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## EXTENDING USAF F-16 FORCE STRUCTURE

by

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## *Preface*

After having recently completed a tour working at the National Guard Bureau managing the Air National Guard's fleet of F-16 aircraft, I am concerned that there may not be sufficient combat capable F-16 aircraft available to meet Air Force needs prior to fielding of the Joint Strike Fighter. The Air National Guard fleet, the oldest, largest, most diverse fleet in the USAF, provides key insight into the direction the overall health of the USAF fleet may take. Sustaining this diverse fleet helped me gain an understanding of the key issues affecting F-16's ranging from block 10 to blocks 15, 25, 30, 32, 40, and 42, through the newest block 52 aircraft. The purpose of writing this paper is to attempt to answer the question, "Will there be sufficient combat capable F-16 force structure to meet CAF requirements prior to fielding of the Joint Strike Fighter?" If the research concludes that there will not be sufficient combat capable F-16 aircraft to meet demands, I will make my recommendations for extending F-16 availability through JSF Fielding.

I would like to acknowledge the Air National Guard's F-16 Weapons System Manager and the ANG Program Element Monitor for their help in getting started. The F-16 System Program Office East and West, the ACC F-16 Weapons System Team, the ACC Plans and Programs office, and Lockheed Martin Aero Company all made significant contributions to this study. Last, I'd like to thank my faculty research advisor for his guidance.

### *Abstract*

By fiscal year 2008, the Air Force will have a 108-fighter deficit based on a 20 Fighter Wing Equivalent requirement. That number grows to 311 by fiscal year 2021. These numbers are based on the today's programmed F-16 attrition rate of 3.6%, an estimated 8,000-hour F-16 service life, and fielding of the Joint Strike Fighter beginning in fiscal year 2009. This research study will attempt to answer the question, "Will there be sufficient combat-capable F-16 aircraft available to meet USAF force structure requirements prior to fielding of the JSF?" The study attempts to answer the question by looking at the current state of the USAF F-16 fleet and then by looking at the Joint Strike Fighter Program as the replacement for the F-16, its forecast schedule, funding, and associated risk. Finally, the study gives some recommendations to mitigate the risk of "running out" of aircraft before the JSF is fully fielded.

The study concludes that there will not be sufficient F-16 force structure available to meet requirements. The aircraft's current structural configuration will not meet its service life goals, and attrition losses will outpace replacement. The study also concludes that the Joint Strike Fighter will not likely be fielded as programmed. Cost cutting measures and competing modernization interests will cause the aircraft to be fielded in fewer numbers, stretched over a longer period of time.

Finally, the study makes recommendations in areas consisting of service life improvement, attrition reserve preservation, and force structure enhancements.

## Chapter 1

### Statement of the Problem

The Joint Strike Fighter (JSF) is the U.S. Air Forces answer to replace its aging F-16 and A/OA-10 multi-purpose fighter force, comprising approximately 87% of the entire USAF multi-purpose fleet. Of that, the F-16 accounts for 68%. Will the USAF be capable of replacing 68% of our multi-purpose fighter force with the JSF as programmed?

Over the last six years or so, lawmakers have debated over continued procurement of the F-16 Falcon, the Air Force's primary multi-role fighter. Proponents of continued procurement argued that failure to keep the production lines flowing would result in a two things; a reduction in the available industrial capacity due to the lack of an active production line, and the possibility that there would not be sufficient numbers of aircraft available to meet USAF force structure requirements after the turn of the century.<sup>1</sup> Fast forward to the year 2001. Lawmakers have managed to leverage small attrition buys with Foreign Military Sales to solve half their problem, that is to keep the production line open. As for the other, well, they need to worry. Today, the USAF is faced with an F-16 program that may not last long enough to meet the programmed fielding of its replacement, the Joint Strike Fighter. Currently projected fighter strength shows a two-and-a-half Fighter-Wing-Equivalent (FWE) shortfall by fiscal year 20. These projections are based on an 8,000-hour F-16 service life and initial fielding of the first JSF Flying Training Unit (FTU) beginning in fiscal year 2009.<sup>2</sup> These projections will miss the mark for two reasons.

First, the 8,000-hour service life limits that F-16 force structure is designed around will not be realized. Some major structural components will not make the 8,000-hour projection, causing catastrophic damage where repair or replacement is not economically feasible. Additionally, engineering analyses and structural upgrades will not keep pace with changes to the way we utilize the aircraft. Secondly, the current fielding schedule for the JSF is high risk at best, most likely being fielded in fewer numbers and later than originally programmed.

### **Study Limitations and Assumptions**

In solving this perplexing problem, there are a number of limitations that should be stated up front. First, while much of the study will focus on the JSF as a replacement for the F-16, it will also replace the aging USAF A/OA-10 fleet. When considering effects on force structure, a seemingly obvious solution may be to replace an F-16 with an A/OA-10 in units who's primary roles may be well-suited for either airframe, such as the Forward Air Control (FAC-A) and Close Air Support (CAS) roles. This study does not address this issue. Second, force structure, budgets, and aircraft availability are dynamic, changing day-by-day. For the purpose of this study, data used is generally from the fiscal year 02 POM development period and prior. Recent events, to include the passing of the torch from former President Clinton to President Bush and his cabinet are making significant impact on the issues discussed in this study. The impending Quadrennial Defense Review (QDR) and the development of a new National Security Strategy will also impact any recommendations brought forth in this study. Finally, all structural and flying hour data provided for this study by F-16 SPO engineers at Ogden ALC is based on Aircraft Structural Integrity Program (ASIP) analysis from fiscal year 1999.

This study also draws from the assumption that the 20 FWE requirement is valid, and that certain portions of the force structure dedicated to training and test are not available for combat,

or can be counted as part of the overall FWE. Additionally, having worked closely with F-16 sustainment, much of the information in this study is familiar, weighing heavily on the conclusions presented here. In many cases information presented is from memory, but backed up with sources where appropriate.

## **Research Question and Preview of the Argument**

By fiscal year 2008, the Air Force will have a 108-fighter deficit. By fiscal year 2021 that number will grow to 311. These numbers are based on the today's programmed F-16 attrition rate of 3.6%, an estimated 8,000-hour F-16 service life, and full fielding of the Joint Strike Fighter for training beginning in fiscal year 2009. This research study will attempt to answer the question, "Will there be sufficient combat-capable F-16 aircraft available to meet USAF force structure requirements prior to fielding of the JSF?" There are primarily two parts to this answer. The first is to gain an understanding of the current status of the F-16 fleet. The second part of the answer will examine fielding of the JSF as the replacement for the F-16, its forecast schedule, funding, and risk associated with procurement. Lastly, I will examine what actions can be taken to mitigate the risk of "running out" of aircraft before the JSF is fully fielded. In attempting to answer the first is question, I will look at the F-16 fleet, its background, current status, and force structure.

### **Notes**

<sup>1</sup> Cooper, Bert H. *F-16 Aircraft Issues: Debate Over Continued Procurement*, Congressional Research Service Report for Congress Report 94-642 F, Library of Congress, Washington, DC 1994: CRS-4

<sup>2</sup> Lt Col Rudy Turco, Air Combat Command Plans and Programs, Global Attack Division, Langley AFB, VA, interviewed by author, 20 Nov 2000

## Chapter 2

### Current Status of the F-16 Fleet

*“The need for continued procurement of F-16s for the USAF will depend on a variety of force structure factors: the projected size and composition of US fighter/attack forces; the perceived need to modernize these forces over time; service life extension plans for aircraft now in service; and usage and attrition rates.”*

—Bert H. Cooper, Congressional Research Service, Aug 1994

Today the F-16 is experiencing many of the same problems that a majority of the USAF fighter fleet is facing. Issues relating to aging structures and components, diminishing manufacturing sources, reduced spares availability, inexperienced operators and maintainers, reduced budgets, large infrastructure, and staggering OPTEMPO. As a result, it is easy to see how over the last decade, the F-16 consistently fails to meet its mission capable rate goal.<sup>1</sup> So what is different about the F-16, and why does its health or lack thereof, have such an impact on our ability to meet future force structure requirements? Basically, this question can be answered by looking at three general areas related to the F-16.

First, the aircraft's current structural configuration will not meet its original service life goals. This failure lies primarily in the difference between the aircraft's original design criteria, and the manner in which it has actually been flown. But also, the failure of the acquisition, engineering, and sustainment communities to accurately identify, program for, and modify the aircraft to meet changing operational demands contributed to the problem.



**Figure 1 Two F-16 Aircraft with Cracked Bulkheads<sup>2</sup>**

Secondly, attrition losses will severely impact USAF's ability to meet future fighter force structure requirements. Engines are top among the primary contributors to the current programmed annual attrition rate of 3.6%.<sup>3</sup> Other contributors such as spatial disorientation (Spatial-D), G-induced loss of consciousness (GLOC), and controlled flight into terrain (CFIT) (The latter drove congress to mandate installation of an automatic ground collision-avoidance system, termed AUTOGCAS, that is meeting with great resistance amongst the operational requirements community.) play a smaller role in the programmed attrition. Additionally, Congressional support for continued attrition aircraft purchases, which is always divided and hotly debated, will fail to keep pace with attrition losses. Also of significance is the fact that the annual programmed attrition rate is calculated each year based on the actual number of mishaps and aircraft losses. Losses due to service life have not been of much consequence. But as the fleet's average flight time starts to approach those service life limits, our attrition forecasts will increase accordingly.

