# Senate Hearings

*Before the Committee on Appropriations*

# Lightweight Fighter Aircraft Program

*Fiscal Year* 1976

94th CONGRESS, FIRST SESSION

# LIGHTWEIGHT FIGHTER AIRCRAFT PROGRAM

## HEARING

BEFORE A

## SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS UNITED STATES SENATE

NINETY-FOURTH CONGRESS

FIRST SESSION

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TUESDAY, MAY 6, 1975

U. S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
*Washington, D.C.*

The subcommittee met at 10:15 a.m. in room 1223, Everett McKinley Dirksen Office Building, Hon. John L. McClellan (chairman) presiding.

Present: Senators McClellan, Young, Hruska and Stevens.

## LIGHTWEIGHT FIGHTER AIRCRAFT PROGRAM

DEPARTMENT OF DEFENSE

### STATEMENT OF HON. MALCOLM R. CURRIE, DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

#### OVERVIEW STATEMENT

Chairman MCCLELLAN. The subcommittee will come to order, please.

Today we will hear testimony and explanation of current lightweight fighter aircraft programs within the Department of Defense.

The first witness will be Dr. Malcolm R. Currie, Director of Defense Research and Engineering, who will be followed by Lt. Gen. William J. Evans, Deputy Chief of Staff for Research and Development for the Air Force; and Vice Adm. W. D. Houser, Deputy Chief of Naval Operations for Air Warfare.

Very well; you may proceed, Dr. Currie.

Do you have a prepared statement?

Dr. CURRIE. Yes, sir; a brief overview statement.

#### STATUS OF LIGHTWEIGHT FIGHTER PROGRAMS

Mr. Chairman and members of the committee: It is my privilege to appear here with my colleagues from the Air Force and the Navy to summarize for the committee the status of the proposed lightweight fighter programs of the Defense Department.

These programs are central to our ability to maintain and enhance our tactical force structure and fighting power under the severe fiscal constraints which exist now and will continue into the future.

To satisfy the requirements for replacement of our aging F–4 fighter forces which begins in the early 1980's—and for which developments

must be initiated now—we felt that we must explore concepts which turn away from increasingly complex and costly top-of-the-line fighter aircraft as exemplified by the Navy F–14 and Air Force F–15 and seek less expensive complements to these capabilities. The new lightweight fighter programs are the result.

Using advanced technology originating in the highly successful Air Force YF–16 and YF–17 prototype competition, we have achieved designs which combine the attributes of low cost and extraordinary performance and which—when used with the more costly end of the mix—will attain our objective of much greater over-all force effectiveness for a given dollar investment.

I wish to stress that we are placing major emphasis in these programs on the attainment of new levels of reliability and low costs of ownership. These costs of maintenance and operations, over a 15- to 20-year life cycle, dominate in magnitude initial acquisition costs and it is here that great savings can be achieved and fighting readiness can be enhanced.

## AIR FORCE PROGRAM

In January of this year, the Air Force announced the selection of the General Dynamics YF–16 as their choice for a lightweight air combat fighter. This followed many months of flight test and evaluation of the prototypes.

During the subsequent DSARC process, the final detailed F–16 configuration was defined and rigorous reliability and maintainability criteria were established. The avionics development schedule was uncoupled from that of the aircraft. If the reliability goals for the full avionics system are not substantiated, F–16's with an austere avionics package will be produced.

A unit fly-away cost of $4.5 million was established—fiscal year 1975 dollars, 650 aircraft at a maximum rate 10 per month with learning to 15 per month.

## F–16

The F–16 program is a minimum risk and minimum overall cost program; it achieves important commonality with the F–15 through use of common turbofan Pratt and Whitney engine having excellent fuel consumption characteristics; it will bring in a remarkable new level of capability at acquisition and ownership costs that will permit us to arrest the decline in numbers of tactical aircraft.

Its foreign sales potential is substantial, as is indicated by the serious thought currently being given by the consortium of four European nations who consider the F–16 to be a leading candidate as a replacement for their aging F–104's.

## NAVY PROGRAM

Now I would like to address the Navy air combat fighter program and events leading to the selection of the McDonnell Douglas/Northrop design.

An objective of both the Defense Department and the Congress was to explore means of achieving the maximum practical level of commonality between the Navy and Air Force lightweight fighters. The

goal was reduced cost through reduced development costs, by common purchase from a larger production base and more common logistics support.

In accordance with this objective, industrial teams of LTV/General Dynamics and McDonnell Douglas/Northrop submitted Navy designs based on the YF–16 and YF–17 prototypes, respectively.

In January, it was evident that none of the modifications satisfied the Navy carrier compatibility requirements and that it would take additional months of effort to develop designs suitable to the Navy with the probable outcome still in doubt.

Furthermore, it was evident that the cost savings to the Air Force in going with their F–16 selection were such that, regardless of the eventual Navy selection, there would be no appreciable cost advantage to the Government by the Air Force adoption of the F–17 derivative in the event this was the Navy's choice.

This was supported by the Chairman of the OSD Cost Analysis Improvement Group—CAIG—and by the DSARC principles. The decision to proceed with the F–16 program was therefore taken.

In the intervening time, three derivatives of the YF–16 have been studied extensively by the Navy. None of these derivatives were found to be suitable for carrier operations. Two of the three designs involved very significant scaling as well as new engine developments in which most of the commonality with the F–16, and hence the cost benefits, were lost. The third design was inadequate from a performance viewpoint and was, therefore, not acceptable.

The Navy derivative of the YF–17 incorporates a modified version of the original General Electric J–101 turbojet engine in which the bypass ratio has been increased and the thrust increased by about 17 percent over the engine proposed for the Air Force evaluation.

TURBOFAN ENGINE F–404

The new turbofan engine is designated F404 and has improved fuel efficiency over the original design. The resulting aircraft will meet the safety and suitability requirements for carrier operations and meets or exceeds the stringent operation performance requirements. Although it builds directly on the YF–17 prototype, it is sufficiently different in terms of engines and structural details for carrier use that it has been given the new designation F–18.

NAVY F–18

During the months ahead, the final avionics configuration will be defined and test programs, schedule, reliability programs, and rigorous cost objectives will be established. This will lead to a DSARC review in late summer for approval of full-scale development of the Navy F–18 air combat fighter.

DEVELOPMENT OF NAVY F–18

Chairman McClellan. Do you think it can be ready by summer?

Dr. Currie. Yes, sir; and it will be in August.

Admiral Houser will, in a few minutes, go over that program and say what has to be done.

Chairman McCLELLAN. When did development begin on this F–17?

Dr. CURRIE. The YF–17 and the YF–16. The F–18 is a new designation for the Navy version of the YF–17.

Chairman McCLELLAN. When did you start developing the so-called Navy version?

Dr. CURRIE. It has only been so far on paper in the nature of a proposal. The individual details will be defined in the next several months before we make the decision to go ahead in full-scale engineering of the plan, itself.

Chairman McCLELLAN. When did we start making this proposal on paper?

Dr. CURRIE. It was about last October 1974.

Chairman McCLELLAN. That is what I am trying to determine. Then, before an effort was made to follow the instructions of the Congress—that is, to work with the Air Force to choose a plane useful for both services—you began designing an entirely new plane and a new engine; is that correct?

Dr. CURRIE. No, sir. At the time the Air Force was deciding between the F–16 and the F–17, both companies came forward with Navy versions of these designs so that they could be considered by the Navy at the same time the Air Force was considering their selection.

So, in January, the Air Force had before it a very complete proposal for both of these airplanes and it chose the F–16.

The Navy had before it proposals for Navy versions of both of these airplanes and in January it was felt to be far too premature to commit to either one of these designs because they were just not carrier suitable.

Chairman McCLELLAN. Then, if I understand correctly, the Navy had determined last October that neither of the designs submitted by the two competing companies for the F–16 and the F–17 were going to be satisfactory?

COMPANIES INVOLVED IN DEVELOPMENT

Dr. CURRIE. No, sir; that is the time when we issued a request for the companies to study the Navy version of the F–16 and YF–17.

Chairman McCLELLAN. What companies?

Dr. CURRIE. McDonnell Douglas/Northrop for the YF–17, and LTV/General Dynamics for the YF–16.

We asked them to come forward with another version.

Chairman McCLELLAN. How long did that take?

Dr. CURRIE. It was a crash effort and they came forward in January with designs—rather, in December—with designs, and by mid-January we knew that neither one of these designs were suitable for the Navy requirement.

Chairman McCLELLAN. You reached that decision in January?

Dr. CURRIE. Yes, sir.

Chairman McCLELLAN. You had determined then that a derivative from either plane, regardless of which one the Air Force selected, would not be suitable for the Navy missions?

Dr. CURRIE. That is correct.

At that time, it was evident that it would require several months more of fairly intensive work to really see if the designs could be made suitable. That is the work that has gone on in this interim time.

Chairman McClellan. When did you direct that a new plane be designed separate and apart from a derivative of the Air Force selection?

Dr. Currie. We did not direct that at any time.

The McDonnell Douglas/Northrop version of the YF–17 was studied and it was found to be suitable. They improved the engine in it. As a matter of fact, it is a superb design and we have just given it the definition F–18. It is not a new airplane.

ENGINE DEVELOPMENT

Chairman McClellan. What is new, just the engine? Certainly that is new.

Dr. Currie. It is scaled up slightly and has a modified engine.

To all outward appearances, its engine would be the same as the General Electric YJ–101 turbojet flown in the YF–17.

Chairman McClellan. It was the instruction of the Conferees in their report that every effort be made to build a plane for the Navy as a derivative from whatever plane was selected by the Air Force.

Dr. Currie. Yes, sir; absolutely correct.

Chairman McClellan. When did you determine that you would not or could not do this?

Dr. Currie. The Navy designs, the Navy derivatives of both of these airplanes are necessarily considerably different from the original Air Force prototype airplanes. We have found out that through this intensive study effort in the last six months or so.

NAVY CHOICE OF DERIVATIVE

The airplane that the Navy has chosen can very properly be regarded as a close derivative of the YF–17. It is a derivative.

Chairman McClellan. You would say it is a derivative of the 17?

Dr. Currie. Yes, sir; it is very close to the YF–17.

Chairman McClellan. It violates the instructions, then, only in that it is not a derivative of the plan selected by the Air Force?

Dr. Currie. Yes, sir; that is right.

Chairman McClellan. That is the only departure from the instructions?

Dr. Currie. It is a departure from the strict instructions.

As I mentioned, we have studied three separate derivatives of the Air Force selection, three Navy versions of the F–16; two of these three were considerably larger. They were geometrically scaled up. They had new engine developments.

One of the airplanes was very close to the Air Force F–16 but it was totally inadequate in performance. Everybody agreed to that. It did not have enough performance left, because when you add the weight you need to land on carriers, the engines simply didn't have enough power to give it the performance.

Chairman McClellan. Are you saying you found it impractical, then, to secure and develop a Navy plan as a derivative from the F–16?

Dr. Currie. Yes, sir.

We studied three of them and none of the three were adequate.

Chairman McClellan. None were adequate?

Dr. CURRIE. No, sir.

Chairman MCCLELLAN. The one that you are now seeking our approval on—is it still on paper?

Dr. CURRIE. It is a very close derivative of the YF–17 that has already flown. It is extremely close. If you stood back and looked at the airplane, you wouldn't notice any difference. We just changed an inch in dimension, the diameter of the engine; we changed the length a little but superficially it is exactly the same and based directly on the extensive test data accumulated by the Air Force in the last year or so.

Chairman MCCLELLAN. I am trying to understand this myself, as well as to get complete information for the record.

Would you say, then, that the Navy plane, the one that you are selecting, is a better plane than either of the others? Even though it is still only on paper?

Dr. CURRIE. Yes, sir; absolutely. That is based not only on the extensive flight test data but on the performance of the J–101 engine, on the extensive wind tunnel tests and a great deal of engineering that we have done in the Navy Department evaluating these designs.

This design is probably more solid at this point than any fighter aircraft that the Navy has built to date.

Chairman MCCLELLAN. All right. I'm sorry for the interruption. You may continue your statement.

PROGRAM COSTS

Dr. CURRIE. Mr. Chairman, I would like now to discuss more completely the question of cost on these programs. This is a major driving factor in our considerations and is of great importance to this committee.

In comparing costs of various alternatives, there often is considerable difficulty in insuring that we are making a true comparison based on the same ground rules. We have 15-year life cycle cost numbers, unit flyaway numbers, unit production numbers and various other ways of characterzing our costs—each appropriate for different comparisons.

For this discussion, I believe it is appropriate to simply focus on the total life cycle costs, from this day forward, of the various alternative approaches. It is not enough to try to minimize research and development costs alone. It is not enough to try to minimize procurement costs alone. What is important is the total cost of ownership of any major system over a good portion of its entire lifespan. Moreover, costs that have already been incurred are not pertinent in today's considerations.

When looked at on this basis, both the F–16 and F–18 proposed by the services must offer substantial cost savings in procurement and operation and maintenance to compete with the F–15's and F–14's currently in production since with the new aircraft we still have the research and development and production startup costs ahead of us.

We have made independent comparative cost analyses in OSD. Let me discuss two ways of looking at this comparison.

Mr. Chairman, these are investment strategies, if you will, based on the total cost of the Government over the life of these programs.

COST OF OPERATION

Chairman McClellan. Is the cost of operation included in that total cost?

Dr. Currie. Specifically, yes, sir; because the cost of operating, the fuel, the men it takes to repair the airplane, change the engines, these costs over a 15-year period are much larger than the initial research and development or even the acquisition costs.

We are trying in the Department of Defense to look at all of our systems on what it costs the Government in total over its lifespan and compare them on that basis.

Chairman McClellan. All right. You may proceed.

15-YEAR LIFE CYCLE COST

Dr. Currie. The first way, we can ask the question: How many aircraft do we need to buy before there is a crossover on the 15-year life cycle cost?

Chairman McClellan. What do you mean, "crossover"?

Dr. Currie. That is when you reach the break-even point.

How many F–16's, for example, do I need to buy before the total 15-year life cycle cost of these aircraft are equal to life cycle costs associated with buying and operating an equal number of F–15's?

The second way of making this comparison is to estimate the cost difference, over 15 years, of buying the planned number of aircraft. In these comparisons we have attempted to use the same ground rules between programs and to insure that the assumptions made are fair and rational.

If we look at the F–15 versus the F–16, the OSD estimate is that the crossover occurs between 100 and 200 aircraft. Thus, any number of aircraft purchased over 200 provides a clear life cycle cost advantage to the Air Force by buying F–16's.

If we look at the total cost of the projected 650 aircraft buy of the Air Force, it is estimated that the savings are about $3 billion out of approximately $12 billion 15-year costs. With this large saving, it is apparent that it would take a substantial change in our assumptions before the F–16 would not show a clear cost advantage over the F–15.

In considering the F–14 versus the F–18, that is, the two Navy planes, the CAIG calculates that the crossover point is at 200 to 250 aircraft. If we assume that the Navy will purchase 800 of these aircraft [as assumed in the source selection evaluation], a 15-year savings of better than $4 billion would be realized when compared to a comparable number of F–14's.

If one looks at only the F–4 fighter inventory requirements of approximately 600 aircraft, the 15-year-savings would be roughly $3 billion out of an approximately $12 billion total life cycle cost. It is possible that a later version of the F–18 may also replace the Navy's A–7 fleet in the late eighties.

Again the margin is sufficiently large that the conclusion that the F–18 will provide substantial savings over the continued buy of F–14's is unaffected by minor changes in the assumption or method of calculation.

In both the Air Force and the Navy programs, one can further modify these analyses by assuming stripped versions of the F–14 and F–15 having more austere avionics. However, with the substantial advantages that I have just indicated, there is no rational stripped package of avionics which brings the conclusion into question.

Mr. Chairman, there are two other very significant points to be made in the development of the F–16 and F–18.

One is the importance of having options in future defense planning.

### HIGH-LOW MIX APPROACH

One great benefit of the high-low mix approach is that, having both types of aircraft in production simultaneously provides us the opportunity to increase or decrease the production of either in proportion to changes in the emerging threat.

Second, we have found that there is nothing so effective in holding cost down as the existence of ongoing competition between manufacturers. Development of the F–16 and F–18 provides a stimulus to keep costs down on the F–14 and F–15. While the existence of the F–14 and F–15 assures that the costs of the F–16 and F–18 cannot increase very much. Moreover, both the F–16 and F–18 in some measure compete with one another—while also providing two important options for additional foreign sales.

To be able to achieve this level of competition in our fighter aircraft is a situation we have not had for over 20 years—and is now available with virtually no increase in the overall cost of ownership. This is an opportunity for the American business tradition to work by itself—I feel the payoff will be substantial.

### FOREIGN SALES IMPACT

Chairman McClellan. You just mentioned foreign sales.

What impact are possible foreign sales having on our decision?

Dr. Currie. None at all, Mr. Chairman.

The Navy program is predicated, it is costed out and it is planned for in the Defense Department independent of any foreign sales at all and all the cost savings that I have mentioned have nothing to do with selling one airplane overseas.

Nevertheless, there does exist a very large world market eventually for fighter airplanes in the general class of the F–16 and F–18, and I am just pointing out this will exist in the future.

### OVERSEAS PLANTS FOR AIRCRAFT PRODUCTION

Chairman McClellan. I have gotten a report that consideration is being given to building plants overseas to produce these planes, or substantial parts of them, in those countries that are prospective purchasers.

Dr. Currie. Yes, sir; a consortium of four nations, Denmark, Holland, Norway, and Belgium, are considering the F–16 as replacement for their F–104's. As part of this offer, an arrangement with them, a portion of the airplane would be built in their factories in these nations.

Chairman McClellan. We are not going to build any new factories over there?

Dr. CURRIE. These are factories which exist and will allow them to maintain some kind of viable industrial base.

That is the only basis on which they will participate and buy our airplanes.

Chairman MCCLELLAN. We are not building any factories over there?

Dr. CURRIE. To my knowledge, no.

Chairman MCCLELLAN. Are we investing in the remodeling or upgrading of theirs?

Dr. CURRIE. No, sir; that is a national investment on their part.

Chairman MCCLELLAN. There is nothing involved in here of that nature?

Dr. CURRIE. No, sir.

Chairman MCCLELLAN. Are we making any accommodations in the design or in the configuration of these planes, solely or primarily to induce or accommodate foreign markets?

