DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE COMMITTEE ON ARMED SERVICES

SUBCOMMITTEE ON AIRLAND FORCES

UNITED STATES SENATE

SUBJECT: F-22

STATEMENT OF: MRS. DARLEEN DRUYUN
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NOT FOR PUBLICATION UNTIL RELEASED
BY THE COMMITTEE ON ARMED SERVICES ON AIRLAND FORCES
UNITED STATES SENATE

Mr. Chairman and members of the Committee, I thank you for the opportunity to appear before you to discuss the Air Force's F-22 program. I am pleased to provide an update on the progress of the F-22 Air Dominance Fighter program. As you requested, my update will include: changes in the flight test program, flight test accomplishments, an assessment of the efficacy of the Congressional Cost Caps, and a summary of where we stand with respect to production costs on the program.

AEROSPACE SUPERIORITY

Control of the vertical battlespace has been, is, and will remain a major element of United States national security policy. DoD's *Joint Vision 2020* envisions the U.S. military dominating all aspects of a conflict—Full Spectrum Dominance. Control over what moves through air and space provides a fundamental benefit to joint forces. Full spectrum dominance depends on the inherent strengths of aerospace power: speed, range, flexibility, stealth, precision, lethality, global/theater situational awareness, and strategic perspective.

Air Dominance is key to the successful employment of military power. Protection of U.S. and allied joint forces is the number one priority--their protection requires the Air Force to quickly control the vertical battlespace. Air Dominance prevents our adversaries from using air and space to attack, maneuver, or perform reconnaissance that could interfere with the operations of our air, land, or surface forces. Air Dominance provides the freedom from attack, the freedom to maneuver, and the freedom to attack at a time and place of our choosing. While the U.S. and our allies had Air Dominance during Operation Desert Storm, newer and more effective weapon systems are emerging that threaten our ability to achieve Air Dominance in the future. Our forces must be modernized to maintain the edge over our potential adversaries, which we now enjoy.

Control of the 21st Century air battle requires a combination of low observability, supercruise, integrated avionics, and high maneuverability to defeat the emerging fighter and surface-to-air missile threats. The F-22 combines all of these features into an affordable portion of the Air Force's modernization program. The F-22 and the complementary Joint Strike Fighter (JSF) provide the Air Force with a comprehensive and affordable modernization plan to exploit our nation's ability to control the vertical dimension well into the 21st Century. The F-22 will enable the United States to obtain Air Dominance--the total denial of the airspace to the enemy.

The multi-mission F-22 Raptor is a key element in the Air Force's modernization program and the highest acquisition priority. The F-22 brings a revolutionary capability to the battlespace in replacing the aging F-15. In the hands of Air Force aviators, the F-22 will dominate the aerial arena of the 21st Century. We appreciate your concern, support, and funding for our efforts to modernize and sustain the world's most respected Aerospace Force.

U.S. TACTICAL AIR FORCE MODERNIZATION

To maintain its viability, our Air Force needs to modernize as the threat evolves and to avoid technical obsolescence. The Air Force's ongoing time-phased modernization effort is based on developing the Air Force's core competencies and striking an affordable balance between readiness and modernization of the aerospace force. Within our total force modernization efforts, the tactical aviation modernization program envisions an evolution of the current F-15/F-16 high-low mix to a high-low mix of the F-22 and Joint Strike Fighter (JSF) aircraft to provide the most combat capable, efficient, and lethal air force possible. The proper mix of the high capability F-22 and the lower cost JSF provides the Air Force with the necessary combat aircraft to defeat the full spectrum of potential

threats in the first decades of the 21st Century at a minimum risk to the lives of our aviators. Within our strategy, the F-22 is the high capability force designed to destroy enemy aircraft and attack highly defended, high-value targets. The lower cost JSF, purchased in large numbers, will provide the bulk of the attack force once the air-to-air threat has been eliminated by the F-22. The low cost design of the JSF relies on the F-22 for air superiority.