Finally, the current F-16 force structure is too large to support, given the first two factors. This is significant for two reasons. First, as each block/series of F-16 approach zero attrition reserve aircraft available, the ability of ACC and Air Staff force planners to move assets within the USAF (Active and Reserve components) becomes more difficult. Moreover, their ability to mix aircraft to meet required roles and missions is limited by “tribal politics” and protection of individual “rice bowls”. Secondly, the Active/ARC mix of aircraft leaves a sizable portion of force structure unavailable for immediate deployment. The ARC possesses approximately 45% of the entire F-16 fleet, ranging from blocks 10 through 52.<sup>4</sup> This will significantly impact the ability of the USAF to meet future Expeditionary Air Force (EAF) requirements. When combined with the service life and attrition issues, they add up to difficulties maintaining required force structure in the future.

## **Background**

The fact that the current structural configuration of the F-16 will not meet its original service life goals is significant only if there is nothing done to remedy the fact. This will require addressing those issues that led to the current state of affairs, primarily the F-16’s original design criteria, its’ actual utilization, and how the engineering, acquisition, and logistics community failed to take appropriate action.

### **Design Criteria**

The F-16 is the first fracture-based designed aircraft.<sup>5</sup> The fracture-based design consists of two components, durability life, and damage tolerance life. Durability life refers to “the ability of the structure to resist failure for a specified period of time due to cracking, corrosion, wear, etc.” Basically, durability life represents the service life of the airframe without major structural

repair. Damage tolerance life refers to the criteria imposed on safety-of-flight structures, which if failed would cause loss of life and/or aircraft. Damage tolerance life provides for crack growth that would not cause catastrophic failure at any time during service. Damage tolerance life provides for aircraft safety-of-flight. In layman’s terms this means the aircraft sub-structure (Bulkheads, longerons, etc.) were designed to allow for cracking, but not fail catastrophically. The damage tolerance life for the F-16 aircraft, referred to as service life, varies by block, and is the single most important planning factor in determining expected life of the aircraft and future force structure. The F-16 structure was originally designed for an 8,000-hour service life requirement (with the exception of Blocks 25/30/32, which were designed for an 8,000-hour service life goal) at a gross weight of 22,500 lb. (See Table 1) Although touted as a lightweight multi-role fighter, it was primarily designed for an air-to-air role.<sup>6</sup>

<b>Block</b>	<b>Req vs. Goal</b>	<b>Design Life</b>	<b>Comment</b>
10/15	Requirement	8,000	To Design Usage
25/30/32	Goal	8,000	To Design Usage
40/42	Requirement	8,000	To Design Usage
50/52	Requirement	8,000	To Design Usage

**Table 1 F-16 Design Service Life Criteria<sup>7</sup>**

Risk of continued cracking to failure is mitigated through the Aircraft Structural Integrity Program.<sup>8</sup> According to the Air Force Instruction on aircraft structural integrity monitoring, the ASIP program “establishes, evaluates, and substantiates the structural integrity of aircraft structures. ASIP acquires, evaluates, and applies operational usage data to provide a constant update of structural integrity of operational aircraft. ASIP provides quantitative information on force planning, inspection, and modification priorities and related support activities.” ASIP gets

its data through multiple points throughout the aircraft, collected by an on-board flight data recorder (FDR, CSFDR).

## Where We Stand Now

Changes in weapons, tactics, and training have significantly reduced the aircraft's available service life. A 1999 ASIP analysis made a startling discovery that many aircraft were experiencing actual stress loads up to 10-times higher than its original design. A primary measurement of stress on aircraft structures during flight is the relationship of number of G-forces in relation to weight and moment. A typical comparison of design versus operational usage is shown in Figure 2 below. It depicts the number of times a specific data point (of over 180 measured on the F-16) on the aircraft exceeded 6 Gs (Normal Load factor NZ) per 1,000 flight hours. While the aircraft was originally designed for 1,000 G-exceedences per 1,000 flight hours, (or 1 per flight hour) it is actually experiencing 10,000 (or 10 per flight hour).

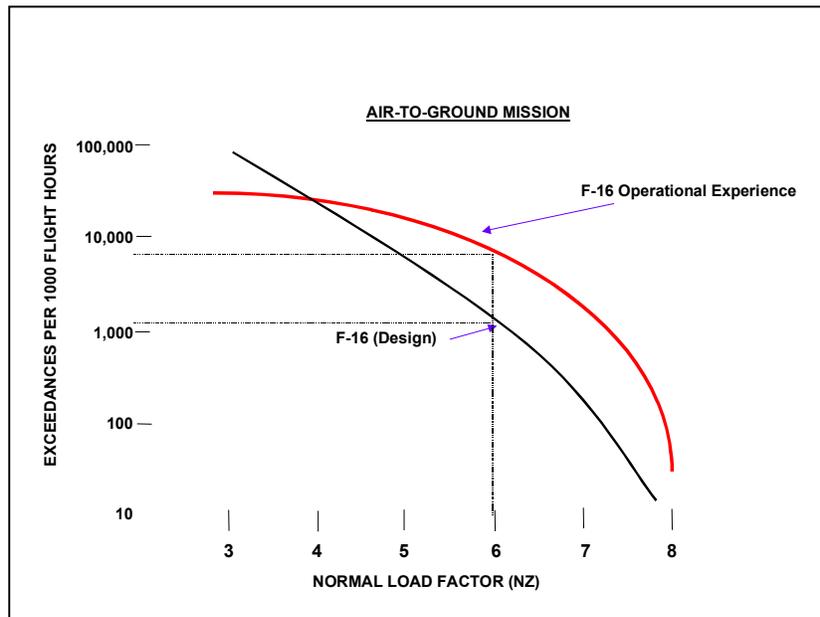


Figure 2 Typical Comparison: Design vs. Operational Usage<sup>9</sup>

Another example for comparison is the exceedence comparison multiplied by aircraft gross weight. The design baseline for a block 30 aircraft is approximately 250 180,000 G-lb. exceedences per 1,000 flight hours, but what was actually experienced at many general purpose units were up to 600, and up to 1,033 in the Thunderbirds.<sup>10</sup>

ASIP analysis determined leading structural components most likely to fail, and at what point in terms of number of hours it would fail. It was determined that for the Block 10/15, the component most likely to fail first is the Fuselage Station (FS) 357.8 Upper Bulkhead Aft Intermediate Flange at approximately 4,000 flight hours. At the current rate of 173 flight hours annually, you could expect 90% of the A/B model fleet to be grounded by the year 2004. The leading component expected to fail on the Block 25/30/32 aircraft is the FS 446 Lower Bulkhead at 4,500 hours, which if not replaced could ground 90% of the fleet in the year 2011 (The first year the JSF is fielded in a combat coded unit) based on an average of 217 hours annually. The block 40/42 and 50/52 grounding component would be a failure of the FS 479 Upper Bulkhead at 5,000 hours. Ninety percent of the block 40/42 fleet would be grounded in the year 2012, with the block 50/52 being grounded in 2014.<sup>11</sup> These figures are shown in Table 2.

<b>Block</b>	<b>Average Life (Hours)</b>	<b>Annual Average (Hours)</b>	<b>Average Age (Years)</b>	<b>Projected Failure</b>	<b>@ (Hours)</b>
25/30/32	3,330	262 (240 ANG)	12.9	FS 446 BH	4,500
40/42	2,760	293 (268 ANG)	9.5	FS 479 BH	5,000
50/52	2,064	321 (231 ANG)	6.0	FS 479 BH	5,000