Dr. CURRIE. None whatsoever, Mr. Chairman.

We have a minimum package of avionics on the F–16 and if the NATO consortium wants to add on additional complexity and additional capability, they will pay for it all.

Chairman MCCLELLAN. My position is that we should build a plane, develop it for our own purpose.

If somebody wants to buy it as is, and we are inclined to sell it, then I feel we may do so.

Dr. CURRIE. Yes, sir.

Chairman MCCLELLAN. I could not understand any concessions being made to attract potential foreign customers.

Dr. CURRIE. I assure you they are not, Mr. Chairman.

Chairman MCCLELLAN. I think our whole concern should be what we need, what is best for us, and that we get it. Then we can consider these other things.

Dr. CURRIE. These airplanes we are talking about this morning have been designed and predicated purely on that basis, how it will affect our force structure and our costs.

Chairman MCCLELLAN. All right. Please proceed.

### R. & D. RECOUPMENT

Dr. CURRIE. I would like to add to that, should overseas sales be made, we have a policy of R. & D. recoupment——

Chairman MCCLELLAN. What is that?

Dr. CURRIE. That means that in the sale price of these airplanes that we sell overseas, we recoup research and development costs which we have invested in these products.

Chairman MCCLELLAN. You recoup a proportionate share on each sale?

For instance, if we buy 300 planes and other countries buy a total of 300, they would be expected to pay half of the development costs?

Dr. CURRIE. Yes, sir; that is exactly what we are doing.

Senator HRUSKA. May I ask a question?

Chairman MCCLELLAN. Yes, sir; both of you, please feel free to ask questions, wherever you need to.

EFFECT ON BALANCE OF PAYMENTS OF OVERSEAS MANUFACTURE

Senator HRUSKA. The manufacturers of these planes and their plans for sales abroad, what effect would that have on the balance of payments for us here in this country?

Dr. CURRIE. They are vital—sharing the production at some level is vital to the sale to begin with and making this sale on balance creates a net inflow into this country. That is, the sale will create a favorable balance in our favor even though we have some production over there.

Senator HRUSKA. Not as large as if we produced them here in this country?

Dr. CURRIE. Yes, sir.

Senator HRUSKA. We don't have that option; we must do it there?

Dr. CURRIE. Yes, sir.

Senator HRUSKA. Part of that favorable impact on balance of payments would consist of that recoupment of research and development?

Dr. CURRIE. That is right; that is included in the costs of the airplanes.

Senator HRUSKA. Can that be determined as to range on the assumptions of a given volume?

Dr. CURRIE. Yes, sir; we have—I will submit the exact number for the record here—but we have spread the R. & D. development costs over our own Air Force buy over this consortium buy and over 200 or 300 extra airplanes that will be sold if the consortium makes the initial 350 aircraft purchase.

Senator HRUSKA. What does that involve, the F–16?

Dr. CURRIE. Yes; the F–16.

Senator HRUSKA. They are not interested in our Navy plane?

Dr. CURRIE. No; they need a land-based airplane of lesser cost and, as you will see in this hearing, the cost of the Navy airplane is slightly higher because of its need for carrier suitability and it is a slightly larger airplane.

Senator HRUSKA. Mr. Chairman, when that information is received, may it be incorporated in the record at this point so it will have some continuity?

Chairman MCCLELLAN. Very well. That may be done.

[The information follows:]

[Deleted.]

F–16 COST DISTRIBUTION BETWEEN CONUS AND NATO

Senator YOUNG. What percent of the cost of the F–18 will be spent in the United States and what percent in NATO countries?

Dr. CURRIE. In the F–16—we are talking about the F–16 now on this consortium purchase—10 percent of our aircraft, 10 percent will be constructed over there and 90 percent will be constructed here.

Senator YOUNG. That is on the F–16?

Dr. CURRIE. Yes, sir.

Senator YOUNG. That is the only one they are talking about buying now?

Dr. CURRIE. That is right.

Chairman MCCLELLAN. Are you using 90 percent in terms of dollars or in terms of the physical construction.

Dr. CURRIE. Ninety percent in total dollar amount.

Senator HRUSKA. Does that mean the missions of the factories abroad

in the consortium would be basically and essentially an assembly line?

Dr. CURRIE. Yes, sir; in the initial stages, and they will build very simple parts of the airplane. Eventually, as we get into the mid-1980's, sales will be made to third-party member nations, that is, to other allies elsewhere, and there they will build 10 percent of our aircraft for our Air Force.

AIRCRAFT CONSTRUCTION BREAKDOWN

For the aircraft that they purchase, they will build 40 percent of it and we will supply these breakdowns for the record.

[The information follows:]

The plan which we have outlined with the consortium calls for their building 10 percent of our aircraft; 40 percent of their own; and 15 percent of any sold to other buyers. If one goes through these numbers it becomes evident that the U.S. builds in this country about 145 additional aircraft (in work content) than the 650 we are building for our needs.

EFFECT OF CURRENT U.S. KNOW-HOW ON NATO FAMILY

Senator YOUNG. I suppose our latest technology is in this plane and, if a NATO country like Portugal, who might go Communist later, they would have the advantage of this technology.

Dr. CURRIE. We are carefully watching that, Senator Young.

Portugal isn't involved here. It is Norway, Denmark, Holland, and Belgium, and the key parts of our technology in the avionics area, in the jet engine area, will be time-phased so that they get that over in the 1970's. They pick up the simple technology in the early years.

But, in any case, we will be operating aircraft of our own in NATO and we will be able to accrue very large cost savings through having a common logistics support structure with these countries if we are all flying the same airplane.

So, in terms of standardization of NATO, we will make money.

Senator YOUNG. I am alarmed that we are giving or showing other countries our latest equipment. We have our latest planes in Iran.

Senator YOUNG. That is one of my problems. Maybe I should have

Dr. CURRIE. I share your concern and I think it bears close management.

Chairman MCCLELLAN. Don't you think that Russia will immediately acquire full knowledge of this plane once we begin selling it abroad?

Dr. CURRIE. I think they will be able to obtain superficial knowledge of it; that is, dimensions, materials, and so on.

What Russia will not gain is the deeper technological know-how and the manufacturing technology required to reproduce it.

Your point is a good one.

Eventually, technology that is brought into production in any stage, even in this country, eventually it diffuses; the rest of the world learns from it.

Chairman MCCLELLAN. I just think it gets to them a lot faster if we scatter something among our allies immediately after we develop it. There is more exposure of it to the Russians that way and they probably get it much quicker than if we retained it here.

Dr. CURRIE. The underlying reason for this is to strengthen these countries and get them to pick up more of the burden.

Chairman McClellan. There is an argument both ways; I understand that. The trouble is our ally of today may not be our ally tomorrow. That is the risk we have to take.

Senator Young. That is one of my problems. Maybe I should have more confidence in NATO.

Senator Hruska. If that consortium of four, or any one of them, should turn sour, Portugal might be doing so shortly, we would have the option of ceasing or desisting from further cooperation with them in further sales?

Dr. Currie. If they are no longer our allies and we no longer feel they support us, we always have that option.

Chairman McClellan. If they have the planes, though, we can't get them back.

Senator Young. We can't get some of our planes back from Thailand.

Senator Hruska. That know-how to which you referred, that would apply particularly to the [deleted].

Dr. Currie. Particularly to the [deleted].

These are the elements of technology that will be time phased such that they go over there last.

URGENCY OF AIRCRAFT REPLACEMENT IN 1980'S

Chairman McClellan. All right. You may proceed.

Dr. Currie. In summary, Mr. Chairman, I feel that we have been successful in meeting our management objectives and fulfilling our responsibilities to the Congress. The need for replacing the aging F–4 fighter force in both services will be urgent a few years from now in the 1980 period. This cannot be accomplished with the F–15 and F–14 designs without an unacceptable diminution of the size of our tactical air forces.

We have come forward with two superb aircraft based directly on prototype hardware demonstrations. Very importantly, both services agree that their operational requirements have been met and they enthusiastically support the programs. The goal of major cost savings both in acquisition and over a 15-year life will be met. An important new trend has been established in bringing to reality the high-low force mix concept.

As is well known, these programs have the full support of Secretary Schlesinger and Secretary Clements. For the F–18, this selection is a necessary initial step. We now proceed with the normal DSARC management process in scrubbing down the avionics and in establishing rigorous cost targets prior to initiating full-scale development this summer.

We ask for the full support of the committee for these programs.

Thank you very much.

STATUS OF F–18

Chairman McClellan. Let me ask you, what is the status of the F–18 with respect to decisions made or authority to proceed with it?

Dr. Currie. The winner of this competition, namely, McDonnell Douglas/Northrop, will be placed on a sustaining engineering contract of a few million dollars which is in the 1975 budget. This will enable us to work with them in the finalization of the details of the program, how much avionics should the airplane have, how complex should the radar be, what should the initial cost targets be.

That brings us to this summer when we have the DSARC with the Navy and at that time the Secretary will decide on proceeding with the full-scale development program.

We are asking in the fiscal year 1976 budget the sum of $110 million to initiate that program.

Chairman McCLELLAN. This is for the F–18?

Dr. CURRIE. Yes, sir.

Chairman McCLELLAN. We are going to have some problems. I don't know yet just what my position on it will finally be, but there is concern in some quarters.

Some competitors, I am sure, are unhappy in this matter, and that is why I would like to get a thorough and complete record to help us make a judgment that is equitable between them, and also make a judgment that will be in the best interests to serve our country.

VIOLATION OF CONFERENCE REPORT DIRECTIVE

Do you regard what has happened as a violation of the directive in the conference report?

Dr. CURRIE. The final outcome has not been in strict literal accordance with that report.

I feel, however, that it is fully in accord with the spirit of the report, the intents of Congress to get solutions which save money and which do satisfy the needs of the services.

Chairman McCLELLAN. How do you feel that it is not in keeping with the literal instructions?

Dr. CURRIE. The literal instruction was for the Navy to—let me read from the conference report.

Chairman McCLELLAN. Very well.

Dr. CURRIE. It says that: "The Conferees direct that the development of this aircraft make maximum use of the Air Force lightweight fighter and air combat fighter technology and hardware."

We have complied 100 percent with that directive.

Chairman McCLELLAN. In what way have you not complied with part of it?

Dr. CURRIE. In the final line, it says, "Future funding is contingent upon the capability of the Navy to produce a derivative of the selected Air Force combat fighter design."

We have found that we are not capable of producing a derivative of the selected Air Force combat fighter design, that is, the F–16.

As I mentioned, we have examined three derivative versions of the F–16, none of which have been judged adequate for carrier suitability, landing on carriers and performing the Navy mission.

Chairman McCLELLAN. Is it correct then that you undertook to live up to the directives of the conference report?

Dr. CURRIE. Yes, sir.

Chairman McCLELLAN. You were, however, unable to develop a satisfactory weapon under those instructions?

Dr. CURRIE. Under the literal instructions.

Chairman McCLELLAN. When you couldn't do that, then you went to other sources?

Dr. CURRIE. We were evaluating the other source simultaneously because, when this was written, we had no idea what the Air Force's

choice would be between the YF–16 and YF–17. So, we brought forth studies of Navy version of both of them.

ACCEPTANCE OF F–17 DERIVATIVE

Chairman McClellan. As I understand your statement, you are accepting what you regard as a derivative of the F–17?

Dr. Currie. It is a very close derivative of the F–17, and in that regard complies fully with the congressional report.

Chairman McClellan. Then you would say there is no noncompliance with the directive?

Dr. Currie. Only to the extent that we have been unable to finally produce a Navy version of the YF–16 which will meet the Navy requirements.

Chairman McClellan. You haven't produced it; you don't have the prototype?

Dr. Currie. We don't have the design.

Chairman McClellan. I thought you said you do have a design.

Dr. Currie. We have three designs, but none are acceptable.

Chairman McClellan. You could not accept any of the three designs?

Dr. Currie. No, sir; we have not accepted any of the three.

Chairman McClellan. What is the F–18 if it is not one of the designs; is it a derivative?

Dr. Currie. We have three derivative designs of the YF–16 and one derivative of the YF–17. So, we are considering four designs.

Chairman McClellan. So, the congressional directive was for you to get a derivative from the one accepted by the Air Force; is that correct?

Dr. Currie. Yes, sir.

Chairman McClellan. You were unable to do that.

Dr. Currie. That we have been unable to do after examining three designs.

Chairman McClellan. But you are able to develop a derivative from the F–17, one of the prototypes, that is satisfactory?

Dr. Currie. Exactly, sir.

Chairman McClellan. And you are now seeking congressional approval to begin producing it?

Dr. Currie. Exactly.

F–18 ENGINE

Chairman McClellan. Tell us more about the engine in the F–18.

Dr. Currie. It is a modification of the engine that was flown in the YF–17. Let me give you an idea of what that modification consists of.

It involves increasing the diameter of the engine nine-tenths of 1 inch and that allows the engine to suck more air through it and increase the thrust. It is this increase in thrust of the engine that has given the Navy version of the YF–17 its high performance.

Chairman McClellan. If that modification would give greater thrust and thus improve the Navy plane, why wouldn't that same engine be better in the Air Force plane?

Dr. Currie. The Air Force chose the F–16, which has a different engine. It is a single engine and it is much more powerful. It is the

same engine that the Air Force uses in their F–15 fighter. In the F–16, they have one of the same engines; there are two in the F–15.

Chairman McClellan. I am no expert in this field but I want to get thorough and accurate facts for the record, because I think this may develop into an issue.

Would you say that each contractor had equal opportunity to develop another engine, or to modify their prototype so as to be suitable for Navy usage.

Dr. Currie. Yes, sir; in the case of LTV and General Dynamics, they built three separate versions in the three separate versions of the F–16. One was the same engine as used by the Air Force; the second was a modified Air Force engine in which one builds a much larger fan on it. It gets more thrust. The other was a modification of the engine used in the B–1.

So, they proposed derivatives of the F–16 involving three separate engines.

The McDonnell Douglas/Northrop team proposed only one engine and that was the General Electric somewhat modified J–101 engine that had flown in the YF–17.

### DETERMINATION OF F–18 ENGINE AS NEW

Chairman McClellan. Can there be a legitimate question among experts in this field as to whether the engine in the F–18 would be regarded as a new engine, something different from the prospectus that you submitted to each?

Dr. Currie. You are referring to the original engine in the YF–17?

Chairman McClellan. Yes.

Dr. Currie. I have convened experts in the Defense Department, from the Navy and the Air Force, and from my own office, jet engine experts. Their evaluation is that this is a very reasonable modification of that engine. It is not a new engine. It involves most of the same components that existed in the original one. Furthermore, they have jointly concluded that the risk is very low in making this modification.

Chairman McClellan. What risk are you referring to?

Dr. Currie. The risk—any time when one designs anything, a new airplane or makes any changes at all, inherently there has to be some risk involved.

Chairman McClellan. You mean the ordinary modification of an engine doesn't incur much risk, does it?

Dr. Currie. That is correct, and that is what they judged in this case.

Chairman McClellan. They are saying the modifications submitted and processed here do not incur much risk of it not working?

Dr. Currie. Yes, sir; based on their detailed analysis.

Chairman McClellan. I think there is going to be some argument about that.

Senator Hruska. May I ask a question to that point?

Chairman McClellan. Yes, certainly.

### COMPARATIVE STUDIES ON 3 ENGINE DESIGNS

Senator Hruska. Have any comparative studies been made as to the three engine designs that were devised for this purpose by the other

team as compared with the low-risk features of the McDonnell Douglas/Northrop team?

Dr. CURRIE. Yes, sir, one engine we know about completely because that is the same as the Air Force engine; the second engine, the Navy has spent already in past years $350 million on the modification of the engine proposed by LTV/General Dynamics for their so-called model L–300. So we have extensive knowledge of that.

The third engine was a modification of the F–100 engine which fits in the B–1 and there was less study of that.

Given the performance of that engine as stated by General Electric, the aircraft was still inadequate for carrier operations.

Senator HRUSKA. Did those three designs involve a difference, a modification of an existing engine or take an existing engine?

Dr. CURRIE. They all involved modifications of existing engines.

Senator HRUSKA. You indicated the risk is low in the General Electric engine. What is the risk as to the modifications in the other three designs?

Dr. CURRIE. I think we would have accepted all of those as being very reasonable.

Senator HRUSKA. But they were not qualified to do the job for a carrier-based plane; is that the idea?

Dr. CURRIE. That is correct. Even with their stated thrust and performance characteristics, in the airplanes proposed, in the derivative airplanes of the F–16, they were inadequate for carrier landing.

When you come into a carrier, your approach speed has to be relatively low. It involves building larger wings, putting very complex lifting devices into these wings. It involves heavy structure in the rear end of the airplane and these airplanes had a tendency to come in tail heavy and bank. These were the considerations studied extensively in this evaluation.

Senator HRUSKA. So that when we speak of a modification of the General Electric engine, there are comparable modifications and alternatives which were made and which were found wanting?

Dr. CURRIE. Absolutely.

Senator YOUNG. What were the major reasons why the Navy couldn't use the F–16? Were the two engines a factor?

Dr. CURRIE. I can state from a Department of Defense point of view the Navy was totally unbiased versus one engine or two engines. Admiral Houser, I think, will corroborate that.

Admiral HOUSER. That is correct, sir.

Senator YOUNG. One engine could have served your purpose?

Admiral HOUSER. Yes, sir. We have operated single engine airplanes for a number of years very satisfactorily. We didn't put as a major consideration whether the plane had one or two engines but instead, whether it would have satisfactory performance in either of the configurations.

CARRIER NONSUITABILITY OF F–16

Senator YOUNG. What was the major reason for not selecting the F–16?

Admiral HOUSER. Really in performance, Mr. Young. It was a question of performance in certain models and carrier suitability in all models.

As Dr. Currie has stated, the carrier suitability characteristics were not acceptable to the Navy. They involved high risk and the other airplane did not.

Senator YOUNG. High risk; what do you mean?

Admiral HOUSER. High risk in some of the mechanisms that were used to try to make the airplane carrier suitable. The source selection board which looked at this problem extensively over the last 3 months in particular, and over the last 6 months, decided that the airplanes were not satisfactory for carrier operations in a repeated sense.

Senator YOUNG. Was landing operations a factor?