FLIGHT TEST PROGRAM STATUS

We are behind in testing right now, but we are not going to rush testing. Late aircraft deliveries are the principal reason we are behind in our testing schedule. This has impacted our ability to start DIOT&E as originally planned in August 2002. While the Air Force is fully committed to cost control, we will not rush the start of DIOT&E. As the table below illustrates, we lost valuable testing time due to late aircraft deliveries. In some cases, aircraft first flight dates slipped by more than a year, placing increased pressure on the test program.

Aircraft Delivery Schedule

Aircraft	Planned First Flight (JET) *	Current First Flight	Ferry to Edwards
4003	Jul 99	Mar 00	Mar 00
4004	Aug 99	Nov 00	Jan 01
4005	Jan 00	Jan 01	Mar 01
4006	Jun 00	Feb 01	May 01
4007	Sep 00	Sep 01	Sep 01
4008	Feb 01	Oct 01	Dec 01
4009	Jul 01	Oct 01	Oct 01

* JET is Joint Cost Estimate Team

In light of the fact we are behind, the Air Force convened two teams of flight test experts to review the F-22 test program over the past year. In August 2000, the Air Force assembled a team of test experts, F-22 Flight Test Review Team, to evaluate the flight test requirements and make recommendations to improve flight test efficiencies. One of the key recommendations by the Flight Test Review Team was to slip the start of Dedicated Initial Operational Test and Evaluation (DIOT&E) by 4 to 6 months. DIOT&E marks the start of operational testing. Slipping the start of DIOT&E from August 2002 to December 2002 gave us an additional 4 calendar months of flight testing with no impact to the December 2005 Initial Operational Capability (IOC). In order to get EMD cap relief for this slip, the Director of Operational Test & Evaluation (DOT&E) determined in a January 19, 2001 letter to Congress that the increase of the EMD cost cap by 1.5 percent was necessary to ensure adequate testing. The 1.5% cap adjustment equals $307M, which is sufficient to fund the 4-6 month slip (August 2002 to December 2002) to the start of DIOT&E.

The F-22 Flight Test Review Team also made two other key recommendations to increase flight test efficiency, both of which were implemented by the Air Force. The team also recommended adding a 4th Mission Control Team. By adding manpower for the 4th Mission Control Team, we increased the weekly sortie generation rate from 8 to 10 sorties. Secondly, by adding additional analysts at the Participating Test Organizations, we significantly improved our test analysis capability, which is very important for anomaly resolution and efficient flight test operations.

After the F-22 Flight Test Review Team completed their efforts, which resulted in a revised test program, I personally assembled a Red Team to conduct a thorough "independent" assessment of the revised test program. I chartered the Red Team to accomplish the following tasks:

1) Review the test program findings and recommendations of the F-22 Flight Test Review (FTR) Team
2) Provide an independent assessment of the test program
3) Present recommendations concerning the test program's effectiveness, efficiency, and adequacy to verify F-22 system effectiveness and suitability

The members of the Red Team had a wealth of test experience to provide an independent assessment of the proposed F-22 flight test program. Members of the team were:

?? Mr. John E. (Jack) Krings, former Undersecretary of Defense for DOT&E, and current DoD and NASA consultant
?? Dr Eugene E. Covert, former Air Force Chief Scientist and current Professor Emeritus in the Department of Aerodynamics and Astronautics at MIT

?? Maj Gen (ret) George Harrison, former Air Force Operational Test and Evaluation Center (AFOTEC) commander and current consultant for GTRI

?? Mr Jim Smolka, Chief Pilot, NASA Dryden Flight Research Center

The Red Team completed their efforts by briefing their recommendations to the Defense Acquisition Executive, Acting Director of Operational Test and Evaluation, Secretary of the Air Force, the Chief of Staff of the Air Force, and SAF/AQ in late May 2001. Overall, the Red Team was very impressed with the F-22 program and was highly complimentary. Listed below are the most significant recommendations/findings from the Red Team:

