	85[a]/77[b]	75[a]/70[b]
Aircraft	F-14A Tomcat		E-2C Hawkeye	KC-10 Extender	OH-58D Kiowa
Service	Navy		Navy	Air Force	Army
Goal	65[a]/50[b]		70[a]/54[b]	85[a]/77[b]	75[a]/70[b]
Aircraft	F-14B Tomcat		P-3C Orion	KC-130F Hercules	SH-60B Seahawk
Service	Navy		Navy	Marines	Navy
Goal	65[a]/50[b]		85[a]/61[b]	72[a]/53[b]	77[a]/58[b]
Aircraft	F-14 D Tomcat		EA-6B Prowler	KC-130R Hercules	SH-60F Seahawk
Service	Navy		Navy / Marines	Marines	Navy
Goal	71[a]/61[b]		73[a]/54[b]	75[a]/58[b]	75[a]/60[b]

[6]Three models (F/A-18A, F/A-18C, and EA-6B) were used by both the Navy and Marines. For our analyses, the Navy and Marine versions of each were considered to be separate models.

[7]To determine which aircraft should be included in the scope of our review, we used listings of key active duty aircraft provided by each service. We excluded aircraft operated by reserve units from the scope of our review, as well as active duty aircraft used for training and for transporting service officials on official business.

2002 mission capable/full mission capable goals in percents					
Category	**Fighter/Attack aircraft**	**Bombers**	**Electronic command/control**	**Tankers/Cargo aircraft**	**Helicopters**
Aircraft Service Goal	F/A-18A Hornet Navy /Marines 75[a]/58[b]				MH-53E Sea Dragon Navy 70[a]/60[b]
Aircraft Service Goal	F/A-18C Hornet Navy / Marines 75[a]/58[b]				CH-46E Sea Knight Marines 80[a]/77[b]
Aircraft Service Goal	F/A-18D Hornet Marines 75[a]/58[b]				CH-53D Sea Stallion Marines 73[a]/65[b]
Aircraft Service Goal	F/A-18E Super Hornet Navy 75[a]/58[b]				CH-53E Super Stallion Marines 70[a]/60[b]
Aircraft Service Goal	AV-8B Harrier Marines 76[a]/70[b]				AH-1W Super Cobra Marines 85[a]/75[b]
Aircraft Service Goal					UH-1N Huey Marines 85[a]/75[b]

Source: Military services' records.

Legend: NA = not applicable.

[a]2002 mission capable goal.

[b]2002 full mission capable goal.

DOD Instruction 3110.5, dated September 1990, requires all military services to establish quantitative availability goals and corresponding condition status measurements for these aircraft and other mission-essential systems and equipment. The goals established must estimate the maximum aircraft performance that is achievable on the basis of the aircraft's design characteristics and planned peacetime usage, and assuming full funding and optimal operation of the peacetime manpower and logistic support systems. Military personnel, civilian contractors, or both may perform the required maintenance under these systems. The instruction prescribes a basic set of condition status measures, including FMC, partial MC, and MC, that each service must use to describe the capability of systems or equipment. FMC indicates that an aircraft has all of the mission-essential systems and equipment it needs to perform all of its missions installed and operating safely. Mission-essential systems are those required to perform primary functions such as fire control, bombing, communications, electronic countermeasures, or radar. Partial MC indicates that an aircraft has the operable mission-essential equipment it needs to perform at least one of its missions, but not all. For example, an aircraft expected to be able to carry troops into combat during wartime in

all weather conditions, as well as to be able to fly humanitarian missions during peacetime, would be considered partial MC if some of its equipment were broken and it could fly only humanitarian missions in clear weather. MC consists of the sum of the partial MC and FMC measures; that is, the number of MC aircraft is equivalent to the sum of the aircraft rated partial MC and the aircraft rated FMC. This report focuses on MC and FMC goals because the Army, Navy/Marines, and parts of the Air Force do not establish separate partial MC goals.

DOD Aircraft Experienced Widespread Problems in Meeting MC and FMC Goals

Many of DOD's key aircraft have been unable to meet their MC and FMC goals since at least 1998. For example, during fiscal years 1998-2002, only 23-35 percent of the 49 aircraft models we reviewed were able to meet their MC goals, and 31-49 percent met their FMC goals.[8] In most cases, the actual rates were at least 5 percentage points below the goals. Average MC and FMC rates varied by service and type of aircraft. For example, the Army and Air Force had the highest average MC rates, followed by the Marines and the Navy. These rates have increased slightly since fiscal year 2001 in all services except the Navy. Among aircraft types, the average MC rates varied from 60 to 80 percent. Average MC rates were the highest for helicopters, followed by cargo aircraft and tankers, fighter/attack aircraft, bombers, and electronic command/control aircraft. While the rates have fluctuated, MC and FMC goals have generally remained constant over time. Since 1998, only 11 of 49 aircraft models (22 percent) experienced a change to their goals—and 7 of these changes were to raise the goals.

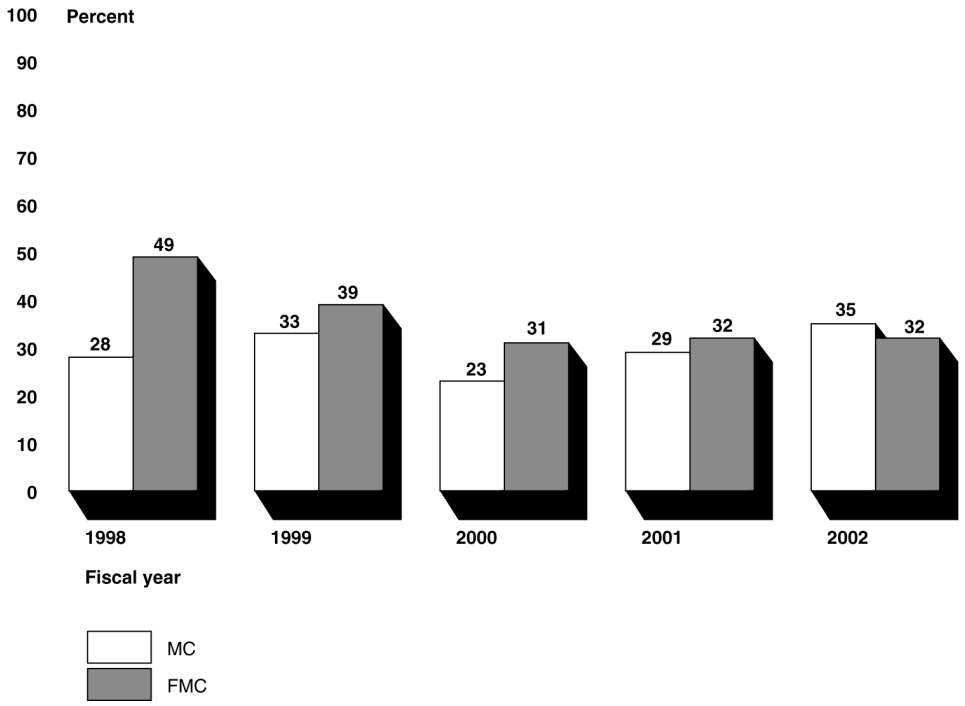
Less Than One-Half of the Aircraft Models Met Goals

DOD's key, high-demand aircraft have experienced widespread difficulties in meeting MC and FMC goals since at least 1998. (Appendix I provides a full listing of MC and FMC goals, rates, and other information by year for each aircraft model we reviewed.) For example, during fiscal years 1998-2002, the percentage of aircraft models meeting their MC goals never

[8]FMC goals appear to be more difficult to meet because aircraft must be capable of performing more missions to meet them than MC goals. However, since the FMC goals were always lower, this resulted in higher percentages of aircraft models meeting the FMC goals in fiscal years 1998-2001. For example, current MC goals range from 3 to 30 percentage points higher than FMC goals, with an average difference of 13 percentage points.

exceeded 35 percent. (See fig. 1.)[9] During this period, the rates for the individual aircraft models were more than 5 percentage points below their MC goals in 62 percent of the cases. The percentage of aircraft models meeting FMC goals during the same period ranged from 31 to 49 percentage points, and 71 percent of the cases were more than 5 percentage points below the goals.

Figure 1: Percentage of Aircraft Models Meeting MC and FMC Goals, Fiscal Years 1998-2002

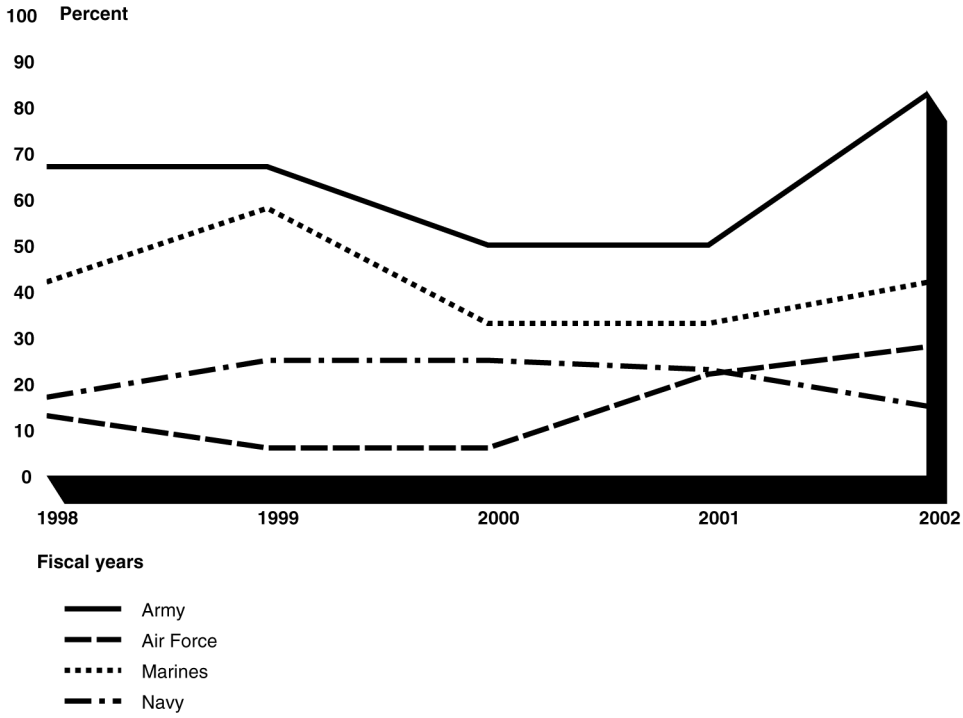


Sources: Military services (data), GAO (presentation).

At the service level, Army aircraft generally met their MC goals the most frequently, followed by the Marine Corps, Air Force, and Navy. (See fig. 2.) The same rank order held for FMC goals.

[9]The services provided overall yearly MC and FMC rates for each aircraft model we reviewed. We computed the percentage of aircraft models meeting their MC and FMC goals by taking the ratio of the total number of aircraft models meeting the goal in that year to the total number of aircraft models that could have met the goals in that year.