Admiral HOUSER. This had to do with operations aboard the carrier. They had other differences. As Dr. Currie said, one of the designs lost a great deal of performance because of weight of the structure needed for carrier operations. But the other airplanes were not similarly affected so it was principally on the carrier suitability.

Senator YOUNG. I have learned to respect the Navy's judgment. On the F–111 you didn't think it would work and it didn't, did it?

Admiral HOUSER. No.

Senator YOUNG. Do you find as much objection to the F–16 as you did to the F–111?

Admiral HOUSER. We may have someone aboard with experience. We have Admiral Lee, who was head of the Source Selection Council, under whose aegis the selection was made. I don't believe he was on there for the selection of the F–111. Maybe Mr. Linden could answer that.

Mr. LINDEN. I worked on it a number of years.

Admiral HOUSER. He is the only one with a direct tie.

Senator YOUNG. You thought in the beginning it would not be suitable for carrier purposes?

Mr. LINDEN. I would say the situation is comparable.

Senator YOUNG. Now to the F–16?

Mr. LINDEN. Yes, sir. It is not 1 for 1 but it is in the same category in my view.

Senator YOUNG. Some time during the hearing I would like to bring out more of the reasons why you think the F–16——

Admiral HOUSER. We have that in a briefing coming up shortly.

Dr. CURRIE. May I give a simple explanation? The F–16 is a land-based fighter for the Air Force, a superb fighter. When you make it suitable for carrier operations, you have to add several thousand pounds of structural weight so it becomes heavier. You have to add a great deal of wing area and complicated devices that fold in and out of the wings to give it its approach characteristics.

Senator YOUNG. And a stronger frame?

Dr. CURRIE. Yes, sir. And then it is too heavy for the same engine, the engine doesn't have enough thrust to give it the air combat performance. So you say, let's build a bigger engine.

We studied two designs with the bigger engines. When you do that you have scaled the whole airframe up; it is 10 percent or so larger. That is why the problem gets more and more complex when you depart from the original F–16.

So they did all these things and it was still inadequate. They could never catch up in their design with the increased weight and complexity.

ADAPTABILITY OF SAME PLANE FOR AIR FORCE/NAVY USE

Chairman McClellan. Would you say it is practical at all to try to build planes for the Navy and the Air Force from the same prototype. If I understand what you are saying, the Navy plane has to have a much stronger structure which makes it much heavier. So how can you use the structure in either? How could you have conceived the idea that either of these planes could be adapted to the Navy in the beginning?

Dr. Currie. We hoped to have derivatives in which the changes that were to be made were so minor that the airplanes could be virtually identical. This is not the case.

Chairman McClellan. I don't see how you could anticipate that it would be possible if the structure of the Navy plane has to be much stronger than that of the Air Force fighter? How could you have ever thought that you could get a derivative in the sense that you could take the Air Force fighter and make it a Navy plane?

Dr. Currie. I think, Mr. Chairman, the model that both the Congress and the Defense Department were using at that time was the case of the F–4. If you will recall the F–4 was developed as a Navy fighter airplane and then versions of it later on were stripped down, lightened a little bit and made suitable for Air Force use.

Chairman McClellan. Here you are starting with an Air Force plane which you have tried to buildup for Navy purposes?

Dr. Currie. That is correct.

Chairman McClellan. If what you now say is correct, I don't know why you ever thought that you could have a real derivative from the F–16 fighter and make a Navy plane out of it.

What do you say about that, Admiral?

Admiral Houser. That was our belief and we were instructed by the Congress to look at the prototypes.

Chairman McClellan. Then you always wanted a different plane?

Admiral Houser. We wanted a plane that would do our job and it was very difficult to get these planes to do the job. As Dr. Currie mentioned earlier, in the first evaluations completed in January, none of the candidates met the Navy requirements. Subsequently, with a great deal of work by both contractors, the one design did come in to meet the requirements.

NEW SYSTEMS DEVELOPMENT VERSUS AIR FORCE E–16 DERIVATIVE

Chairman McClellan. I want to ask one thing. Both these contractors were definitely in competition and had equal opportunities to present you with something that you would accept?

Admiral Houser. I would say unequivocally and will ask Admiral Lee, who was head of the Source Selection Advisory Council and is now head of our Naval Air Systems Command to corroborate that.

Admiral Lee. Yes, sir.

Chairman McClellan. It seems to me that this may become an issue, whether this engine might be regarded as a new, separate development. The only breach would be that you don't have a derivative of the plane selected by the Air Force?

Admiral Houser. That is correct, sir.

Chairman McCLELLAN. Do you feel the F–18 is the best fighter attack weapons system which you could obtain?

Admiral HOUSER. I do, sir.

Chairman McCLELLAN. As I ask these questions now, I am addressing them to any of the three of you. Whoever wants may answer them, but I am anxious to get accurate facts in the record.

What is the answer to that question?

Admiral HOUSER. We would never know the answer without a full-scale competition between all the competing firms, Mr. Chairman. To the best of our knowledge for the moneys that have been estimated for the program, we do not think that we could get a significantly better airplane than the F–18.

EFFECT OF COMMONALITY REQUIREMENTS ON DESIGN IMPROVEMENTS

Chairman McCLELLAN. Do you believe that the industry could design a better fighter attack aircraft if not constrained by commonality requirements? You still have some commonality requirements in this F–18 since it is a derivative of the F–17.

Admiral HOUSER. We don't know. As I said earlier, until a full-scale competition has been run we believe we would not get an appreciably better airplane.

Chairman McCLELLAN. You believe you would not get an appreciably better airplane?

Admiral HOUSER. I would like to ask Admiral Lee, head of the Source Selection Advisory Council, to respond. He deals with these contractors daily.

Chairman McCLELLAN. All right. Admiral Lee, you may respond further.

Admiral LEE. Mr. Chairman, we have discussed that and debated it within the Naval Air Systems Command over the last 2 or 3 months. Your question was whether we could get a better design if we competed throughout industry instead of picking a prototype.

Chairman McCLELLAN. In other words, if we started all over, industrywide, with no commonality requirements.

Admiral LEE. We agree with Admiral Houser's answer. We don't think we could get an appreciably better design by competing throughout industry. We think the F–18, a derivative of the F–17, will be a very fine carrier airplane. It would be very difficult for other members of the industry to appreciably better that design.

Chairman McCLELLAN. Is the fusilage and so forth, the structure of the plane, the F–18, a derivative from the F–17?

Admiral LEE. Yes, sir.

Chairman McCLELLAN. You say it is?

Admiral LEE. Yes, sir; is is a derivative of the F–17.

F–404 GENERAL ELECTRIC ENGINE

Chairman McCLELLAN. Was the F–404, General Electric engine listed as a candidate engine in the request for proposals for the Navy air combat fighter?

Admiral LEE. Mr. Chairman, the request for proposals did not list candidate classes of engines as Government furnished equipment. The

covering letter for the RFP required the use of the prototype engine in at least one derivation. The J–101 and F–404 are basically the same engine.

Chairman McCLELLAN. It is sufficiently different to have a new name and a new number, as if it is a separate and distinct engine?

Admiral LEE. Now it is a turbofan engine. Normally, the designation——

Chairman McCLELLAN. What was it before?

Admiral LEE. The J–101.

Chairman McCLELLAN. What is the difference?

Admiral LEE. The J–101 means it is a turbojet engine. When you put an "F" in front it means it is a turbofan engine. It has a fan in front.

Chairman McCLELLAN. Is there a substantial difference in them?

Admiral LEE. Not a substantial difference. They made a change in the fan, increased the diameter by about nine-tenths of an inch, as Dr. Currie described. They increased the bypass ratio from 0.2 to 0.32, and made some other improvements in the afterbody of the engine, in the afterburner section.

Basically, it is the same engine, same components.

Chairman McCLELLAN. Would you say this engine now comes within the guidelines of the proposal submitted to all builders?

Admiral LEE. Yes, sir. In our opinion, it does.

Chairman McCLELLAN. There will be some differences of opinion on that.

Admiral LEE. I would like to point out that the competitor, namely, the LTV/General Dynamics firm, submitted three different engines.

Chairman McCLELLAN. Were they within the guidelines of the proposals?

Admiral LEE. In our opinion, they were.

Chairman McCLELLAN. All of them were?

Admiral LEE. Yes, sir.

Chairman McCLELLAN. You are saying that this one is also within those guidelines?

Admiral LEE. In our opinion it is. We didn't mark down any of the proposals because of engine modifications that were submitted. It is normal to modify an engine to fit an airframe.

Senator HRUSKA. May I ask a question at that point?

Chairman McCLELLAN. Certainly.

### ENGINE/AIRFRAME SUITABILITY

Senator HRUSKA. If they were within the guidelines, why were they not chosen, those three?

Admiral LEE. The engines, as Dr. Currie described earlier, were acceptable to us, that is, the engines in all three derivatives of the F–16. We assessed the risks of the modifications in the development of those engines as we assessed the risks of the J–101, the F–404, as it is now called. The winner was not chosen because of the engines specifically but, because of the performance of the engine and airframe combination. The other combinations were not suitable to the Navy.

Senator HRUSKA. They were within the guidelines but didn't satisfy the requirements of the plan for carrier use?

Admiral LEE. That is correct and they were also deficient in other areas of performance.

Chairman MCCLELLAN. Was this F–404–GE–400 engine included in the original McDonnell Douglas Navy air combat fighter proposal?

Admiral LEE. No; it was not. It was called the J–101 in the original proposal.

Chairman MCCLELLAN. Was this engine given a complete technical and financial evaluation by the Navy Selection Board?

Admiral LEE. Yes, sir; it was.

Chairman MCCLELLAN. When?

Admiral LEE. After it was submitted.

From the 4th of February up until very recently, we have examined and reexamined this engine and this engine proposal. As a matter of fact, Dr. Currie asked his engine man to come look at it, as he mentioned to you earlier.

Chairman MCCLELLAN. There is another factor in that you don't know what the cost is. You have only an estimated cost, is that right?

Admiral LEE. Yes, sir; it is an estimated cost.

Chairman MCCLELLAN. Is the Navy confident that the research and development estimate, the dollar figure of this engine, is reliable?

Admiral LEE. Yes, sir; to the best of our costing ability, and we have our costing man here today, who has been in the costing business for many years.

Chairman MCCLELLAN. It would be most unusual if you produced this one, or any other, on the base estimate. I don't recall it being done very often. So, you just say they are all reliable and take them generally?

Admiral LEE. Yes, sir. We do the best we can in costing but it is a very difficult area.

Chairman MCCLELLAN. I know it is difficult. I have seen some of them even double and triple.

COMMONALITY OF F–16/F–18

Would you say that the F–18 falls within the commonality guidelines of the Navy air combat fighter request for proposals?

Admiral LEE. The F–18 is not common with the Air Force selected F–16.

Chairman MCCLELLAN. You say it does not fall within the commonality of these guidelines?

Admiral LEE. It does not fall within the strict interpretation of that last sentence in the Conference Report.

Chairman MCCLELLAN. Would you say it is a directed procurement of an aircraft that does not meet the original guidelines?

Admiral LEE. No, sir; I wouldn't say it is a directed procurement of an aircraft which doesn't meet the guidelines.

We were instructed to look at derivatives of the F–16 and the F–17, two aircraft in the Air Force prototype program. We followed those instructions very carefully. We looked at three derivatives of the F–16 and found none would suit our requirements; none were suitable. We looked at one derivative of the F–17 and after much careful study of this proposal, we found it meets the requirements and we think it will make a very satisfactory carrier airplane.

Chairman McCLELLAN. You do regard this as a derivative of the F–17?

Admiral LEE. It is a derivative of the F–17.

Chairman McCLELLAN. Admiral, did you want to say something?

Admiral HOUSER. I will defer and wait for another question.

ENGINE COMBINATIONS SUBMITTED BY LTV/GENERAL AND M'DONNELL DOUGLAS/NORTHROP

Chairman McCLELLAN. How many airplane engine combinations did the McDonnell Douglas and LTV submit in response to the Navy's air combat fighter request for proposals?

Admiral LEE. I will take the F–16 derivative first, LTV/General Dynamics.

Chairman McCLELLAN. How many?

Admiral LEE. Three airplane/engine combinations were submitted to LTV/General Dynamics.

From McDonnell Douglas/Northrop, for the F–17 derivative, one airframe. Their first proposal contained a different version of the J–101 engine so they really submitted two combinations, one airframe, but two different engine modifications.

Chairman McCLELLAN. One airframe and two different engines for it?

Admiral LEE. Yes, sir; two different modifications of a basic engine.

Chairman McCLELLAN. Did any of their proposals or submissions ignore the commonality guidelines?

Admiral LEE. No, sir.

Chairman McCLELLAN. And you say you don't think the F–18 ignores any of them?

Admiral LEE. No, sir, not in terms of the contractor following his commonality guidelines of making it as common as possible with the F–17 prototope. We think he was very faithful in trying to do that.

Chairman McCLELLAN. Can you tell us how the F–18 and the LTV airplane compare financially?

Admiral LEE. We have some information in the briefing. A technical briefing will be given here shortly.

Chairman McCLELLAN. When you reach that point in the briefing, would you specifically make reference to this question and answer it.

Admiral LEE. I will make reference to this question and answer it during the course of the briefing.

Chairman McCLELLAN. All right.

Is it correct that the Air Force showed roughly $1.3 billion in savings in the estimated life cycle operating costs of the F–16 over the F–17?

General EVANS. Yes, sir, that is correct. It is a 15-year life cycle cost.

Chairman McCLELLAN. Has the Navy projected life cycle cost for all the Navy air combat fighter proposals? If so, how do they compare?

Admiral HOUSER. We have not projected them for a comparison between the F–16 and F–17, but in various mixes of airplanes, as a question from you suggested, Mr. Chairman, and when the programs all

get finished and the airplanes are procured, we project savings of about $1.5 billion a year over the previous mixes.

RATING OF F–18

Chairman McCLELLAN. Would you say that the F–18 can be rated superior to all other air combat fighter responses in performance and mix effectiveness both as a fighter and as an attack airplane, that is, in comparison to the other models or other proposals that were submitted?

Admiral LEE. Yes, sir.

Chairman McCLELLAN. You maintain that is true?

Admiral LEE. Yes, sir.

Dr. CURRIE. And I testify to that from the Department of Defense viewpoint.

Chairman McCLELLAN. You verify that, Doctor?

Dr. CURRIE. Yes, sir.

Chairman McCLELLAN. Is the F–18 the most cost-effective of all the aircraft you evaluated?

Admiral HOUSER. It is the only one that was suitable in the evaluation.

Chairman McCLELLAN. What do you mean, the others were not suitable?

Admiral HOUSER. They were not suitable because of their characteristics for operations from the carrier or from other performance.

Chairman McCLELLAN. Will you explain those characteristics?

Admiral HOUSER. Yes, sir, that will be coming in the briefing.

Chairman McCLELLAN. Be sure you do.

Senator YOUNG. Why this new F–18 rather than the F–14? Is it a better plane than the F–14? Does it serve a better purpose?

Admiral HOUSER. It is a lower cost complement to the F–14. We were directed by the Congress to look for a lower cost complement to the F–14. The competition was done on that basis and the F–18 was selected.

Senator YOUNG. Will the F–18 do as good a job in every respect as the F–14?

Admiral HOUSER. Not in every respect. It has some superior attributes and some inferior aspects.

I will cover that in my presentation.

Dr. CURRIE. Senator Young, if I could amplify that, in a rough kind of way, the cost of the F–18 will be about half the cost of the F–14.

Chairman McCLELLAN. That is the original cost per unit?

Dr. CURRIE. Yes.

Admiral HOUSER. The recurring cost per unit, it will cost about half as much. It will take some time to amortize the initial investment.

In operating costs, we expect the F–18 will be between 60 and 65 percent of the cost of the operation of the F–14. That is where the savings are expected.

Chairman McCLELLAN. Will the F–18 carry the Phoenix missiles?

Admiral HOUSER. No.

Dr. CURRIE. The F–14 carries the Phoenix but is also much more expensive.

Chairman MCCLELLAN. We will still maintain the F–14?

Admiral HOUSER. Yes, sir.

LTV 1602 AIRCRAFT

Chairman MCCLELLAN. Was the LTV 1602 airplane with the same engine as the B–1 considered comparable to the F–18 in performance and operational requirements?

Admiral LEE. It was considered comparable except in two or three areas.

Chairman MCCLELLAN. What are those areas?

Admiral LEE. Well, we have a performance assessment versus requirements for all of these airplanes as a result of our source selection.

The 1602 was the third version of the LTV design submittals. They submitted three design proposals. We had a requirement for a maximum mach number, maximum speed with intermediate thrust only, without afterburner of [deleted] for that particular airplane, they gave us [deleted] mach number. We asked for a combat ceiling of [deleted] feet; we hoped for [deleted] we computed that that design would only give us [deleted].

Our requirement for specific excess energy, QPs, was [deleted] feet per second minimum and that design was computed to only give [deleted].

CARRIER SUITABILITY OF AIRCRAFT

A more important area was the carrier suitability of this airplane. This might be a good time to talk about it since the question has come up so many times.

As you know, an airplane, to be successfully operated from an aircraft carrier has to be very precisely designed. This particular airplane, the 1602 and the other F–16 derivatives, in order to get down to slow speeds, used very complex and sophisticated high-lift devices, such as leading edge flaps with a combined Krueger flap in front of that, trailing edge flaps with boundary layer control. This gave them a maximum coefficient of lift at about 28° angle of attack. That is, maximum lift is attained with an angle of attack of 28°.

It turned out in this design that they couldn't use all that lift, that we would have paid a lot of money to obtain because if that airplane had come in at a higher angle of attack than about 20°—angle of attack is the altitude of the plane relative to its flight path—if they had allowed us in the design to use more than about 20° on touchdown or landing on the carrier, the tail of this airplane would have bumped the deck, a very undesirable characteristic, as you can understand.

So, in this particular control system, LTV designed in what they called an angle of attack limiter, allowing the use of no more than 20° of angle of attack in the approach. We have had no experience with that type of control system.

That, combined with the complex high-lift system and the fact it had no mechanical backup to the fly-by-wire control system, we felt

this airplane was a very high risk for carrier work, for carrier suitability, and we rated it unacceptable on those grounds.

Chairman McCLELLAN. How does that compare with the F–18?