**Table 2 Current F-16 Fleet Flight Hours Average (As of 08/00)<sup>12</sup>**

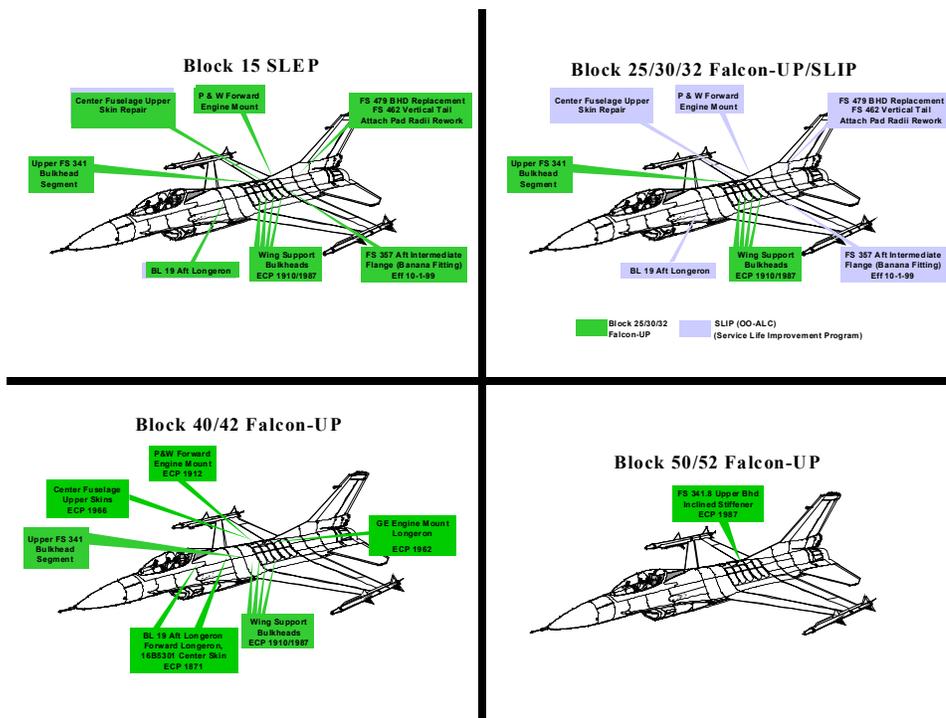
How could we have missed the mark on number of G-exceedences? Well there are a number of reasons. First, the design criteria assumed a mission mix consisting of primarily air-

to-air, and was not sufficiently structured for heavy gross weights. The current maximum allowable gross weight for pre-block 40 aircraft has increased to 37,500 lbs, with up to 42,500 lbs allowed during contingency operations. This increase was approved without accomplishing a service life analysis, to determine the effects of additional weight on airframe structures.<sup>13</sup> Second, introduction of low-level air-to-ground tactics with increased gross weights placed additional stress on aircraft structures. Third, modifications made to aircraft, such as the addition of a targeting pod, defensive countermeasure dispensers, reconnaissance pods, etc have added to the gross weight issues. And last, improvement in pilot comfort systems, such as the high-G seat configuration, forced breathing apparatus, and improved G-straining devices (G-suit) have made it easier for pilots to endure longer periods of high G forces.

But there is more to the story. What role did the engineering, acquisition, and logistics communities have in ensuring the fleet would meet its expectations and what are they doing now? First, the F-16 aircraft does not fall under the Program Depot Maintenance (PDM) concept. A PDM is a recurring inspection requirement that must be performed by the aviation depot, where certain inspections or repairs must be done on a recurring basis, and can only be performed by depot-level technicians. As a result of the damage tolerance life design, the F-16 has no components that can not be inspected at the base level, and it has no recurring maintenance requirements driving it in to a depot for repair.<sup>14</sup> Second, we must go back to the ASIP program. There are two key components to the system: good collection, and good analysis. Where we failed is in the analysis area. Each year, Air Combat Command, the Air National Guard, and the Air Force Reserve pay \$6.54 million to fund ASIP through the Sustaining Engineering Requirements Plan (SERP).<sup>15</sup> Prior to 1999, no funds were actually provided by the MAJCOMs to analyze this data. Therefore no monitoring of fleet usage or

proactive failure predictions took place. In 1999, The MAJCOMs did fund ASIP analysis, resulting in the information presented in this study.

**Structural Modification Programs:** In the absence of a PDM, structural modifications are performed as required at the depot facility at Ogden ALC. The F-16 has undergone one major modification program, one major repair program, and is in the process of planning a second major modification program. Falcon-UP began in fiscal year 93 as the first major modification program accomplished at Ogden, and will continue through fiscal year 04. The purpose of the program was to upgrade those structural components identified by ASIP analysis and actual failures in the field to be of most concern. Falcon-Up (Figure 3) included all blocks except blocks 10/15, and when accomplished would provide additional service life to those components, enabling them to reach



**Figure 3 Falcon-UP, SLIP, and SLEP Components**

the 8,000-hour mark. Air Combat Command, exercising their lead-command influence elected not to support investment in the complete Falcon-Up package for blocks 25/30/32. Therefore the SPO developed a repair program dubbed “SLIP”, or “Service Life Improvement Program” to bring the aircraft structures up to configuration with the block 40/42. SLIP will go through fiscal year 04.<sup>16</sup>

Finally, based on the latest ASIP analysis, the next round of structural upgrades is being planned, nicknamed Falcon-STAR, or **S**tructural **A**ugmentation **R**oadmap. Falcon STAR, planned to start in fiscal year 04, is a \$460M program (\$600M if the 56 A/B model aircraft are included) that will span 10 years, includes blocks 25-52, and is funded as a new initiative in the fiscal year 02 Budget Estimate Submission. Again, exercising their lead-command responsibilities, ACC elected not to fund the additional structural modifications<sup>17</sup> on any A and B-model aircraft, despite the fact that A/B-models are programmed through fiscal year 28. Falcon-STAR will replace components identified as high fail potential, and extend the expected service life for those components to 8,000 hours.

Falcon-STAR will not be the last of the structural modification programs. While it will extend the expected service life on replaced structural components based on today’s ASIP data, it cannot predict changes due to new weapons, tactics, and training. The introduction of new GPS-guided and standoff munitions, new targeting pods, advance integrated weapons pylons, and new defensive system dispensers, tactics are certain to change, not to mention the aircraft stress points. These changes will drive additional structural modifications that can not yet be predicted. So with this in mind, how many hours of service life should programmers depend on when determining future force structure planning? The question is not easily answered?

## Attrition

Attrition losses will severely impact USAF's ability to meet future fighter force structure requirements. Unexpected losses due to engine failures and Congress and DoD's resistance to adequately fund attrition replacement aircraft are major contributors to the attrition shortfall. Today in the year 2001, the block 42 version of the F-16 is below attrition reserve levels, with no programmed replacement. (See Table 3) The blocks 32 and 40 are forecast to go below attrition reserve levels by the year 2002, with blocks 25 and 50 following close behind. All have no programmed replacement with the exception of the block 50, which Congress has funded replacement of. Although of little consequence now, attrition due to expiration of service life will soon become a major driver in reducing inventory.

	ANNUAL		MISHAP	SERVICE	PAA	BAA	AR	TAI
	USAGE (HRS)	ARC	RATE (PER 100,000 HRS)					
F-16 B10	174	174	3.70	8000	31	2	-6	27
F-16 B15	174	174	3.70	8000	86	10	19	115
F-16 B25	308	238	3.60	8000	177	22	6	205
F-16 B30	292	243	3.60	8000	299	36	24	359
F-16 B32	321	252	3.60	8000	45	4	3	52
F-16 B40	314	278	3.60	8000	212	22	0	234
F-16 B42	273	265	3.60	8000	165	17	-4	178
F-16 B50	336	0	3.60	8000	163	16	6	185
F-16 B52	291	231	3.60	8000	40	5	9	54

**Table 3 Current F-16 Fleet Inventory<sup>18</sup>**

Despite being the safest single-engine fighter in USAF history<sup>19</sup>, engine failures are a leading contributor to the 3.6 attrition rate. In 1999, known engine anomalies and “technical surprises” accounted for 8 class-A mishaps, and 25 over the last 5 fiscal years.<sup>20</sup> How could this have happened? Money! Historically there has been a pattern of underfunding for engine modification through the POM process. The Component Improvement Program (CIP), funded by the Engine Program Element Monitor (PEM) provides engineering analysis, modernization

recommendations, and associated risk factors for aircraft engines, but does not actually provide funding for the modernization itself.<sup>21</sup> The weapon system PEM must be an advocate for and provide funding for engine modernization. Unfortunately, weapon system priorities tend towards new capabilities, with engines being viewed as a maintenance and repair “problem” that should not compete for the weapon systems limited modernization funds. As a result many safety related modifications go unfunded. In the USAF Program Objective Memorandum (POM) submissions for fiscal year 02, zero new modifications or disconnects were funded, while 15 recommended safety modifications remained unfunded.<sup>22</sup>

Further exacerbating the problem is Congress and DoD’s failure to adequately fund procurement of attrition replacement. Bert Cooper addresses this issue in a report for Congress on the debate over continued procurement of the F-16. In 1995, Congress was divided on whether or not to continue procurement of the F-16. The House Committees supported continued procurement citing “continued procurement of the F-16 is necessary to maintain force structures and capabilities after 2000.”<sup>23</sup> In the fiscal year 01 Budget, Congress managed to add \$52 million to buy a pair of block 50 aircraft. The DoD did not ask for any purchases.<sup>24</sup>

Referring to the future prospects of sustaining future force structure, Burt Cooper, in his report to Congress over continued procurement made the following statement. His comment serves to be somewhat prophetic, as we look back over history from today.