Figure 2: Percentage of Aircraft Models Meeting MC Goals by Service, Fiscal Years 1998-2002



Sources: Military services (data), GAO (presentation).

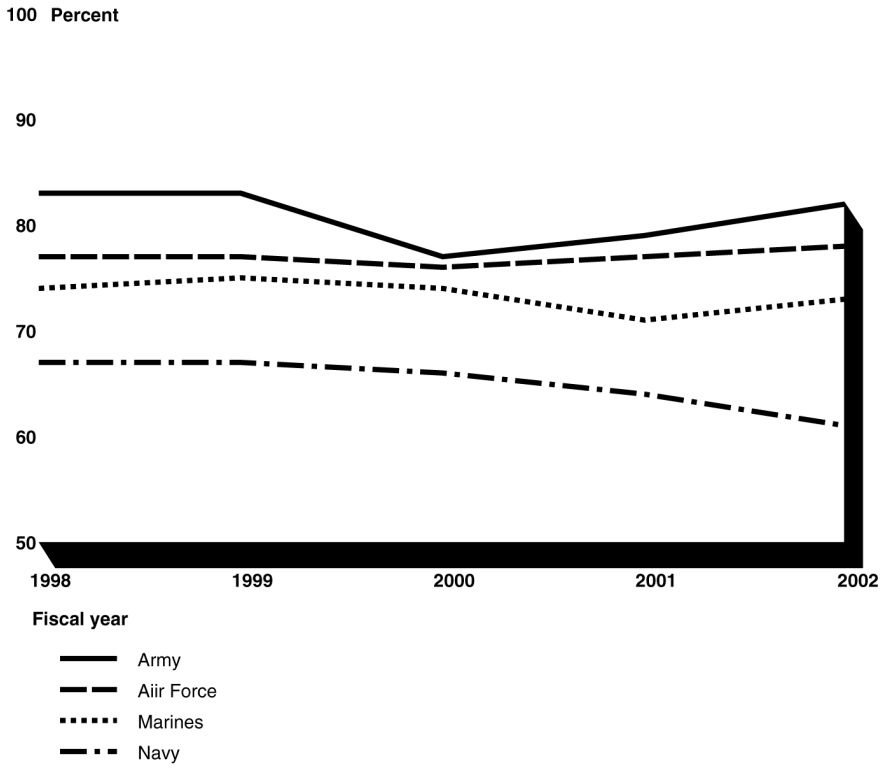
As previously shown in table 1, the level at which the goals were set showed little consistency, varying widely even among the same type of aircraft. For example, MC goals for the bombers in our review ranged from 50 to 80 percent, and MC goals for the fighters, from 65 to 83 percent.

Actual MC Rates Varied by Service and Type of Aircraft

Actual MC rates also varied between services and the various aircraft types. MC and FMC rates are based on the ratio of the number of hours an aircraft was actually available to the total number of hours it could have been available. The Navy/Marines and Air Force reduce the latter figure by the amount of time an aircraft was away for scheduled depot maintenance, while the Army does not make this adjustment. We computed the average rates by service and aircraft type from service data on the total number of hours each aircraft model was MC and FMC, and the total hours each aircraft model was available each year.

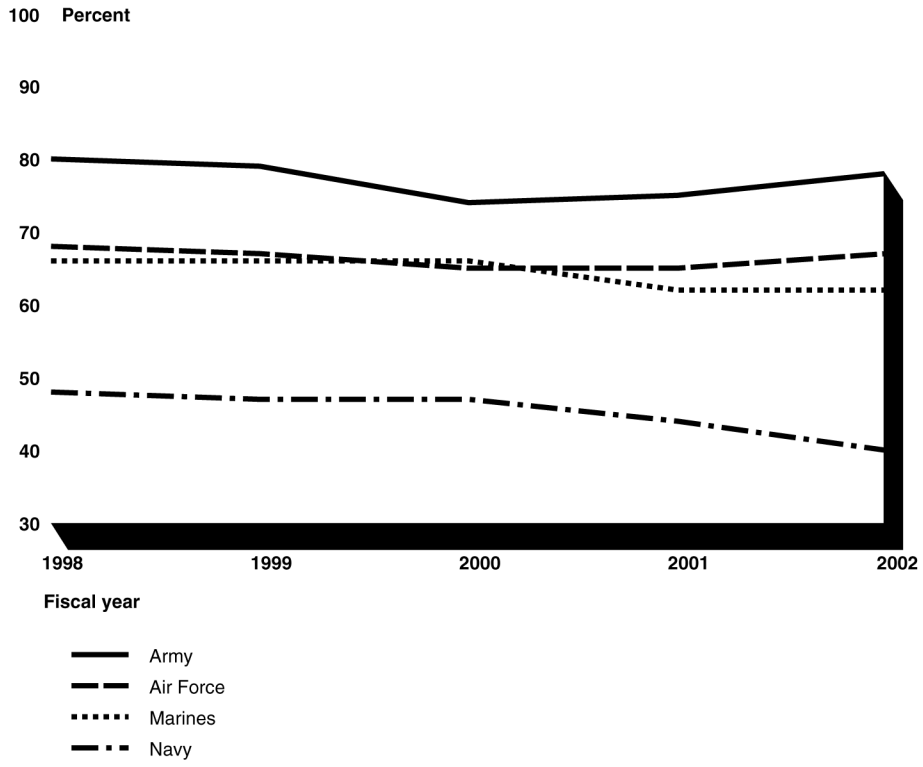
The average annual MC and FMC rates for the services as a whole are shown in figures 3 and 4. The Army and the Air Force had the highest average MC rates, at 77-83 percent during fiscal years 1998-2002; followed by the Marines, at about 71-75 percent; and the Navy, at 61-67 percent. A similar pattern follows for the average FMC rates for the services.

Figure 3: Average Annual MC Rates by Service, Fiscal Years 1998-2002



Sources: Military services (data), GAO (presentation).

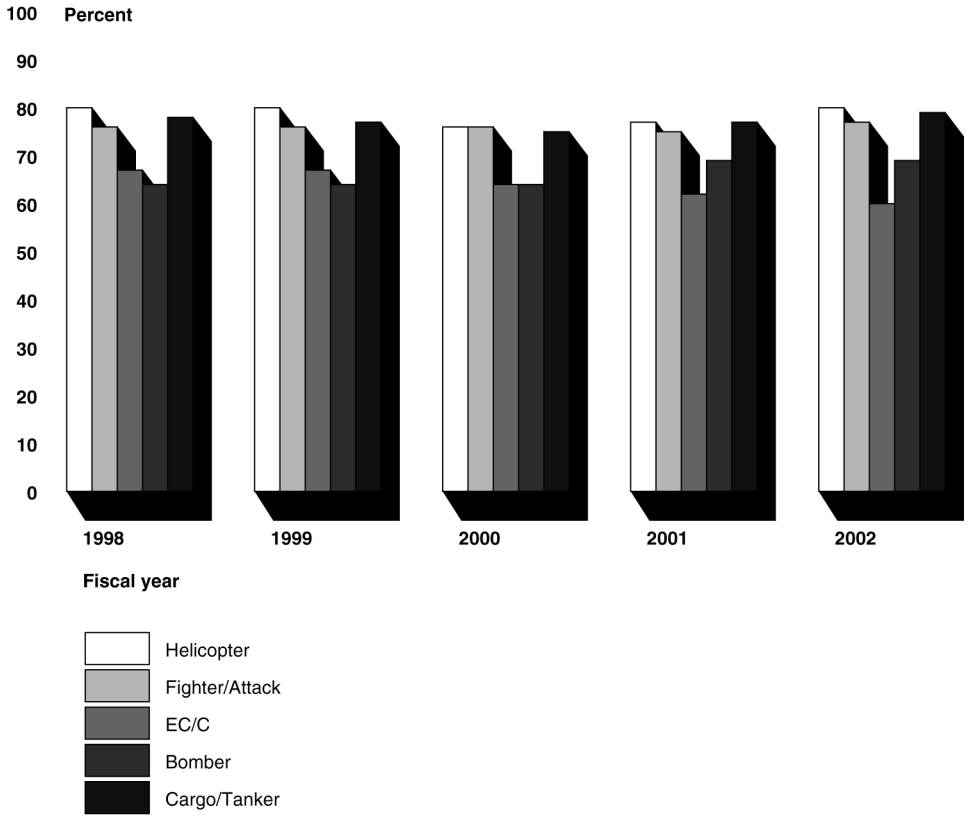
Figure 4: Average Annual FMC Rates by Service, Fiscal Years 1998-2002



Sources: Military services (data), GAO (presentation).

When grouped by type of aircraft, average annual MC rates were highest for helicopters (76-80 percent), cargo/tankers (75-79 percent), and fighter/attack aircraft (75-77 percent). Average annual MC rates for bombers (64-69 percent) and electronic command/control aircraft (60-67 percent) were somewhat lower. Average FMC rates showed similar rank orders. (See figs. 5 and 6.)

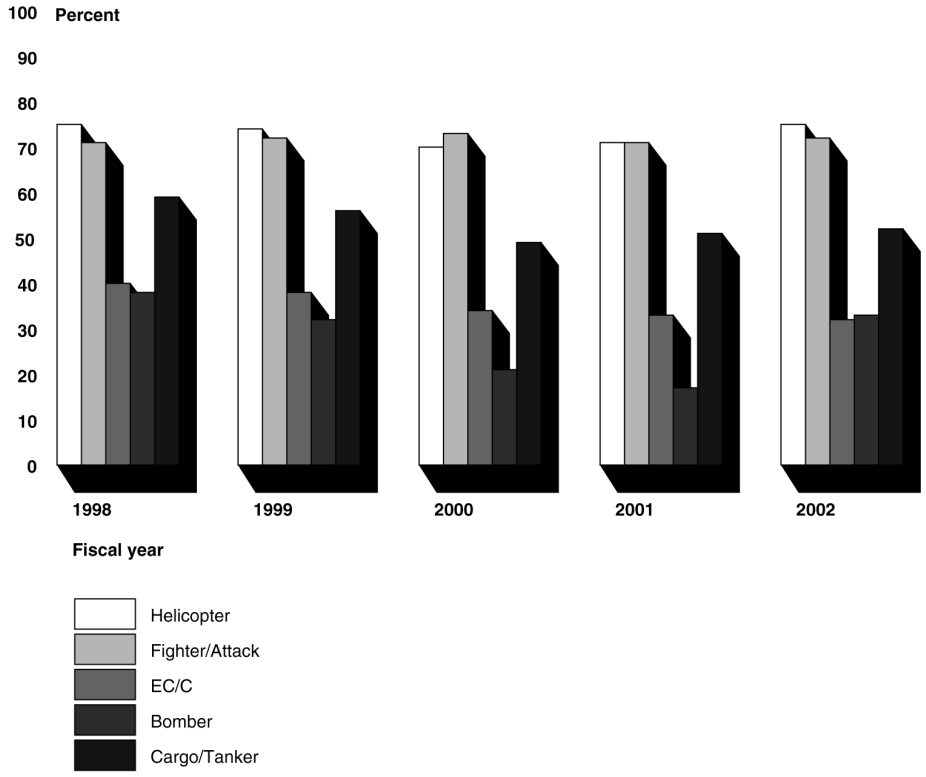
Figure 5: Average Annual MC Rates by Aircraft Type, Fiscal Years 1998-2002



Sources: Military services (data), GAO (presentation).

