

**Embargoed Until Release by the  
House Committee on Government Reform**

**Statement of**

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**Before the  
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International Relations**

**of the**

**House Committee on Government Reform**

**on**

**Acquisition Reform: Controlling Costs in Tactical Aircraft Programs**

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Mr. Chairman and Members of the committee, I am pleased to come before you today to talk about the F-22 program, and the acquisition system that is and has been managing the cost, schedule, and technical aspects that together make a program that has as its goal to bring to the defense of America the best tactical fighter aircraft that this country has ever produced. The aircraft, now designated the F/A-22, has characteristics to address the threat to our freedom for many years into the future. Though this aspect is not the thrust of this hearing, it is important to keep the purpose of the acquisition in mind.

Secretary Aldridge set out five goals as we set out to improve the acquisition process in general, and the first among them was the restoration of credibility in the budgeting process to gain your confidence that year after year cost increases on weapons systems could be minimized. This provided an opportunity for the inclusion of the independent cost estimate in the determination of annual and program budgets, reconciling differences and making an informed judgment if there were variances between the estimates. This policy has in fact led to a dramatic reduction in cost-driven changes, and allowed some focus on stability in other areas that impact cost, such as technical risk and changes in quantity.

The F/A-22 program, which has been in existence for some time prior to this policy, had in fact suffered from previous steps to manage cost using caps for

R&D and Production. The cap for R&D had the program coping with inadequate test articles and consolidated Avionics Integration as well as a clear erosion of systems engineering, which looked like redundant engineering, on this highly integrated weapons system. During this same period, the acquisition workforce was being steadily downsized. Program offices were directed to be of a certain size in attempting to comply with downsizing pressures, yet expected to retain the fiduciary and legal oversight. This led to a reduction in analytic engineering capability within the program offices in general, and for the F/A-22, particularly in the area of systems engineering and integration. This pressure continues, and has the potential to introduce more risk in the process. The areas that suffer are areas that seem redundant when things go well, but seem essential when things don't.

Disciplined systems engineering is essential as software and integrated systems are becoming the vogue for defense. Two million lines of diversified distributed software code are being integrated for F/A-22, and 6 million are forecast for Joint Strike Fighter; and I believe triple that again for the Future Combat Systems. We've also seen the same occurrence in the area of space products. I have spoken out on the need for increased systems engineering in the community at large, and firmly believe that as we have addressed the cost risk, we must also address technical risk by restoring and agreeing to pay for our supplier capability in this critical software skill area; and within our own community, stop the erosion of our capability to be smart buyers.

Here we have turned to another capable group, the Federally-Funded Research and Development Centers to assist in reviewing the current crop of problems and advising on a good path forward. Though their primary role is in research, and not troubleshooting, they are also great sources for talented engineers who can and have helped. I would ask that as you deliberate the complex budget, you consider them as yet another part of the engineering talent pool that the Department draws on, that has over time been reduced in numbers using the rubric of budgetary savings and often accused as being redundant to the Department workforce.

I digress to emphasize that we are here today talking about an effect, cost increase for a specific weapons system; and recognize that to get at it in a systemic way; we must as well look at causes. For if we are blind to the causes, then we are destined to confront the same issues in another forum like this. As one author put it 'History doesn't repeat itself, but it rhymes well'

We have also introduced the concept of spiral development and evolutionary acquisition. These are concepts to allow difficult requirements to be time-phased; and difficult engineering problems to be resolved in follow-on development cycles. If we are ever to get at shortening the cycle time for acquisition, we cannot be confronted at every turn with concurrency and test

deficiencies that in the end lead to lengthened cycles. This is another way to parse the technical risk, while maintaining a focus on the ultimate warfighter requirements.