“F-16 Supporters argue that procurement of the aircraft should continue in order to sustain the multi-role fighter force through the early 2000s, noting that normal peacetime attrition will result in inventory shortages around the turn of the century and well before any JAST-derived (JSF) aircraft is likely to be in production. (Bert H. Cooper, F-16 Aircraft Issues: Debate Over Continued Procurement, Congressional Research Service Report for Congress, 8 Aug, 1994)

## Force Structure

A recent article in Aviation Week & Space Technology reports that “An additional \$8 billion per year for 11 years (2006-17) to rebuild the USAFs rapidly aging fleet of fighters, tankers, airlifters and reconnaissance/Intelligence-gathering aircraft at a rate of 150-170 new aircraft per year, 87 of which will be fighters.” Not only is the purchase of additional aircraft required to address reducing numbers of available aircraft, but that the age of the fighter fleet remaining is driving additional downtime due to maintenance and upkeep. “The average age of AF fighters is now 14.5 years. After 15 years, fighter maintenance costs start to climb quickly. Since 1991, the time needed for an aircraft to complete major depot maintenance has increased from 150 days to 400 days. By the year 2020, the fighter fleet will be 21 years old. Even with

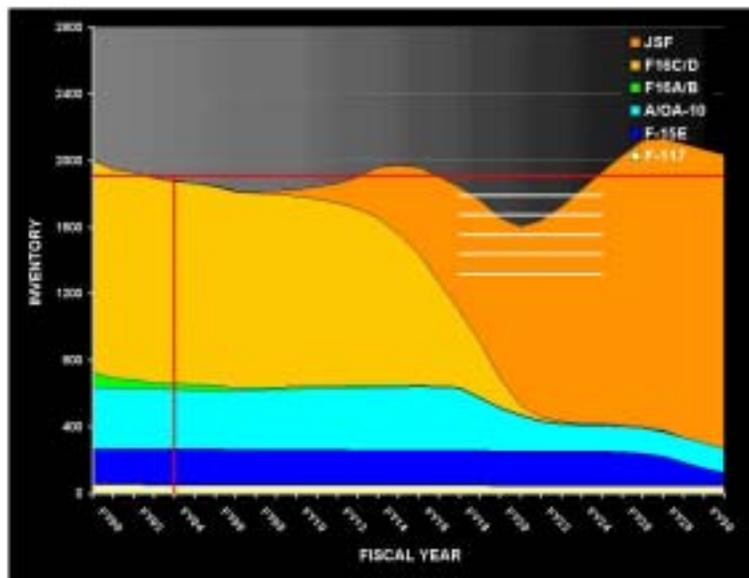


Figure Figure 4 Fiscal Year 00 Fighter Attrition Charts

### 4 Fiscal Year 00 Fighter Attrition Charts

an aggressive acquisition schedule, Air Force planners contend the service will be 200 aircraft below requirements by 2016.”<sup>25</sup> According to ACC’s force planning office, the USAF fighter

force will have a 108 aircraft deficit by fiscal year 2008, and by fiscal year 2021 that number will grow to 311<sup>26</sup>, most of which is attributed to the F-16. (Figure 4)

How many aircraft are required, and how many are enough? According to ACC planners, the total combat aircraft requirement is 2391 aircraft, or roughly 20.21 fighter wing equivalents (FWE). But that is not the entire requirement. Aircraft assigned in Air Defense squadrons do not figure in to the FWE calculation. Based on the current forecast of service life and attrition losses, there will be a USAF force structure “bathtub” of 2.5 FWEs.<sup>27</sup>

Inefficiencies exist in the current F-16 force structure and it is too large to support, given the service life and attrition issues. This is significant for two reasons. First, as each block/series of F-16 approach zero attrition reserve aircraft available, the ability of ACC and Air Staff force planners to move assets within the total force (Active and Reserve components) becomes more and more difficult. Moreover, their ability to mix aircraft to meet required roles and missions is limited by “tribal politics” and protection of individual “rice bowls”. Secondly, the Active/ARC mix of aircraft leaves a sizable portion of force structure unavailable for immediate deployment, significantly impacting the ability of the USAF to meet future Expeditionary Air Force (EAF) requirements. When combined with the service life and attrition issues, they add up to difficulties maintaining required force structure in the future. Take one example for instance of the political influence that the Reserve Component has on the force. In order to meet the growing demand to train pilots, the Air Force ordered the reserve command to stand-up a field-training unit (FTU) at Luke AFB, AZ. Standing up the FTU required more two-seat (C-Model) aircraft than the Reserve unit possessed. The Air National Guard possessed the required two seat aircraft. As a result, ACC ordered the movement of one two-seat aircraft from one ANG unit to the Luke Reserve unit. The ANG unit ordered to transfer the two-seater, concerned with their

ability to recruit flight surgeons, was reluctant to give it up. Furthermore, two neighboring ANG F-16 units whom did not possess a two-seat aircraft of their own, as a standard practice would borrow this unit's two-seater as incentive for their own flight surgeons. Upon hearing the order to transfer the aircraft, the three units raised the issue with their state leadership, eventually involving their legislative constituency. Political pressure applied by the three states involved made a letter from the Secretary of the Air Force necessary to prompt the unit to give up their aircraft. This illustrates the difficulties that Air Force and ACC planners encounter when trying to level the fleet. Similarly, state legislators from the New York delegation threatened to strike all F-16 modernization and programmed force structure changes in the fiscal year 01 budget unless the USAF provided the 174 FW at Syracuse, NY with a newer version of the F-16. As a result ANG was forced to make internal changes, planning to move a complete block 30 squadron from another ANG unit to Syracuse, in exchange for a squadron of KC-135s. As more and more aircraft are lost through attrition, these types of delays and resistance will effect readiness.<sup>28</sup>

### **Aircraft Set-Aside**

How does the Pentagon intend to address a potential shortfall in the F-16 prior to fielding the JSF? In an Aug 1996 Program Decision Memorandum for the 1998 Budget Estimate Submission (BES), the Deputy Secretary of Defense, recognizing the need to have a contingency plan for filling force structure shortfalls prior to fielding of the JSF, issued the following in a Program Decision Memorandum (PDM);

“The Secretary of the Air Force will reserve in inviolate storage for potential future U.S. use the following F-16A/B Block 15 aircraft: Immediately, 100 good condition aircraft; in the year 2000, in addition, 100 aircraft received from the Air Force Reserve and Air National Guard. The need for maintaining this secure storage program will be reviewed one year prior to commencement of long lead procurement for low-rate initial production of the Joint Strike Fighter.”<sup>29</sup>

What this is saying is that the USAF should hold in a special storage status, 200 block 15 aircraft in “good condition” to be placed back in service in the event current force structure doesn’t hold out until the JSF is fielded. Unfortunately, these aircraft will not be suitable for combat without significant investment. They will be under powered (A majority of Block 15 aircraft being held in inviolate storage are equipped with the Pratt & Whitney F100-200 engine, currently in service at only one base with imposed speed and altitude restrictions), require multiple Time Compliance Technical Orders (TCTO’s) and modifications be accomplished, and even that structural components, such as bulkheads and landing gear be replaced.<sup>30</sup> Even with all of these items accomplished, most of the block 15 aircraft will have configuration and gross weight restrictions, not to mention the fact that few will have the accurate up-to-date avionics software, or even be capable of firing an AMRAAM missile. This is not the answer to filling the impending gap between the F-16s useful life and the JSF.

As we have seen the prospect for retaining sufficient combat capable F-16 aircraft to meet USAF force structure requirements prior to fielding of the JSF is grim. The aircraft’s current structural configuration will not meet its original service life goals. This failure lies primarily in the difference between the aircraft’s original design criteria, and the manner in which it has actually been flown. But also, the failure of the acquisition, engineering, and sustainment communities to accurately identify, program, and modify the aircraft to meet changing operational demands contributed to the problem. Additionally, attrition losses severely impact our ability to meet future fighter force structure requirements, primarily due to engine related losses and a failure to support continued attrition aircraft purchases. Finally, the current F-16 force structure is too large to support, given the first two factors.

Now to answer the second part of the question “Will there be sufficient combat-capable F-16 aircraft available to meet USAF force structure requirements prior to fielding of the JSF?” Having already looked at the F-16’s prospects for the future, we now need to look at the Joint Strike Fighter program to have sufficient information to completely answer the question. Primarily when will it be fielded, how many will we buy, and what is the risk associated with fielding?

### Notes

<sup>1</sup> F-16 Customer Support Page, On-line Internet, 12 Jan 01, Available from <https://f16support.hill.af.mil>. Historical performance data over a ten year period (From 1991 through 2000) is presented on the website and shown in Appendix A.

<sup>2</sup> Sorenson, Tim, Engineer, F-16 System Program Office, “Falcon STAR” briefing. 12 Sep 1999. The photo are of the first catastrophic failure of the Upper fuels shelf on two separate aircraft from the ANG unit at Kingsley Field, Or. The aircraft were off station as static displays at a local airshow. Both were found leaking significant amounts of fuel into a non-vented area as a result of cracked bulkheads in the wing root/fuel shelf area. These aircraft were the first to exhibit significant structural failure, kicking off a series of structural upgrades.