Note: EC/C refers to electronic command and control aircraft

Figure 6: Average Annual FMC Rates by Aircraft Type, Fiscal Years 1998-2002



Sources: Military services (data), GAO (presentation).

Note: EC/C refers to electronic command and control aircraft.

Goals Generally Remained Constant over Time

MC and FMC goals have generally remained constant over time. Since 1998, only 11 of 49 aircraft models (22 percent) experienced a change to their MC goals, FMC goals, or both. Seven models had their goals raised, and three had their goals lowered. One model's MC goal was changed but then returned to its initial level. Ten of the 11 changes were for aircraft operated by the Air Force. The remaining change was for a Marine Corps aircraft. (See app. I for additional details.)

In fiscal year 2002, for example, the Air Force raised the MC goal for its E-8 Joint Stars electronic command and control aircraft from 73 to 75 percent. According to officials, the E-8 is a relatively new (3-year-old) aircraft that is slowly increasing its performance level as it matures and Air Force maintenance personnel understand the aircraft better. The increase in the MC rate was based on an analysis of actual E-8 MC rates

that were showing an upward trend in performance. The Air Force is the only service that routinely conducts formal reviews of its goals. Air Force officials told us that they generally try to keep the goals high because it is difficult to stop the goals from dropping further once they begin to be lowered. Moreover, officials believed that contractors need to be held to high standards to keep spare parts inventories and other aspects of maintenance at high levels. In another case, the MC goal for the Marine Corps' F/A-18D Hornet fighter was raised from 60 to 75 percent, and its FMC goal, from 46 to 58 percent at the beginning of fiscal year 2000. According to Navy documents, this increase was due to a change in the aircraft's assigned mission.

While most of the goals were either unchanged or increased, the Air Force's Air Combat Command developed a set of interim goals in fiscal year 2000 for some of the fighters, bombers, and electronic command/control aircraft under its command. These interim goals were lower than its official MC goals.[10] In 1999, the Command determined that problems with suppliers and manpower shortages were undercutting its ability to meet MC goals and lowering unit morale. To combat this problem, the Command developed the interim goals listed in table 2. In 2002, the Command returned to using the pre-2000 goals for all but six aircraft (A-10, E-3, F-15 C/D, F-15 E, RC-135, and U-2). According to Command officials, the lower goals applied only to their units. Goals for suppliers remained at official levels to keep spare parts inventories high. Neither the other services nor the Air Force's other major commands responsible for aircraft operations have developed interim goals.

[10]The Air Force refers to the MC and FMC goals as "standards." For simplicity and consistency with the other services, we use the term "goals" throughout this report.

Table 2: Air Combat Command Interim MC Goals, Fiscal Years 2000-2002

Percent						
	2000		2001		2002	
Aircraft	MC goal	Interim goal	MC goal	Interim goal	MC goal	Interim goal
A-10	84	74	84	78	82	78
B-1	67	57	67	63	67	NA
B-52	80	79	80	NA	80	NA
E-3	85	73	85	81	85	83
F-15 C/D	83	75	83	77	83	81
F-15 E	80	75	80	77	81	77
F-16	84	79	84	81	83	NA
RC-135	75	65	75	72	75	72
U-2	85	83	85	84	85	80

Source: U.S. Air Force, Air Combat Command.

Legend: NA = not applicable

Mission Capable Problems Caused by a Combination of Factors

According to DOD officials, difficulties in meeting MC and FMC goals are caused by a complex combination of interrelated logistical and operational factors, with no dominating single problem. The complexity of aircraft design, the lack of availability and experience of maintenance personnel, aircraft age and usage patterns, shortages of spare parts, depot maintenance systems and other operational factors, and perceived funding shortages were all identified as causes of difficulties in meeting the goals. As indicated below, our work found that some indicated factors were valid causes, while the impact of others was less certain.

Aircraft Design Considered Key

Officials believe that the complexity of military aircraft affects its availability, and thus its ability to meet MC goals. Military aircraft are designed to handle a specific set of missions and provide a specific set of capabilities over a projected useful lifespan. According to officials, each aircraft can be inherently complex and maintenance intensive, or, depending upon the missions and capabilities it was designed to provide, simple and easy to maintain. For example, the B-2 bomber had the lowest MC rates (32-44 percent) of any aircraft we reviewed. However, according to Air Combat Command officials, one reason for these low rates is the complex design of the aircraft. The B-2 is a very advanced aircraft with low observable (stealthy) characteristics using new composite materials, and Air Force personnel are still learning how to maintain the aircraft. In contrast, the B-52 bomber had some of the highest MC rates (76-84 percent) of all the aircraft we reviewed. According to Air Force officials,

the B-52 is a relatively simple and flexible design intended for ease of maintenance and durability.

Availability and Experience of Maintenance Personnel Have an Impact

Service officials also frequently linked shortages of the total number of maintenance personnel, as well as their experience level, to the failure to meet MC goals. Navy officials told us that the growing sophistication of their aircraft in general requires maintenance personnel to take longer to learn the complex computer and electronic skills needed to handle the aircraft. However, high demand for these skills in the private sector makes it difficult to retain personnel with these maintenance skills, leading to turnover and increasing the difficulty in meeting the MC goals. Similarly, a recent study published in the *Air Force Journal of Logistics* found that the number and experience level of maintenance personnel correlated highly with the MC rates of F-16 aircraft.[11] As the number of experienced personnel assigned to an aircraft increased, the MC rates increased as well. Army officials also cited shortages of experienced maintenance personnel as a cause of lower MC and FMC rates. However, they also stated that it may be possible to raise the rates by maximizing the time that maintenance personnel actually spend maintaining the aircraft. For example, one Army Audit Agency study in 1998 found that maintenance personnel at one unit were spending about 70 percent of their time on nonmaintenance activities such as administrative duties, training, and time attending to personal duties.[12]

Personnel management is an area that we have cited as a major management challenge and program risk for DOD.[13] For years, DOD has been wrestling with shortages of key personnel because of retention problems. In 1999 we reported that the majority of factors cited as sources of dissatisfaction and reasons to leave the military were related to work

[11]Steven A. Oliver, et al, "Forecasting Readiness: Regression Analysis Techniques," *Air Force Journal of Logistics* (fall 2001): 1, 3, 31-43.

[12]Army Audit Agency, Aviation Maintenance: 25th Infantry Division (Light) and U.S. Army Hawaii, AA 98-185 (May 4, 1998).

[13]See U.S. General Accounting Office, *Major Management Challenges and Program Risks: Departments of Defense*, State, and Veterans Affairs, GAO-01-492T (Washington, D.C.: Mar. 7, 2001).

circumstances, such as the lack of spare parts and materials needed to perform daily job requirements.[14]

Aircraft Age and Usage Patterns Also Believed to Influence Availability

The advancing age and usage patterns of aircraft were other factors often cited by service officials as reasons why aircraft did not meet MC goals. DOD's inventory of aircraft is getting older. The Congressional Budget Office recently reported that from 1980 to 2000, the average age of active-duty Navy aircraft rose from 11 years to more than 16 years; Air Force aircraft, from 13 to more than 20 years; and Army helicopters, from 10 to over 17 years.[15] Logistics officials told us that aging influences on MC rates typically follow a cyclical pattern over the life of an aircraft. When aircraft are initially introduced, they go through a "shake down" period and have low MC rates as new equipment and supply systems stabilize and maintenance personnel learn to understand the aircraft. Eventually, MC rates begin to rise and then stabilize at a higher working level. However, as more and more flying time is accrued over the passing years, problems due to materials and parts fatigue, corrosion, and obsolescence increase, and MC rates begin to fall again. Modernization programs are then instituted to replace worn and obsolete equipment, and the pattern begins again.

Although age may affect MC rates, we found no statistical evidence that age alone explains difficulties in meeting MC goals. For example, our analysis of average aircraft ages and 2002 MC rates found no indication that older aircraft have the lowest MC rates. (See table 3.)[16] With an average age of 40 years, the B-52 is the second oldest aircraft in DOD's inventory. However, its MC rate of 81 for 2002 and historical MC rates consistently in the upper 70s and low 80s rank it among the highest performers we reviewed. According to Air Force officials at the Air Combat Command, in addition to their simplicity, B-52s have a relatively low number of actual flight hours, averaging about 16,000 hours each despite their age. These officials believed that accrued flight hours are a more appropriate measure of wear and tear than chronological age.

[14]See U.S. General Accounting Office, *Military Personnel: Perspectives of Surveyed Service Members in Retention Critical Specialties*, GAO/NSIAD-99-197BR (Washington, D.C.: August. 16, 1999).

[15]Congressional Budget Office, *CBO Paper: The Effects of Aging on the Costs of Operating and Maintaining Military Equipment* (Washington, D.C.: August 2001).

[16]We performed a statistical test of the relationship between average age in years and the MC level and found no relationship between those two factors.

Moreover, according to these officials, the B-52 was originally scheduled to retire in the mid-1990s. However, because of its durability and flexibility, the Air Force decided to retain the aircraft until the average age reaches 32,000 hours, projected at about 2040.

Table 3: Aircraft Ages and 2002 MC Rates/Goals

Aircraft model	Average age (years)	2002 MC rate/goal (percent)	Aircraft model	Average age (years)	2002 MC rate/goal (percent)
KC-130F	40.1	64/72	F-14D	15.3	67/71
B-52	40.0	81/80	B-1	14.6	61/67
KC-135	39.6	82/85	CH-47D	14.4	75/75
RC-135	38.3	76/75	AH-64A	14.2	83/75
C-141	35.0	74/80	SH-60B	13.7	63/77
CH-46E	33.6	76/80	CH-53E	13.7	70/70
CH-53D	31.9	78/73	AH-1W	12.3	73/85
C-130	29.2	81/75	MH-53E	11.5	48/70
UH-1N	27.6	69/85	F-16	11.1	80/83
S-3B	26.2	43/70	F-117	10.7	83/80
KC-130R	25.4	65/75	SH-60F	10.6	54/75
P-3C	24.5	61/85	F-15E	10.2	76/81
E-3	22.0	74/85	F/A-18C-Navy	10.2	66/75
F-14A	21.0	69/65	F/A-18C-Marine	10.2	82/75
A-10	20.1	76/82	E-2C	10.2	51/70
C-5	20.0	66/75	F/A-18D	9.6	78/75
EA-6B-Navy	19.8	58/73	OH-58D	8.5	88/75
EA-6B-Marine	19.8	68/73	UH-60L	7.6	84/80
F-15C/D	18.7	79/83	B-2	7.4	44/50
UH-60A	18.4	76/80	AV-8B	7.0	71/76
U-2	18.3	76/85	C-17	4.1	83/88
KC-10	16.9	83/85	AH-64D	3.3	83/75
F-14B	16.0	73/65	E-8	3.0	84/75
F/A-18A-Navy	16.0	62/75	F/A-18E	1.8	71/75
F/A-18A-Marine	16.0	80/75			

Source: Military services' data.

