



UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

109441



LOGISTICS AND COMMUNICATIONS  
DIVISION

MAY 22, 1979

B-168664

The Honorable Harold Brown  
The Secretary of Defense

Dear Mr. Secretary:

In our October 1977 report (LCD-77-423) we pointed out that the planned procurement quantities for F-15 and F-14 combat aircraft to be used for training purposes, peacetime attrition, and replacements for combat aircraft undergoing overhaul, were in excess of needs.

We reported that the services used inconsistent and imprecise criteria to forecast needs for support aircraft and that with tighter management controls and closer scrutiny of supporting data, they could reduce computed needs for such aircraft. For the F-15 and F-14 aircraft, we concluded that the services' computed needs for the three support categories were overstated by 178 aircraft which we estimated would cost about \$2.5 billion. We recommended the use of more realistic data in estimating these needs. A synopsis of the findings contained in our October 1977 report is included as enclosure I.

The Department of Defense, in its response to a draft of our report, did not specifically address our conclusions and recommendations. It agreed, however, that all programs must be based on realistic and supportable data and stated that the Department was making a special review of support aircraft needs and would change the aircraft procurement objectives if warranted. As part of the Department's *special review*, the Office of Program Analysis and Evaluation asked the Defense Audit Service to follow up on our report.



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*Letter Report*

LCD-79-420  
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*[PLANNED Procurement Quantities for F-15 and F-14 ARE IN EXCESS OF NEEDS]*

The Defense Audit Service, in its classified report (79-003) of October 11, 1978, concluded that the services overstated the number of F-15 and F-14 aircraft needed for the previously mentioned categories. The Audit Service estimated the overstatement of support aircraft to be 111 F-15s and 41 F-14s, which it estimated would cost around \$2.7 billion. A synopsis of the findings contained in the Audit Service's October 1978 report is included as enclosure II.

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An official in the Office of Program Analysis and Evaluation said that the Department is continuing to study how to compute needs for aircraft to be used to support combat squadrons. The official also said that the Department is planning to award a contract to a private firm to further study the matter.

While the number of aircraft to be procured for training, peacetime attrition, and overhaul substitution is difficult to estimate, we believe our findings and those of the Defense Audit Service clearly show that procurements should be reduced. The latest procurement schedule for the two programs shows that only 150 F-15s and 126 F-14s remain to be funded by the Congress. Therefore, actions to reduce the number of F-15 and F-14 aircraft being procured must be taken now, before it is too late. We believe this area has been studied sufficiently and the time has come to act.

Copies of this letter are being sent today to the Chairmen, House and Senate Committees on Appropriations and Armed Services, the House Committee on Government Operations, and the Senate Committee on Governmental Affairs; the Director, Office of Management and Budget; and the Secretaries of the Navy and Air Force.

Sincerely yours,



R. W. Gutmann  
Director

SYNOPSIS OF FINDINGSCONTAINED INGAO'S OCTOBER 1977 REPORT

In addition to buying aircraft for operational squadrons, the services buy aircraft to train pilots, to replace planes lost in peacetime operations, and to substitute for operational aircraft which are being overhauled. These additional aircraft account for 41 percent of the Air Force's F-15 aircraft program and 55 percent of the Navy's F-14 aircraft program.

Based on our review of the Air Force's and Navy's justification for aircraft being procured for these three support categories, we estimated that the Air Force overestimated F-15 aircraft requirements by 108 aircraft and the Navy overestimated F-14 aircraft requirements by 70 aircraft. Details on our reported findings follow.

TRAINING AIRCRAFT

The Department of Defense (DOD) limited training aircraft to 25 percent of the number of aircraft required for operations (i.e., one training aircraft for every four operational aircraft). In contrast, we felt that use of more realistic data would have shown that the training aircraft percentages should have been about 16 percent for the F-15 program and about 17 percent for the F-14 program.

To compute their needs for training aircraft for internal planning purposes, both the Air Force and Navy estimated the number of training aircraft required by 1981 by considering pilot replacement rates, training curriculum, and aircraft flying capability (i.e., how many hours aircraft can fly each month). Our review of the data entered into these computations indicated that the Air Force overestimated pilot replacement rates, and both services overestimated flying hours required in course curriculums and underestimated potential aircraft use. As a result, we believed the services were buying 37 F-15 and 18 F-14 aircraft in excess of that needed for training. Furthermore, if flying training could be done on Saturdays, the procurement of 18 additional aircraft could be avoided.

We noted the following weaknesses in the Air Force's system for projecting training aircraft needs.