<sup>3</sup> Lt Col Rudy Turco, Air Combat Command Plans and Programs, Global Attack Division, Langley AFB, VA, interviewed by author, 20 Nov 2000

<sup>4</sup> Ibid

<sup>5</sup> Sorenson, Tim, Engineer, F-16 System Program Office, “Falcon STAR” briefing. 12 Sep 1999

<sup>6</sup> Ibid

<sup>7</sup> Ibid

<sup>8</sup> Air Force Policy Directive (AFPD) 63-10, *Aircraft Structural Integrity*, November 1997

<sup>9</sup> Sorenson, Tim, Engineer, F-16 System Program Office, “Falcon STAR” briefing. 12 Sep 1999

<sup>10</sup> Ibid

<sup>11</sup> Ibid

<sup>12</sup> Maj Gen Paul Pochmara, “Beyond Falcon STAR,” briefing, ANG/AFRC Working Group, Warner-Robins ALC, GA., 17 Nov 2000

<sup>13</sup> Sorenson, Tim, Engineer, F-16 System Program Office, “Falcon STAR” briefing. 12 Sep 1999. AFRC initiated a maximum gross-weight waiver request to accommodate heavier gross weights on assigned block 25, 30, and 32 aircraft to accommodate addition of a new targeting pod and precision munition capability. ACC supported the waiver and the F-16 System Program Office approved it. No engineering analysis was conducted to determine the effect on aircraft structures or service life.

<sup>14</sup> Ibid. Two studies have been accomplished by Litton to determine if a PDM is appropriate for the F-16. Each time the study concluded that there were no components that required repair at regular intervals.

## Notes

<sup>15</sup> Aeronautical Systems Division, ASC/YP, to Headquarters Air Combat Command, Air National Guard, and Air Force Reserve Command, letter, subject: FY99 Requirements Calls for Air Force Sustaining (Maintenance) Engineering by Elements of Expense and Investment Code (EEIC) 583, 1 Jul 1998

<sup>16</sup> Sorenson, Tim, Engineer, F-16 System Program Office, “Falcon STAR” briefing. 12 Sep 1999

<sup>17</sup> Captain Stephen Macleod, F-16 Structures Team, F-16 System Program Office, Hill AFB, UT, interviewed by author, 15 Jan 2001

<sup>18</sup> Lt Col Rudy Turco, Air Combat Command Plans and Programs, Global Attack Division, Langley AFB, VA, interviewed by author, 20 Nov 2000

<sup>19</sup> Maj Ben Rodarte, “F-16 Propulsion Issues” briefing, Air Combat Command F-16 Integrated Planning Team, Langley AFB, VA, 18 May 2000

<sup>20</sup> Capt John Schroeder, Air Combat Command Flight Safety Office, Operations Division, Langley AFB, VA, interviewed by author, 15 Mar 2001

<sup>21</sup> Maj Ben Rodarte, “F-16 Propulsion Issues” briefing, Air Combat Command F-16 Integrated Planning Team, Langley AFB, VA, 18 May 2000

<sup>22</sup> Ibid

<sup>23</sup> Cooper, Bert H. *F-16 Aircraft Issues: Debate Over Continued Procurement*, Congressional Research Service Report for Congress Report 94-642 F, Library of Congress, Washington, DC 1994

<sup>24</sup> Rolfsen, Bruce “Millions OK’d for F-16 as JSF Simmers,” *Air Force Times* 13 Nov 2000

<sup>25</sup> Fulghum, David A. “USAF: We Need 170 New Aircraft Yearly.” *Aviation Week & Space Technology*, 22 Jan 2001, 32

<sup>26</sup> Lt Col Rudy Turco, Air Combat Command Plans and Programs, Global Attack Division, Langley AFB, VA, interviewed by author, 20 Nov 2000

<sup>27</sup> Ibid

<sup>28</sup> Rolfsen, Bruce “Congressman Gives Ultimatum on F-16 Funding: “Upgrade Guard unit’s fighters or forget about spending in 2001.” *Air Force Times*, 5 Jun 2000

<sup>29</sup> Deputy Secretary of Defense, Program Decision Memorandum, subject: Tactical Aircraft Modernization, 15 Aug 1996

<sup>30</sup> Myself. I know this from personal experience in retiring F-16 A/B Model aircraft, blocks 10 and 15.

## Chapter 3

### Fielding of the Joint Strike Fighter

*‘The Joint Strike Fighter program will develop and field an affordable, highly common family of next generation multi-role strike fighter aircraft for the Navy, Air Force, Marine Corps and allies.’*

JSF Program Office

To answer the research question completely, we must look at the Joint Strike Fighter program. Specifically, when it will be fielded, how many will we buy, and what the risk is associated with fielding? The first three questions are relatively easily answered. The answer to the fourth has significant impact on the ability of the USAF to maintain adequate multi-role fighter force structure through the year 2020.

Simply stated, the JSF will not be fielded as planned. This is so for a couple of reasons. First, there is an extremely high possibility that defense procurement budgets will not meet the services’ full modernization requirements. When procurement dollars fall short, trade-offs will be made in terms of numbers, length, and even survival of major force programs, all three of which the JSF is vulnerable to. Secondly, the JSF may not have all the political support in the Legislative and Executive branches it will require to survive. Certainly the recent change in administration has cast a new shadow of doubt on the immediate need for the JSF, further exacerbating the F-16 issue.

## **The Joint Strike Fighter Program**

**Requirements:** The Joint Strike Fighter (JSF) program, also known as the “Joint Aircraft Strike Technology” program, is the DOD’s focal point for developing the next-generation multi-role strike weapon system for the Navy, Air Force, Marine Corps, and our allies. The focus of the JSF program is capability, affordability, and interoperability. Combining development, production, and total ownership costs reduces the overall program cost. The JSF will meet the Air Force’s stated needs as a primarily air-to-ground multi-role fighter to replace the F-16 and A-10<sup>1</sup>. The Pentagon’s current plan is to buy 2,852 Joint Strike Fighters, with 1,763 going to the USAF.<sup>2</sup> According to Air Combat Commands Fighter Force Structure Office, the first USAF Joint Strike Fighter will be fielded in fiscal year 2004 for Design Test and Evaluation (DT&E). The first Field Training Unit will not be fully equipped until fiscal year 2010, with the first combat unit fielded by fiscal year 2011. Procurement is programmed to continue through the year 2029.<sup>3</sup>

**Cost and Funding:** Unit flyaway cost for the Air Force’s version of the JSF (conventional takeoff and landing) was originally planned at \$28 million each. But recent reports show the cost has risen to \$31 million a copy.<sup>4</sup> Compare the JSF price to the current F-16 block 50 price tag of \$26 million each<sup>5</sup>. As far as funding goes, then President Clinton requested almost \$857 million in the fiscal year 2001 budget for Engineering and Manufacturing Development (EMD), but Congress reduced that amount to \$687 million with the fiscal 2001 defense authorization bill.<sup>6</sup>

## Risk

*“We’re not falling off a cliff tomorrow, it’s not a crisis”*

F. Whitten Peters

**Impact of Reduced Funding:** There exists an extremely high possibility that in the event procurement funding falls short of stated needs, the JSF program will be at risk of losing funds, forcing the number of total purchases to be reduced, fielding to be pushed further to the right (outyears), or for the program to be discontinued. As discussed earlier, in the first year of EMD, congress cut the amount requested by DoD by \$168 million, a full 20% over stated need. A November 13th article in the Air Force Times stated that “Congressman are concerned the Pentagon was moving too quickly with the joint fighter program”<sup>7</sup> If the same thought logic follows the JSF that did the F-22, we can expect a reduction in aircraft purchases. According to a December article on the subject, Tony Capacio reported that the USAF will postpone the purchase of 15% of the F-22 fighters it planned on between now and fiscal year 2004, citing a requirement of “\$9 billion more than Congress will allow.”<sup>8</sup>

According to a January article in Defense Week, Air Force Secretary F. Whitten Peters agreed that there will be a money crunch when the bills come due to replace the aging Air Force fleet of tactical aircraft. He added that he’s “not sure the political will is there yet to appropriate the money to buy all the needed aircraft. But something has to be done eventually”

**Political Support:** Political support for the purchase of the Joint Strike Fighter is weak at best. The JSF, dubbed by some as a “Democratic” airplane<sup>9</sup>, is in jeopardy of being the first victim of a “re-thinking” about ongoing major force modernization programs. This is spurred on by the recent debates over procurement funding shortfalls, a change of administration, and a new National Security Strategy.