Admiral LEE. We rated the F–18's carrier suitability as marginal, because the minimum usable approach speed exceeded our requirement.

Chairman McCLELLAN. Those are general terms. I want to know about the things where you downgrade.

Admiral LEE. I had started to talk about the same characteristics in the F–18.

In the F–18 design more conventional high-lift devices were used, a simple drooped leading edge, simple flaps, no boundary layer control and, more importantly, the control system did not limit the angle of attack for approach. There was no limitation; we could use the full range inherent in the design slow speed range of the airplane and still not have a tail-bumping problem.

It was more or less a conventional design for carrier use. As you can understand, our people such as Mr. J. Linden, sitting on my right, who heads our technical evaluation group, have had years of experience in looking at designs and trying to work with the various designers in order to come up with a satisfactory, suitable plane for carrier operations.

The F–18, for reasons I have just described, its slow-speed characteristics, conventional high-lift system, conventional control system, no angle of attack restrictions throughout the entire range, and no tail-bumping problem. For all of these reasons we think the F–18 would make a very successful airplane.

For those very same reasons, I should say for the deficiencies in these areas we think the LTV designs were very high risk. We wouldn't like to go into a design of that risk without building a prototype and thoroughly testing it aboard aircraft carriers. Otherwise we might have something we would not be happy with.

### CARRIER STABILITY OF LTV'S AND MACAIR'S

In order to further clarify this discussion, I will provide for the record a more detailed discussion regarding the carrier suitability of the competing designs, both LTV's and MACAIR's.

[The information follows:]

### CARRIER SUITABILITY OF NACF DESIGNS

#### GENERAL COMMENTS

The conversion of any land based airplane design to a naval carrier based design is a far more difficult task than is imagined by those who are not familiar with the design constraints imposed by the carrier environment. In most cases, substantial redesign is necessary to provide a modified wing with additional lift, wing folding, arresting and catapulting provisions, a substantial increase in landing gear strength, modified fuselage structure for catapult and arresting loads, and a tail redesign for stability purposes. In developing a naval air combat fighter from the Air Force's light weight fighter prototypes, the task was even more formidable than usual, due to the fact that the prototypes now flying were developed primarily as technology demonstrators rather than as combat vehicles. The

growth step from a technology prototype to a land based air combat fighter, however, was not too great and was apparently accomplished without undue difficulty by the Air Force and the manufacturers concerned.

In trying to meet the goals that a Navy version be derived from the selected Air Force design, a much larger growth step was required. This proved to be an impossible task except by major redesign, including greater wing area, more fuel, larger engines, and improved high lift devices in addition to the usual carrier based design modifications. The overall design job was fully as demanding as any faced by designers of naval aircraft in recent years. In the final analysis, the McDonnell/Northrop design team provided a solution which the Navy found acceptable while the design offered by the Vought/General Dynamics team were found to be high risk for initiation of full scale development.

SPECIFIC COMMENTS

The MACAIR model 267 is considered to be more carrier suitable than the LTV/GD models 1600, 1601, or 1602. It was rated marginal in carrier suitability because the estimated minimum useable approach speed of [deleted] knots exceeded the required speed by [deleted] knots. Also, wind-over-deck for arrestment is estimated to be 12 knots as compared to the zero knots requirement. This is due in part to airplane strength limitations which prevent use of maximum arresting gear capacity. Other carrier suitability characteristics were judged to be acceptable.

The LTV/GD designs were all judged to be of high risk in the total sense and therefore unacceptable in carrier suitability. Although no one item is disqualifying in itself, the combination of all of the items which affect carrier suitability is such that these designs were rated as unacceptable. The high lift system is complex and includes modifications from the F–16 by increasing aileron droop from 20° to 50°, adding aileron boundary layer control, and adding a full span Kreuger flap to the leading edge flap. While wind tunnel tests demonstrated maximum lift coefficients in excess of 2.0, this is some 10% higher than our experience has indicated to be state-of-the-art. Compared to state-of-the-art and in terms of complexity of design, the LTV/GD design is of higher risk.

Another high risk area in the LTV/GD designs is the use of an angle-of-attack limiter to restrict angle-of-attack in the landing configuration to 20°, whereas maximum lift is obtained at 28°. This device permits the pilot to use only 50% (models 1600 and 1601) or 57% (model 1602) of the available lift or load factor. The purpose of the limiter is to restrict angle of attack such that the airplane aft fuselage will not contact the deck during carrier arrestment and to prevent landing gear failure during a free flight engagement. We have never used such a device on landing of a carrier based airplane and therefore have no flight experience with such a device incorporated in a Navy operational aircraft. From our viewpoint it is not prudent to incorporate an exotic high lift system, such as used in the LTV/GD designs, and then limit the attainment of this lift or useable load factor. Because of lack of experience and limiting of available load factor the use of the limiter is considered to be a high risk item. Prior to commitment of a design to a program of the funding level envisioned for the NACF, we would strongly feel that the limiter be prototyped and tested on an airplane to gain experience in the carrier environment. The limiter presents an unknown risk in the critical carrier landing characteristics.

The particular application of the limiter in the LTV/GD designs was largely a result of constraints dictated by the baseline F–16 airplane. A specific concern is the lack of flexibility of departure from the 20° angle-of-attack limit. At a higher angle-of-attack, tail interference, nose landing gear strength, and visibility problems would be encountered. At a lower angle-of-attack a higher approach speed would result due to less than the required load factor being available. Thus the design is pretty well "boxed-in" to 20°.

Another factor in carrier suitability is the space required for engine removal. The MCAIR 267 engines are removed from the side which permits the engines to be changed within the length of the aircraft. The LTV/GD designs are such that the engine is removed aft, requiring in excess of 12 feet in addition to the length of the airplane.

The LTV/GD designs use a hydrazine fueled Emergency Power Unit which requires special shipboard handling and storage facilities for safety reasons.

The MCAIR Power Unit uses standard JP–5 jet fuel for which handling and stowage facilities are available.

Spotting factor of the MCAIR 267 is 1.17. However, by rotating the horizontal tail [D] nose down, the spot can be reduced to 1.02. The LTV/GD designs spot at 1.20 for the 1600 and 1602 and 1.11 for the 1601.

PROTOTYPES FOR F–18

Chairman McClellan. Are you going to accept the F–18 and obligate the Government to procure it without having a prototype?

Admiral Lee. In the F–18, Mr. Chairman, we have two prototypes now. They are called the F–17, and then in our proposed research and development program we would build 11 research and development aircraft. Two or three of these aircraft would be devoted to carrier suitability and we would determine carrier suitability by experiment, by landings aboard carriers and by arrested landings and catapult shots at our Patuxent River Test Center. We would test this for suitability prior to the time of going into production.

As Dr. Currie says, we have a paper design, but in prior designs, every craft developed for the Navy started out as paper designs. Our engineers evaluate this and come to conclusions as to whether or not this airplane, the proposed paper design, would make a successful carrier craft.

That is what we have done in this case.

Chairman McClellan. Now, on the F–16 procured by the Air Force, do they have a prototype which has been flown and tested?

Admiral Lee. Yes, sir.

Chairman McClellan. Before they begin procuring?

Admiral Lee. Yes, sir.

Chairman McClellan. And they have satisfied themselves about its performance and capability?

Admiral Lee. Yes, sir.

Chairman McClellan. Do you have a prototype of the F–18 that has been flown and tested? Or is it your proposal to select the F–18 without a prototype, to select it on paper?

Is the Navy selecting the F–18 on the basis of paper design and proposal?

Admiral Lee. The two F–17 aircraft which the Air Force had Northrup build for them, we would consider as prototype aircraft for the F–18.

The F–18 aircraft has certainly followed very faithfully most of the design in the F–17. In the best sense of the word, the F–18 is a derivative of the F–17 and we plan to use those two aircraft in our development program.

Chairman McClellan. Do you think it is far enough advanced in development or in design, to make a procurement decision? Do you think it is that reliable?

Admiral Lee. Yes, sir; I think at this particular stage of the program, the development, we know more about this plane than any other new Navy plane in a comparable stage. The F–14 and S–3 and all the other Navy planes we developed, we didn't have a prototype. We consider these two, the F–17 aircraft and the work that has gone on

there in the last 3½ years, plus the flight testing, as a marvelous data base for us in developing the F–18.

ENGINE PROBLEMS

Chairman McClellan. Haven't we had experience in the past of selecting a plane based on a paper design, then having a lot of trouble with the engine?

Admiral Lee. Yes, sir; we have.

Chairman McClellan. Are we going to repeat that experience in this instance?

Admiral Lee. We hope not, Mr. Chairman.

Chairman McClellan. Well, you hope not. You didn't hope to in the first instance; you hope not in every instance.

Now, are we gambling on this thing—are we again taking a risk on the possibility that a suitable engine may not be developed?

Admiral Lee. Mr. Chairman, we have had our engine experts in the Naval Air Systems Command and in the Air Force and, as Dr. Currie said, his own engine experts look at this engine.

We think that the modifications——

Chairman McClellan. But you are looking at it on paper, aren't you?

Admiral Lee. This J–101 engine has been operating for something upwards of a year. It is the engine which is in the F–17, the J–101 engine.

Chairman McClellan. What is this engine going to be called? It is going to be given a different number and different name.

Admiral Lee. It is being given a different name; it is called the F–404.

DESIGNATING PLANES AND ENGINES BY NAME AND NUMBER

Chairman McClellan. Tell me how you arrive at these names, the numbers, and so forth. How do you name a plane or an engine?

Admiral Lee. May I provide that for the record, Mr. Chairman.

Chairman McClellan. It would be helpful to me right at the moment.

What I am trying to find out is, if the engine for the F–18 is only a modified version of the engine in the F–17—and modified only to the extent that you are confident that there is no risk involved in accepting the changes—why must it have a new name and number?

When you have an engine that you are constantly improving, you don't give it a new name and number. So why, if you don't consider the changes on this engine to be major changes, must it receive a new name and number?

Admiral Lee. The terminology used for years for turbojet engines was a "J" number, such as the J–57, J–70, and J–101, the General Electric engine developed for the F–17. It is a turbojet.

Now, to distinguish between turbojets and fanjet engines, the fanjet engines were given an "F" number, such as F–101 for the B–1 and in this particular case the F–404 for the F–18 and so forth.

So, the turbojet engines are given a "J" number and normally it is in a sequence of numbers such as the J–79 and the next in that development cycle would have been the J–80, and so forth.

Your question of why was the J–101 given a different number. It was given a different number because the original engine, the J–101, had a very small bypass ratio, that is, the amount of air the fan pumps by on the outside of the engine casing.

The bypass ratio was about 0.20. General Electric proposed in their modification of this engine that the bypass ratio be increased from 0.2 to 0.32, which means that 0.3 of the total air passing through that engine goes on the outside of the compressor casing.

In doing this they decided that it would be proper to call it a fanjet engine now rather than a turbojet engine, so they took the next number they would have normally used and called it an F–404. But the engine is still basically the J–101 engine with a new fan on the front.

ENLARGEMENT OF FAN ENGINE AIR INTAKE

Chairman McCLELLAN. One of the major improvements in the new design is an enlargement of the air intake in the plane?

Admiral LEE. Let me describe briefly the changes.

Chairman McCLELLAN. I am asking a question. What did you call the part that takes in the air?

Admiral LEE. The fan.

Chairman McCLELLAN. It didn't have a fan and you are putting a fan on it?

Admiral LEE. It had a smaller fan on the air intake.

Chairman McCLELLAN. What are you enlarging to increase the air intake?

Admiral LEE. The inlet duct.

Chairman McCLELLAN. So then, Admiral, would you say that the two major changes distinguishing the F–18 from the F–17 are the enlargement of the inlet duct and the addition of a larger fan?

Admiral LEE. The inlet duct would, of course, be sized to match the fan, but the big change was the fan. That allowed us to get more thrust out of the engine. There were two other changes in the engine of some magnitude.

Chairman McCLELLAN. Two other changes beside the one we are discussing now?

Admiral LEE. The inlet duct, we would consider a minor change.

Chairman McCLELLAN. It is just an enlargement?

Admiral LEE. They are enlarging the inlet duct.

Chairman McCLELLAN. How about enlarging the fan?

Admiral LEE. I don't know that a major change is the proper description, we think it is a modest change.

Chairman McCLELLAN. All right, that is a modest change. What are the major changes? We have been talking about these, but you have not mentioned the major changes.

Admiral LEE. We don't think there are really any major changes. We think the changes proposed are very reasonable, at least our engine people do.

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Chairman McClellan. These are the two principal changes?
Admiral Lee. There are two other changes that are important.
Chairman McClellan. More important?
Admiral Lee. No, equally important.
Chairman McClellan. Could you describe them?

REDESIGN OF AFTERBURNER

Admiral Lee. The afterburner section of this engine, you know, the afterburner section is where fuel is injected in the aft part of the engine and you get thrust augmentation after the bulk of the fuel passes through the core of the engine. The afterburner part of the engine was increased in diameter by 2.2 inches. The nozzle, the throat-to-exit ratio was changed. Also it was programed to the mach number of the aircraft.

Chairman McClellan. To what?

Admiral Lee. The nozzle for the afterburner section is programed to open and close as a function of airspeed.

Chairman McClellan. That isn't on the J–101?

Admiral Lee. The big change was the nozzle area ratio. The area of the nozzle exit to the area of the nozzle throat in the original J–101 engine, that ratio was about 1.4, and in the new one the ratio is about 1.6.

Chairman McClellan. What is the other one?

IMPROVEMENT OF COMPONENT EFFICIENCIES

Admiral Lee. We plan to improve component efficiences. Improve various sections of the engine, make them more efficient as they go into production, but these are minor changes.

The third major change would be the——

Chairman McClellan. Principal change, if you don't want to use major.

Admiral Lee. The third principal change would be increasing turbine inlet temperature by about 50 degrees.

Chairman McClellan. That is four principal changes you have described.

Admiral Lee. If you consider the inlet duct a principal change, that would be four.

Chairman McClellan. Are there any other changes that you wouldn't regard as principal or major?

Admiral Lee. I think there are other minor changes in it, Mr. Chairman, but none as important as those four.

Chairman McClellan. These are the most important changes?

Admiral Lee. Yes, sir.

Chairman McClellan. After this testimony I want to ask you again—would you say these changes made it a different engine or merely an improved version of an existing engine?

Admiral Lee. I would call it an improved engine or improvement on an existing engine.

Chairman McClellan. You don't consider it a new engine even though it has a new name and new number?

Admiral LEE. Yes, sir. I do not consider it a new engine.
Senator YOUNG. Mr. Chairman, may I ask a question?
Chairman MCCLELLAN. Certainly, Senator.

PROTOTYPE AIRCRAFT

Senator YOUNG. I would like to ask a question for clarification. You spoke, as I recall, of 2 prototype F–17's and then you also spoke of 11 F–18's. As I recall, two or three would be for prototype purposes and test purposes.

Admiral LEE. Senator Young, in almost every development program we build a certain number of research and development aircraft, initially, to put through the test and evaluation phases of a development. I believe the Air Force is planning to build research and development aircraft for their F–16 aircraft. We priced and plan to build 11 research and development aircraft in our F–18 aircraft.

Senator YOUNG. Would you call all of them prototypes?

Admiral LEE. All in a sense would be prototypes. That is where we prove the engine and prove the carrier suitability and landing characteristics, it is where we make sure we know what we are getting before going into production.

Senator YOUNG. How would those differ from the two F–17's?

Admiral LEE. We have those now.

Senator YOUNG. How would the 11 differ?

Admiral LEE. The two prototypes are not carrier-suitable planes, they don't have the hooks on them for carrier landing, no provisions for catapulting and do not have the structure for carrier-based operations. The 11 would have all those things built in them.

Chairman MCCLELLAN. How then can you call the F–17 a prototype if you have to make all those changes? You will have to rebuild the plane, it seems to me.

Dr. CURRIE. To put this in a little more perspective, in the Air Force program it contains 8 more airplanes and in any development program we need at least 6 to 10 airplanes, or 11 airplanes, to do the structural testing, fatigue testing, exhaustive flight testing before you make a production commitment.

Chairman MCCLELLAN. I can understand that you would need more planes. That is a general practice, I think. As you start production you take two or three and use them as prototypes, the initial run?

Dr. CURRIE. Before we tool up and commit to production we build research and development models.

Chairman MCCLELLAN. Even after you get a prototype?

Dr. CURRIE. Yes, sir.

Chairman MCCLELLAN. Why do you need 11 of that nature?

Admiral LEE. In the end we may not build 11 but the Air Force, as I said, are buying 8 for their F–16 program.

Chairman MCCLELLAN. I understand you need more planes, but I don't understand all of the changes you have to make, how you can call it a prototype. It looks like a new plane altogether.

Admiral LEE. The aerodynamics are essentially the same, the fuselage is similar with added strength for carrier use, the tail is the same, the engine core is the same, we think we can get a lot out of the two prototypes.

"PAPER AIRPLANE" DESIGNS

Senator YOUNG. I think you said the Navy had two or three planes started out as paper planes rather than a prototype. Can you clarify that?

Admiral LEE. My statement was that in all of our airplanes, such as the S–3 and F–14, we go to industry with our requirements, they come in with their engineering designs, which is what Dr. Currie called paper airplanes. We evaluate the engineering designs, as we did for the F–14 and S–3, and select a winner. So this is really the first time in a number of years that we have had prototypes which have flown before we got into the engineering design proposals in a competition.

Senator HRUSKA. Is the F–16 a paper plane at this stage?

Admiral LEE. No, sir, there were two prototypes of the F–16 which are now in being, I guess, at Edwards Air Force Base.

Senator HRUSKA. You just told us F–18 is a paper plane. If the F–16 got to the stage of a paper plane and, if so, when and where did it graduate from the paper plane?

Admiral LEE. The F–16 was a prototype program. By that I mean General Dynamics built two prototype airplanes which the Air Force tested. In addition, General Dynamics came in with a proposal which could be called a paper plane, and this proposal was what competed against the F–17 proposal and the F–16 won. The F–16 was similar to the prototype.

General EVANS. The change from the YF–16 to the production version of the F–16 is very small. The prototype more represents the end items in the F–16 than does the change between the 17 prototype and the 18. Nonetheless, it is also a derivative of the prototype.