Commendations:

(1) Applauded the F-22 program for doing trail-blazing work in developing methodologies to test complex, highly interactive and integrated systems

(2) Praised team for first in-flight aircraft signature measurement meeting specification

(3) Hailed engine performance as exemplary

Recommendations:

(1) Establish periodic decision points over the next year to objectively reassess DIOT&E and Milestone III (High Rate Production) schedules. If necessary, reschedule rather than compress testing to meet unrealistic milestones

(2) Conduct gun testing before DIOT&E

(3) Work with DOT&E to explore additional improvements in avionics and missile test efficiency

(4) Extend DT&E at least 4 months (beyond December 2002) to reduce schedule risk and improve DIOT&E success potential

The Air Force has implemented all of the Red Team recommendations. Specifically, we slipped the start of DIOT&E another four months from December 2002 to April 2003 giving us additional valuable test time to ensure adequate testing is accomplished. This slip will require an additional adjustment to the EMD cost cap above the previous 1.5% adjustment. This slip will not impact the December 2005 Initial Operational Capability (IOC). The revised test program now includes gun testing prior to the start of DIOT&E. The F-22 team has also worked very diligently with DOT&E to resolve our differences with avionics testing to include missile shots. Today, I'm pleased to report these differences have been resolved and are being formally documented in change pages to the Test and Evaluation Master Plan (TEMP).

Description of Current Flight Sciences Flight Test Program

The current Flight Sciences plan has margin to the start of DIOT&E and is built on the historically achieved test point accomplishment rate.

Description of Current Avionics Flight Test Program

The current avionics flight test program plans to conduct 1,530 hours of testing by April 2003. The program maintains a direct lineage to the original 1,970 hour Green Team baseline test matrix that was built following a strategy to task methodology. This methodology involved ACC describing how the F-22 would be employed (strategy) and the test team building a program to ensure complete testing of those required functions (task). The Green Team baseline matrix was refined by the Green Team II

activities during the first six months of 2001. The Green Team II identified several ways to conduct more efficient testing, for example, conducting more tests concurrently and reducing live open air missile scenarios to only those that required an actual missile fired to satisfy developmental technical objectives. They refined the execution plans accordingly and the result was a 1,454 hour program. Subsequent to that refinement, six missile scenarios were upgraded back to open air missile shots to satisfy AFOTEC concurrent operational test objectives and OSD operational test concerns. Gun live fire testing was also reinstated and the result is the current 1,530 hour program. Smartly refining the test plan while adhering to the original Green Team philosophy has led to a robust yet efficient avionics flight test program plan that begins with subsystem testing and progresses to Integrated Systems Evaluations of the entire weapon system.

The plan does account for the fact that some test runs will have to be repeated after anomalies are discovered and corrected. An anomaly factor to re-fly 33% of the test runs is included accordingly. In addition, not all runs will achieve the proper test conditions on the first attempt. For example, a target emitter failure during a data collection run generally would require another attempt to collect the data. For these and other similar reasons, a factor to re-fly 30% of the runs due to test inefficiencies is part of the planned program. Both the anomaly and inefficiency factors are supported historically. The F-22 Avionics Analysis and Integration Team and the Combined Test Force Mission Avionics Test Team will continuously guide test planning and execution to ensure that the F-22 will be certified ready for IOT&E when required.

Flight Test Accomplishments

During the last few months, the F-22 team experienced a significant turnaround in flight test accomplishments by setting personal best for sorties in March, April and May 2001.