- In determining the annual F-15 pilot training replacement rate, the Air Force estimated that one-third of the F-15 pilots would rotate from F-15 flight duties annually. Based on our analysis of F-4 data for the year ended June 30, 1976, we estimated that the F-15 rate was overstated and that 238 pilots, instead of 298, were needed for annual training purposes.
- In estimating flying experience required for course curriculums, the Air Force estimated it in terms of sorties (a sortie is one takeoff and landing). We found that Air Force's estimates of sortie requirements did not conform to the course curriculum and did not consider the impact of anticipated improvements in pilot training. We estimated that had these and other factors been considered, the Air Force could have reduced F-15 annual sortie requirements from 23,508 to 16,328.
- In determining training aircraft requirements, the Air Force also used the number of annual flying days available for training. Our analysis of historical data indicated that the number of annual flying training days should be increased from 231 to 244 primarily because the Air Force overstated the number of flying days lost because of weather.
- In computing the number of F-15s required for training, the Air Force estimated a sortie production rate (average number of times each day an aircraft can be scheduled to fly) of 0.80. This rate is equivalent to only about 20 flight hours per month per aircraft. An increase in the sortie production rate would have reduced the number of F-15s required for training. Our review indicated that certain management problems have been depressing the sortie production rate. By correcting these problems, we estimated that a sortie production rate of 1.0 was a reasonable management goal by 1981; accordingly, we reduced the Air Force's F-15 training aircraft requirements in our computations.

We noted the following weaknesses in the Navy's system for projecting its training aircraft needs.

--The Navy estimated its curriculum flying requirements in terms of hours. We found that the Navy did not consider improvements already made in the course curriculums or the future impact of advanced flight simulators. For example, to arrive at hours required in 1981 for each category I student (first tour in any fighter), we reduced the Navy's estimate by 6 hours to conform to the curriculum and 10.5 hours to compensate for the advanced simulators. Had these adjustments been made for all 273 students in all categories, the Navy could have reduced total F-14 training hour requirements from 19,911 to 17,084.

--The Navy determined the number of F-14s required for training by dividing total student flying hours required in 1981 by the annual flying hour capability of each F-14 training aircraft. The Navy estimated that these aircraft would fly 30 hours a month or 360 hours a year. Its estimate was somewhat outdated, however, since newer F-14 training aircraft were averaging 40.7 hours per month from March to September 1976. In determining that a reduced number of F-14 aircraft was required for training, we used 40 hours a month or 480 flying hours a year as opposed to the Navy's 360 hours a year.

#### ATTRITION AIRCRAFT

The Air Force and Navy used different approaches in supporting their requests for aircraft to replace attrition losses expected during peacetime.

#### Air Force

We estimated in our review that the Air Force overprojected its F-15 attrition requirement by at least 71 aircraft.

Since the early 1970s, the Air Force has projected F-15 peacetime attrition loss requirements by estimating a loss rate per 100,000 flying hours and applying the loss rate to the total estimated flying hour program. Thus, the Air Force projected an F-15 attrition requirement of 146

aircraft based on a 2.056 million flying hour program and a loss rate of 7.1 losses per 100,000 flying hours. This loss rate was based on a predecessor of the F-15, the F-4E, which experienced 16 losses in its initial 226,000 hours flown through June 1970.

According to historical data on existing working aircraft, however, (1) loss rates gradually decrease as the aircraft flying hours increase and (2) newer series of aircraft are safer than their predecessors. For example:

--We analyzed the loss rates of the F-15's two principal predecessors, the F-4D and F-4E. Actual experience on the F-4D resulted in a decline of the cumulative loss rate from 12 to 6.25 aircraft per 100,000 flying hours after 1.695 million flying hours. Similarly, the F-4E's cumulative loss rate dropped from 7 to 4.52 after 1.327 million flying hours. In both cases, the aircraft system's loss rate dropped progressively as the system's flying hour experience increased.

--The improvement in aircraft safety is readily apparent in the following table which shows (1) the year both single and twin-engine fighters were first flown and (2) the number of actual losses sustained by each aircraft system under peacetime conditions at the 1 million flying hour level.

| <u>Aircraft</u>         | <u>Year of first flight</u> | <u>Losses at 1 million hours</u> |
|-------------------------|-----------------------------|----------------------------------|
| Single engine fighters: |                             |                                  |
| F-84                    | 1946                        | 520                              |
| F-86                    | 1948                        | 420                              |
| F-100                   | 1953                        | 300                              |
| F-104                   | 1954                        | 250                              |
| F-105                   | 1955                        | 190                              |
| A-7                     | 1970                        | 77                               |
| Twin engine fighters:   |                             |                                  |
| F-4C                    | 1963                        | 89                               |
| F-4D                    | 1965                        | 68                               |
| F-4E                    | 1967                        | 49                               |

Although the Air Force adopted a regulation that uses a learning curve to simulate the above factors on existing aircraft, it did not apply this methodology in computing F-15 attrition aircraft requirements because of insufficient experience in the F-15 program. At the time of our review, the F-15 program had accumulated less than 15,000 flying hours and had sustained 1 loss.