Turning to the present situation with the F/A-22, we have a case where the airframe has been proven to be superior in its characteristics. I refer to Lt. General Corley's previous testimony regarding the fact that the F/A-22 is meeting or exceeding the Key Performance Parameters regarding aircraft performance. These parameters were covered in flight testing to date to demonstrate the capabilities that meet the requirements for the Air Combat Warriors. Vertical fin buffet problems, that the GAO refers to, have been with us since the F-111, through the F-14, F/A-18, and now the F/A-22. Though we still have flight testing to go on this highlighted deficiency, thus far the structural fix with the titanium substitute for carbon graphite has provided additional structural strength reducing the risk of fin buffet to the aircraft, and appears to be an acceptable fix. Testing below the 10,000 foot altitude, a harsher environment, is not expected to change that outlook, according to the computer simulations. Flight testing is currently scheduled for June of this year.

From a technical risk perspective, this leaves as the highest risk area the integration of the software and the embedded instabilities being discovered in the avionics software. There are two sides to this issue. We felt that we needed to

bound the direct impact, from a cost perspective, of the resolution to this problem. Second, we needed to consider the secondary, but still important impact of the resolution to this problem, duration, and see if we could bound that as well. At our request, and with great cooperation from the Air Force, the Director, Defense Research and Engineering, formed the Avionics Advisory Team made up of software experts from DoD, academia, and industry to do two primary tasks. First, to identify underlying systemic flaws, and to advise OSD as to the likelihood of a fix requiring a change to the avionics architecture and flight/weapons control computers. Second, to identify impediments to resolving the issue, and to provide suggested approaches to the Air Force and contractor design teams.

Let me address each in turn. First, the team reported that they have not uncovered any evidence that the architecture is fatally flawed, and they added that radical changes to the architecture would likely make it harder, not easier, to resolve the underlying software integration issue in a timely manner. This was very good news to all, in that this now changed the outlook, in a similar way to your home computer, that one CD with a changed program would clear up the problem. Now for their second report, the team identified systems engineering concerns which likely contributed to the problem and trouble shooting software tools that they suggested would help reduce the schedule for resolution.

The F/A-22 team has embraced the Avionics Advisory Teams recommendations in the areas of instrumentation and testing modalities to assist in detecting and correcting root causes for the software instabilities. The Air Force, as you will hear, has allocated 60 additional days to the resolution process. We want Dedicated Independent Operational Test and Evaluation to be ‘event driven’, not schedule driven, and have established some objective criteria representing the product we want for the Air Combat warrior. This includes a run time stability measure to allow testing to be performed efficiently.

While we are encouraged by recent reports of progress, we remain concerned about meeting this criterion within the allocated 60 days. We have scheduled a review in mid-June to determine courses of action to best address all of our concerns, and we are following the F/A-22 design team’s progress.

### **Discussion on F/A-22 Cost**

In your invitation letter you requested that we focus on cost. Cost, schedule, and performance challenges are not unusual for a program with technologies as advanced as the F/A-22. Nonetheless, F/A-22 cost control has been, and remains, a key item for the Department for some time. We continue to

use special Defense Acquisition Executive quarterly reviews to examine cost and schedule trends and track program progress.

You questioned why program costs continue to rise. I will address this in two parts – engineering and manufacturing development, or EMD, and production – and explain the steps the Department is taking in these areas.

**For EMD**, we have had a rough year in terms of cost. Flight testing progress was impeded in the past year due to delays in the delivery of test aircraft and slower than anticipated accomplishment of the test points. Flight testing progress has improved during the past year, but not in all areas. Flight envelope expansion, known as flight sciences, has improved since the Air Force and its contractor made changes in the flight sciences test program. Mission avionics testing, which was not affected by these changes, has been impeded by late software deliveries and instability. Consistent start-up performance and run time before reset are the key stability metrics we track. We are not yet satisfied with either. During the summer months, the Air Force had a “Red Team” of software experts review the software architecture and make recommendations. In the fall, the Department’s Director of Defense Research and Engineering led two additional teams to provide assistance to the Air Force. An Avionics Review Team, comprised of members from government and Federally-Funded Research and Development Centers, focused on potential near-term fixes to the stability

issues. A Science and Technology-based Avionics Advisory Team of recognized experts from government, industry, and academia focused on long-term solutions to systemic design weaknesses and implementation errors. Both teams made numerous recommendations. The Air Force is looking to implement all but two; those two are still being investigated. The good news was that hardware changes do not appear necessary and there was no evidence to indicate that the architecture is fatally flawed. However, the software engineering process needs better discipline. A way to capture embedded data to diagnose and resolve the stability problems is currently being added to the software and should shortly provide a good foundation for fixing software issues. The Defense Acquisition Board reviewed the program in December 2002 and March 2003, and will do so again in mid-June.