CHANGES IN ENGINE DESIGN

Senator HRUSKA. Mr. Chairman, would it be in order to ask the witness—he has now described four principal changes and other changes and so on. Would it be in order to ask what about the expected fruits of those changes, how will that generate better performance or more thrust or more power? What changes have been wrought by these changes?

Admiral LEE. Two principal changes——

Chairman MCCLELLAN. You are speaking of the engine, Senator?

Senator HRUSKA. Yes, the engine.

Admiral LEE. Two or three principal changes. In the first place, we got more thrust.

Senator HRUSKA. How much more?

Admiral LEE. I could give you a chart. I can describe you a couple of points. We can provide for the record some curves but I will describe a couple of points.

The original engine at sea level had a thrust rating of about 10,000 pounds in intermediate; the modified engine had a thrust rating of about 10,600 pounds at sea level intermediate. The original engine in afterburner had a thrust rating of 14,900 pounds at sea level and the modified engine had a thrust rating of 16,000 pounds at sea level.

So you see these were not major changes or increases in thrust.

Now, the major change which Dr. Currie pointed out, about 17 percent, took place at [deleted] and I don't have the specifics of that thrust at [deleted] in the J–101 versus what it is in the modified engine.

Senator HRUSKA. You can supply these for the record.

[The information follows:]

[Deleted.]

Dr. CURRIE. We talk about these as if they are so-called principal changes. Now, we have looked into these engine designs in very great detail and these changes that we have talked about are of the magnitude of about 6 percent. That is the cost of these engines with the 1-inch increased fan section with the mixing section and with the slightly higher turbine inlet temperature will cost about 6 percent more. This is on a piece-part basis so that gives you the magnitude of the changes which are relatively minor; that is, compared to designing a new engine.

The basis of experience for these is accumulative engine flight test in flight of 692 hours as of the middle of January, and a total operating time of this engine on which this design is based of 2,359 hours.

This is a very large amount of experience, a very large engineering data base on which this 6 percent change is predicated.

Senator HRUSKA. You are talking about the F–404?

Dr. CURRIE. Yes, sir.

Going from the J–101 to the F–404——

PERCENTAGE DIFFERENCE IN J–101/F–404

Chairman MCCLELLAN. What was the percentage of difference in those?

Dr. CURRIE. Six percent in cost, 6 percent in complexity.

Chairman MCCLELLAN. That figure represents the change from the J–101 to the F–404?

Dr. CURRIE. That is the change I am talking about, about 6 percent in complexity, 6 percent in cost, and for that you get the increased thrust that Admiral Lee mentioned, about a 17 percent increase in thrust and much better fuel consumption characteristics, much lower consumption of jet fuel. That is what you get for it.

Chairman MCCLELLAN. One thing that has concerned us so much is that it is called a new engine; you have given it a new name.

Dr. CURRIE. I think that was very unfortunate.

Chairman MCCLELLAN. It sounds as though you are going out to develop a new engine.

Dr. CURRIE. I will have to take responsibility for injecting this confusion. GE renamed their engine and I allowed the name of the 17 to go from the F–17 to the F–18 thinking it would clarify the issue rather than confuse it, which was a mistake.

Chairman MCCLELLAN. I am not trying to blame anybody. I am saying if there is only 6 percent change, it seems to me it would be regarded as an improved J–101 instead of a new F–404.

Dr. CURRIE. Exactly, and that is what we should have called it. Many of our engines are improved to a far greater extent than these small changes.

Chairman McClellan. That is what I don't understand, as a layman. I think many others will also have difficulty understanding it. It makes it appear that you are trying to get a whole new engine.

Dr. Currie. Which is not the case.

Chairman McClellan. Also, when it appears that it is a new engine, it is disturbing that you do not have a prototype. That you have not tested the engine.

Dr. Currie. I can understand that.

Chairman McClellan. Initially, it seems that you had completely disregarded the instructions of the Congress, that you had gone your own way instead of working within the guidelines set by Congress.

Dr. Currie. I hope we have cleared up our self-imposed confusion.

Chairman McClellan. We have made a little progress. Let's hope we don't run into something else now. I have learned to have some reservations concerning DOD requests. For instance, Secretary Schlesinger called me in January and had to have a decision at once because the European countries were going to make a decision in the next 2 or 3 days as to which aircraft they were going to buy. That was in January and they haven't made the decision yet, have they?

Dr. Currie. No, sir.

SUBCOMMITTEE RECESS

Chairman McClellan. We will recess now and resume at 2 o'clock in room 126 in the Capitol.

[Whereupon, at 12:15 p.m., the subcommittee was recessed, to reconvene at 2 p.m. the same day in room 126, the Capitol.]

(AFTERNOON SESSION, 2:15 O'CLOCK, TUESDAY, MAY 6, 1975)

# LIGHTWEIGHT FIGHTER AIRCRAFT PROGRAM

## DEPARMENT OF THE NAVY

### STATEMENT OF VICE ADMIRAL W. D. HOUSER, USN, DEPUTY CHIEF OF NAVAL OPERATIONS (AIR WARFARE)

#### NAVY FIGHTER PROGRAM

Chairman MCCLELLAN. The subcommittee will come to order, please.

Any further questions before we turn to the representative of the Navy, Admiral Houser?

All right, Admiral, you may proceed.

Admiral HOUSER. Mr. Chairman, members of the committee, it is a privilege to be present this afternoon to discuss the Navy's fighter program. The maintenance of an adequate fighter force is presently the most pressing tactical air problem in the Department of the Navy. The Navy is in the process of phasing down to 12 carrier air wings with 24 fighter squadrons. The Marine Corps is maintaining 12 fighter squadrons to support three active wings. Additionally, there are four Navy and two Marine Corps reserve fighter squadrons.

In August 1974 the Secretary of Defense established a force level of 18 F–14A squadrons for the Department of the Navy and has approved plans for the procurement of a total of 390 F–14A's. Within this total the Navy would organize and operate 14 squadrons and the Marine Corps four squadrons. The remainder of the fighter squadrons will be composed of the older F–4B and F–4J models through the use of a major service life extension program which will add 6 to 8 years of additional service life to each aircraft. With this combined program, a projected shortfall of about 45 fighters will occur in 1980 and this shortfall will increase to 75 by 1981. Initial deliveries to the fleet of the Naval Air Combat Fighter (NACF) would begin in 1981 and start to reduce this deficit.

The Navy's fighter program was on track until 1971 when the existing plan to buy an all F–14 force was changed by then Deputy Secretary of Defense Packard. He limited the approved buy to 313 F–14A's which was then in the 5 year defense plan (FYDP), but did not foreclose future procurement. Subsequent financial difficulties in the multiyear fixed-price contract with the prime contractor resulted in a limitation in procurement rate to 50 per year, whereas a rate of up to 96 per year had been planned. Thus by the end of fiscal year 1975 only 234 F–14's had been ordered.

In 1973 Deputy Secretary of Defense Clements proposed a prototype flyoff program between a lower cost version of the F–14 and a

Naval version of the F–15. Congress rejected this proposal as being too expensive and not worthwhile. Navy Fighter study IV was organized to investigate and compare F–14 variants, Naval versions of the F–15, and a new lighter weight fighter to complement the F–14's then planned for procurement. Subsequently in April 1974 the Navy recommended an improved version of the F–14 without the Phoenix missile, but with the capability to incorporate it. This recommendation was not approved by the Secretary of Defense, but an additional proposal by the Navy was accepted. This proposal was to investigate a lighter weight, lower cost, multimission aircraft which could serve as a fighter to replace certain F–4's and also eventually replace A–7's in the attack mission. A presolicitation notice was issued in June 1974 and responses were received in July. It was also desired that a version of this airplane be capable of V/STOL operations for use on other than large carriers. This multimission airplane, the V/FAX, was terminated by Congress in 1974 when the Navy was directed to investigate only Naval versions of the lightweight fighter prototypes, the YF–16 and YF–17.

In September 1974 the Congress appropriated $20 million for an NACF. The conference report supported the need for a lower cost alternative fighter to complement the F–14A and replace the F–4 and A–7 aircraft. It was also directed that development of this aircraft make maximum use of the Air Force lightweight fighter technology and hardware. The conherence report added that adaptation of the selected Air Force Combat Fighter (ACF) to be capable of carrier operations is a prerequisite for the use of the funds provided. Since the development was initiated in October 1974, only shortly after the Air Force had issued its request for proposals for the ACF, requests were issued by the Navy through the Air Force for naval derivatives of both aircraft. This information and subsequent progress on the selection of an NACF has been the subject of an exchange of correspondence between congressional committees of Congress and the Department of Defense from October 1974 through March 1975.

In selecting an NACF, the Navy needed an aircraft which would satisfy the following: Capable of carrier operations; able to fight on favorable terms with projected threat aircraft of the 1980's; serve as a complement to existing F–14 aircraft; have lower procurement and operating costs than the F–14; and, through multirole employment permit a reduction in aircraft types. This latter would be possible through use in a light attack role and in reconnaissance missions.

REDUCTION IN TYPES OF AIRCRAFT

Chairman McClellan. One of the objectives we have been discussing, is that it would permit a reduction in aircraft types.

Admiral Houser. Yes, sir. That was the objective before we got to the derivative stage. The objective for the next plane we built, was that it would be capable of doing more than one thing so we could reduce types of aircraft. This was in the airplane that the Congress cancelled in 1974.

Chairman McClellan. This one has already been cancelled out?

Admiral Houser. We had an airplane in 1974 and requested funds to look for a new airplane. Congress terminated that, and instead directed us to use the lightweight fighter prototypes.

Chairman McClellan. You wanted then to go after a new plane?

Admiral Houser. Exactly.

Chairman McClellan. You wanted one not associated with the Air Force plane?

Admiral Houser. I would say that we hadn't looked at that. We were looking for a naval airplane and we knew these others were land based prototype fighters.

Chairman McClellan. The Congress wanted you to work with the Air Force to see if possibly a derivative of the Air Force selection could be used for the Navy mission.

Admiral Houser. With very specific language they said that.

F–18/F–14 COMPARISONS

Senator Young. What is the speed and altitude capability of the F–18?

Admiral Houser. The maximum speed is estimated to be about mach [deleted] combat ceiling about [deleted] feet in afterburner.

Senator Young. How does that compare with the F–14?

Admiral Houser. It is slower than the F–14. The altitude is about 3,000 feet greater.

Senator Young. Is that fast enough?

Admiral Houser. For the way this plane is envisioned, it would be fast enough. The maximum speed of the plane is not entirely usable. It means you have a clean design and powerful enough engine to get you there, but when in a fight you can't achieve it, because it takes so much time and fuel to reach it.

Senator Young. What is the speed of the F–14?

Admiral Houser. A little greater than the F–18.

As a fighter, the NACF would be armed with two Sidewinders and two Sparrow missiles plus a cannon. Its radar would have a detection range of about [deleted] NM. Gross weight for take off would be about 34,000 pounds. Almost all specifications of the F–18, the proposed NACF, meet or exceed the published requirements. Noteworthy are specific excess power available, sustained high G buffet-free maneuvering, structural G limits and lower maintenance personnel requirements. Carrier landing speed is acceptable, but slightly higher than desired, and this will be given special attention during development.

ADAPTABILITY OF F–18 TO CARRIER USE

In an effort to reduce different types of aircraft aboard carriers, we are proposing a basic aircraft capable of multiple missions. In view of the critical fighter shortage, it is necessary to pursue the fighter replacement configuration first. Subsequently, we expect to develop an attack version of the V–18 to phase into the fleet after 1985. The use of the F–18 in a reconnaissance role is also contemplated. The attack configuration would have overall capabilities equal to or exceeding the A–7E.

Chairman McClellan. You say the carrier landing speed of the F–18 is unacceptable?

Admiral HOUSER. It is acceptable.

Chairman MCCLELLAN. But slightly higher than desired?

Admiral HOUSER. Yes, sir.

Chairman MCCLELLAN. This morning you were critical of the F–16 because of certain flaps on it that are designed to ease the landings. Will you have to resort to these flaps on the F–18?

Admiral HOUSER. No, sir, the engineers believe they can reduce this landing speed somewhat just by fine tuning of the design during this engineering period without adding the types of mechanisms that were described this morning, the angle of attack limiter, the double flaps, and others.

Chairman MCCLELLAN. Admiral, if you had to make a decision on this plane in its present condition, with respect to its landing capabilities, and its general performance, would you accept or reject it?

Admiral HOUSER. We can accept it.

Chairman MCCLELLAN. Even as it is now?

Admiral HOUSER. Yes, sir.

Chairman MCCLELLAN. But you hope to make improvements?

Admiral HOUSER. The airplane lands slower than some of the planes we have on board our carriers now so it will not be the swiftest of the lot. Our desire is to reduce the landing speed in some of the designs. We have done that in others and it has been most fruitful.

Chairman MCCLELLAN. But it is within an acceptable range.

Admiral HOUSER. Yes, sir, but it is higher than we had asked for.

In comparing the F–18 with the F–14A, the F–14A has higher maximum speed, [deleted] longer radar detection range [deleted] and the ability to track 24 targets at one time, higher fighter escort radius [deleted] increased missile capability [deleted] and lower carrier landing speed [deleted] knots vs. [deleted] knots.

CAPABILITIES OF F–14

Chairman MCCLELLAN. Is the F–14 a better plane than the F–18?

Admiral HOUSER. The rest of my paragraph will point out the highlights of the other one.

The F–14 is a better plane overall than the one we are going to get but it is also more costly.

As Dr. Currie mentioned this morning, the idea was to get complementary airplanes.

Chairman MCCLELLAN. You will retain the F–14?

Admiral HOUSER. Yes, sir; and these will be complementary to it.

Chairman MCCLELLAN. How many F–14's do we have in stock?

Admiral HOUSER. We have ordered 234 and about 134 have been delivered.

Chairman MCCLELLAN. How far does that go toward achieving the goal?

Admiral HOUSER. 390 airplanes have been approved.

Chairman MCCLELLAN. How many F–18's do you want?

Admiral HOUSER. Over the next 15 years through the 1980's about 800 production models, sir.

Chairman MCCLELLAN. It seems to me that if the F–18 is an inferior plane to the F–14, that is, inferior in overall performance, you may be investing too heavily in the numbers of this plane.

F–18 REPLACEMENT OF A–7E

Admiral HOUSER. We plan to use some of these planes for the attack missions in which it would be superior to the attack plane it is replacing.

Chairman MCCLELLAN. Superior to the F–14 in an attack mission?

Admiral HOUSER. No, sir; superior to the attack plane it is replacing.

Chairman MCCLELLAN. It will replace an attack plane. What is that?

Admiral HOUSER. The A–7E. But this would not be until about [deleted.]

Chairman MCCLELLAN. Ultimately you are getting this larger number with the view of replacing this other plane?

Admiral HOUSER. Yes, sir.

Chairman MCCLELLAN. As compared to that plane, is this a much better plane?

Admiral HOUSER. Yes, sir. I have it here in my statements, the difference between them, and both have advantages and disadvantages but for the future this plane will be a better attack airplane.

Chairman MCCLELLAN. All right, go ahead.

F–18/F–14A COMPARISONS

Admiral HOUSER. The F–18 exceeds the F–14A in maximum structural "G" limit [deleted] faster acceleration [deleted] and smaller size. In a summary comparison then the F–14A is overall a superior fighter because of its two-man crew, more capable and versatile avionics system, and wider selection of weapons. The F–18 is smaller, should excel in aeronautical agility and thus in individual air combat. The F–18 should provide an excellent lower cost complement to the F–14A.

Fighter performance of the F–18 substantially exceeds that of present Soviet fighter aircraft, [deleted] and is expected to meet the projected threat of the 1980's.

Concerning costs, further study will be required to define the exact configurations and cost. However, the evaluation thus far indicates that a procurement of 800 production aircraft would result in an approximate average recurring flyaway unit cost of $5.8 million in fiscal year 1975 dollars. Our estimate for R.D.T. & E. is $1.43 billion of which $300 million is for the F–404 engine development. Of the remaining $1.13 billion, $765 million is for the airframe and avionics development, $7 million for Government furnished equipment. The remaining $358 million is for test and evaluation, management and support. These would be considered as estimates for the upper limits of the program. During the next several months, these estimates will be refined and there is a high probability that they will be reduced.

A direct comparison of costs between the F–14A and F–18 is difficult to make because of the different status of the two aircraft. In the case of the F–14A, all the R. & D. and much support equipment has been procured and installed. No funds have been expended for these items for the F–18. The F–14A procured at the currently authorized

rate of six per month has a flyaway cost about twice that estimated for the F–18 at the planned rate of nine per month. Operating costs of the F–18 are estimated to be 60 to 65 percent of those for the F–14A.

Chairman McClellan. Do you mean this new plane has only 65 percent of the performance of the F–14A? Is that what you are saying?

Admiral Houser. No, sir; this is in the operating cost, not the performance.

Chairman McClellan. The cost of operating it will be about 65 percent of what it takes for the F–14?

Admiral Houser. Yes, sir; it takes fewer people and less fuel.

COST SAVINGS WITH F–18 PROGRAM

Chairman McClellan. Admiral Lee, you point out savings resulting from procurement of the F–18 rather than F–14 for the Navy fighter force. By the same token, the F–18's which replace the Navy attack aircraft, the A–7, A–4, and A–6, are more costly than the replaced aircraft. What numbers of attack aircraft will be replaced? What will the difference in cost be to replace the attack aircraft with F–18's rather than, say, A–7E's?

Admiral Lee. It is programed that the F–18 will replace only the A–7's, not the A–4's or A–6's. The inventory objective for A–7's is about 491 aircraft. The flyaway unit cost, in fiscal year 1975 dollars, of the A–7E is $4.5 million, compared to the recurring flyaway unit cost of $5.8 million for the F–18. However, the A–7E cost figure does not include the funds which would be required to develop an A–7E replacement in the [deleted].

F–14 ENGINE CAPABILITIES

Chairman McClellan. Doesn't the F–14 have two engines?

Admiral Houser. Yes, and is a two-place plane. This has one engine and is a one-place plane.

Mr. Chairman, in announcing the selection of the successful NACF contractor, we concluded an intensive competition between two teams of leading aerospace manufacturers, LTV/General Dynamics and McDonnell-Douglas/Northrop. The various designs proposed by these firms made use of engines by Pratt-Whitney and General Electric.