Table below provides flight test accomplishments:

MONTHLY FLIGHT TESTS: HISTORICAL

Month	**Sorties**	**Flight Hours**
March 2000	4	11 hrs
April 2000	10	25 hrs
May 2000	4	6 hrs
June 2000	12	19 hrs
July 2000	6	9 hrs
August 2000	24	56 hrs
September 2000	13	31 hrs
November 2000	21	48 hrs
December 2000	5	9 hrs
January 2001	12	23 hrs
February 2001	11	18 hrs
Average	**11.1**	**23.2 hrs**

MONTHLY FLIGHT TESTS: RECENT RESULTS

Month	**Sorties**	**Flight Hours**
March 2001	32	72 hrs
April 2001	37	92 hrs
May 2001	49	113 hrs
June 2001	28	74 hrs
Average	**36.5**	**87.8 hrs**

Since March 2001, the F-22 team test has significantly increased the monthly our sortie rate and monthly flight hours. I attribute this turnaround to two factors. First, delivery of aircraft to the F-22 Combined Test Force (CTF) at Edwards Air Force Base. Second, the improved efficiency resulting from the implementation of the F-22 Flight Test Review Team recommendations.

Presently, we have five aircraft at Edwards AFB conducting flight tests, and the contractor is on track to deliver the remaining 3 EMD aircraft by the end of this year. The present F-22 fleet at Edwards AFB includes 2 Flight Sciences aircraft and 3 avionics aircraft. With the acceptance of three new Raptors later this year, this will round out our fleet at eight aircraft. As part of the EMD contract, the contractor will deliver 9 aircraft. After completing all of its useful testing at Edwards AFB, aircraft 4001 retired from flight testing several months ago and is now undergoing Live Fire Testing at Wright-Patterson Air Force Base.

The F-22 Team has achieved several significant performance milestones in the test program this year. Some of these accomplishments are listed below:

- First flight of aircraft 4005 with Block 3.0 software has been completed.
- Radar Cross Section (RCS) testing has been unprecedented. Aircraft 4004 startled the experts by being under the specification requirement in the critical areas measured during our DAB criteria test. This has never been done before and is directly attributable to the very detailed and rigorous development efforts to ensure a mature Low Observable capability for the first airplanes built. By comparison, it took the B-2 program the 14th production aircraft to make this same claim.
- The F-22 Radar's performance has been outstanding. On 12 April 2001, the team verified that the F-22 radar meets the Acquisition Program Baseline (APB). The F-22 Radar Acquisition Program Baseline is the detection range at which the radar range search mode has a 50% probability of detection against a 1 square meter target. The flight test results demonstrated the radar met 105% of the APB value.
- AIM-9 launch at 100 degrees/second roll rate has been completed.
- CY 01 Program Criteria (see table below) is on track.

CY01 Program Criteria

2001 Program Criteria	Estimated Completion	Remarks
Conduct sufficient engine Initial Service Release testing to determine engine hot section life	Jun	Complete
Conduct full-scale airframe fatigue testing sufficient to define life limits and initial airframe inspection requirements	Sep	Report only

Complete F-22 radar detection range	May	Complete
Complete F-22 first block 3 avionics AIM-120 guided launch	Jul-Aug	On Track
Complete first segment of radar cross section (RCS) stability over time testing	Aug	Started
Establish flight envelope for Block 2 airframe structures	May	Complete

Avionics Testing

The team has achieved remarkable success with avionics Block 3.0 testing. On 5 January 2001, aircraft 4005 flew the first flight of Block 3.0 avionics. This event was clearly the most technically demanding challenge the program faced with regard to completing the Defense Acquisition Board (DAB) Low Rate Initial Production (LRIP) criteria. The Block 3.0 software provides and controls the "first look, first shot, first kill" warfighting capability of the F-22. Block 3.0 provides the multi-sensor fusion F-22 pilots will need to accurately acquire, track, identify and engage multiple targets. Block 3.0 also provides the ability to employ both the AIM-120C and AIM-9M missiles. In addition to the successful radar detection range testing, the avionics system with Block 3.0 has demonstrated the ability to maintain missile quality track accuracies at impressive ranges and has successfully demonstrated sensor fusion supporting target identification. Avionics is no longer a technical issue. Test and verification of system avionics design is the present challenge.