The test delays and avionics challenges, as well as several unexpected engineering design issues, contributed to a delay in the planned start of Dedicated Initial Operational Test and Evaluation (DIOT&E) and an EMD cost overrun. The Air Force critically reviewed the funding requirement, redefined the content of modernization spirals, and prepared the Fiscal Year 2004 President's Budget request for F/A-22 to ensure EMD was appropriately funded. Consistent with the Department's buy-to-budget strategy for F/A-22, this \$876M EMD overrun was sourced primarily from production funding within the total F/A-22 program budget. Buy-to-budget means that the total program budget remains constant, and

any program adjustments should be made from within that topline amount. Therefore, cost overruns are sourced from within the program funding, typically lowering the quantity of aircraft; and conversely, reductions in the unit prices allow for additional quantities to be procured within the programs budget. It is an effective way to control the total program cost, and we will continue to follow this strategy.

At this juncture, I would like to point out that we have assessed the impact of reducing numbers of aircraft in lieu of reducing planned modernization. The Air Force and the Department have separately confirmed that modernization, particularly enhanced air-to-ground capability, provides significant benefits which can offset some reductions in aircraft quantities.

**For Production**, cost growth can be attributed to higher prices bid by contractors who remain concerned about program stability, and to the loss of economies-of-scale when aircraft quantities are reduced. During this year's budget preparation, the Department undertook a detailed look at the overall Combat Air Forces force structure, including plans to retire aging aircraft and buy new F/A-18E/Fs, F/A-22s, Joint Strike Fighters, and Unmanned Combat Aerial Vehicles. As a result, we reduced the F/A-22 maximum production rate to 36 aircraft per year from the Fiscal Year 2003 President's Budget planned peak level of 56. This rate adjustment contributes to unit cost increases, but we believe that

the adjustment was prudent to reduce the production rate to a more-realistic level and to ensure that the production line is synchronized to accommodate a smooth introduction of Joint Strike Fighter.

There is no way to guarantee that costs will not rise in this program, especially until we start seeing measurable improvement with avionics stability – our biggest challenge. However, we believe that actions taken over the past year are critical to stabilizing F/A-22 program costs. Improving test practices, disciplining software development and test, adding another avionics laboratory, resolving the EMD cost using buy-to-budget, reducing to a reasonable production rate, and planning for a multi-year procurement all put us on a firmer foundation, which should stabilize program quantity and budget.

A good example of positive progress is in our production cost estimate. Both the Department's Cost Analysis Improvement Group, or CAIG, and the Air Force updated their production cost estimates in preparation for the Defense Acquisition Board review in March 2003 of lot 3 aircraft production. The Air Force estimate indicates a total of 276 aircraft can be procured within the program budget, and the CAIG estimates 270 aircraft. These estimates were within 3% of each other. This gives us good confidence in the production cost estimates. Differences were noted in the estimates of modernization and retrofit costs, that is to say the cost of the content associated with future spirals to enhance capabilities.

The Air Force and CAIG will continue to work to refine their methods to ensure that we have a good estimate of all costs.

The remainder of my comments will address the two F/A-22 related Government Accounting Office, or GAO, reports published this year. The Department respects the role of the GAO and values its insights and advice. However, in the case of these two F/A-22 reports, we do not agree with their recommendations.

**GAO-03-280 “DoD Needs to Better Inform Congress about the Implications of Continuing F/A-22 Cost Growth.”** As stated above, the Department non-concurred on the recommendations of this report. The GAO’s recommendations were primarily focused on Producibility Improvement Projects, or PIPs, a major component of the F/A-22 Production Cost Reduction Projects, or PCRPs. PCRPs included initiatives in areas of producibility improvements, process changes, adoption of new manufacturing techniques, dealing with parts obsolescence, and implementation of acquisition reform principles. The Department agrees in general with the GAO that the PCRPs will have a reducing effect on cost and are well worth undertaking. This is not an issue. There are, however, disagreements between the estimators about the magnitude of the reductions to be achieved by the PCRPs and about how cost experience to-date will apply in the future.