Detailed performance, cost, and technical evaluations were conducted by Navy and civilian technical personnel, including a review of performance of the competing contractors. Following this analysis, the source selection authority, Admiral Michaelis, Chief of Naval Material, selected McDonnell-Douglas/Northrop and General Electric as the winners of the competition to develop the Navy's new air combat fighter, to be designated the F–18.

As required by the Navy's proposal instructions, the McDonnell-Douglas/Northrop F–18 is a derivative of the YF–17, Northrop's entry in the USAF air combat fighter—ACF—competition. Although the F–18 and YF–17 designs differ in many respects, the F–18 incorporates much of the technology and hardware developed and demonstrated during the USAF lightweight fighter prototype competition. Cost data from the YF–17 prototypes provides confidence that the F–18 can be developed and produced at the calculated prices.

That completes my statement, sir.

Chairman McClellan. You say in your summation, "Although the F–18 and the YF–17 in design differ in many respects, the F–18 incorporates much of the technology and hardware developed and demonstrated during the USAF lightweight fighter prototype competition."

That is the competition you speak of between Northrop and General Dynamics?

Admiral Houser. Yes, sir, exactly.

NEW PLANE STATUS OF F–18

Chairman McClellan. This statement is one that will eventually lead to trouble. It is an admission to some extent that the F–18 is a new plane, not one considered in the competition.

Although the F–18, and the YF–17 designs differ in many respects. That opens the door again.

Now let me ask you this. Suppose we simply started anew and said we need a new plane for this Navy mission. How long would it take to send out proposals to the aircraft industries to give them all an opportunity to compete for this contract?

Admiral Houser. About 6 months, sir.

Chairman McClellan. Wouldn't it take more than that in order to get designs and so forth?

Admiral Houser. Well, sir, we started out with a presolicitation notice in 1974. The general outline of what we wanted had already been published to industry. They had come in with responses to this. The contractors probably would take those basic designs and refine them into engineering proposals.

We had made an estimate about 1 year ago, or last summer it was, that we would get a response back about this time of year to some solicitations that were going out in October. So this was about a 6 to 8 month period.

SHORTAGE OF FIGHTER AIRCRAFT

Chairman McClellan. Would that delay be of serious consequence in getting this program under way, and getting the ultimate delivery of the planes?

Admiral Houser. It would be a serious consequence to the extent we have a serious shortage of fighter planes already which would become more serious in the event of further delay. Perhaps some of the delay could be made up by putting money in at a faster rate but the consequence would be a greater shortage of fighter planes in the future around 1980 or 1981.

Chairman McClellan. I don't want to hear later that we could have found a better plane for this mission, or that we could have built this one at less cost. I want to be sure that further solicitation of the industries would not be beneficial.

Admiral Houser. This point was argued at some length last summer, Mr. Chairman, that the Navy had tried to go out to industry for an industrywide competition. It was the Congress that told us not to do that and told us to use the lightweight fighter prototypes as the basis for the next Navy airplane.

Chairman McCLELLAN. That is true.
Admiral HOUSER. Yes, sir.

INDEPENDENT PROCUREMENT

Chairman McCLELLAN. That was your desire at all times, wasn't it—to go out to the industry independent of the Air Force procurement?
Admiral HOUSER. That was our hope in the beginning.
Chairman McCLELLAN. You were not permitted to do that?
Admiral HOUSER. By the Appropriations Act of fiscal year 1975.
Chairman McCLELLAN. All right.
Now, I expect someone will say this is just another ruse to get back to what you wanted in the first place. We had that argument on the old TFX; they said Grumman didn't try. They wanted to get back and do it with an independent plane of their own.
Do you expect we will be confronted with that sort of logic in this situation?
Admiral HOUSER. I would expect, as in all cases of competition, the losers will not take it very gracefully.
Chairman McCLELLAN. Do you have that experience often in the military?
Admiral HOUSER. We talk to a lot of losers because for every winner there has to be a lot of losers in a competitive sense.
As Admiral Lee and Dr. Currie stated this morning, the initial results of the first evaluations were that the performance of the airplane would be satisfactory. The fact we got a satisfactory design means somebody went to work very diligently, and it was not a question of sending it in pro forma; there was a great deal of effort and much technical expertise provided in the programs.
Chairman McCLELLAN. As I ask these questions I hope no one gets the erroneous impression that I am partial to General Dynamics. I don't think my past record would warrant that kind of assumption.
On the other hand, I think I can say, without any equivocation or reservation, I have no prejudice toward General Dynamics. All I am concerned with is getting the facts and making a record that will help us—the members of this committee, as well as the Congress—to make an evaluation.
Senator YOUNG. You were right all along.

NAVY USE OF AIR FORCE PLANE WITH MODIFICATIONS

Chairman McCLELLAN. I was right on one thing. You can't tell engineers they have to take certain materials and parts and build two different planes out of it. I don't think it can be done. You have somewhat the same problem here. We were trying to require you to take the prototype that was selected by the Air Force and get a derivative plane to suit Navy purposes. That was to some extent trying to require you to observe commonality so far as you could. That was not my idea, to say you have got to take the Air Force plane and use it as it is with all the commonality of parts to build yours.
But I thought then, and I think now, that there is too much diversity. If the services would work together more closely than they have in the past, you could often come up with a prototype with proper modifications that would serve the interests of both services.

Admiral HOUSER. You are right, Mr. Chairman.

Chairman MCCLELLAN. Perhaps my view will prove to be a minority one, but I would not go so far as to say you have to accept the Air Force prototype. I don't mean that. But I do think in view of what the Congress has said to you in the past, it is a justification for what you are recommending. I think the burden is on you to do that.

Admiral HOUSER. In that regard I would say the evidence is that the Navy has made an effort not only to comply, but to get an airplane that meets its requirements. Most of the wise heads in Washington who have experience I think fully expected the Navy to turn down both designs because they were prototype land based fighters.

I personally would not, and I know Admiral Lee wouldn't have selected the airplane had it not met the requirements except for the few things I mentioned. He will discuss the others later. The airplane met the requirements set out for it and it was only through the hard work between the Naval Air Systems Command and the designers that we got the plane we did. We could not simply put a hook on either land based plane and call it a Navy fighter.

Chairman MCCLELLAN. I want the facts in this record to be a refutation of any charges that may be brought against your decision to go with the F–18. So I think you have the opportunity here to state everything that you want to have considered and you think appropriate to be considered to sustain the action you have taken.

Senator, any questions?

Senator YOUNG. Yes, Mr. Chairman.

### RADAR AND MISSILE CAPABILITY COMPARISON OF F–18/F–14

How will the radar and missile capability of the F–18 compare with the F–14?

Admiral HOUSER. The radar will be less sophisticated. It will be shorter ranged and will not have some of the sophistication, such as the multiple tracking of 24 targets and the multiple scanning of the F–14. The airplane will be operated by one person, which means the radar will be simpler than that of the F–14A. It is a complement to the F–14A and not a replacement.

Senator YOUNG. Does the F–18 have an all-weather and air-to-ground capability?

Admiral HOUSER. The F–18 will have an all-weather air-to-air missile. In the later configuration it will have probably limited all-weather air-to-ground.

### DIFFERENT VERSIONS OF F–18

Senator YOUNG. Will the F–18 be built in different versions?

Admiral HOUSER. Yes; the fighter version would be one, the attack version would be two, and the reconnaissance another. The reason is that to build one plane with the total capabilities of all three would burden that plane both in operation and performance. The fighter would not necessarily need all of the attack capabilities that the attack version would.

Similarly the attack version should not be burdened by some of the fighter avionics and weapons. If we have the basic airplane and the

engine, this combination is capable of performing the missions we set out for it. We think we can put the equipments in the plane to do the missions.

Senator HRUSKA. I would like to direct your attention to the language in the Conference Report at page 27. It was discussed this morning: "Future funding," down at the fifth line from the bottom on page 27, "Future funding is to be contingent on the capability of the Navy to produce a derivative of the selected Air Force air combat design."

It was testified this morning, I believe, that it was found in due time that the Navy did not have that capability to which reference is made.

Now, implied in the report language, as I read it, is that if capability was found to be lacking, you were not to stop and just let the world go by, you were presumed to do, that is it was expected that you would do exactly what you did do, to wit, you informed the committees of the Congress of the stalemate and then you outlined in correspondence the letter of March 7 by Mr. Clements to the chairman of the Committee on Appropriations what you proposed to do. Am I correct?

Admiral HOUSER. Entirely, sir. I have a copy of that letter before me. Shall I read the pertinent sections?

Senator HRUSKA. Yes.

Admiral HOUSER. Mr. Clements' letter of March 7, some 2 months after the Air Force selection was announced to you, Senator McClellan: "In view of the considerable investment already made toward the design of derivative aircraft by the two contractors, we have instructed the Navy to complete its evaluation of both firms' proposals in a fully competitive atmosphere."

Senator HRUSKA. May I suggest this letter and the two replies be inserted in the record?

Chairman MCCLELLAN. Of course. You were quoting from the letter from the Deputy Secretary of Defense?

Admiral HOUSER. Yes, sir, March 7, 1975.

Senator HRUSKA. It was the last sentence——

COMMUNICATIONS

Chairman MCCLELLAN. That letter from the Deputy Secretary of March 7, 1975, together with the letter of March 13 from Chairman Mahon, Deputy Secretary of Defense, and likewise my letter of March 17, 1975, to the Secretary of Defense may be inserted in the record at this point.

Senator HRUSKA. Also the letter of May 2, 1975, to the Appropriations Committee from Deputy Secretary Clements advising of the decision.

Chairman MCCLELLAN. Yes, that letter is included with the others.

[The letters follow:]

THE DEPUTY SECRETARY OF DEFENSE,
*Washington, D.C.*

Hon. JOHN L. MCCLELLAN,
*Chairman, Committee on Appropriations,*
*U.S. Senate, Washington, D.C.*

DEAR MR. CHAIRMAN: I am writing to inform you of the current status of the Navy's evaluation of proposals for its Air Combat Fighter (NACF). Pursuant to your letter of November 21, 1974 approximately $12,000,000 of the $20,000,000 appropriated for this effort was applied toward the development of derivative NACF designs by both of the original Air Force ACF competitors. At the time of

the Air Force ACF selection last month the Navy's own evaluation was still in its early stages. In view of the considerable investment already made toward the design of derivative aircraft by the two contractors, we have instructed the Navy to complete its evaluation of both firms' proposals in a fully competitive atmosphere.

The Navy expects to present the results of its evaluation in early May. If none of the proposed designs can satisfy the solicitation criteria we will terminate the present competition and perform further trade off analysis of stated requirements in an attempt to meet the desired goal of a lower cost alternative fighter-attack aircraft for Navy use. If any or all of the derivative designs are acceptable the Navy will likewise recommend its choice.

Should an acceptable design be found it will be necessary to use the remainder of the present appropriation to contract with the selected firm to refine its design and sustain its engineering effort pending formal program approval to undertake full scale development in FY 1976. I believe this is a prudent course of action whichever firm is selected and I would appreciate your concurrence. We will also advise you should the evaluation disclose a need to revise our current budget figure for this aircraft in light of the considerable redirection which has overtaken its original submission.

Sincerely,

W. P. CLEMENT, Jr.

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CONGRESS OF THE UNITED STATES,
HOUSE OF REPRESENTATIVES,
COMMITTEE ON APPROPRIATIONS,
*Washington, D.C., March 13, 1975.*

Hon. WILLIAM P. CLEMENTS, Jr.,
*Deputy Secretary of Defense,*
*Washington, D.C.*

DEAR MR. SECRETARY: This is to acknowledge your letter of March 7th with regard to the plans of the Department of the Navy to evaluate competitive designs of the Navy's Air Combat Fighter.

You state that the Navy expects to complete its evaluation in early May and that if an acceptable design is found, the Navy will use the remainder of the present appropriation, approximately $8,000,000, to contract with the selected firm for design and engineering effort.

I have no objection to the approach you have set forth. However, the Subcommittee on Defense Appropriations expects to carefully review the FY 1976 funding requests and I could not comment on possible Committee action on the FY 1976 request at this time.

Sincerely,

GEORGE MAHON, *Chairman.*

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U.S. SENATE,
COMMITTEE ON APPROPRIATIONS,
*Washington, D.C., March 17, 1975.*

Hon. W. P. CLEMENTS, Jr.,
*Deputy Secretary of Defense,*
*Washington, D.C.*

DEAR MR. SECRETARY: This is in response to your letter of March 7, 1975, concerning the Department of the Navy's evaluation of the proposal for a Navy Air Combat Fighter.

The Navy plans to complete the evaluation within the next few weeks and either terminate the competition or conduct further tradeoff analysis. If one of the designs is selected, I understand that the remainder of the funds appropriated for the Navy Air Combat Fighter study will be used to refine the selected design.

The Committee has no objection to your plans for expending the amount appropriated in fiscal year 1975. I understand that you will notify the Committee of a final selection in May so that the Committee will have the necessary information during consideration of the fiscal year 1976 request for the Navy Air Combat Fighter.

With kind regards, I am

Sincerely,

JOHN L. MCCLELLAN, *Chairman.*

THE DEPUTY SECRETARY OF DEFENSE,
*Washington, D.C., May 2, 1975.*

Hon. JOHN L. MCCLELLAN,
*Chairman, Committee on Appropriations,*
*U.S. Senate,*
*Washington, D.C.*

DEAR MR. CHAIRMAN: By letter of March 7, 1975 I advised you of the progress being made in the evaluation of the Navy Air Combat Fighter and of our intention, upon the selection of an acceptable derivative, to use the remainder of the present appropriation to contract with the selected firm to refine its design and sustain its engineering effort.

The Navy has now completed its evaluation and has selected the McDonnell Douglas/Northrop Model 267A aircraft as the Navy Air Combat Fighter now designated the F–18. Accordingly, I have authorized the Navy to enter into sustaining effort contracts with McDonnell Douglas and General Electric, the related engine manufacturer, pending Congressional approval to undertake full scale development in FY 1976.

Sincerely,

W. P. CLEMENTS, Jr.

CONTINGENCY IN CONFERENCE REPORT

Senator HRUSKA. I believe these insertions will aid you in achieving the goal you have been aiming for this morning; namely, all the facts so we can review them and decide. That will give us all the facts.

I have been puzzled and in fact a little disturbed by the language in this Conference Report until this correspondence came along and it cleared some of the mist away in my mind, not finally, but it will be helpful.

I think the point should be borne in mind, the record makes the point, it should be borne in mind here was a contingency expressed in the conference report; it was impossible to achieve and comply with that contingency. The services did what is reflected in this correspondence. They did the next best thing; they referred to the matter of preserving that competitive attitude and the alternative, of course, would have been to just lay down your tools or forget about the whole thing until these hearings would occur and then ask for our instructions as a result of the debate and discussions.

Chairman MCCLELLAN. What I am wondering to myself now is whether I should have called this committee together and let the DOD make a presentation at the time of the request to proceed. But there are times when it just isn't possible to do that.

Senator HRUSKA. I understand that.

Senator YOUNG. You made the right decision, I believe. If the full committee had met, I think they would have agreed with it.

Chairman MCCLELLAN. I think so, but again in situations like this, I wish I had the reenforcement of that committee action.

CONTRACTOR COMPETITION

Admiral HOUSER. Mr. Chairman, I might be able to relieve you of that total responsibility. In the four appearances that I have made on the Hill this year before the two Appropriations Committees and the two Armed Services Committees this subject has been discussed, not in detail but the fact that competition was going on between the two contractors—these were all this spring.

Senator HRUSKA. I have served on this committee a long time, not as long as my colleague, Senator Young, but even among your pred-

ecessors this program has been going on and I have yet to see an instance when the chairman made a decision where I felt that I would second-guess him or there would be grounds for second guessing. They are not perfect situations, but sometimes time is of the essence.

Chairman McCLELLAN. We do maintain some check on the proceedings and control over the money.

Senator YOUNG. Mr. Chairman, you maintained more than in previous years. You have held hearings that we never used to do.

Chairman McCLELLAN. Senator Stevens?

Senator STEVENS. I wasn't here this morning, I just returned to town so I may be redundant.

F–14 COSTS IN 1975 DOLLARS

What is the cost of the F–14 in 1975 dollars?

Admiral HOUSER. In fiscal year 1975, the flyaway cost is about $12 million; the procurement cost, which includes spares and support, is about $14 million. The higher the rates of production, the lower the unit cost.

Senator STEVENS. I am not critical of the committee's procedure at all. What I am interested in is the 16, if I understand it, has a flyaway cost of $4.5 million.

You say this was a cost of $5.8 million and the items that you listed as the advantages of the 18 seem to be evasive whereas the advantages of the 14 seem to be in terms of attack, performance capability, range and targeting.

The 18 has a faster acceleration and is a smaller size.

I can't understand the decision; maybe I need to be educated as a pilot. It seems to me you have a smaller airplane.

Admiral HOUSER. I think when you see the next presentation you will understand. The procurement rate is limited and we have been told repeatedly to look for a lower cost replacement.

We think we have come up with a good lower cost supplement or complement to the F–14.

COMPARISONS OF F–16/F–18

Senator STEVENS. It seems we do better comparing the 16 and 18, not the 14 and 18. What are the comparisons between the 16 and 18?

Admiral HOUSER. Of course the big difference is that the 16 won't land on a carrier, so that characteristic makes it unsuitable. Several versions of the F–16 were looked at for Navy use powered by different engines and for one reason or another they were not suitable; therefore the F–18 was selected.

Senator STEVENS. Then why didn't we go to something else? It seems to me you should have some definition of what your mission capability is that you want. One of them certainly ought to be detection in this day of ground missiles and another ought to be an increased radius in terms of vulnerability of the flight. As you reduce your risks, another should be an increased capability to carry your own missiles, yet you are going away from that in terms of your selection here.

Admiral HOUSER. As to the missiles, we can carry all the missiles except the [deleted].

Senator STEVENS. You can carry, but not the same amount, anywhere near the same amount.

Admiral HOUSER. You can't carry the same amount on a smaller plane as a larger one. You can get more of these aircraft on a carrier deck. You can get about 25 percent more of the smaller fighters on the carrier deck than the larger ones. These are tradeoffs that have to be looked at. Cost of procurement, the cost of operation, size, and maintainability. How many people it takes to maintain it all are considerations.