Logistics officials also believe that MC rates are affected by usage patterns and whether the aircraft is operated under the conditions for which it was designed. Officials told us that the large increase in deployments in recent years has caused many DOD aircraft to be operated at rates higher than expected during their design, thus accelerating aging problems. For

example, according to the *Air Force Journal of Logistics* study, F-15 fighters sent to Saudi Arabia in 1997 were flown at over three times their normal rate.[17]

Spare Parts Inventories Critical

Shortages of spare parts have been recognized by us and others for years as a major contributor to lower-than-expected MC rates. As a result, we have also cited DOD inventory management as a major management challenge and program risk since 1990.[18] Service officials continued to cite spare parts shortages as a frequent cause of difficulties in meeting MC goals. Spare parts shortages are caused by a number of problems, including underestimates of demand, and contracting and other problems associated with aging aircraft or small aircraft fleets.

We have reported on DOD's problems in estimating aircraft spare parts requirements for years. For example, in 1999 and again in 2001, we reported that shortages of spare parts caused by inaccurate forecasting of inventory requirements was degrading MC rates for key Air Force aircraft such as the B-1B bomber, C-5 cargo planes, and F-16 fighters.[19] In 2001 we reported that key Navy aircraft were also having readiness problems because of spare parts shortages resulting from underestimates of demand.[20] Officials continued to raise this issue as an underlying factor in spare parts shortages. In addition, some officials also believed that the higher operating tempos associated with increased deployments have caused parts to fail quicker than expected, exacerbating weaknesses in forecasting inventory requirements.

Air Force officials told us that aging aircraft, in particular, may experience parts shortages and delays in repairs because original manufacturers may no longer make required parts. To obtain a new part, officials must wait for it to be manufactured. However, this may not be a high priority for the

[17]Steven A. Oliver, et al (fall 2001).

[18]See GAO-01-492T.

[19]See U.S. General Accounting Office, *Defense Inventory: Continuing Challenges in Managing Inventories and Avoiding Adverse Operational Effects*, GAO/T-NSIAD-99-83 (Washington, D.C.: Feb. 25, 1999), and U.S. General Accounting Office, *Air Force Inventory: Parts Shortages Are Impacting Operations and Maintenance Effectiveness*, GAO-01-587 (Washington, D.C.: June 27, 2001).

[20]See U.S. General Accounting Office, *Navy Inventory: Parts Shortages Are Impacting Operations and Maintenance Effectiveness*, GAO-01-771 (Washington, D.C.: July 31, 2001).

commercial supplier because of the relatively low profit potential. Alternatively, another company could make the part if the original manufacturer were willing to give up its proprietary rights. However, this can take longer and be more expensive than simply waiting for the original manufacturer. Moreover, officials also told us that spare parts inventories are sometimes reduced when aircraft are nearing the end of their projected life. For example, Air Force officials said that in the mid-1990s they began to shut down the spare parts supply for the B-52 because of its anticipated retirement. This resulted in a depletion of inventories, the canceling of contracts, and ultimately a drop in MC rates from 1997 to 2000. As a result of the decision to retain the B-52, the supply system is recovering and MC rates are moving up.

Similarly, the size of the aircraft fleet can also influence spare parts inventories and MC rates. According to officials, manufacturers may see little profit in stocking large inventories of spare parts for a small fleet of specialized military aircraft. Small fleets of aircraft can also suffer from having their MC rates strongly influenced by the MC failures of just a few aircraft. Large fleets of aircraft also have an advantage in having more opportunities to remove serviceable parts from one aircraft and install them in another—termed "cannibalizing"—thus helping to insulate their MC rates from the impact of parts shortages. However, we recently reported that while cannibalization is a widespread practice among the services, it increases maintenance personnel workloads and lowers morale and retention.[21]

Maintenance Approach and Other Operational Factors May Affect MC Rates

Air Force and Navy officials cited changes to their maintenance approaches as a significant cause of slower repair times and lowered MC rates. In the mid-1990s the Air Force changed from a three-level maintenance approach to a two-level approach.[22] This change moved much of the intermediate maintenance functions, such as the replacement or

[21]See U.S. General Accounting Office, *Military Aircraft: Services Need Strategies to Reduce Cannibalizations*, GAO-02-86 (Washington, D.C.: Nov. 21, 2001).

[22]Under the three-level approach, maintenance is divided into organizational, intermediate, and depot categories. Organizational maintenance is performed at the air base level and includes functions such as inspections, minor repairs, and servicing. Intermediate maintenance generally takes place at shops on the air bases and consists of activities such as calibration, repair, or the emergency manufacture of parts, and technical assistance. The more sophisticated depot maintenance requires more extensive facilities and is conducted at government or contractor industrial facilities.

emergency manufacture of parts, away from the air base level to centralized maintenance depots. According to officials at both the Air Combat Command and Air Mobility Command, these changes slowed the pace of repairs significantly. Repair expertise was taken away from the base level, and aircraft were shipped away from home base more often for repairs. Moreover, officials believed that many experienced maintenance people were lost as they refused to move to other locations associated with the reorganizations. In this regard, our 1996 review of depot closures noted that DOD's outplacement program helped limit the number of involuntary separations and that jobs were often available for employees willing to relocate.[23]

The Army continues to use a three-level maintenance system, as does the Navy. However, Navy officials said they also changed their system in the mid-1990s by introducing the integrated maintenance concept. This approach, in contrast to the Air Force approach, increased the amount of aircraft modernization and other work performed at the base level during a time when funding for depot-level work was being reduced. However, officials believed this change overloaded the base-level maintenance systems and ultimately lowered reported MC rates.

From fiscal year 1988 to fiscal 2001, DOD reduced the number of major depots from 38 to 19. During this same period, the maintenance workforce was reduced by about 60 percent (from 156,000 to 64,500). These reductions were the result of overall force structure reductions since the end of the Cold War, as well as DOD's desire to reduce costs by relying more on the private sector for the performance of depot maintenance. We have raised concerns that DOD's downsizing of its depot infrastructure and workforce was done without sound strategic planning and that investments in facilities, equipment, and personnel in recent years have not been sufficient to ensure the long-term viability of the depots.[24]

Other operational factors can also affect MC rates. For example, from 1997 to 2000, the Air Force's B-1 bomber had a major power system problem that lowered MC rates by 12 points. To address the problem, the Air

[23]See U.S. General Accounting Office, *Closing Maintenance Depots: Savings, Workload, and Redistribution Issues*, GAO/NSIAD-96-29 (Washington, D.C.: Mar. 4, 1996).

[24]See U.S. General Accounting Office, *Defense Logistics: Actions Needed to Overcome Capability Gaps in the Public Depot System*, GAO-02-105 (Washington, D.C.: Oct. 12, 2001).

Combat Command instituted a system of frequent video teleconferences between the offices involved in the maintenance response to provide more intensive management of the response. This approach worked, as the MC rate climbed by 9 points by 2002. Management integration between the operations and logistics sides of the organization was also viewed as key. Good coordination between these two groups is essential because of the complex and multifaceted causes of MC problems. Finally, Air Force officials noted that some of the problems with Air Force MC rates could be explained by a change in reporting procedures. During the mid-1990s, the Air Force returned an aircraft to MC status after it was repaired but prior to the actual check flight to ensure that it was operating correctly. Now, the aircraft must pass the check flight before being classified as MC. Officials believe that this change would tend to lower MC rates slightly.

Funding Levels Raise Concerns

Officials from all services cited underfunding of spare parts inventories, maintenance depots, and other aspects of the maintenance and supply systems as a key problem. For example, Army and Navy officials told us that they often use remanufactured parts instead of new parts to save money.

DOD reports in its Fiscal Year 2000 Performance Report that it has increased funding for spare parts and depot maintenance requirements.[25] For example, the report indicates that funding for depot maintenance increased from $5.58 billion to $7.01 billion from fiscal year 1997 to fiscal 1999 (most recent year that data are available). However, the report also acknowledges an unfunded requirement of about $1.18 billion in fiscal year 1999. Notwithstanding claims regarding the lack of funding for spare parts, we recently reported that when provided additional funds for spare parts, DOD was unable to confirm that those additional funds were used for that purpose.[26]

The pressures for more funding to maintain DOD's aircraft may well go up even more in coming years as the aircraft inventory continues to age. The Congressional Budget Office estimates that spending for operations and

[25]See U.S. Department of Defense, *Government Performance and Results Act: Department of Defense FY 2000 Performance Report* (Washington, D.C.: Mar. 2001).

[26]See U.S. General Accounting Office, *Defense Inventory: Information on the Use of Spare Parts Funding Is Lacking*, GAO-01-472 (Washington, D.C.: June 11, 2001).

maintenance for aircraft increases by 1 to 3 percent for every additional year of age.[27]

DOD'S Goal-Setting Process Is Largely Undefined and Undocumented

Despite the importance of MC and FMC goals as measures of readiness and logistical funding needs, we found widespread uncertainty over how the services' MC and FMC goals were established and who is responsible for establishing them, as well as basic questions about the adequacy of those goals as measures of aircraft availability. The services could not explain and document how the original MC and FMC goals were set for any of the aircraft in our review. Furthermore, some officials questioned which goals are the best to use in reviewing aircraft availability: MC goals, FMC goals, or perhaps a new type of goal. DOD's instruction provides little or no guidance on these and other key issues. DOD officials told us that the instruction has not been updated to reflect the current environment of increased deployments and other changes since the end of the Cold War.

Goals Are Important Indicators of Readiness, Operational Effectiveness, and Logistical Funding Needs

MC and FMC goals are used as fundamental measures of readiness throughout DOD, used as indicators of operational effectiveness, and used to help determine the size of spare parts inventories and other logistical resources needed to maintain aircraft availability. As a result, the level at which the goals are set can influence not only perceptions about operations and readiness, but also millions of dollars in spending for logistical operations.

In addition to the requirement to maintain MC and FMC data set forth by DOD Instruction 3110.5, the services use MC and FMC measures as a component of overall unit readiness determinations under DOD's Global Status of Resources and Training System.[28] The System requires commanders to rate their unit's readiness at levels 1 (highest) through 5 on the basis of a combination of their professional judgment and the readiness ratings in four specific areas: personnel, training, equipment on hand, and equipment condition. MC and FMC measures are used to determine the ratings for equipment condition. For example, the Army measures equipment condition (termed "serviceability" by the Army) for

[27]See Congressional Budget Office (August 2001).