The avionics flight test pace to date has been slowed due to aircraft availability. Aircraft 4004 began an upgrade to Block 3.0 on 29 June 2001. The aircraft was originally delivered in a Block 1.2 configuration. While Block 1.2 allowed the program to accomplish significant testing with aircraft 4004, test utility and productiveness were limited since Block 1.2 contained only partial CNI and no EW

functionality. As a result, 4004 was restrained from fully contributing to flight test execution and run completion/burndown. Aircraft 4005 underwent a six-week modification period to install additional instrumentation and software stability fixes to maximize test efficiency and to support the upcoming first avionics AIM-120 missile shot. Aircraft 4006 entered a similar modification period on 7 June 2001 and will not return to flight test until the latter half of July 2001. These required modifications to increase long-term test efficiency take the aircraft out of service and have slowed the avionics test pace in the short term. Flight test execution planning continues to balance the accomplishment of test points against removing aircraft from service for software block modifications so that over the long term, the maximum amount of test runs can be accomplished as efficiently as possible.

Static Testing

Static testing is progressing very well. The team has successfully completed all of the Air Vehicle Design Ultimate Load conditions, wherein the whole airframe is subjected to 150% of the design limit load and approximately half of the localized static testing. Completion of the remainder of the local test conditions is projected by mid September 2001. No major failures have been experienced in any of the testing to date. The completion of static testing is significant, as the test results directly support F-22 envelope expansion flight testing.

Fatigue Testing

As of 5 July 2001, the F-22 team completed 1258 equivalent flight hours (equivalent to 15.7% of the 1 lifetime), which means we are behind schedule for fatigue testing. Per the plan, we should be over 30% complete by now. The team has experienced some down periods resulting in the program

being behind schedule. First, down period occurred on 26 February 2001 due to excessive motion of the text fixture "dummy" engines, which caused damage to the "dummy" engine and engine bushings. To correct this problem, the team changed the size of the bushings and made other modifications. Testing resumed on 21 March 2001. Second, down period occurred on 10 May 2001 with a "dummy" Main Landing Gear repair. The dummy left main landing gear trunnion shaft cracked. Analysis error inaccurately predicted Main Landing Gear door internal loads. Testing resumed on 8 June 2001. Both of the above failures are not representative of the fleet. Presently, the team is having problems with the pads sticking to the fatigue article. The fatigue article is located in an open bay facility, which is not environmentally controlled. As a result of this situation, the team is experiencing adhesion problems with the pads sticking to the fatigue article. At our 28 June 2001 F-22 CEO meeting, I assigned an action item for Lockheed to assemble a team of experts to fully examine this adhesion problem. Despite these problems, we should complete the first fatigue lifetime test by the end of calendar middle of February 2002.

Engine Tests

On 3 May 2001, Flight Test Engine (FTE) 18, the Initial Service Release (ISR) qualification test engine, completed 4,332 Total Accumulated Cycles (TACs) of accelerated mission testing (AMT). This is equivalent to 1/2 the engine design service life requirement in the specification (full hot section design service life).

While it is clear there is still considerable work to be done to complete the F-22 development program, at this stage in development, the F-22 is far more mature than any other aircraft weapon system program at this point in the development cycle. As of 2 July 2001, the F-22 Team accumulated

more than 1,229 hours of flight testing. No other fighter program has accumulated as many hours at their production decision as the F-22 program. The table below illustrates this point:

Flight Test Hours Comparison at Production Decision

Aircraft	**# Aircraft in Initial Lot**	**Flight Test Hours at Production Decision**
F-15	30	250 hrs
F-16	16	460 hrs
F-18A/B	9	345 hrs
F-22	10	1,229 hrs and growing

ENGINEERING AND MANUFACTURING DEVELOPMENT (EMD) COST CAP

In 1997, Congress enacted a cost cap for the F-22 EMD program. This cap has been an effective cost control tool for the F-22 program. The F-22 EMD program has resulted in a weapon system that is currently meeting or exceeding all key design goals, and the production configuration is essentially complete. The EMD contract is over 95% complete with all hardware design finalized; all Key Performance Parameters (KPP) and technical Acquisition Program Baseline (APB) criteria are being met. The remaining effort on the EMD program includes efforts to finish integration and testing of final software build and contractor/government efforts to complete system level verification and Development Test and Evaluation (DT&E). Another major effort is required for DIOT&E. Continued enforcement of the cap will inhibit completion of the development program and will necessitate the need for future cap adjustments.