One of the most attractive features of the F–18 is its ability to serve in more than one role. We think it will be a lower cost airplane that can serve in the three roles I mentioned, the fighter role, attack role, and reconnaissance role.

By procuring this aircraft we will be able to do with one airplane what might take two or three to do. It is an important consideration when you are maintaining eight to nine airplanes of different types aboard different carriers. That is what we are attempting to do, and this is a goal of this airplane.

Senator STEVENS. I had the feeling what we had done before was set about to get some efficiencies of mass production back in the procurement business, and it seems to me we have taken a 180° turn from that in this decision.

FIGHTER AIRCRAFT PRODUCTION

Admiral HOUSER. In the case of the F–14 you are entirely right. Secretary Schlesinger pointed this out, I think, in earlier testimony to the House Armed Services Committee when he was asked about keeping the procurement of the F–14 at a low level. He replied he didn't want to cause a problem in the employment situation by having lots of employment at one time and little employment at another time. He wanted to level it out.

The second thought was to keep a fighter line open so additional fighters could be procured if there were an emergency, or the planes were needed for some other reason.

Senator STEVENS. Now, we will have two planes

Admiral HOUSER. Yes, sir.

Senator STEVENS. You are procuring 800?

Admiral HOUSER. That is the number through the 1980's, yes.

Senator STEVENS. And the Air Force, 650. I wondered if it wasn't possible to secure the results the Congress originally thought, that was to have a single procurement concept, and the efficiencies of mass production that would come about.

Admiral HOUSER. I think I will defer to Dr. Currie on that. He is the overseer between the services as to why the present scheme seems to be a better one. I mentioned why we could not use the F–16.

Dr. CURRIE. We have studied this possibility extensively since last fall. As mentioned earlier, it was impossible to comply with the literal direction by Congress in this report. We were unable to achieve a satisfactory maneuverability of the F–16 aboard a carrier, although we studied three derivatives.

We feel we complied with the spirit of the congressional directive, and certainly the directive which states earlier that the development of this aircraft make maximum use of the Air Force lightweight fighter and air fighter combat technology and hardware.

Now the Air Force selection of the F–16 is the best selection for the Air Force. It is a smaller, lighter airplane. It shares commonality not with the Navy, but with their F–15. That has exactly the same engine as the F–15. The logistics savings in achieving that com-

monality were found after extensive analysis in the Department of Defense to offset any artificial type of commonality that one might drive the two services toward in connection with this lightweight fighter.

So I believe this question has been addressed responsibly, and in depth.

Senator STEVENS. Mr. Chairman, I don't wish to be raising too much objection, but I can't understand the decision. What it means is we are going away from the very thing we are urging our NATO allies to go toward; that is, some common denominator as far as this equipment is concerned. The 18 is onshore at an Air Force base. They are not going to be able to find their parts. They won't find the people that know them. There is no interchange capability, and I thought we were going toward finding an aircraft that could be modified to meet the dual roles of the Air Force and the Navy, and I think this decision is wrong.

I have to tell you that. I think the decision—we should have gone back to the drawing board, if that was the situation.

Maybe the time frame as far as the international competition was such you couldn't with the 16. I have been told that was the case; is that correct?

Dr. CURRIE. There was that consideration, but I think the primary one is the one we mentioned. None of our Department of Defense decisions in the end were driven by external pressures or external involvement. We made the decision we felt was right at the right time and right place for our own requirements.

### R. & D. COSTS OF F–16

Senator STEVENS. What is the origin of the statement here that lists the R. & D. costs for the 18? What is the R. & D. cost for the 16?

General EVANS. $496 million, sir.

Senator STEVENS. $496 million?

General EVANS. Yes. That is in 1975 dollars.

Senator STEVENS. Does that compare with this $1.43 billion for the 18?

Dr. CURRIE. It compares with it in a rough type of way. The Navy accounting system puts in more of its internal Navy Department costs than does the Air Force accounting system, but I think it is roughly right. You might say $500 million roughly for the Air Force development, and about $1 billion for the Navy on an apples to apples basis.

Senator STEVENS. I just think it is a wrong decision, that is all.

Thank you, Mr. Chairman.

Chairman MCCLELLAN. General Evans, now we will hear you.

Dr. CURRIE. Excuse me, Mr. Chairman, as part of the Navy presentation we do have a short briefing which will answer some of the questions that you raised this morning.

Chairman MCCLELLAN. All right, we will have the briefing first.

Admiral LEE. Mr. Chairman, a good part of this briefing, is to give you a quick picture of our selection, namely, the naval air combat fighter, the F–18. At least some parts have been covered this morning, as you will see. I will go quickly through those parts.

### PROGRAM BACKGROUND

At the beginning we have a background for the program where we review the guidance we have received over the last 2 years.

# PROGRAM BACKGROUND

- SECDEF MEMO (JUN 73)
  - DIRECTED NAVY TO CONDUCT F-14D/F-15N/F-4 PROTOTYPE FLY-OFF
- SECDEF PDM (AUG 73)
  - " . . . NAVY WILL ACTIVELY PURSUE . . . A LOWER COST ALTERNATIVE FIGHTER TO THE F-14 . . ."
- SENATE COMMITTEE ON ARMED SERVICES (SEP 73)
  - "THE NAVY SHOULD OBTAIN PROPOSALS FROM INDUSTRY AND EVALUATE THESE PROPOSALS TO DETERMINE IF A SMALLER AND PRESUMABLY CHEAPER AIRCRAFT CAN BE DESIGNED TO SERVE AS AN AIR-SUPERIORITY FIGHTER TO COMPLEMENT THE F-14."
- DDR&E FY-75 RDT&E BUDGET REVIEW GUIDANCE (FEB 74)
  - "THE NAVY SHOULD RE-EXAMINE THE BASIC OPERATIONAL REQUIREMENTS FOR A LIGHTWEIGHT, LOW COST FIGHTER AIRCRAFT WITH THE INTENT OF DETERMINING WHETHER A LOWER COST, LESS SOPHISTICATED SYSTEM THAN THAT CHARACTERIZED BY THE VFX . . . CAN BE USED TO COMPLEMENT THE F-14A ABOARD CARRIERS."
- DEPSECDEF TESTIMONY TO SENATE ARMED SERVICES COMMITTEE (2 MAY 74)
  - "IT APPEARS POSSIBLE THAT A LIGHTER WEIGHT, LESS EXPENSIVE, COMBINATION FIGHTER AND ATTACK AIRCRAFT, WHICH WE MIGHT CALL "VFAX" COULD BE DEVELOPED WHICH WOULD COMPLIMENT F-14 . . . AND ALSO PROVIDE AN EVENTUAL REPLACEMENT FOR THE A-7."

NAVY COMPARISON STUDIES

We are going through the program background. Then the threat on which the Chief of Naval Operations based his operational requirements. The F–18 versus requirements, costs, as we see them, threat comparisons with the F–18, the operational capabilities, and then our recommended conclusions.

In June 1973, the Secretary of Defense directed the Navy to conduct an F–14D/F–15N, F–4 prototype flyoff, as you might remember. This was proposed to the Congress, and Congress elected not to fund this program, and instead told us to study it more so that we should probably make these comparisons in computer studies.

Later that year the Secretary of Defense in a program decision memo told the Navy we should actively pursue an alternative fighter to the F–14.

The Senate Armed Services Committee in September told us to obtain proposals from industry, and evaluate these proposals to determine if a smaller, cheaper aircraft could be designed for a smaller fighter to complement the F–14.

In a budget review guidance received in February 1974, we were told the Navy should reexamine basic operational requirements for a lightweight, low-cost, fighter aircraft with the intent of determining whether a low cost, less sophisticated system than that characterized by the VFX can be used to complement the F–14 aboard carriers.

In response to much of this guidance the Chief of Naval Operations in the summer of 1973 commissioned what came to be called Naval Fighter Study Four. Out of that came some of the requirements, the presolicitation notice, and finally the RFQ for this NACF.

Now, on May 2, 1974, Mr. Clements appeared before the Senate Armed Services Committee, accompanied by a number of us, and he said there that it appears possible that a lighter weight, less expensive combination fighter and attack aircraft, which we might call the VFAX could be developed which would complement the F–14, and eventually provide a replacement for the A–7.

COMMITTEE REPORT

This is the committee's report of September 18, 1974, referred to a number of times here today. I won't go through that.

- **APPROPRIATIONS COMMITTEE REPORT (18 SEP 74)**
  - ". . . $20,000,000 PROVIDED . . . (FOR) 'NAVY AIR COMBAT FIGHTER' RATHER THAN VFAX. ADAPTATION OF AIR FORCE AIR COMBAT FIGHTER . . . IS THE PREREQUISITE FOR USE OF THE FUNDS PROVIDED . . . FUTURE FUNDING IS TO BE CONTINGENT UPON CAPABILITY OF THE NAVY TO PRODUCE A DERIVATIVE OF THE SELECTED AIR FORCE AIR COMBAT FIGHTER DESIGN."

## SUBSEQUENT GUIDANCE

- DEPSECDEF LTR TO COMMITTEE CHAIRMEN OF APPROPRIATIONS COMMITTEES OF 1 NOV 1974
  - "...IT IS ESSENTIAL THAT STUDIES AND EVALUATIONS BE MADE OF NACF DESIGNS OF BOTH ACF CONTRACTORS."
- CONGRESSIONAL REPLY (20 NOV 74)
  - "...THE COMMITTEE INTERPOSES NO OBJECTION TO THE UTILIZATION OF FUNDS AS SET FORTH IN YOUR LETTER."
- DEPSECDEF LTR TO COMMITTEE CHAIRMEN OF 7 MAR 1975
  - "...WE HAVE INSTRUCTED THE NAVY TO COMPLETE ITS EVALUATION OF BOTH FIRMS' PROPOSALS IN A FULLY COMPETITIVE ATMOSPHERE."

CONTRACTOR STUDIES ON F–16 AND F–17

In a letter to the committee Chairman of November 1, 1974, the Secretary of Defense requested that the Navy be allowed to use a part of that $20 million which was in the fiscal year 1975 budget, saying that it is essential that study and evaluations be made of NACF designs of both ACF contractors. What he was asking was permission to use about $12 million to have both contractors make studies and present derivatives of the F–16 and F–17 for our evaluation.

The committees replied, in effect, and said that they interposed no objection to the utilization of funds as set forth in his letter.

Then the Secretary of Defense's letter of March 7, 1975, which was sent after the Air Force selected the F–16. Mr. Clements informed you at that time, as stated earlier, what he intended to do, namely, he wanted us to continue the evaluation in a competitive atmosphere, and evaluate these proposals on their merits.

Chairman Mahon's reply, and your reply to Mr. Clements are shown here.

SUBSEQUENT GUIDANCE

Chairman Mahon HAC reply (13 Mar. 75) ; ". . . I have no objection to the approach you set forth."

Chairman McClellan Sac reply (17 Mar. 75) ; ". . . The committee has no objection to your plan for expending the amount appropriated in FY-75."

PROPOSAL REQUESTS TO INDUSTRY

This reviews very quickly for you and for the record what happened in this particular competition. We went out for request for proposal through the Air Force to General Dynamics/LTV on the one hand, and McDonnell Douglas/Northrop on the other in October 1974.

FISCAL YEAR 1975 NACF STATUS

Initial RFQ responses received, Dec. 2, 1974.
Complete RFQ response received, Jan. 13, 1975.
Technical discussions with contractors, Jan. 15–16, 1975.
Amended contractor proposal received, Feb. 3, 1975.
Source selection announced, May 2, 1975.
Sustaining engineering contract award, May 2, 1975.
FSD contract award expected in August 1975.

SOLICITATION RESPONSES

We received the initial responses, primarily technical responses, on December 2, 1974. You might remember that we didn't go out with this RFQ until October, so these companies had to work very quickly. They had a lot of work to do in a short time.

Chairman MCCLELLAN. You sent out your solicitation in October?

Admiral LEE. October of 1974.

Chairman McClellan. And you had received responses by December.

Admiral Lee. Partial response by December. A good part of the technical information by December.

Chairman McClellan. They had a complete response by the 13th of January?

Admiral Lee. Yes, sir. And on the 13th of January the Air Force announced their selection of the F–16.

Our initial evaluation of this, as stated by Dr. Currie, was that neither design would be acceptable to us for carrier use, that is neither derivative as proposed initially by the two teams I have mentioned, namely, LTV/General Dynamics and McDonnell Douglas/Northrop.

We got complete responses in January of 1975 and, as is customary in a source selection competition, we had detailed technical discussion with the two companies on 15 and 16 January where we pointed out what our technical people had found out about these proposals. We pointed out the weak areas. The areas where we thought these proposals were deficient, and we didn't make any suggestions as to how they could fix it, but we felt, as is usual in these proposals, the companies should have our views of them so they can make corrections if they so choose.

We got amended contractor proposals on February 3, and from February 3 to May 2 we evaluated these proposals, the complete proposals, and during this week preceding May 2 we made our recommendation that the McDonnell Douglas/Northrop entry be declared the winner of this source selection, and that McDonnell Douglas/Northrop be awarded a sustaining engineering contract to last about 4 months for $4.4 million, and that General Electric, winner of the contract, be awarded $2 million in a sustaining engineering contract to last about 4 months. The full-scale development contract, provided the program is approved, would be awarded in August or September of 1975.

INTERIM CONTRAST TO NORTHROP

Chairman McClellan. I understand you have already awarded an interim contract to Northrop?

Admiral Lee. Yes, sir. On May 2, in accordance with Mr. Clements' letter to you and your approval, he requested permission to use the rest of that $20 million to award sustaining contracts, which were awarded to McDonnell Douglas and General Electric.

Chairman McClellan. How much was left?

Admiral Lee. There is $7.5 million left of the $20 million, I believe.

Chairman McClellan. That is all you are absolutely committed to at this point?

Admiral LEE. We are only committed to the $6.4 million, $4.4 million to McDonnell Douglas/Northrop, and $2 million to General Electric.

Chairman MCCLELLAN. There is still the opportunity for the Congress to take action if it disapproves your decision? It can take action without any great loss?

Admiral LEE. Yes, sir.

Chairman MCCLELLAN. We may lose valuable time, but we wouldn't sustain any financial loss of any consequence?

Admiral LEE. Yes, sir.

THREAT DEFENSE INTELLIGENCE PLANNING PROJECTION

| | Radar range | Missile BVR range | Number | Percent |
|---|---|---|---|---|
| Aircraft: | | | | |
| Fishbed | [Deleted.] | | | |
| Flogger | | | | |
| New air superiority | | | | |
| FTR | | | | |
| Foxbat | | | | |
| [Deleted] | | | | |
| Surface-to-air: [Deleted.] | | | | |

Now in writing the operational requirements, of course the Chief of Naval Operations uses the Defense Intelligence Planning Projections and evaluates the performance of threat fighters not only currently but those in the 1980's. I won't dwell too long on this, but our people in Admiral Houser's organization looked at [deleted].

U.S./U.S.S.R. FIGHTER AIRCRAFT COMPARISONS

Chairman MCCLELLAN. Wouldn't you agree that Russian is also planning new planes as well?

Admiral LEE. [Deleted.]

Senator YOUNG. Russia plans to build new fighters. How do they compare in speed?

Admiral LEE. Senator Young, I have a chart later on, and I make that comparison.

VFAX [NACF] OPERATIONAL REQUIREMENTS

OPERATIONAL BUDGET

Multi-mission close-in fighter;
Day and night attack in high-threat environment [visual conditions].
Number VFAX's will be used in air superiority missions: Beyond visual range air-to-air;

Two-seat operational trainer.

VFAX [NACF] OPERATIONAL REQUIREMENT—PERFORMANCE

| Parameter | Threshold | Goal |
|---|---|---|
| Fighter escort radius (NM) | [Deleted.] | |
| Strike mission radius w/4 mk 83 (NM) | | |
| Load factor, subsonic (D) | | |
| $P_s$ (mn=.9; 10,000 ft) | | |
| Accel (mn=[deleted] [deleted] | | |
| Combat ceiling, int. thrust | 45000 ft | [Deleted] ft. |
| Minimum useable approach speed | [Deleted] kts | [Deleted] kts. |
| Deck spot factor | 1.1 | 1.0. |
| Freefall bomb accuracy | [Deleted] mil | [Deleted] mil. |
| TOGW (less than) | | 30,000 lb. |

VFAX [NACF] OPERATIONAL REQUIREMENT

AVIONICS

Air superiority missions: Radar; [Deleted.]

Air-to-ground missions: Radar; [Deleted]; Visual atack; Conventional and guided munitions.

REQUIREMENTS SENT TO NASC

Admiral LEE. The requirements as sent to the Naval Air Systems Command—as you understand, I am in the procurement business, and these requirements are sent over to us. I won't read all of these but these are the requirements that were sent to us.

The operators wanted an airplane that would have a fighter escort radius of [deleted] miles, a strike mission radius, and an attack mode of [deleted] miles, a load factor—namely, that is a measure of maneuvering performance—of [deleted] G's, specific excess energy, which is another measure of performance, of [deleted] feet per second, acceleration capabilities at [deleted] feet going from mach [deleted] to mach [deleted.]

We wanted a ceiling of [deleted] feet using intermediate thrust. A minimum approach speed for carrier landing of [deleted] knots was required. We wanted a deck spot factor of 1.1. The bigger the plane the fewer you can put aboard a carrier. We like to have them as small as possible.

We wanted the ability to drop free fall bomb with less error.

For those aircraft assigned for air superiority minimum we wanted the plane to have a radar with a range of [deleted] have [deleted].

For those aircraft assigned for air-to-ground missions the Chief of Naval Operations asked that this plane have a radar capable of air-to-ground rangefinding and ground mapping employ the [deleted] have a day or night usual attack capability and handle conventional bombs and munitions.

# F-17 TO F-18 WEIGHT BUILD UP

| | |
|---|---|
| TAKE OFF WT F-17 | 25,500 |
| + | |
| STRUCTURES & CARRIER SUIT | 2,564 |
| + | |
| ENGINES & PROPULSION | 188 |
| + | |
| AVIONICS & EQUIPMENT | 1,068 |
| + | |
| WEAPONS & PROVISIONS | 1,222 |
| + | |
| ADDED FUEL | 3,100 |
| = | |
| TAKE OFF WEIGHT F-18 | 33,642 |
| △WT F-17 ⟶ F-18 | 8,142 |

OPERATIONAL REQUIREMENTS

Admiral LEE. In terms of operational requirements, the F–18, winner of the competition, has these requirements with the carrier approach speed slightly high. This has been talked about briefly here during the course of this morning and this afternoon.