[28]The Global Status of Resources and Training System is the automated reporting system within DOD used as the central registry of readiness information for all U.S. operational units.

aircraft by using the FMC rate. An FMC rate of 75 percent or more is required for a level-1 readiness rating, the highest available. Congress also requires DOD to include Status of Resources and Training System information on the condition of equipment as well as specific information on equipment that is not mission capable in its quarterly readiness reports to Congress. These reports assist Congress in its general responsibilities for overseeing DOD readiness and operations.

Similarly, according to DOD and service officials, MC and FMC goals are used as management tools within DOD units to diagnose problems and motivate personnel. For example, officials in the Air Combat Command told us that their use of lower interim goals beginning in fiscal year 2000 was an attempt to raise unit morale that had suffered as a result of their inability to meet the actual goals owing to shortages of personnel and spare parts. In this regard, DOD's instruction specifically calls for the services to use the goals and condition status measurements, such as MC and FMC, to review maintenance and supply effectiveness and to have programs to identify and correct problems with systems and equipment.

Service officials told us that the goals also affect DOD's funding levels because the goals are used to help determine the size of spare parts inventories and other logistical resources needed. Higher goals require more money to maintain parts inventories and other resources needed to achieve the goals. For example, officials told us that in the early 1990s, a $100 million contract for logistics support for one Air Force aircraft contained an MC goal of 90 percent. During this period, the contractor kept supply bins full of parts and MC goals were met. However, in the mid-1990s a new contractor was brought in, and the MC goal was dropped to 85 percent. According to Air Force officials, their decision to lower the MC goal by 5 percentage points allowed the contractor to lower spare parts inventories and reduced the price of the maintenance contract by $10 million. However, MC rates also dropped and eventually fell below the new goal. The services have developed mathematical models to determine the size and cost of the spare parts inventories needed to support various levels of MC and FMC goals and other measures of aircraft availability. For example, the Navy uses a model called "Readiness Based Sparing" that takes a given FMC goal and determines the level of funding and spare parts inventories needed to reach that goal. Such models are useful in the case of spare parts inventories. However, we were not able to identify any models in widespread operational use that integrated the other influences on MC rates, such as maintenance personnel assigned, into an overall model able to predict the impact of changes in those resources on MC and FMC rates. Army and Air Force officials told us that they had recently

developed such integrated models, and they are currently in limited use to test their validity. Navy officials told us that they did not yet have an integrated model.

The potential amount of funds affected by the level at which MC and FMC goals are set is large. Military service estimates of the spending of operations and maintenance funds for aircraft spares and repair parts were over $7 billion in fiscal year 2001.[29] This figure does not include spending from other sources such as procurement and working capital funds.

Methods Used to Set Goals Unknown

Precisely how MC and FMC goals are established is unknown. DOD officials said that a combined DOD and military service team establishes operational requirements and MC goals during the acquisition process. After approval, these requirements are recorded in the Operational Requirements Document or other documents associated with the process. According to officials, part of this process involves an engineering analysis of the expected operational availability of the aircraft and the underlying level of maintenance support elements needed. "Operational availability" is an engineering term referring to the probability that equipment is not down owing to failure.[30] In comparison, MC and FMC goals represent the expected percentage of time that an aircraft will be able to perform at least one or all of its missions, respectively.

Service officials reviewed the acquisition documents for many of the aircraft in our review, but were unable to explain and document how the actual MC and FMC goals were chosen. According to officials, many of these aircraft were acquired 20 to 30 years ago, under processes that have changed over the years, and with no clear documentation of the basis for the specific goal chosen. Moreover, there was often confusion over which organizations were responsible for setting the goals.

[29]See U.S. General Accounting Office, *Defense Inventory: Better Reporting on Spare Parts Spending Will Enhance Congressional Oversight*, GAO-03-18 (Washington, D.C.: Oct. 24, 2002).

[30]Operational availability is calculated by dividing the mean time between maintenance events by the sum of the mean time between maintenance events and mean downtime (time needed for corrective and preventive maintenance and waiting time).

For example, Navy officials pointed to a 1996 Center for Naval Analyses study that attempted to determine how the MC and FMC goals for Navy aircraft were originally computed.[31] According to the study, however, "no one knows the origin of the numbers or the method used to compute them. Now, the numbers are routed to knowledgeable people for revision, which are made without documenting the rationale for the changes." In a July 17, 2002, letter to us, the Navy further explained that it believed that the MC goals were established in the early 1980s "to be in line with the reported status quo for the day" with "no analytical rigor applied at the time of their birth." We requested a written explanation of how the goals were set because, despite repeated referrals to various offices over several months, no Navy official could explain how the goals were established or identify the responsible office. According to Navy officials, there was uncertainty between the program and policy offices as to who is responsible for establishing the goals and who should answer our questions.

Similarly, Army officials could not explain how their goals were set, and two separate Army organizations believed the other was responsible for setting the goals. The Army's written response to our request for an explanation of how the goals were set (dated July 31, 2002) was prepared by officials from the Army's Training and Doctrine Command and forwarded to us by a letter from the Office of the Deputy Chief of Staff for Logistics. The Deputy Chief of Staff's letter states that MC goals for Army aircraft are extracted from the System Readiness Objective contained in the Operational Requirements Document established during an aircraft's acquisition, and that the Training and Doctrine Command is responsible for establishing the System Readiness Objectives.[32] However, the Training and Doctrine Command's letter states that it does not set System Readiness Objectives and that the Deputy Chief of Staff for Logistics is responsible for establishing readiness goals. Nonetheless, the Training and Doctrine Command researched the operational requirements documents for the Army aircraft in our review in an attempt to answer our question about how the MC and FMC goals were set. The Command's letter identified the operational availability requirements for most of the aircraft but did not explain how these requirements were set or make any reference to the MC or FMC goals. Officials from the Office of the Deputy

[31]See Center for Naval Analyses, *Naval Aviation Goals Study* (Alexandria, Va.: June 1996).

[32]The System Readiness Objective is defined as the measurable criterion used to assess the ability of a weapons system to undertake a set of missions at planned utilization rates.

Chief of Staff for Logistics told us that the Army is considering changing the FMC goals for all its aircraft to 75 percent to match the requirement for the highest-level readiness rating for equipment serviceability under the Global Status of Resources and Training System's criterion. They did not know how the 75-percent-readiness-rating criterion was chosen.

Air Force officials also could not explain how the initial MC and FMC goals for their aircraft were established. Officials from the Air Combat Command—responsible for Air Force fighters, bombers, and electronic command/control aircraft in our review—told us that they could find no historical record of the process used to establish most of the goals. Similarly, officials from the Air Mobility Command—responsible for the cargo and tanker aircraft—stated that the Command was formed in 1992 out of elements from the Military Airlift and Strategic Air Commands and did not know how the previous Commands had established the goals. According to these officials, each of the major Commands that operate aircraft and other major weapon systems in the Air Force is responsible for establishing its own MC goals, and no one has published a standardized methodology to use. Moreover, some of the documentation related to the goals was lost when the Military Airlift and Strategic Air Commands were deactivated. Similar to the Navy, however, officials from both Commands believed that the goals were set on the basis of the historical performance of similar aircraft and/or subjective Command judgments.

While Air Force officials could not explain how the initial goals were established, they told us that their annual reviews of the goals are based on a mix of historical trend analysis and requirements reviews. The Air Force is the only service that conducts formal reviews of its goals each year. According to officials from the Air Mobility and Air Combat Commands, until 1997-98, reviews of the goals in both Commands were based on an analysis of actual historical MC and FMC rates. For example, analysts at the Air Mobility Command compared the goals with the actual rates for the previous 2 years. Depending upon actual performance, the goal could then be changed, sometimes on the basis of subjective judgments. According to Air Combat Command officials, the MC goal for the B-2 bomber was set in fiscal year 2000 using an analysis of historical rates and command judgment. The first B-2 was delivered in 1993.

In 1997-98, the two Air Force Commands began to develop so-called "requirements-based analyses" to review the standards. According to officials at the Air Combat Command, for example, it was recognized that the historical approach to reviewing the standards can perpetuate relatively low standards because it simply accepts the low funding levels

and other problems that may lower MC rates without focusing on actual mission needs. The new approach attempts to factor in wartime operational requirements, peacetime flying hour requirements for pilot training, and other such requirements. A mix of both approaches is currently used by the commands to review the goals.

The services also differed in their treatment of other important aspects of managing the goals, such as whether to vary the goals on the basis of an aircraft's deployment posture. The Navy was the only service to tier its goals on the basis of its traditional practice of cyclical deployment schedules on board its ships and aircraft carriers. Operational aircraft in the Navy follow a cyclical pattern of deploying to sea on aircraft carriers and other vessels for a set period of time, such as 6 months. Once the deployed units are replaced, they experience a stand-down period during which they recover from the rigors of deployment until it is time to begin preparing for the next movement. The Navy varies the intensity of its maintenance and its MC and FMC goals according to this pattern. Navy aircraft more than 90 days away from a deployment have goals that are 5 percentage points lower than aircraft within 90 days of a deployment, and aircraft actually deployed have goals that are 5 percentage points higher than those within 90 days of deploying.[33] In comparison, aircraft in the Marine Corps[34] and other services have a level approach to maintenance where the goals do not vary, and maintenance is kept at a relatively constant level. Navy officials believed that the cyclical approach to maintenance could lower overall MC rates over time compared with the level approach. This is because of the reduced maintenance attention when the aircraft are not deployed.

Adequacy of MC and FMC Goals Questioned

Some officials questioned whether the MC and FMC goals are adequate measures of an aircraft's availability. For example, officials from the Air Force's Air Mobility Command stated that they focused on the MC goal and not the FMC goal because their primary readiness objective is the specific mission currently assigned, not every possible mission the aircraft

[33]As agreed with Navy officials, we used "overall" MC and FMC goals in our analyses of Navy and Marine Corps aircraft. The overall goals are a combined goal for the various categories of deployment status.

[34]Marine Corps aircraft share the same goals as the Navy aircraft. However, according to officials, Marine Corps aircraft do not follow the cyclical pattern of deployments and thus maintain the same goal throughout the year.

was designed for. Moreover, the Air Combat Command did not even establish FMC goals. This Command was the only one we reviewed that did not set FMC goals for its aircraft. Air Combat Command officials told us that they could find no documentation to explain why the Command did not establish FMC goals.

In contrast, Army officials stated that their units focus primarily on the FMC goal because it is directly connected to readiness ratings under the Status of Resources and Training System. Furthermore, Navy officials stated that the military is moving away from the MC and FMC goals in newer aircraft, such as the Joint Strike Fighter. This is because the MC and FMC goals provide only a limited historical perspective and do not address issues that are important to war-fighting commanders such as how often an aircraft can fly missions over the course of a day and the probability that the aircraft will complete its mission. The Joint Strike Fighter, for example, is using a concept called "mission reliability" instead of MC and FMC goals. Mission reliability is the probability that the Joint Strike Fighter will complete its required operational mission without a failure. According to Navy officials, the predictive value and information on flight frequency and reliability provided by this new measure is very valuable to war-fighting commanders and is better for mission-planning purposes than the MC and FMC measures. Officials said that the mission-reliability concept could be used throughout DOD's inventory of aircraft.