Prior to the elections, a top Bush advisor was quoted as saying “if elected Mr. Bush is to review the pentagons three tactical aviation programs, and may conclude that less than 3,000 aircraft are necessary,” saying that “skipping a generation” of weapon systems may be the best course of action, considering today’s threat.<sup>10</sup> Now President Bush has been heard saying that he considers the proposed production of 3,000 Joint Strike Fighters to be “a bit much.”<sup>11</sup>

In his January article in Defense Week, Christian Lowe quoted a noted aerospace expert as saying “The JSF program is in serious trouble, and it’s future is in doubt. With President Bush’s pledge to review all the tactical aviation programs, and calling for “skipping a generation” of weapons systems, many feel the JSF will come under the skeptical eye.”<sup>12</sup>

As the newly appointed Secretary of Defense, Mr Rumsfeld will more than likely weigh in heavily in favor of reviewing the Joint Strike Fighter program. According to a reporter from the Washington Times, “There are at least seven major procurements that Mr Rumsfeld will scrutinize. Among the systems most likely to get a close look: the JSF.”<sup>13</sup> Other incoming Pentagon officials have already begun discussing options for killing or curtailing major weapons systems, with the JSF mentioned as a possible casualty. In tentative discussions, Pentagon officials have broached the idea of killing the Joint Strike Fighter. In return, the Bush team would make” commitments” to the Marines’ V-22, the Navy’s F-18 Super Hornet, and the Air Force’s F-22.”<sup>14</sup> According to Cai von Rumohr, a defense industry analyst for SG Cowan Securities Corp, “Whether it’s the JSF, the V-22, or the Zumwalt Destroyer, there’s an enormous likelihood of something slipping this year.”<sup>15</sup> According to a noted aerospace expert “the great JSF savior are the Marines, but right now I think they have all they’re attention on the V-22 in terms of funding and political lobbying.”<sup>16</sup> While the Pentagon originally planned to pick a

winner by next spring, officials said yesterday that the selection now is likely to take place in fall of 2001.<sup>17</sup>

If this information isn't enough to convince anyone that the JSF will most likely not be fielded on time, consider the following. In 1997 the GAO released a report on the affordability of DOD's investment strategy for aircraft procurement. The report noted that the Pentagon's strategy to fund modernization from the "large savings generated from initiatives to downsize defense infrastructure and acquisition reform" was unrealistic in that Congressional projections at that time suggested that in the foreseeable future, overall defense spending would remain stable at best. The report suggested that the DoD has "historically made long-term commitments to acquire weapon systems based on optimistic procurement profiles and then significantly altered those profiles because of funding." The report also suggests that to deal with funding shortfalls, the DoD may need to "reduce planned aircraft procurement."<sup>18</sup>

Finally, the title of a May 2000 GAO report "Joint Strike Fighter Acquisition: Development Should be Changed to Reduce Risks" need say no more. Citing "immature technologies" at the beginning of the engineering and manufacturing development (EMD) phase, the GAO suggests the program will experience increased program risk, schedule delays, and increased cost.<sup>19</sup> With this in mind, the answer to the question "Will the JSF be fielded as programmed?" is not likely. That said, what should the US do to ensure the F-16 is around until the JSF is fielded?

### Notes

<sup>1</sup> "About the Joint Strike Fighter." On-line. Internet, 22 Nov 2000. Available from [http://www.jast.mil/html/body\\_aboutjsf.htm](http://www.jast.mil/html/body_aboutjsf.htm)

<sup>2</sup> Wolfe, Frank "Bush Advisor: Less Than 3,000 Tactical Aircraft Likely Required." *Defense Daily*, 27 Sept 2000, 1

<sup>3</sup> Lt Col Rudy Turco, Air Combat Command Plans and Programs, Global Attack Division, Langley AFB, VA, interviewed by author, 20 Nov 2000

## Notes

<sup>4</sup> Skeen, Jim “Cost Of Air Force Joint Strike Fighter Climbing,” *Los Angeles Daily News*,” 27 Nov 2000, B1

<sup>5</sup> Rolfsen, Bruce “Millions OK’d for F-16 as JSF Simmers,” *Air Force Times* 13 Nov 2000

<sup>6</sup> “Pentagon Gives JSF, F-22 Wiggle Room For Meeting Requirements,” *Aerospace Daily*,” 13 Oct 2000

<sup>7</sup> Rolfsen, Bruce “Millions OK’d for F-16 as JSF Simmers,” *Air Force Times* 13 Nov 2000

<sup>8</sup> Capaccio, Tony “U.S. Air Force to Delay Some F-22 Buys to Control Rising Costs.” *Bloomberg.com*, 18 Dec 2000

<sup>9</sup> Lowe, Christian “Joint Strike Fighter Draws Fire as Democratic Plane.” *Defense Week*, 22 Jan 2001, 6

<sup>10</sup> Wolfe, Frank “Bush Advisor: Less Than 3,000 Tactical Aircraft Likely Required.” *Defense Daily*, 27 Sept 2000, 1

<sup>11</sup> Little, Robert “Bush Makes Defense Firms Nervous.” *Baltimore Sun*, 21 Jan 2001

<sup>12</sup> Lowe, Christian “Joint Strike Fighter Draws Fire as Democratic Plane.” *Defense Week*, 22 Jan 2001, 6

<sup>13</sup> Scarborough, Rowan “Pentagon Considers Cuts in Major Weapons Systems.” *Washington Times*, 22 Jan 2001, 1

<sup>14</sup> Ibid

<sup>15</sup> Little, Robert “Bush Makes Defense Firms Nervous.” *Baltimore Sun*, 21 Jan 2001

<sup>16</sup> Lowe, Christian “Joint Strike Fighter Draws Fire as Democratic Plane.” *Defense Week*, 22 Jan 2001, 6

<sup>17</sup> Schneider, Greg. “Lockheed Flies Joint Strike Fighter Offering.” *Washington Post*, 25 October 2000, E2

<sup>18</sup> Government Accounting Office, “Aircraft Acquisition: Affordability of DODs Investment Strategy.” letter report, report number GAO/NSIAD-97-88, 9 Aug 1997

<sup>19</sup> Government Accounting Office, “Joint Strike Fighter Acquisition: Development Schedule Should be Changed.” letter report, report number GAO/NSIAD-00-74, 9 May 2000

## Chapter 4

### Conclusions

After serious consideration of the facts presented in this study, it is clear to see that if the 20 FWE requirement is valid, there will not be sufficient F-16 aircraft available to meet future fighter force structure requirements. There are four primary reasons that I make this conclusion. First, the aircraft's current and planned structural configuration will not meet its required service life. Second, attrition replacement will not keep pace with losses, severely impacting the USAF's ability to meet future fighter force structure requirements. Third, current F-16 force structure is too large to adequately support through the first two decades of this century. And finally, the Joint Strike Fighter will not be fielded as originally programmed.

**Service Life:** The F-16 in its current configuration, will not meet its service life expectations. This is primarily attributed to the difference between the aircraft's original design criteria, and the manner in which it has actually been flown. Originally programmed to reach an 8,000-hour service life at the design criteria, the F-16 has experienced actual loads up to 10 times more severe than expected. But also, the failure of the acquisition, engineering, and sustainment communities to accurately identify, program, and modify the aircraft to meet changing operational demands contributed to the problem. Timeliness of analysis of ASIP program data left long period gaps between modification programs. Once ASIP analysis was accomplished, the scope and size of the recommended modifications were reduced to save money. Failure to

adequately fund these structural modifications also contribute to the service life problem. ACC, ANG, and AFRC failed to fund engineering studies outside of the ASIP program to look into structural components consistently failing in the field. Additionally when new capabilities are programmed for the aircraft, no service life analysis is done to determine the overall effect on the aircraft service life. Many thought Seek EAGLE flight certification testing was sufficient analysis, unfortunately Seek EAGLE testing just provides certification of airworthiness. Although planners have fully funded Falcon STAR for all aircraft block 25-52, this will only guarantee an 8,000-service life on those components it replaces. Other major structures will fail prior to the 8,000-hour mark.

**Attrition:** Attrition losses will severely impact USAF's ability to meet future fighter force structure requirements, primarily due to engine failures and the USAF inability to replace attrition reserve aircraft. As a leading cause of attrition, known safety-related modifications are not funded nor implemented in a timely manner. This is due in part to the fact that there is no advocacy for funding such modifications. The engine PEM only has obligation authority for maintenance and upkeep of engines, whereas the weapon system PEMs must be the advocate for modifications affecting their weapon system. Additionally, the historical debate in Congress over continued procurement of the F-16, and the DoD's unwillingness to provide the resources necessary to purchase sufficient replacement aircraft have reduced attrition reserves significantly. By the end of next year, three of the seven block models of aircraft, excluding blocks 10 and 15, will no longer have attrition reserve aircraft available. The Program Decision Memorandum to store 200 "good condition" block 15 aircraft in inviolate storage as reserve for force structure shortfalls fills force structure "holes" with incapable aircraft at significant cost.