Prior to the hardware design being finalized, the EMD cost cap was an effective tool for making design trades, but given the remaining EMD work principally involves testing and we have limited funding, we would only have the option of reducing tests. Given this situation, we now believe EMD cost cap should be eliminated. Retaining the cap now could prevent completion of final development efforts and key DT&E and DIOT&E efforts. These efforts are needed to verify safe and effective operation of the combat fielded system. The correction of minor deficiencies can be accomplished and fielded in the Initial Operational Capability systems if cap headroom allows. Shortage of cap headroom now would prevent the Air Force from completing minor deficiency and system level verification tasks.

While the EMD cost cap was useful earlier in the F-22 program, it now has the potential of harming the test program. During last year's testimony before this committee (22 March 2000), the former Director of DOT&E, Mr. Philip Coyle recommended doing away with the EMD cost cap. He believed the EMD cost cap was causing many programmatic changes to reduce costs, which almost always translated into less testing and increased development risks. He also commented at this point in the EMD phase, cost reductions are largely test related since the test budget is essentially the only remaining uncommitted EMD budget. Not only are testing tasks often eliminated, but there is concomitant inefficient rescheduling of the remaining tasks. Any further reduction of testing tasks increases the risk of not being ready to start or successfully complete IOT&E. In light of these concerns, Mr. Coyle recommended a most helpful Congressional action would be to remove the EMD cost cap and institute an alternative method for controlling the F-22 program cost.

Even though we strongly recommend the EMD cost cap be eliminated, let me assure this subcommittee that the F-22 team remains firmly committed to cost control. An absent EMD cap, cost control pressures still exist for a few reasons. First, this is probably the most reviewed program in the

Air Force. I personally conduct Monthly Execution Reviews to monitor cost performance. Second, I conduct semi-annual F-22 Chief Executive Officer (CEO) meetings to ensure the top program challenges such as cost performance receive the highest level of corporate attention. Third, at our Quarterly Defense Acquisition Executive reviews with Office of Secretary of Defense the focus is on cost performance. Fourth, the government grades the contractor on how well they maintain cost performance as part of the Award Fee process. Finally, the Contractor Performance Assessment Report (CPAR) process provides annual grades to the contractors on their cost performance, which serves as an input for future DoD source selections. I'm confident the above tools give the Air Force and the contractor ample influence and incentive to control program costs.

PRODUCTION COST

I personally review the F-22 program on a monthly basis and can assure you that the F-22 Government/Contractor team understands the desire and need for close control of F-22 costs. I would like to begin by affirming that the F-22 team remains absolutely dedicated to the objective to deliver 339 production aircraft to the warfighters at an affordable cost. Presently, we have two cost estimates for the F-22 production, both of which exceed the production cost cap of $37.6B. One by the Office of Secretary of Defense Cost Analysis Improvement Group (OSD CAIG) and the Air Force CAIG. We are continuing to work to narrow the variance between the two estimates. The plan is to have this resolved by the Low Rate Initial Production (LRIP) the Defense Acquisition Board (DAB). While OSD has not scheduled a LRIP DAB yet, the Air Force is ready to have a DAB now. Once the DAB is complete, we will submit any revisions to our acquisition strategy and cost estimate to Congress. A revised acquisition plan has been formulated by the Air Force and presented to OSD for review and

consideration. This plan will be formally approved by DoD as part of the LRIP DAB process and submitted to Congress in response to the statutory requirements laid out in Section 131 of the National Defense Act for Fiscal Year 2000 (P.L. 106-65. Complete details of the revised acquisition strategy will be released when the internal DoD review and decision process are complete.