The first GAO recommendation, requiring the Secretary of the Air Force make funding of PIPs at the planned level a priority, is unfounded. While the yearly phasing has been a bit different, from Fiscal Year 2000-2003 the AF has funded PIPs to the originally planned level. Furthermore, the AF has budgeted for the 2004-2006 projections, bringing the total PIP funding through 2006 to \$475.3M. PIPs, which are investments to improve manufacturing processes or incorporate new technology, are being prioritized and implemented based on their expected return-on-investment. The Department believes this implementation strategy is prudent.

The second GAO recommendation, results in the Secretary of Defense providing Congress with documentation showing PIPs are being funded at the planned level or justify why not. The Department will provide information to Congress, by virtue of the Conference Report for the FY2003 Appropriations Act, which requires the Air Force to submit a request justifying any reprogramming of PIP funds used for alternative purposes. Further, this recommendation suggests the Secretary project for Congress the potential cost of F/A-22 production if PCRPs do not offset cost growth as planned and the resulting impact on the quantity of aircraft. The GAO report itself states that the GAO agrees “that there are many factors that can cause F/A-22 production costs to rise,” and that “projected offsets generated by PIPs and other costs reduction plans are uncertain

and may not materialize, even if investments are made as planned.” It goes on to state, “Shifts in these realities are frequent and create a constantly changing picture of F/A-22 production costs, offsets and aircraft quantities.” Therefore, it is the Department’s position that it is neither practical nor appropriate to formally report on projected PCRPs savings and speculate on the resulting aircraft quantity changes. The Department regularly reviews the program and adjusts funding and quantities in the Planning, Programming, and Budgeting System process and reflects those changes in the annual President’s Budget request.

A finding in the report alludes to the fact that the Department will formally request legislation to change to the Congressionally-mandated production cost cap. This has been the case since the Low Rate Initial Production review in August 2001, when the Defense Acquisition Executive directed the Air Force to fully fund the F/A-22 program to the Department’s independent cost estimate of \$43 billion (\$5.4B higher than the congressionally directed production cost cap of \$37.6 billion). This was documented on September 13, 2001, when the Department submitted a revised acquisition plan to Congress in accordance with Section 131(b) of the National Defense Authorization Act for Fiscal Year 2000.

Finally, within the report GAO asserts that the production estimate does not include approximately \$1.3 billion in cost factors. Unfortunately, the GAO’s assessment is based on an old program estimate. Both the Air Force and the

CAIG's estimates prepared for the Lot #3 Defense Acquisition Board review include all of these cost factors that the GAO cites.

**GAO-03-431 “DoD Should Reconsider Decision to Increase F/A-22 Production Rates While Development Risks Continue.”** The Department formally non-concurred with this report. The GAO recommendation suggests the Secretary maintain an annual production rate of no more than 16 aircraft until operational testing is completed to gain greater knowledge of any need for modifications. As was the case in the Department's November 2002 certification to the Congressional defense committees, restricting the quantity to 16 will incur termination costs, manufacturing inefficiencies, and inflation effects for later purchases that are greater than the likely cost to retrofit. We believe the current risk for expensive retrofit on the F/A-22 program is low. F/A-22 systems having retrofit potential, structures and air vehicle subsystems, are tested and mature. The highest risk, that of avionics stability, does not drive a retrofit risk since it will likely be limited to software fixes. The Department will continue to monitor program costs closely, and maintains the flexibility to adjust the production rate, if warranted.

The Department's objective is to ensure that the F/A-22 program, meeting established performance requirements, will be accomplished for an acceptable cost

and on an acceptable schedule. The Department's senior leadership believes it has an obligation to Congress and the American taxpayer to achieve this objective.

Thank you very much.