**Force Structure:** The current F-16 force structure is too large to support. Failure to replace attrition losses as mentioned earlier has led to the current situation in which we are now. Low availability of attrition reserve aircraft make moving aircraft difficult at best. With the possibility of three of the seven block models of aircraft going below attrition reserve levels by the end of next year, the ability of planners to re-shuffle aircraft within the total force is becoming more and more difficult. With over 45% of the entire F-16 force structure residing within the Air Reserve Component, planners must balance force needs with the ARC political influences. Moreover, Air Staff and ACC programmers are basing force structure requirements based on an expected 8,000-hour aircraft service life, which is high risk at best.

**JSF Fielding:** Finally, the Joint Strike Fighter will not be fielded as programmed for two reasons: procurement funding will not meet needs and there may be a lack of political support in the legislative and executive branches for the new jet. When these two issues clash, the JSF may fall victim to the services internal prioritization, with the F-22, V-22, F-18 “Super Hornet” and the Army “Transformation” possibly being defended as their top priorities. President Bush’s emphasis on “skipping a generation” of weapons systems and skepticism that the DoD needs almost 3,000 new fighter aircraft make the current program high risk.

## **Chapter 5**

### **Recommendations and Summary**

Faced with the realization that something must be done to ensure the F-16 is around until the Joint Strike Fighter arrives at combat units, two groups have been formed throughout the Air Force to address the issue. In early 1999, then COMACC General Eberhardt commissioned a group led by ACC/XP to address the F-16 issue, consisting of logisticians, operators, and planners from the Air Staff, all of the MAJCOMs, Guard, and Reserve, with the goal of developing solutions and alternatives for possible implementation in the USAF's fiscal year 2002 program objective memorandum.<sup>1</sup> At around the same time an ANG/LGMF-led group was formed to study the issue of structural modernization, operational usage, and their effects on aircraft service life.<sup>2</sup> Although the ACC-led group is now disbanded, both organizations developed possible courses of action with mixed success. I will utilize what has already been done as a stepping off point to make recommendations for extending the availability of the F-16 into the year 2020.

### **Recommendations**

#### **Service Life**

Certainly the area for greatest improvement is in the area of extending the aircraft's service life to guarantee the aircraft will make it to the 8,000-hour mark that all our future force

programming is based on. To do so will require a combination of operations and logistics working together to reduce impact on the fleet.

**Recommendation 1: USAF fully fund Falcon STAR along with future structural modifications for the entire F-16 fleet.** Certainly it goes without saying that the Air Force must continue to support full funding for Falcon STAR, projected to begin in fiscal year 2004. That must include modifying the 56 block 15 aircraft that are programmed to remain through the year 2028. But Falcon STAR will only provide us an 8,000-hour service life on those components it replaces based on the way the aircraft is currently being flown. As tactics, training, weapons, and gross weights change in the future, other components will need replacement to realize the 8,000-hour expectation. Those too must be fully funded for all aircraft programmed to remain in the inventory. Finding what those components are the basis for my next service life recommendation, engineering analysis funding.

**Recommendation 2: Aggressively fund predictive engineering analysis and sustaining engineering projects for structures.** ACC, ANG, and AFRC pay a combined \$6.5 million annually to maintain the ASIP program<sup>3</sup>. F-16 SPO engineers must do a better job of analyzing that data, and being proactive about championing modification efforts. The period between complete ASIP analysis for implementation of Falcon-Up and Falcon STAR was at least 10 years. Additionally, ACC, ANG, and AFRC must invest in sustaining engineering studies over and above those currently funded. In the Sustaining Engineering Requirements Plan (SERP) for fiscal years 2001 through 2007, there are zero structures related studies outside of ASIP.<sup>4</sup>

**Recommendation 3: Implement a stress severity mitigation program.** The USAF should implement a unit-level stress severity awareness and mitigation program. Through ASIP data analysis, a stress severity index should be developed by mission type and configuration. This

will give operators real time insight as to the actual significance and impact on structures for G-s and maneuvering under certain gross weights, configurations, and mission types. The RNLA developed a similar system, where units are measured by the total amount of “stress” placed on aircraft structures.<sup>5</sup> A simple, single number is used to evaluate unit commander and pilot performance against the aircraft design life. This data can be easily tracked at the unit level for trends, aircraft configurations, missions, and priority of need for modification.

**Recommendation 4: Implement user awareness training; educate aircrew on service life impacts by profile and configuration.** There are two parts to this recommendation, with the first resulting from the development of a unit-level stress severity index. This will give operators real time awareness as to the effects of certain maneuvers, gross weights, and configuration on aircraft service life. Second, there should be an academic requirement at every unit to re-educate operators on the current structural health of the fleet they fly, and what actions, if any, they can take to mitigate the risk to aircraft structures. I must stress however that I do not recommend changing tactics or the way we fight. A training video entitled “F-16 Pilot Structural Awareness” narrated by Bland Smith, a Lockheed-Martin Aero Corporation senior test pilot, was produced by the Air Force, and is available through normal media publication channels.

**Recommendation 5: Implement limitations for certain configurations and sortie types.** While I will admit this is a last resort, it may at some point in time be absolutely necessary. To impose limits on G’s, certain missions, configurations, and gross weights would ensure sufficient F-16 aircraft are available for use in a major conflict. This option should only be implemented at such a time there is risk of having insufficient combat aircraft to effectively prosecute a war, at which time the limits must be lifted.

**Recommendation 6: Install an integrated overload warning system.** The USAF should consider the installation of an on-board overload warning system similar to the one currently installed on the F-15. The purpose of such a system would be to warn pilots of situations in which they were approaching overload situations on the aircraft structures.

### **Attrition**

There are two major recommendations for mitigating the attrition factor. First, to place emphasis on reducing engine-related attrition by investing in engine modernization. Second, we must simply purchase more aircraft to replace our attrition losses.

**Recommendation 7: USAF provide engine program element monitor with authority to program and obligate modernization funds.** By providing the USAF and ACC engine PEMs authority to budget and obligate modernization funds, (3010 appropriations) implementation of necessary safety-related modifications can be accomplished when needed. All too often, engines don't get the attention needed in terms of dollars, until a crisis situation exists. This mentality led to over two-dozen aircraft losses in over the last five fiscal years.

**Recommendation 8: Purchase more F-16s.** As we have seen throughout this study, the USAF, DoD, and Congress have struggled with whether or not to continue procurement of the F-16. It is also apparent that at some point in time, lawmakers were concerned that failure to continue procurement in the mid to late 90's would result in shortfalls after the turn of the century. ACC submitted in its fiscal year 2002 POM submission a request for 6 aircraft to replace attrition losses. That never made it through the Air Force Group level. As long as foreign military sales are keeping the production lines open, we must continue to replenish the fleet.

## **Force Structure**

Finally, by restructuring the F-16 force, we can help to alleviate current and potential problems with certain block models, while still meeting USAF readiness requirements. I must say however that movement of force structure is the most difficult thing to do in many cases. The politics involved in moving aircraft, missions, and possibly jobs between state lines normally tends to bring the politicians heavily into the fray. The political influence brought by the ARC makes this issue even more difficult. The following recommendation serves the purpose of freeing-up F-16 force structure by finding new roles, missions, and aircraft for some units.

**Recommendation 9: Re-role the 150 FW (ANG) at Kirtland AFB to an associate unit of the special operations FTU.** The 150 FW is an F-16 block 40 LANTIRN-equipped unit, the only such unit in the ANG. As such, they are limited from deploying as a “rainbowed” package in an AEF. Their total availability for an AEF is limited to 45 days. Additionally, the 150 FW possesses 7 Block 30 aircraft that are not currently programmed or directly funded. These aircraft support DoD Defense Systems Evaluation (DSE) testing, and are in most cases directly reimbursed for their support. The 58WG (AETC) at Kirtland AFB currently operates all field training for special operations aircraft. By re-roling the 150 FW into an associate unit with the 58WG, we free up 18 block 40 aircraft that can be integrated into the active component, possibly creating greater availability for supporting an AEF. Additionally, 7 block 30 aircraft can be added to existing attrition reserve, enough so to completely retire a combat coded block 15 or 25 unit.

**Recommendation 10: Convert the 144 FW (ANG) from F-16 ADF to F-15 ADF.** The 144 FW, at Fresno, CA is currently the only F-16-equipped air defense unit in the USAF. Three other such units are currently equipped with the F-15 A/B. As the F-22 is initially fielded,

sufficient F-15C/D aircraft will become available to convert the 144 FW from F-16 block 25 aircraft to the F-15. This will free-up sufficient block 25 aircraft to either convert current block 15 combat units to block 25, or to bolster force structure at the FTU at Luke AFB, AZ.

**Recommendation 11: Convert Thunderbirds to Block 15 aircraft.** Despite their place as aviation's elite, the USAF Thunderbirds utilize force structure that is needed elsewhere. The Thunderbirds currently fly the block 32 variation of the F-16. By converting them to a block 15 variant, their aircraft can be utilized to provide attrition aircraft at the FTU at Luke AFB, AZ, or at any one of the ANG's block 25 or 32 combat units, as the block 25 and 32 are ultimately interchangeable.