Because experience has shown that newer aircraft series have lower loss rates than older ones, we believe that total attrition requirements for the F-15 should not exceed those of its immediate predecessor, the F-4E, and, therefore, that the Air Force overestimated total attrition requirements.

We computed the F-15 attrition aircraft overstatement by (1) assuming that the loss rate on the F-15 would be as good or better than its immediate predecessor, the F-4E, over an identical flying hour program and (2) using the Air Force's learning curve to project how many attrition losses the F-4E would sustain if its flying hour program were comparable to the F-15's 2.056-million flying hour program. We computed attrition to be 75 aircraft which when subtracted from the Air Force's 146 F-15 attrition requirement gives an overstatement of 71 aircraft.

#### Navy

We estimated that the Navy overestimated its total F-14 attrition requirement in its planned fiscal year 1978 funding request by at least 31 aircraft.

The Navy also based its attrition requirement on experience with predecessor aircraft; but rather than using flying hours the Navy estimated the percentage of the average F-14 operating inventory it expected to lose annually over a predetermined number of years. This estimated percentage of operating inventory lost for each year is called the annual loss rate.

Since 1973 the Navy has used an annual loss rate of 4.5 percent in estimating F-14 aircraft losses. Thus, the Navy estimated that 191 attrition F-14 aircraft would be required through fiscal year 1990--the last year for which attrition aircraft will be needed. Navy officials said that the F-14 loss rate was established by reviewing the experience of the F-4 family of aircraft. They also said that, even after considering previous years' loss experience and analyzing

recent trends in the loss rate data, a certain amount of subjective judgment was still involved in establishing the F-14 rates.

The Navy's method of estimating attrition aircraft requirements did not reflect the learning curve principle that an aircraft system's attrition rates decrease as its flying experience increases. The Navy's F-14 attrition projections through fiscal year 1990 used a fixed annual loss rate which reflects only previous experience and subjective judgment. While the Navy's use of the 4.5 percent since 1973 is lower than the 6.3 rate experienced by the F-4 in 1973, it is still a fixed percentage throughout the useful life of the aircraft. In contrast to the fixed rate the Navy used for the F-14, the following figures show that over the years, the annual loss rates have generally decreased.

| <u>Aircraft</u> | <u>Fiscal year</u>                            |             |             |             |             |             |             |
|-----------------|---|-------------|-------------|-------------|-------------|-------------|-------------|
|                 | <u>1970</u>                                   | <u>1971</u> | <u>1972</u> | <u>1973</u> | <u>1974</u> | <u>1975</u> | <u>1976</u> |
|                 | (percent of average operating inventory lost) |             |             |             |             |             |             |
| F-4J            | 7.1   | 5.7         | 5.7         | 6.3         | 4.9         | 3.0         | 4.6         |
| F-4B            | 7.8   | 5.6         | 4.2         | 6.4         | 2.4         | 3.2         | 3.8         |
| F-4N            | -   | -           | -           | -           | 4.5         | 1.2         | 2.6         |
| All F-4s        | 7.4   | 5.7         | 5.2         | 6.3         | 4.2         | 2.7         | 4.0         |

Furthermore, our review of F-4 data showed that the rate of attrition decreased with flying hour experience similar to that of the Air Force's F-4D and F-4E aircraft. These facts can probably be attributed, in part, to "state-of-the-art" improvements in aircraft technology, pilot training, and safety procedures.

In addition, using the Navy's own method of computing loss rates and actual F-14 data, the F-14 had a loss rate of only 3.3 percent from induction into the operating inventory in September 1972 through June 1976. But the Navy continued to use the 4.5-percent rate in September 1976 to compute the number of attrition aircraft required through fiscal year 1990. Had the actual 3.3 percentage been used instead, the Navy would have estimated 39 fewer F-14 losses or a total attrition requirement of 152 aircraft, rather than 191.

To get a better idea of attrition requirements up to 1990, we reviewed the projected flying program for the F-14. Although flying hours can be used to reasonably predict peacetime attrition losses, the F-14 had not yet accumulated sufficient flying hours for us to establish a valid learning curve to predict future aircraft requirements. We were unable to use experience data of predecessor aircraft, such as the Navy's F-4J, because the Navy did not accumulate flying hour data by aircraft model, only by family of aircraft. Therefore, we estimated F-14 attrition requirements on the basis of flying hours but without using the learning curve process.