An important factor in us being able achieve our objective of delivering 339 production aircraft to the warfighters at an affordable cost is a timely LRIP decision. Everyone understands the importance of the department's on-going Strategic Review, but we cannot minimize the impact this has had on the F-22 program. The Strategic Review has effectively delayed our LRIP, which marks the third year this decision has been delayed. This delay is placing enormous cost pressure on the F-22 program. Contractors report that the greatest threat to meeting production program affordability goals is the delay in a LRIP decision. This lack of program "commitment" is perceived as a "risk" in the advertised procurement of 339 aircraft and 777 F119 engines. Unfortunately, "risk" in business base and future business computations ultimately translate into higher individual lot prices. A LRIP decision will benefit the program by affirming DoD's commitment to current and future program execution.

An equally important factor in on cost control efforts are the implementation of effective cost reduction initiatives. These initiatives have become known as the F-22 Production Cost Reduction Plans (PCRPs), a critical tool enabling the Air Force to deliver F-22 aircraft within the production cost cap. More importantly, PCRPs will continue to drive down aircraft costs over the life of the production program. The continuous cost reductions lower the average unit production prices and ensure our warfighters get early access to the revolutionary F-22 capabilities that will enable the United States to guarantee Air Dominance well into the 21st century.

The F-22 program has a well-structured plan continuously pursuing cost savings initiatives. An exceptional management framework is established to provide real time monitoring and oversight of cost savings initiatives. And finally, performance to date is within the performance guidelines established for target price performance during the transitioning from development into production. Some deviations from the plan have occurred, and the F-22 team immediately implemented rational response, to these deviations in order to deliver the program within the requested and available appropriated production budgets. The F-22 team continues to make progress in cutting the cost to produce F-22s. The key management focus for the F-22 team is to constantly pursue cost savings initiatives adequate to ultimately deliver the program with in the appropriated production budgets.

Accordingly, I would like to briefly describe the status of our PCRPs. The production cap forms the basis for the team management approach in establishing the affordability objectives and cost savings targets for PCRP cost reductions. For purposes of clarity, I will use Flyaway Costs as the measure of the cost to produce a jet. The PCRP program is reducing the Flyaway Costs for the F-22. The table summarizes the reductions in Flyaway Costs.

Production Aircraft Lots	**Number of Aircraft**	**Average Unit Flyaway Cost ($M)**
PRTV I	2	$ 318.5M
PRTV II	6	$ 259.1M
Lot 1	10	$ 199.5M

This table demonstrates that jets are cheaper to produce with each succeeding procurement lot. The challenge is whether cost reductions are adequate to deliver the production program within the production cap.

The process of defining PCRPs has been on-going since 1997. With the criticality of PCRPs to meet well known program affordability objectives, the F-22 team built an efficient management structure to jointly oversee the development and implementation of PCRP projects. The management effort includes an on-line interactive database that allows real time reporting of PCRP status spanning idea generation, approval, implementation and tracking. The latest assessment indicate airframe PCRPs are valued at $21.5B and the engine PCRPs are valued at $4.9B. The F-22 team's assessment is that approximately one half of the then year savings for airframe PCRPs ($21.5B) and engine PCRPs ($4.9B) are in the production cost baseline. The remaining PCRPs will be incorporated in future production lots. The paragraphs and charts below provide you a glimpse of some of the PCRPs that we are implementing now.

The Radar Transmit/Receive (T/R) module design was updated in three major areas. The number of Monolithic Microwave Integrated Circuit (MMIC) and Application Specific Integrated Circuit (ASIC) parts were reduced and the cycle time reduced for the acceptance test program. Two MMICs were combined into one and three ASICs were reduced to two.

New High Speed Milling machines have been purchased at Marietta. Reprogramming of machining tapes take advantage of the high speed capability. High speed milling increases quality and decreases production run time up to 40 percent.