DOD Instruction Provides Little or No Guidance on Key Issues

DOD Instruction 3110.5 provides only vague or no guidance on many of the key issues raised in this report. For example, the instruction requires each military service to establish availability goals for its mission-essential systems and equipment, and a corresponding set of condition status measures relative to those goals. The instruction specifically identifies MC, FMC, and other specific capabilities as measures that the services must maintain. However, it does not identify the specific goals that must be established—MC, FMC, or any other—or the primary readiness objective to be served. In this regard, the instruction states that the services should assume planned peacetime usage in setting the goals. According to Air Force officials, peacetime usage can be more taxing than wartime usage because of the extra training and other requirements. Air Combat Command officials told us that they believed that the instruction regarding what goals—including the FMC goal—were required to be established was unclear.

The instruction also provides little guidance on the methodology to be used in setting the goals. It states that the services should provide

estimates of the maximum performance that is achievable, given the design characteristics of the aircraft, and that full funding and optimal operation of the logistics support system should be assumed. Service officials said they believe that actual levels of funding, personnel, spare parts inventories, and other key resources should be factored into the process of setting the goals, since full funding has not been provided for years. The instruction is silent on the issue of whether it is appropriate to use historical trends of similar aircraft in determining the goals, as opposed to a more analytical approach using actual requirements, for example. The instruction is also silent on whether the aircraft availability goals should vary on the basis of the aircraft's deployment posture. Moreover, it includes no requirement for the services to identify the readiness and cost implications of setting the goals at different levels, to help clarify the pros and cons of available choices and the guiding principles used to decide on those choices.

Similarly, the instruction provides little organizational structure for the goal-setting process in DOD. For example, it does not require the services to identify one office as the coordinating organization for goal-setting and other related activities. Furthermore, it does not require the services to document the basis for the goals chosen or outline any of the basic historical documentation that should be maintained for goal-setting and other key activities during the process.

According to DOD officials from the office responsible for the instruction, DOD Instruction 3110.5 dates back to the 1970s when readiness concerns had reached a high point. The focus was on getting the services to set benchmark readiness goals, and the instruction gave them latitude to choose those goals, the methods for setting them, and the processes for managing them. The instruction was revised in 1990. However, officials told us that it has not been updated to reflect the current environment of frequent deployments and other changes since the end of the Cold War, and some now consider it a relic.

We performed our work from February through November 2002 in accordance with generally accepted government auditing standards. The final publication of this report was delayed by the impact on DOD's report review and classification process of the terrorist attacks on September 11, 2001 and DOD's preparations for potential conflict in Iraq.

Conclusions

While many of DOD's key aircraft are not meeting MC and FMC goals, it is difficult to determine how significant this problem is because of the

uncertainty and lack of documentation of the basis for the existing goals. Moreover, without knowing the basis for the existing goals, it is also difficult to know whether that basis is appropriate for the demands of the new defense strategy.

DOD's Instruction 3110.5 fails to clearly define the specific availability goals that all services must establish. Without the perspective provided by clear, consistent, and up-to-date goals, the perceptions of actual performance are subject to continuing uncertainty and disagreement, and confidence in the funding requests based on those perceptions is undermined. Moreover, the lack of a standard methodology for the services to use in setting the goals removes a safeguard for objectivity from the process, risking the possibility that the methods used do not realistically reflect actual requirements. This risk is increased when there is uncertainty or disagreement over basic questions such as whether it is appropriate to base the goals on a historical analysis or an analysis of actual requirements, and whether full funding of logistical support systems should be assumed in an era of reduced funding. Furthermore, the absence of information on the readiness and cost implications of setting the goals at different levels results in a lack of understanding of the pros and cons of available choices and the guiding principles used to make those decisions. Ultimately, inappropriately set goals can unnecessarily raise or lower the cost of spare parts inventories and other logistical resources by millions of dollars.

Also, DOD's instruction requires the services neither to designate one office to coordinate the establishment and maintenance of aircraft availability goals, nor to document the basis for the goals chosen or other key issues in the process. Clear responsibilities and requirements in these areas are fundamental to the effective management of any performance system. Without the transparency provided by adequate documentation of the process, neither DOD nor the Congress can be reasonably assured that the services have selected the optimal goals on the basis of preferred principles.

Recommendations for Executive Action

To ensure that aircraft availability goals and their performance measures are appropriate to the new defense strategy and based on a clear and defined process, we recommend that (1) DOD and the services determine whether different types of aircraft availability goals are needed, (2) as appropriate, DOD and the services validate the basis for the existing MC and FMC goals, and (3) the Secretary of Defense revise DOD Instruction 3110.5 to

- clearly define the specific aircraft availability goals required to be established by the military services and their accompanying performance measures;
- establish a standard methodology identifying objective principles of analysis to be used by all services in setting the goals, including an identification of the readiness and cost implications of setting the goals at different levels; and
- require each service to identify one office to act as a focal point for coordinating the development of the goals and for maintaining a documentary record of the basis for the goals chosen and other key decisions in the goal-setting process.

Agency Comments and Our Evaluation

In written comments on a draft of this report, DOD concurred or partially concurred with all our recommendations. The department agreed to determine whether different types of aircraft availability goals are needed, including the option of tailoring such goals to unique military service and mission requirements. DOD also agreed to validate the basis for the existing goals, including the DOD Instruction 3110.5 requirement that full funding of support systems be assumed in establishing availability goals. In addition, DOD indicated that it would explore alternative methodologies for setting goals, such as one based on unit deployment cycles currently in use by the Navy.

DOD partially concurred with our recommendation for a series of revisions to DOD Instruction 3110.5. It agreed with our recommendation that the instruction be revised to require each service to designate a focal point for the development and historical documentation of the goal-setting process. However, DOD did not agree with the part of our recommendation calling for it to include the performance measures associated with the aircraft availability goals in the instruction. DOD believed that that requirement implied that those performance measures should be the sole or primary measure of the overall state of materiel readiness. That was not our intent. Our recommendation is meant to ensure that the goals and accompanying performance/status measures selected are clearly defined in the instruction. As pointed out in the report, this is not currently the case. We agree that determinations of overall materiel readiness require the consideration of a variety of factors, such as maintenance manning and supply fill rates, as well as metrics such as an aircraft's availability. However, we believe that the instruction should continue its current requirement to include performance/condition status measures relative to those goals. Clearly identifying the goals that are sought and their performance measures in the instruction will help avoid

further uncertainty and disagreement over the level of basic aircraft performance, and does not preclude the consideration of other metrics in broader assessments of overall readiness. For these reasons, we believe no change to our recommendation is needed.

DOD also disagreed with the part of our recommendation calling for the Secretary of Defense to revise the instruction to establish a standard methodology identifying objective principles of analysis to be used in setting the goals. It believed that the services should establish the detailed analytical methodology because the types of goals and their basis may vary by service, and the services have a better understanding of the differences and complexities of their individual environments. We agree with the need for some leeway at the service level to handle individual differences between them. However, we continue to believe that all services should adhere to a standardized set of overarching principles of analysis in order to safeguard objectivity and transparency in the goal setting process. Such principles could be identified in coordination with the services during the department's planned evaluation of the basis for the current goals and alternative methodologies. The services could then develop detailed methodologies consistent with these principles but tailored to their individual environments. Consequently, no change to our recommendation is required.

The department's comments are reprinted in appendix III. DOD also provided technical comments, which we incorporated as appropriate.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies to the appropriate congressional committees; the Secretaries of Defense, the Army, the Navy, and the Air Force; the Commandant of the Marine Corps; and the Director, Office of Management and Budget. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

Please contact me at (757) 552-8100 if you or your staff have any questions concerning this report. The major contributors to this report are listed in appendix IV.

Sincerely yours,

Neal P. Curtin
Director
Defense Capabilities and Management Team

Appendix I: Mission Capable Goals and Rates, Fiscal Years 1991-2002

Aircraft type	Service	Model	Age (yrs.)	Cost/Flying hours	Indicators
Helicopter	Army	CH-47D	14.4	$2,258	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Army	OH-58D	8.5	$1,014	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Army	AH-64A	14.2	$2,442	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Army	UH-64D	3.3	$3,115	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Army	UH-60A	18.4	$1,354	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Army	UH-60L	7.6	$1,189	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Navy	SH-60B	13.7	$2,265	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Navy	SH-60F	10.6	$2,683	MC goal
					MC rate
					FMC goal
					FMC rate

Percent											
FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02
75	75	75	75	75	75	75	75	75	75	75	75
74	71	64	73	77	75	76	74	70	75	74	75
70	70	70	70	70	70	70	70	70	70	70	70
72	69	63	71	75	73	74	72	66	72	71	72
75	75	75	75	75	75	75	75	75	75	75	75
72	59	78	85	79	83	86	88	88	85	86	88
70	70	70	70	70	70	70	70	70	70	70	70
62	53	70	80	77	79	81	84	83	81	82	84
75	75	75	75	75	75	75	75	75	75	75	75
77	77	73	77	75	83	84	84	83	67	79	83
70	70	70	70	70	70	70	70	70	70	70	70
65	69	65	70	71	80	82	81	79	62	75	79
75	75	75	75	75	75	75	75	75	75	75	75
							69	75	64	73	83
70	70	70	70	70	70	70	70	70	70	70	70
							61	67	57	64	80
80	80	80	80	80	80	80	80	80	80	80	80
69	70	70	75	75	76	78	80	79	76	76	76
75	75	75	75	75	75	75	75	75	75	75	75
65	67	68	71	72	73	75	77	75	72	72	73
80	80	80	80	80	80	80	80	80	80	80	80
70	70	66	77	81	85	86	88	86	85	82	84
75	75	75	75	75	75	75	75	75	75	75	75
66	68	63	73	76	82	84	86	84	82	79	82
77	77	77	77	77	77	77	77	77	77	77	77
							61	59	61	62	63
58	58	58	58	58	58	58	58	58	58	58	58
							41	38	40	41	44
75	75	75	75	75	75	75	75	75	75	75	75
							69	74	74	61	54
60	60	60	60	60	60	60	60	60	60	60	60
							56	55	54	47	41

Aircraft type	Service	Model	Age (yrs.)	Cost/Flying hours	Indicators
Helicopter	Navy	MH-53E	11.5	$7,108	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Marines	CH-46E	33.6	$3.138	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Marines	CH-53D	31.9	$4,502	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Marines	CH-53E	13.7	$6,640	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Marines	AH-1W	12.3	$2,518	MC goal
					MC rate
					FMC goal
					FMC rate
Helicopter	Marines	UH-1N	27.6	$1,873	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Air Force	A-10	20.1	$2,247	MC goal
					MC rate
					MC interim goal
					FMC goal
					FMC rate