We first estimated the F-14 flying hour program through fiscal year 1990 on the basis of the Navy's planned 26-hour per month per aircraft flying hour program. Thus, we estimated that the F-14s would fly about 1.33 million hours by 1990. Then we analyzed the F-14 losses as of September 1976 and found that the operational aircraft had accumulated about 75,000 flying hours and had incurred 9 losses. This computes to an average loss rate of 12 aircraft per 100,000 flying hours. We did not include losses incurred in research, development, test, and evaluation because the Navy excluded such losses from its attrition projections.

Using our estimate of 1.33 million flying hours and the current attrition rate of 12 losses per 100,000 flying hours, we estimated that total F-14 losses would be at most 160 aircraft ( $13.31 \times 12$ ) which is considerably lower than the Navy's projected 191. This estimate did not take into account that loss rates normally decrease as flying hours increase. Hence, the total losses would probably be much lower than 160. We therefore felt that the Navy overestimated the F-14 attrition requirement by at least 31 aircraft.

#### OVERHAUL SUBSTITUTES

At any given time, some aircraft are in what the Navy calls the "pipeline" and the Air Force calls "nonoperating active" (NOA) status. Pipeline denotes aircraft that are undergoing depot maintenance while NOA, as used by the Air Force, includes aircraft undergoing depot maintenance plus other nonoperational categories, such as new aircraft awaiting delivery to squadrons, excess aircraft, and aircraft being used for ground instruction.

To compensate for these temporary losses, DOD authorized the services to buy extra aircraft based on a fixed percentage of operating and training aircraft. The Air Force was authorized 10 percent for NOA or 54 F-15 aircraft (432 operational plus 108 training =  $540 \times 0.10$ ). The Navy was authorized 15 percent for pipeline; this amounts to 41 F-14s (216 operational plus 54 training =  $270 \times 0.15$ ).

Although the Air Force and Navy maintain systems to compute the current percentage of NOA and pipeline aircraft based on actual usage data, the number of aircraft that the Air Force and Navy buy for these categories is limited by the Office of the Secretary of Defense to a fixed percentage of operating and training aircraft. Using arbitrary percentage factors to compute the number of aircraft needed to undergo maintenance, however, is no substitute for precise data.

The services need accurate pipeline and NOA forecasts. Otherwise, if too few aircraft are bought, operational readiness cannot be sustained, and if too many are bought, funds will be wasted. However, the services are basing their forecasts on arbitrary or imprecise criteria. We believe that as a result, neither the services nor the Congress has adequate information to determine the quantity of aircraft needed.

Since aircraft procurement is stretched out over several years, the effects of inaccurate forecasts can be corrected, as actual pipeline and NOA rates become known. According to Air Force officials, however, the Air Force probably will not buy fewer F-15s than authorized, regardless of whether actual NOA rates are lower than estimated. We did not estimate Air Force NOA requirements because the F-15 had incurred only limited depot maintenance at the time of our review.

In the case of the F-14, we found that the Navy's pipeline statistics were too unreliable to serve as a basis for accurately revising procurement requirements. Navy officials stated that even more than the 15 percent originally authorized may be needed. We concluded, however, that the Navy's F-14 pipeline requirement could be reduced by 21 aircraft for reasons which included the following.

- Recent studies have indicated that little correlation exists between the number of months aircraft are in service and their need for depot maintenance; as a result a 20-percent reduction in scheduled depot maintenance could be achieved by basing the interval at which aircraft are scheduled for maintenance on flying hours rather than months. This would reduce the F-14's pipeline requirement by six aircraft.
  
- A new maintenance concept called reliability centered maintenance (RCM) employs decision logic to discriminate between those tasks that must be performed and those that can be left undone without affecting safety or reliability. If the same 30-percent reduction in overhaul time could be realized for the F-14 which is expected in the P-3 aircraft program, its pipeline requirements could be reduced by 10 aircraft.
  
- In addition to basic overhaul time, the Navy adds the time required for aircraft modifications when it re-evaluates the sufficiency of its pipeline forecast. We found that headquarters officials were adding 2 months for these modifications, although depot personnel had already included time for modifications in their estimates. As a result, the F-14 pipeline requirement was overstated by five aircraft.

SYNOPSIS OF FINDINGSCONTAINED INDAS'S OCTOBER 1978 REPORT

On October 11, 1978, the Defense Audit Service (DAS) issued a classified report (79-003) based on its followup review of our October 1977 report (LCD-77-423) on the number of extra F-15 and F-14 combat aircraft needed for the three support categories. In its review, DAS estimated that the services overstated the number of aircraft needed for these three categories by 111 F-15s and 41 F-14s.