The cost reduction worked jointly by a Pratt & Whitney/Chemtronics Integrated Product Team addressed the exhaust nozzle transition duct structural bulkhead, the thermal protection liners and eliminated the conformal structural spars. The bulkhead was changed from an Titanium Alloy-C ($200/pound raw material) to a Titanium 6-2-4-2 ($40/pound) near net shape forging. The revision greatly simplified the manufacturing process and reduced the processing time. Thermal liner attachments were changed from a difficult to produce "shaped" thin wall casting to simple threaded rods attached to the transition duct body. With the new liner attachment scheme the conformal structural spars, which required hot forming and expensive metal removal, could be change to simple flat sheetmetal spars. This change is typical of what can be accomplished with minor requirement revisions and experience gained during the development process. Savings per engine are $120,800 with a 50% reduction in manufacturing lead-times and weight savings of 20 lbs.

U.S. AIR FORCE

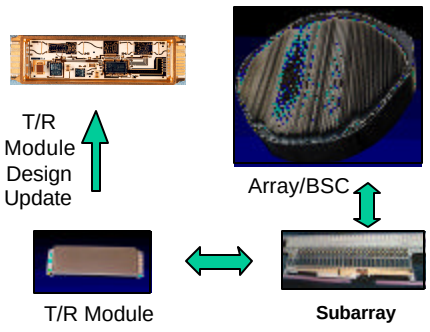
Radar T/R Module Update

PCRP B2 Boeing (Realized)

Background
- Redesign and updated technology
  - Improved Assembly and Test Yields
  - Reduced Support Cost
  - Improved Device Yields

Description
- Combined Driver & Pre-Driver MMICs
- Reduced ASICs from 3 to 2
- Eliminate 3 Filtering Capacitors
- Re-Layout & update of TFN

Status
- Redesign successful; exceed savings target
- Cost reduction included in Lot 1



Basis of Estimate
- Lot 1 negotiated value

Savings ($K)

AA99	$188,886
AA00	$189,358
Difference	($472)

	Projected	Actual
Lot 1	$4,768	$4,692

No DCAA Audit Performed

High Speed Machining

PCRP 276 - Marietta (Validated)

Background

- **High Speed Machining Will Provide Lower Cost and Higher Quality Parts**

Description

- **After Purchasing New High Speed Milling Machines for the Marietta Machine Shop, Reprogram the Machining Tapes to Take Advantage of the High Speed Capability**

Status

- **Implementation Partially Complete**
- **Baseline for Outsourcing Savings**
- **Future Implementation Canceled Due to Decision to Outsource Metal Parts**

Basis of Estimate

Reduce Run Time (Non-Setup) Standard by up to 40% on All In-House Machined Parts

Savings ($K)

AA99	**(Included In Baseline)**
AA00	**$115,736**
Difference	**$115,736**

	Projected	**Actual**
Lot 1	**N/A**	**$4,106**

No DCAA Audit Performed

Integrity - Service - Excellence

Exhaust Nozzle T-Duct Bulkhead Cost Reduction

Description:

- Transition duct aft bulkhead redesigned to replace Alloy C titanium weldment with one piece Ti6-2-4-2 forging for cost reduction.
- Transition duct liner attachment concept changed to eliminate load plate attachment castings for weight and cost reduction

Before After

Basis of Estimate:

- Improved producibility with conventional Titanium - simplified construction
- Reduced labor hours
- Lower raw material costs
- EC incorporated per 99RA275
- Initial estimated savings $129.4K
- Final: $120.8K savings/engine
- 20 lbs. unit weight savings

Savings (Realized $K):

AA99	**$56,678**
AA00	**$114,495**
Difference	**$56,817**

	Projected	**Actual**
Lot 1	**$4,050**	**$3,781**

FTE 18 verification – P&W/Supplier initiative

Integrity - Service - Excellence

Thank you for this opportunity to provide you with an update on the F-22 program, and I look forward to your questions.