**Recommendation 12: Accomplish an aircraft swap between 56 FW (AETC, and 162 FW (ANG).** The 162 FW, at Tucson AZ currently operates the block 15 and 42 versions of the F-16, providing field training for Foreign Military Sales countries. The block 42 version is required since a number of FMS sales have been of an improved (MLU) version of the block 15, modified with avionics similar to the block 42. The 56FW at Luke, AFB also operates the block 42, to provide training to USAF and FMS customers requiring the advanced avionics. As you may recall, the block 42 is in the worst shape as far as available attrition reserve aircraft (negative four). A solution is to accomplish MLU on sufficient block 15 aircraft to achieve the required FMS training at Tucson, and transfer the block 42 aircraft to the 56 FW at Luke AFB.

## Summary

As we have seen the prospect for retaining sufficient combat capable F-16 aircraft to meet USAF force structure requirements prior to fielding of the JSF is marginal at best for a number of reasons. First, we found that the aircraft's current structural configuration will not meet its original service life goals. This failure lies primarily in the difference between the aircraft's

original design criteria, and the manner in which it has actually been flown. Second, we discovered that attrition losses will severely impact our ability to meet future fighter force structure requirements, primarily due to engine related losses and a failure to support continued attrition aircraft purchases. Third, current F-16 force structure is too large to support, given the first two factors, and finally the JSF will not be fielded as planned for a couple of reasons. There is an extremely high possibility that defense procurement budgets will not meet the services' full modernization requirements. When procurement dollars fall short, trade-offs will be made in terms of numbers, length, and even survival of major force programs, all three of which the JSF is vulnerable to. Secondly, the JSF may not have all the political support in the Legislative and Executive branches it will require to survive. Certainly the recent change in administration has cast a new shadow of doubt on the immediate need for the JSF, further exacerbating the F-16 issue. Finally, I made recommendations for extending F-16 force structure in three major areas; service life, attrition, and force structure. While not the complete answer, it is evident that action must be taken right now to preserve our combat capability through the first two decades of the twenty-first century.

### **Notes**

<sup>1</sup> Lt Col Rudy Turco, Air Combat Command Plans and Programs, Global Attack Division, Langley AFB, VA, interviewed by author, 20 Nov 2000

<sup>2</sup> Maj Gen Paul Pochmara, "Beyond Falcon STAR," briefing, ANG/AFRC Working Group, Warner-Robins ALC, GA., 17 Nov 2000

<sup>3</sup> Aeronautical Systems Division, ASC/YP, to Headquarters Air Combat Command, Air National Guard, and Air Force Reserve Command, letter, subject: FY01 Requirements Calls for Air Force Sustaining (Maintenance) Engineering by Elements of Expense and Investment Code (EEIC) 583, 1 Jul 2000

<sup>4</sup> Aeronautical Systems Division, ASC/YP, to Headquarters Air Combat Command, Air National Guard, and Air Force Reserve Command, letter, subject: FY01 Requirements Calls for Air Force Sustaining (Maintenance) Engineering by Elements of Expense and Investment Code (EEIC) 583, 1 Jul 2000

<sup>5</sup> Maj Gen Paul Pochmara, "Beyond Falcon STAR," briefing, ANG/AFRC Working Group, Warner-Robins ALC, GA., 17 Nov 2000

# Appendix A

## F-16 Historical Performance



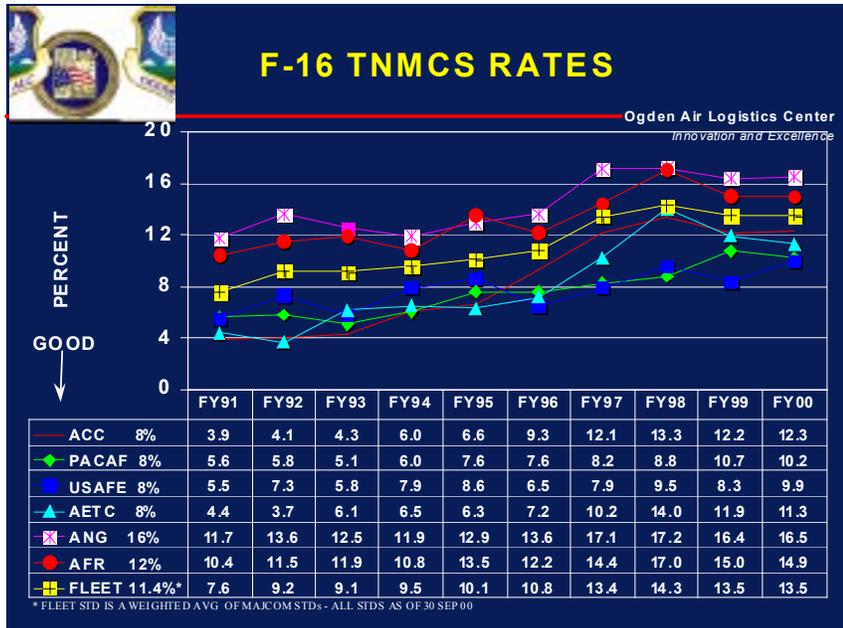
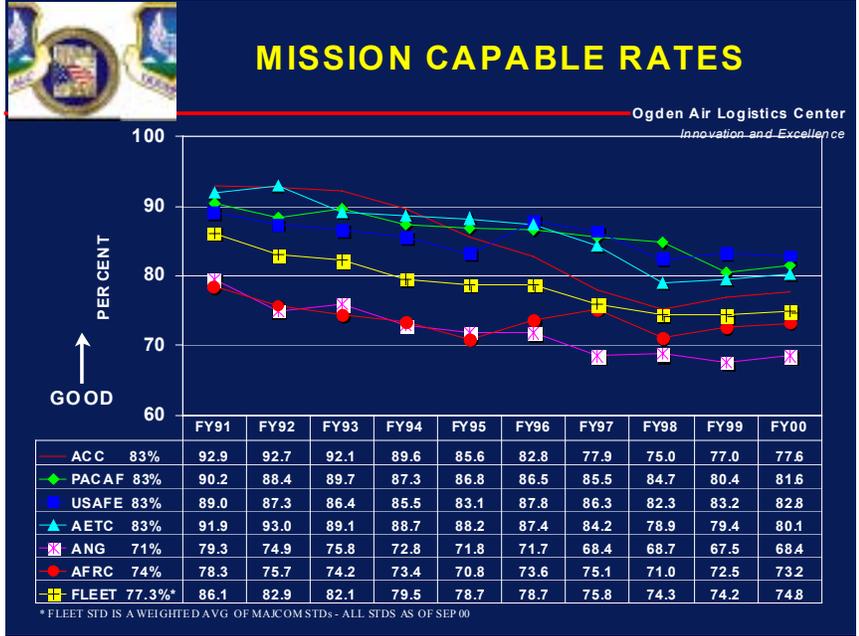
Ogden Air Logistics Center  
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### F-16 HISTORICAL STATISTICS REPORT

#### FY91 - FY00

OO-ALC/YPLA  
Maint Analysis Team  
As Of: 30 Sep 00







# F-16 TNMCM RATES

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		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00
—	ACC 10%	3.5	3.5	4.0	5.1	9.5	10.7	14.7	17.6	15.4	14.8
◆	PACAF 10%	5.6	7.5	6.4	7.7	6.8	7.7	8.4	8.3	11.7	10.3
■	USAFE 10%	6.7	6.9	8.9	7.4	10.7	6.9	7.3	10.3	10.7	10.3
▲	AETC 10%	4.5	4.0	6.2	6.2	7.1	7.1	9.1	10.9	14.9	16.1
⊠	ANG 26%	15.4	19.2	19.1	22.4	24.1	23.8	27.0	26.6	28.2	26.9
●	AFR 20%	14.9	17.1	19.6	20.2	22.9	19.9	14.4	22.4	23.3	21.3
■	FLEET 17.0%*	9.3	12.0	13.0	15.2	16.4	15.9	18.3	19.2	20.0	19.3

\* FLEET STD IS A WEIGHTED AVG. OF MAJCOM STDs - ALL STDs AS OF 30 SEP 00

## *Glossary*

AMRAAM	Advance Medium Range Air to Air Missile
ACC	Air Combat Command
AFRC	Air Force Reserve Command
ALC	Air Logistics Center
ANG	Air National Guard
ARC	Air Reserve Component
ASIP	Aircraft Structural Integrity Program
BH	Bulkhead
CFIT	Controlled Flight Into Terrain
DOD	Department of Defense
DT&E	Development, Test & Evaluation
FS	Fuselage Station
FTU	Field Training Unit
GAO	Government Accounting Office
GLOC	G-Induced Loss of Consciousness
JSF	Joint Strike Fighter
LGM	Maintenance Division
MLU	Mid Life Upgrade
OT&E	Operational Test and Evaluation
PEM	Program Element Monitor
PDM	Programmed Depot Maintenance
SERP	Sustaining Engineering Requirements Plan
SLIP	Service Life Improvement Program
SPO	System Program Office
TCTO	Time Compliance Technical Order

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