In the review, DAS also addressed the number of F-15 and F-14 operational aircraft required for combat squadrons. However, we did not review this latter category and, accordingly, have limited our synopsis to DAS's findings on support aircraft requirements.

TRAINING AIRCRAFT

DAS estimated that the Air Force and Navy overstated their training aircraft requirements by 28 F-15s and 15 F-14s. DAS attributed the overstatements to such factors as overestimating pilot requirements and underestimating training aircraft usage. The Air Force, for example

- used an abnormally high peak year of 1981 in arriving at the number of pilots to be trained;
- did not consider improvements in training courses in computing total annual student sortie requirements; and
- overestimated the number of days that would be lost due to bad weather, therefore, more flying days were available.

The Navy, for example

- used a higher than necessary overhead percentage factor to account for aborted flights, training instructors' flight time, and aircraft testing time, in determining student flying hour requirements and

--used an estimated 360 hours per year for F-14 training aircraft usage, as opposed to actual average usage of 400 hours per year computed by DAS.

### ATTRITION AIRCRAFT

DAS estimated that the number of aircraft that the services were acquiring to replace peacetime attrition losses could be reduced by 74 F-15s and 26 F-14s. The following sections discuss the reasons for this reduction.

#### Air Force

DAS stated that in the early 1970s the F-15 had not flown operationally and that the Air Force computed the attrition loss requirement of 146 aircraft based on the early flying hour and loss history of a predecessor aircraft, the F-4E. It is during this early flying period when losses are generally highest.

DAS noted that its own and outside studies showed that (1) the loss rates of aircraft decrease as flying hours increase and (2) newer aircraft systems incur fewer losses than their predecessor systems. DAS recomputed the F-15 loss requirement by applying a more recent F-4E loss rate history to its revised estimate of the F-15 flying hour program. This resulted in a projected attrition aircraft requirement of 72 F-15s or a reduction of 74 aircraft.

#### Navy

In fiscal year 1973 the Navy estimated the F-14 attrition loss rate of 4.5 percent based on F-4J experience. By applying this fixed rate to the estimated annual operating aircraft inventory for the years 1973-1990, the Navy arrived at a requirement of 191 attrition aircraft.

The Navy stated it does not accumulate flying data by aircraft model, but only by family of aircraft. DAS decided to project F-14 attrition losses by using actual flying hour and loss data accumulated for the F-4 family of aircraft over an extended period. DAS determined that the F-4 experienced an average loss rate of 12.4 losses per 100,000 flying hours between fiscal years 1971 and 1977.

DAS applied the 12.4-loss rate against an estimated F-14 flying hour program of 1.33 million flying hours. This yielded a requirement of 165 aircraft as opposed to the

Navy's requirement of 191 or a reduction of 26 aircraft. DAS cautioned, however, that the F-14 was still experiencing operational problems and that DOD should give priority to reducing the high attrition rate of the F-14.

#### OVERHAUL SUBSTITUTES

DAS estimated that the Air Force could reduce the number of F-15s needed to substitute for operational aircraft undergoing repair by nine aircraft. DAS did not recompute a requirement for F-14 overhaul substitute aircraft, but stated that the Navy could also reduce this requirement.

#### Air Force

The Air Force planned to procure 54 F-15 aircraft to keep forces at full strength while other operational aircraft are undergoing repair. The Air Force computed this requirement by taking an arbitrary 10 percent of the 540 F-15 mission and training aircraft planned in 1981. Actual F-15 aircraft downtime for maintenance during 1977 was about 8.3 percent. Applying an 8.3 factor to the 540 F-15 aircraft resulted in a requirement for about 45 maintenance aircraft to support a 6-wing force or 9 less aircraft than the Air Force planned.

#### Navy

The Navy used an outdated arbitrary 15 percent OSD-directed factor for maintenance aircraft requirements. As a result, the Navy planned to procure 41 F-14 aircraft to keep forces at full strength while other operational aircraft are undergoing repair. The frequency of operation and time spent for maintenance determines how many additional aircraft are needed. The Navy scheduled each F-14 aircraft for depot maintenance at 30-month intervals, regardless of the number of hours flown during that time. DAS stated that if the Navy extended the 30-month repair cycle by adopting a 760-hour flying program or a 42-month cycle as used on previous aircraft systems and reduced depot maintenance time from an average of 9 to 5 months to conform with Navy procedures, requirements for maintenance support aircraft could be reduced.