Percent											
FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02
70	70	70	70	70	70	70	70	70	70	70	70
							56	62	61	56	48
60	60	60	60	60	60	60	60	60	60	60	60
							41	47	54	48	38
80	80	80	80	80	80	80	80	80	80	80	80
							78	78	79	78	76
77	77	77	77	77	77	77	77	77	77	77	77
							72	72	72	72	68
73	73	73	73	73	73	73	73	73	73	73	73
							72	77	80	85	78
65	65	65	65	65	65	65	65	65	65	65	65
							63	69	76	72	64
70	70	70	70	70	70	70	70	70	70	70	70
							70	71	65	61	70
60	60	60	60	60	60	60	60	60	60	60	60
							61	64	58	52	58
85	85	85	85	85	85	85	85	85	85	85	85
							77	76	76	74	73
75	75	75	75	75	75	75	75	75	75	75	75
							66	66	67	64	61
85	85	85	85	85	85	85	85	85	85	85	85
							79	79	77	76	69
75	75	75	75	75	75	75	75	75	75	75	75
							69	65	68	64	55
84	84	84	84	84	84	84	84	84	84	84	84
91	92	87	89	88	87	84	78	75	71	72	76
									74	78	78
91	91	85	88	87	85	79	73	72	70	68	75

Aircraft type	Service	Model	Age (yrs.)	Cost/Flying hours	Indicators
Fighter	Air Force	F-15C/D	18.7	$6,694	MC goal
					MC rate
					MC interim goal
					FMC goal
					FMC rate
Fighter	Air Force	F-15E	10.2	$7,970	MC goal
					MC rate
					MC interim goal
					FMC goal
					FMC rate
Fighter	Air Force	F-16	11.1	$3, 446	MC goal
					MC rate
					MC interim goal
					FMC goal
					FMC rate
Fighter	Air Force	F-117	10.7	[a]	MC goal
					MC rate
					MC interim goal
					FMC goal
					FMC rate
Fighter	Navy	F-14A	21.0	$9,097	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Navy	F-14B	16.0	$7,341	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Navy	F-14D	15.3	$8,042	MC goal
					MC rate
					FMC goal
					FMC rate

Percent											
FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02
83	83	83	83	83	83	83	83	81	83	83	83
86	86	84	82	82	82	81	78	76	77	79	79
									75	77	81
83	84	83	80	79	79	80	76	74	76	77	77
80	80	80	80	80	80	80	80	81	80	80	81
88	87	83	83	82	81	79	77	76	77	74	76
									75	77	77
88	85	79	82	79	80	77	75	75	74	72	75
84	84	84	84	84	84	84	84	83	84	84	83
90	91	91	89	88	86	82	79	79	80	80	80
									79	81	83
90	91	89	88	86	82	79	75	78	78	77	78
80	80	80	80	80	80	80	80	80	80	80	80
100	84	62	67	78	85	84	79	83	77	81	83
									80	80	80
100	81	55	67	78	85	84	79	83	77	81	83
65	65	65	65	65	65	65	65	65	65	65	65
							64	71	72	73	69
50	50	50	50	50	50	50	50	50	50	50	50
							56	62	64	59	57
65	65	65	65	65	65	65	65	65	65	65	65
							74	79	76	77	73
50	50	50	50	50	50	50	50	50	50	50	50
							65	71	69	69	59
71	71	71	71	71	71	71	71	71	71	71	71
							61	64	72	72	67
61	61	61	61	61	61	61	61	61	61	61	61
							49	52	54	46	38

Aircraft type	Service	Model	Age (yrs.)	Cost/Flying hours	Indicators
Fighter	Navy	F/A-18A	16	$4,463	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Navy	F/A-18C	10.2	$4,604	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Navy	F/A-18E	1.8	[a]	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Marines	F/A-18A	16.0	$4,463	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Marines	F/A-18C	10.2	$4,604	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Marines	F/A-18D	9.6	$3,751	MC goal
					MC rate
					FMC goal
					FMC rate
Fighter	Marines	AV-8B	7.0	$5,351	MC goal
					MC rate
					FMC goal
					FMC rate

Percent											
FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02
75	75	75	75	75	75	75	75	75	75	75	75
							50	58	44	55	62
58	58	58	58	58	58	58	58	58	58	58	58
							30	42	35	36	53
75	75	75	75	75	75	75	75	75	75	75	75
							72	70	71	68	66
58	58	58	58	58	58	58	58	58	58	58	58
							59	60	62	57	52
								75	75	75	75
										68	71
								58	58	58	58
										43	33
75	75	75	75	75	75	75	75	75	75	75	75
							85	85	81	77	80
58	58	58	58	58	58	58	58	58	58	58	58
							80	78	74	72	75
75	75	75	75	75	75	75	75	75	75	75	75
							82	82	82	82	82
58	58	58	58	58	58	58	58	58	58	58	58
							77	75	77	74	74
60	60	60	60	60	60	60	60	60	75	75	75
							77	82	82	76	78
46	46	46	46	46	46	46	46	46	58	58	58
							72	76	76	67	65
76	76	76	76	76	76	76	76	76	76	76	76
							62	61	61	57	71
70	70	70	70	70	70	70	70	70	70	70	70
							54	51	55	48	60

Aircraft type	Service	Model	Age (yrs.)	Cost/Flying hours	Indicators
Bomber	Air Force	B-1	14.6	$14,343	MC goal
					MC rate
					FMC goal
					MC interim goal
					FMC rate
Bomber	Air Force	B-2	7.4	$6,736	MC goal
					MC rate
					FMC goal
					FMC rate
Bomber	Air Force	B-52	40.0	$6,575	MC goal
					MC rate
					MC interim goal
					FMC goal
					FMC rate
EC/C	Air Force	E-3	22.0	$3,788	MC goal
					MC rate
					MC interim goal
					FMC goal
					FMC rate
EC/C	Air Force	E-8	3.0	$3,057	MC goal
					MC rate
					FMC goal
					FMC rate
EC/C	Air Force	RC-135	38.3	$2,825	MC goal
					MC rate
					MC interim goal
					FMC goal
					FMC rate

Percent											
FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02
65	65	65	65	65	65	67	67	67	67	67	67
57	58	59	67	68	70	64	51	52	52	60	61
									57	63	67
1	4	7	11	11	39	54	39	39	28	23	36
									50	50	50
			25	17	24	32	34	42	39	32	44
			14	4	5	21	19	19	21	9	22
80	80	80	80	80	80	80	80	80	80	80	80
76	81	83	82	83	84	77	78	76	79	84	81
									79	80	80
55	65	69	70	75	76	65	39	28	16	13	31
85	85	85	85	85	85	85	85	85	85	85	85
92	91	85	86	86	83	79	72	74	73	76	74
									73	81	83
89	86	79	82	69	48	42	23	30	26	25	41
									73	73	75
					33	50	66	72	66	74	84
					6	9	20	41	37	45	57
75	75	75	75	75	75	75	75	75	75	75	75
70	69	74	77	79	78	73	74	65	59	64	76
									65	72	72
59	55	48	42	50	62	53	53	43	30	40	45

Aircraft type	Service	Model	Age (yrs.)	Cost/Flying hours	Indicators
EC/C	Air Force	U-2	18.3	[a]	MC goal
					MC rate
					FMC goal
					MC interim goal
					FMC rate
EC/C	Navy	S-3B	26.2	$4,754	MC goal
					MC rate
					FMC goal
					FMC rate
EC/C	Navy	E-2C	10.2	$4,664	MC goal
					MC rate
					FMC goal
					FMC rate
EC/C	Navy	P-3C	24.5	$3,082	MC goal
					MC rate
					FMC goal
					FMC rate
EC/C	Navy	EA-6B	19.8	$5,080	MC goal
					MC rate
					FMC goal
					FMC rate
EC/C	Marines	EA-6B	19.8	$5,080	MC goal
					MC rate
					FMC goal
					FMC rate
Cargo/Tanker	Air Force	C-5	20.0	$9,106	MC goal
					MC rate
					FMC goal
					FMC rate

Percent											
FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02
				85	85	85	85	85	85	85	85
				77	78	86	81	80	76	77	76
									83	84	80
				73	73	84	79	77	72	74	73
70	70	70	70	70	70	70	70	70	70	70	70
							59	61	63	51	43
54	54	54	54	54	54	54	54	54	54	54	54
							31	33	37	30	25
70	70	70	70	70	70	70	70	70	70	70	70
							72	73	69	63	51
54	54	54	54	54	54	54	54	54	54	54	54
							50	40	40	41	35
85	85	85	85	85	85	85	85	85	85	85	85
							64	66	63	62	61
61	61	61	61	61	61	61	61	61	61	61	61
							28	23	17	17	12
73	73	73	73	73	73	73	73	73	73	73	73
							68	62	58	60	58
54	54	54	54	54	54	54	54	54	54	54	54
							50	41	37	39	35
73	73	73	73	73	73	73	73	73	73	73	73
							71	74	63	62	68
54	54	54	54	54	54	54	54	54	54	54	54
							60	64	53	49	51
70	70	75	75	75	75	75	75	75	75	75	75
71	75	72	65	64	66	64	63	61	62	65	66
			60	60	36	37	37	45	45	45	45
34	42	43	37	37	43	37	39	31	28	19	18

Aircraft type	Service	Model	Age (yrs.)	Cost/Flying hours	Indicators
Cargo/Tanker	Air Force	C-17	4.1	[a]	MC goal
					MC rate
					FMC goal
					FMC rate
Cargo/Tanker	Air Force	C-130	29.2	$2,225	MC goal
					MC rate
					FMC goal
					FMC rate
Cargo/Tanker	Marines	KC-130F	40.1	$3,212	MC goal
					MC rate
					FMC goal
					FMC rate
Cargo/Tanker	Marines	KC-130R	25.4	$2,807	MC goal
					MC rate
					FMC goal
					FMC rate
Cargo/Tanker	Air Force	C-141	35.0	[a]	MC goal
					MC rate
					FMC goal
					FMC rate
Cargo/Tanker	Air Force	KC-135	39.6	$2,384	MC goal
					MC rate
					FMC goal
					FMC rate
Cargo/Tanker	Air Force	KC-10	16.9	$4,083	MC goal
					MC rate
					FMC goal
					FMC rate

Source: Military service data.

Percent											
FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02
					81	81	88	88	88	88	88
		52	45	75	87	88	86	85	82	83	83
					73	73	78	78	78	78	78
		5	3	41	41	44	49	41	43	31	3
85	85	85				78	78	75	75	75	75
83	85	83	84	81	80	79	77	74	76	77	81
								48	48	48	48
60	62	62	68	64	64	63	55	55	59	58	63
72	72	72	72	72	72	72	72	72	72	72	72
							73	70	59	58	64
53	53	53	53	53	53	53	53	53	53	53	53
							54	52	36	28	32
75	75	75	75	75	75	75	75	75	75	75	75
							71	75	65	64	65
58	58	58	58	58	58	58	58	58	58	58	58
							57	54	38	35	35
80	80	80	80	80	80	80	80	80	80	80	80
82	83	80	78	74	74	76	74	73	72	74	74
			60	60	64	58	58	59	59	59	59
15	23	24	60	62	60	59	54	56	56	58	64
	85	85	85	85	85	85	85	85	85	85	85
89	89	88	86	85	86	86	85	83	79	81	82
			80	80	71	71	71	77	77	77	77
64	72	75	73	75	74	76	71	63	41	59	66
	90	90	85	85	85	85	85	85	85	85	85
93	93	93	90	90	89	86	87	85	83	83	83
			80	80	77	65	65	77	77	77	77
88	89	89	84	85	74	66	68	75	76	77	73

Legend: MC = mission capable, FMC = fully mission capable, FY= fiscal year, EC/C = electronic command and control.

Notes: We used the “overall” MC and FMC goal for Navy and Marine Corps aircraft, which is a combined goal for the various categories of deployment status used by the Navy and Marines in rating aircraft availability.

Fiscal year 2002 rates are as of February for the Army, Navy, and Marine Corps, and March 31 for the Air Force.

Aircraft ages are as of September 30, 2001 for the Navy/Marines; December 31, 2001, for the Air Force; and April 2002 for the Army.

Aircraft costs/flying hour are as of January 2001 for the Army, and September 30, 2001, for the Air Force, Navy, and Marines.

[a]No data or only partial cost/flying hour data available.

Appendix II: Scope and Methodology

To identify Department of Defense (DOD) and service policies and practices regarding mission capable (MC) goals and rates, we obtained briefings, reviewed DOD and service regulations and prior reports by us and others; and interviewed officials at the Office of the Secretary of Defense: the Office of the Joint Chiefs of Staff; headquarters offices of the Army, Navy/Marine Corps, and Air Force; and aviation commands and other locations as appropriate.

To determine whether key DOD aircraft were meeting established MC and FMC goals, we requested that each service identify its key active-duty operational aircraft. We excluded reserve units from the scope of our review, as well as active-duty training units and executive aircraft used to transport officials on official business. The resultant list included a total of 46 different models of aircraft from the four military services, which we categorized into five basic types: bombers, cargo/tanker aircraft, electronic command/control aircraft, fighter/attack aircraft, and helicopters. Three aircraft models (F/A-18A, F/A-18C, and EA-6B) were used by both the Navy and Marine Corps. For our review, we counted the Navy and Marine Corps versions of these aircraft as separate models, resulting in a total of 49 aircraft models for review. We requested MC and full mission capable (FMC) goal and rate data, aircraft age and cost, and other data for these aircraft back to 1991 to provide a historical perspective on goal and rate history. The Army and Air Force provided comprehensive data from fiscal year 1991 to mid-fiscal year 2002. However, the Navy and Marine Corps could provide data separated by service only from fiscal year 1998 forward. These services changed their reporting system in 1998 and were unable to provide comparable data for prior years. As a result, we focused our report on the 5-year period beginning in fiscal year 1998. However, we included the full array of Army and Air Force data in appendix I. We used these data to conduct analyses of whether the aircraft were meeting their goals. We also provided each service with these databases for review, and they confirmed the results for accuracy.

To identify the causes of difficulties in meeting MC and FMC goals, we reviewed prior reports by us and others and conducted a variety of comparative analyses of our data by service, aircraft type, model, age, cost, and fiscal year. We then held discussions with each service to gain their perspectives on the causes of observed difficulties in meeting the goals.

To determine whether DOD has a clear and defined process for setting MC and FMC goals, we reviewed DOD Instruction 3110.5 and other regulations

and conducted discussions with officials from the Office of the Secretary of Defense and service headquarters in Washington, D.C., and with officials from the headquarters of the Air Force's Air Mobility and Air Combat Commands; the Naval Air Systems Command; and Army Training and Doctrine Command officials at Fort Rucker, Alabama. Because of the difficulty in obtaining clear information on this issue, we also wrote formal letters of inquiry to the Secretaries of the Army and Navy requesting clarification of how the goals were established. Their responses to those letters of inquiry were used in preparing our report.

We performed our work from February through November 2002 in accordance with generally accepted government auditing standards. The final publication of this report was delayed by the impact on DOD's report review and classification process of the terrorist attacks on September 11, 2001, and DOD's preparations for potential conflict in Iraq.

Appendix III: Comments from the Department of Defense

DEPUTY UNDER SECRETARY OF DEFENSE FOR
LOGISTICS AND MATERIEL READINESS
3500 DEFENSE PENTAGON
WASHINGTON, DC 20301-3500

FEB 26 2003

Mr. Neal P. Curtin
Director, Defense Capabilities and Management
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Curtin:

This is the Department of Defense (DoD) response to the GAO draft report, GAO-03-300C, "MILITARY READINESS: DoD Needs a Clear and Defined Process for Setting Aircraft Availability Goals in the New Security Environment," dated November 27, 2002 (GAO Code 350147)."

The Department concurs with recommendations 1 and 2, while partially concurring with recommendation 3. An explanation of the DoD position is enclosed. Additionally, since portions of the draft report supporting the recommendations could be misleading, technical comments are provided to improve the accuracy and clarity of the draft report. The Department appreciates the opportunity to comment on the draft report.

Sincerely,

Allen W. Beckett
Principal Assistant

Enclosure:
As stated

GAO CODE 350147/GAO-03-300C

"MILITARY READINESS: DOD NEEDS A CLEAR AND DEFINED PROCESS FOR SETTING AIRCRAFT AVAILABILITY GOALS IN THE NEW SECURITY ENVIRONMENT"

DEPARTMENT OF DEFENSE (DoD) COMMENTS TO THE RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommended that the DoD and the Services determine whether different types of aircraft availability goals are needed.

DoD RESPONSE: Concur. The Deputy Under Secretary of Defense for Logistics and Materiel Readiness (DUSD (L&MR), in coordination with the Services, will determine the need for aircraft availability goals for different types of aircraft, consistent with the current defense strategy. Consideration will be given to goal categories (e.g., MC, FMC, PMC) tailored for unique Service and mission requirements. For example, the draft report states that the Army prefers FMC goals (and its linkage to their readiness reporting system) while the Air Force's Air Mobility Command prefers MC goals due to the primary mission of its aircraft. Further, DUSD (L&MR) will consider selected alternatives to aircraft availability goals, as may be requested by the Services, such as the potential use of a mission reliability goal for the Joint Strike Fighter. Finally, DoD will examine the desirability of establishing new aircraft availability goals for legacy systems. Appropriate DoD policy documents will be revised to incorporate any changes resulting from this effort.

RECOMMENDATION 2: The GAO recommended that DoD and the Services validate the basis for existing MC and FMC goals.

DoD RESPONSE: Concur. DUSD (L&MR), in coordination with the Services, will validate the basis for the aircraft availability goals and, if required, will develop, coordinate, and disseminate revised DOD policy guidance. The existing basis contained in DODI 3110.5, Materiel Condition Reporting for Mission-Essential Systems and Equipment, (maximum availability achievable with optimal resourcing and peacetime usage), will be evaluated in light of its relevance to the current defense strategy. Alternatives that DUSD (L&MR) will explore include a mission requirements-based methodology; a blend of the maximum availability and mission requirements-based methods; and the use of flexible goals (such as the Navy's which are based on the unit's deployment cycle).

RECOMMENDATION 3: The GAO recommended that the Secretary of Defense revise DoD Instruction 3110.5 to:

- (a) clearly define the specific aircraft availability goals required to be established by the Military Services and their accompanying performance measures;
- (b) establish a standard methodology identifying objective principles of analysis to be used by all Services in setting the goals, including an identification of the readiness and cost implications of setting the goals at different levels, and;
- (c) require each service to identify one office to act as a focal point for coordinating development of the goals and for maintaining a documentary record of the basis for the goals chosen and other key decisions in the goal setting process.

DoD RESPONSE: Partially concur. DUSD (L&MR) and the Services will consider a number of issues relevant to aircraft availability goals in response to Recommendation 3. The issues that will be addressed include the following:

- (a) While aircraft availability is an important metric, the Office of the Secretary of Defense (OSD) and the Services routinely use it in conjunction with other key metrics (e.g., Customer Wait Time, cannibalization, maintenance manning, supply fill rates, MICAP incidents, and aircraft-in-depot status) to assess the overall state of materiel readiness. In addition, the importance of aircraft availability goals is being considered as part of an on-going study that will identify a balanced set of key materiel readiness metrics for use by the DUSD (L&MR).
- (b) While the GAO draft report only addressed active duty aircraft, any DoD policy guidance must consider aircraft from the Active and the Reserve Components as well as other mission-essential weapon systems and equipment including ground combat vehicles and ships.
- (c) The degree that aircraft availability goals are used as the basis for resourcing (via the Planning, Programming and Budgeting System) as opposed to more common methods such as annual flying hour programs and aircraft sustainability modeling.

In addition, any revised DoD guidance may be promulgated in a document other than DODI 3110.5.

With respect to the actions in RECOMMENDATION 3 pertaining to revision of DoD Instruction 3110.5:

- **DoD response to 3 (a):** Per the DoD responses to recommendations 1 and 2, DUSD (L&MR) and the Services will determine the need for different type(s) of aircraft availability and/or mission reliability goals and the basis for such goals. However, DUSD (L&MR) does not concur with the inclusion of other performance measures in DoDI 3110.5. The degree that designated aircraft availability/mission reliability goals are (or are not) met should be measured by OSD and the Services in concert with other key metrics and form the basis for a more complete assessment of materiel readiness. Focusing solely on a performance measure for aircraft availability would distort that assessment.

- **DoD response to 3 (b):** DUSD (L&MR), in coordination with the Services, will review appropriate policy document(s) to ensure sufficient overall readiness goals are available for the Services to set their respective aircraft availability/mission reliability goals. OSD will review overall Service readiness plans and programs as part of the annual budget preparation. Because the types and bases for goals may vary by (and possibly within) each Service, detailed analytical methodology should be retained by the Services. The Services are responsible for the logistical support and operational employment of the Department's weapon systems, and they best understand the differences in complexity of those systems and how they are employed in support of operational requirements. Spares funding, manpower/skill level issues, depot capacity, and wartime tasking are just a few of the Service level factors that impact goals and readiness and are clearly understood at the Service level. In addition, the factors influencing establishing goals at different levels (such as age, complexity, mission requirement, and unit operational priority) are numerous and dynamic and thus better addressed in Service-controlled guidance.

- **DoD response to 3 (c):** DUSD (L&MR) will revise appropriate policy document(s) to include the establishment of the requirement for the Services to designate focal points for the development, periodic review, and historical documentation of aircraft availability and/or mission requirement goals.

Appendix IV: GAO Contacts and Staff Acknowledgments

GAO Contacts

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Staff Acknowledgments

In addition to those named above, Bernice Benta, Katherine Chenault, and R.K. Wild made key contributions to this report.

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