But we asked for a minimal approach speed of about 125 knots with this new airplane. It looks as though the winner will have a minimum approach speed of about 130 knots. We think in building this plane, and especially building a fighter version and an attack version, that minimum usable approach speed will drop because the weight will come down. Our aerodynamicists think by fine tuning the high lift devices, it should drop a bit. As Admiral Houser has pointed out, 130 knots is about the same approach speed as the A–7 and other planes we have in the inventory.

We like to have the airplanes be able to come aboard as slowly as possible. This causes less wear and tear on the airplanes and makes for a safer operation aboard ship.

F–17/F–18 COMPARISON

We have a comparison here of the F–17 versus the NACF or the F–18. The F–17 for the fighter mission weighed about 25,500 pounds. In modifying this F -17 to operate from an aircraft carrier, we added about 2,500 pounds for structure and carrier suitability, arresting hooks, catapult provisions, stronger landing gear, stronger keel, high lift devices, engines and propulsions, avionics equipment, weapons provision, and added fuel.

I should point out this is an RFQ airplane, the airplane that McDonnell Douglas proposed to meet operational requirements I mentioned earlier.

In deciding what the airplane will be like, we take into consideration these two areas here where we think we can take out some weight. If we buy a fighter airplane only, we will not have to put in all the attack provisions and, in addition, there is some question as to whether we need all of these avionics. But the F–18 will weigh roughly 8,000 pounds more than the land-based F–17 from which it was derived.

INCREASED WEIGHT OF F–18

Chairman MCCLELLAN. Is that increased weight primarily because of the strengthening of the frame and so forth, for landing purposes?

Admiral LEE. 2,500 pounds of that is because of carrier suitability structures. Another 3,000 pounds is fuel. And then, of course, about 2,000 pounds are weapons and provisions for attack and avionics.

In these areas we think we can scrub this weight down considerably.

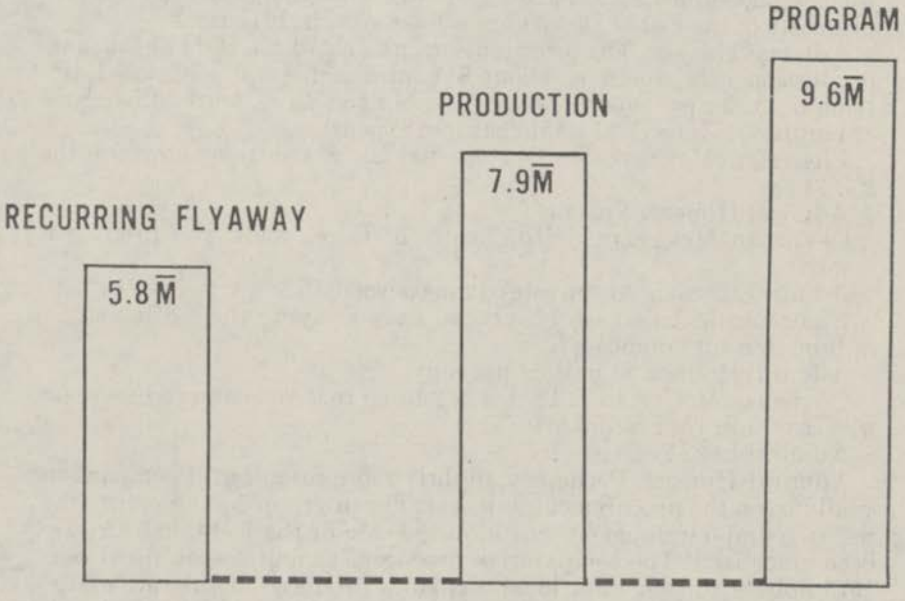
COST ESTIMATES

Our estimates on cost. We estimate the F–18—once again this is the airplane that was proposed by two teams of companies, and we believe that we can bring these costs down if we take a good look and scrub our avionics and, in addition, for the fighter airplanes leave out the attack provisions we don't have to have, and for the attack planes leave out the fighter capabilities such as the capability of carrying a Sparrow and increased radar capability.

# F-18 UNIT COSTS

## NAVAIR ESTIMATES

(FY 75$ - 800 UNITS)



FLYAWAY COST

The recurring flyaway cost would be $5.8 million, procurement unit cost of $7.9 million, and a total program unit cost of $9.6 million. The total program unit cost would include flyaway costs, support, and spares.

Chairman McCLELLAN. That is per unit?

Admiral LEE. Yes, sir.

Chairman McCLELLAN. How does that cost compare with the cost presently of the F–14? Do you have those, Admiral Houser?

Admiral HOUSER. The procurement unit cost of the F–14 at the same production rate would be about $11 million for 800 additional airplanes. At six per month, which it is built at now, it would be about $14 million. So the F–14 would be more expensive.

Chairman McCLELLAN. You are paying $14 million now for the F–14?

Admiral HOUSER. Yes, sir.

Chairman McCLELLAN. How many of these would you produce a month?

Admiral HOUSER. At the rate of nine per month.

Chairman McCLELLAN. So you do have a saving there of about $4 million in round numbers?

Admiral HOUSER. $4 million per copy.

Chairman McCLELLAN. That is assuming that you can produce these planes within your estimate?

Admiral LEE. Yes, sir.

Admiral HOUSER. Perhaps a slightly more meaningful comparison would be on the procurement unit cost. The program cost amortizes the research and development which, in the case of the F–14, has already been amortized. The comparative procurement unit cost in fiscal year 1975 dollars for 800 additional airplanes produced at the rate of 108 airplanes per year is $7.9 million for the F–18, compared to $11 million for the F–14.

Chairman McCLELLAN. What is the cost of the F–14 now? You have $7.9 million for this plane, and the program cost is up there.

Admiral LEE. The current flyaway of the F–14 is about $12 million. Procurement is about $14 million, and program is about $18 million for the F–14.

Chairman McCLELLAN. It is about 80 percent above that of the F–18?

Admiral HOUSER. That is correct.

Chairman McCLELLAN. So we would get a larger number of these for the same dollars?

*F–18 total R. & D.*

[Millions of 1975 dollars]

| | |
|---|---|
| Airframe/CFE | 600 |
| Avionics | 165 |
| Engine—development installation and SP | 68 |
| Other—GFAE | 7 |
| Subtotal | 1,074 |
| Support | 249 |
| Navy ACT./management (includes 20 fiscal year 1975) | 110 |
| Total | 1,433 |

R. & D. COSTS

Admiral LEE. That is right. These are the R. & D. costs in today's dollars, and we hope to reduce these numbers. The airframe and contractor-furnished equipment R. & D. bill would be about $600 million, avionics—$165 million, that makes the assumption we would build a new radar, engine development—$234 million, installed and spare engines for the 11 R. & D. aircraft—$68 million, other Government-furnished equipment—$7 million, for a total of about $1,074 million. This is the total cost for the R. & D. of the aircraft in fiscal year 1975 dollars.

TOTAL COST OF F–18

Chairman MCCLELLAN. What's the total figure?

Admiral LEE. $1,074 million, and then there, of course, would be support costs, which I don't think you have seen in the F–16 program but, as Dr. Currie pointed out——

Chairman MCCLELLAN. What is the total figure?

Admiral LEE. $1,433 million.

Chairman MCCLELLAN. That will buy the 11 planes that you need?

Admiral LEE. Yes, sir; 11 airplanes plus support and spares for those 11 airplanes. It would do all the test flying, the operational test flying and so forth.

Chairman MCCLELLAN. Does that estimated cost include the inflation figure for time you want to begin production?

Admiral LEE. Yes, sir.

Chairman MCCLELLAN. That covers all the cost up to date?

Admiral LEE. Yes, sir.

*F–18 schedule*

| Schedule event: | *Date* |
|---|---|
| Source selection | May 1975 |
| Sustaining engineering | May 1975–August 1975 |
| DSARC II | August 1975 |
| Full-scale development | September 1975 |
| Engine full-scale development | September 1975 |
| Pilot production | November 1980 |
| Rate production | October 1981 |
| IOC | September 1982 |

SCHEDULING EVENT

Admiral LEE. The schedule that has been proposed begins with source selection, which has been completed. The sustaining engineering contracts have been signed, and they will run from May 1975 through August 1976. Of course, whether or not we go any further than that will depend on the action of Congress. But we would plan to have a DSARC II full-scale development in August 1975. If the program is approved, we would enter into a full-scale development contract in September 1975, start pilot production in November 1980, rate production in October 1981, and have an initial operational capability in September 1982.

THREAT COMPARISON

| | F–18 | Fishbed | Flogger |
|---|---|---|---|
| TOGW. (lb.) | [Deleted.] | | |
| Fuel (internal), (lb.) | | | |
| Armament | | | |
| Combat wt. (lb.) | | | |
| Mmax (A.B. [deleted]) | | | |
| Mmax (int. [deleted]) | | | |
| Combat ceiling (AB) ft | | | |
| Combat ceiling (int.) ft | | | |
| Sustained load factor | | | |
| Deleted] | | | |
| Ps [deleted] ft sec | | | |
| Acceleration [deleted] sec | | | |

THREAT COMPARISON

Admiral LEE. Now we come to the threat comparison, and I have the F–18 shown against the [deleted].

There are two or three things I would like to point out. These are threat aircraft, that is the [deleted]. So we think that the F–18 will have a very good performance indeed when compared against these threat aircraft.

Chairman MCCLELLAN. These figures are still on paper, they haven't been tested. There is no prototype by which you can establish the accuracy of these figures? This is still an estimate?

Admiral LEE. Yes, sir. This is still an estimate.

Chairman MCCLELLAN. Hopefully, if you achieve your goal in these areas, that would be the comparison?

Admiral LEE. Yes, sir.

Senator HRUSKA. In which of these factors would the thrust developed in the F–18 reflect itself?

Admiral LEE. It would affect acceleration. It would affect the excess power available. It would affect maximum speed. It would have a very strong affect on all of these performance figures.

Senator HRUSKA. The word "hopefully" was suggested here. Hopefully these results would be attained.

Admiral LEE. Yes, sir. However, I should point out that our engineers express high confidence in the estimates, primarily because of the flight data obtained during the USAF prototype programs.

Senator HRUSKA. If we had an alternative with the other engines and other configurations which were used and discarded, we wouldn't even get to the hopeful stage, would we? We would have a definite negative answer; is that correct?

DEVELOPMENT PROBLEMS OF ENGINES

Admiral LEE. The other three proposals contained, for instance, the F–100 engine also required some modification in one of the LTV proposals, and its performance was not nearly this good. The F–401 engine, which was in another LTV proposal, required considerable modification and development, and its performance was not as good. The B–1 engine, which is in another LTV proposal, that is the F–101, its performance was a little better than the first two LTV models but not as good as the F–18 performance.

I think the development problems associated with the first two engines, namely, the F–100 engine, which they intended to put a new fan on, and the F–401 engine would be about the same in terms of risk as the development problems associated with this, J–101/F–404 engine of the F–18. We think the development problems are comparable in terms of time, in terms of dollars, and in terms of risk.

Senator HRUSKA. At what point of the program will these factors be demonstrated and proven?

Admiral LEE. In the engine in about 30 months. I didn't bring that schedule over but we would be pleased to provide that for the record. It shows the engine development schedule, the point it has to pass its preliminary performance test or rating test, and when it should be qualified. Of course, that is always a key development point in the engines, and I believe that is to take place in accordance with our current schedule in 1978.

[The information follows:]

ENGINE DEVELOPMENT MILESTONES

Full Scale Development Contract—Sept. 1975,
Complete Preliminary Flight Rating Test—March 1978,
Complete Military Qualification Tests—April 1979,
Complete Simulated Mission Endurance Test and Full Scale Development—June 1980,
Delivery of Flight Test Engines—April 1978—June 1979.

ACTUAL TEST FLIGHT DATE

Chairman MCCLELLAN. That is the first testing of the engine?

Admiral LEE. It would be tested in the meantime——

Chairman MCCLELLAN. I mean tested in flight.

Admiral LEE. Yes, sir. The first flight would take place in 1978 also. In the meantime about the time of first flight we would have this engine put in the test cells and put through its paces, so to speak, and pass its preliminary qualification tests and final qualification tests to demonstrate the specifics, namely, the thrust, the fuel consumption, and so forth.

OPERATIONAL CAPABILITIES

| Performance | F–18 | F–4J | F–14A | A–7E |
|---|---|---|---|---|
| Strike radius (NM) | [Deleted.] | | | |
| Ferry range (NM) | | | | |
| Normal carrier approach speed: | | | | |
| (W/6000 lbs), KTS | | | | |
| (W/3000 lbs), KTS | | | | |
| Recovery wind over deck (W/6000 lb), KTS | | | | |
| Deck spot | | | | |
| Sustained buffet free load factor: | | | | |
| (M .65, 10K), G | | | | |
| (M. 90, 10K), G | | | | |
| $P_s$ (M .9, 10K), ft/sec | | | | |
| Structural "G" | | | | |
| Acceleration [deleted] sec | | | | |
| Max speed (max thrust) [deleted] mach | | | | |
| Combat ceiling (mil thrust), ft | | | | |
| Fighter escort radius (NM) | | | | |

COMPARISON OF F–18 TO OTHER AIRCRAFT

The next slide, we compare the F–18 to several of our current aircraft. We compare it to the F–4J. Mr. Chairman, we compare here, as you so succinctly pointed out, this is a paper airplane, and these three planes are in being, we know what they will do. We have compared the operational capabilities of these four planes, the F–18, F–4J Phantom, F–14A Tomcat, and the A–7.

OPERATIONAL CAPABILITIES

| | F–18 | F–4J | F–14A | A–7E |
|---|---|---|---|---|
| Avionics: | | | | |
| Air-to-air radar detection range (NM) | [Deleted.] | | | |
| Air-to-air missiles: | | | | |
| Beyond visual range | | | | |
| Infrared | | | | |
| Air-to-ground delivery accuracy (mils) | | | | |
| Weight (lbs.): | | | | |
| Empty weight | 20,583 | 30,778 | 38,188 | 18,546 |
| Internal fuel capacity | 10,500 | 13,587 | 16,200 | 10,036 |
| Takeoff gross weight | 33,642 | 47,086 | 58,180 | 30,500 |
| Armament | [Deleted.] | | | |
| Maximum catapult takeoff gross weight | 50,064 | 56,000 | 72,566 | 42,000 |
| Maximum catapult payload with full internal fuel | 13,400 | 11,000 | 17,616 | 11,869 |
| Air-to-ground ordnance: | | | | |
| MK–83/84 | [Deleted.] | | | |
| Guided munitions | | | | |

OPERATIONAL CAPABILITIES

As you can see, the strike radius in the F–18 we think will be [deleted] miles. The F–4J is [deleted]. The F–14A is [deleted], and the A–7E is [deleted].

We will talk about operational capabilities of these four aircraft. We start with avionics, and we point out the detection ranges of the radar as currently proposed for this airplane [deleted] miles, the F–4J is [deleted] miles, the F–14A is [deleted] miles, and A–7E has no such radar.

In this next line we tell you what missiles these planes will carry. Of course, only the F–14A can carry the Phoenix.

Then we show you the air-to-ground accuracy. For the F–18 it is [deleted] mils versus the A–7E [deleted] mils, our best light attack plane. [Deleted.] That means air-to-ground accuracy is [deleted] mils. That is 1 foot in 1,000 feet. It would be the error you would expect in delivering a bomb by one of these planes, the average error. The lower the number, the better.

Chairman McClellan. I understand that, but if it is lower, it means a smaller target area. I would like to have some idea what area that [deleted] represents.

Admiral Lee. If you drop bombs at 3,000 feet, half the bombs would hit inside a circle of a radius of [deleted] feet, and half would drop outside the circle of [deleted] feet.

Chairman McClellan. If you hit within [deleted] feet you can do enough damage to put away the target.

Senator Hruska. It is the next figure that would bother me, which is [deleted] mils. How would that multiply out?

Admiral LEE. It would be three times [deleted] half of the bombs in [deleted] feet roughly, and half outside. This is normally the way we measure capability in terms of air-to-ground attack, the mil error that the attack system will give you. It is a measure of its capability.

Then on the next line we talk about empty weight, and that gives you a very good idea of the size of this airplane, empty weight being 20,538 pounds. The F–4J is 30,778. The F–14A is 38,188 pounds, and the A–7E is 18,546.

Operational capabilities, now on the first line on the next page we talk about the strike radius of this airplane. This would be carrying a load of bombs. The F–18 we say would have a radius of about [deleted] miles. The F–4J is [deleted] miles. It wasn't built for this purpose. The F–14A is [deleted] miles. The A–7E about [deleted] miles.

The carrier approach speed, fully loaded [deleted] knots for the F–18, the F–4J is [deleted] knots, the F–14A is [deleted] knots, the A–7E is [deleted] knots.

Chairman MCCLELLAN. These are the landing speeds?

Admiral LEE. Yes, sir, landing speeds. So you see even not making improvements, the F–18 compares very favorably with the A–7E landing speed.

Chairman MCCLELLAN. You testified you would be able to make improvements in that?

Admiral LEE. Yes, sir. We believe we can.

PERFORMANCE FACTORS

The other areas of interest would be the performance factors that I mentioned earlier, namely, the sustained bullet-free load factor of [deleted] G's, and [deleted] G's, which is a measure of performance of the airplane.

Another commonly used measure of performance is how much specific excess power an airplane would have under given conditions. Here we talk about if the airplane is traveling at mach 9 at 10,000 feet, how much additional thrust would it have. It could be translated loosely into terms of rate of climb. It is given in feet per second and called specific excess power. It is just a measure of performance. The F–18 would give us [deleted] feet per second, which tells us you have a real hot performer. The F–4J is [deleted]. The F–14A is [deleted].

Another measure would be acceleration, mach [deleted] to mach [deleted] in [deleted] feet, the F–18 we think would take about [deleted] seconds to accelerate from mach [deleted] to mach [deleted]. The F–4J would take [deleted]. The F–14A would take [deleted].

We will provide this presentation for the record, and all of these numbers, Mr. Chairman.

Senator HRUSKA. In this form?

Admiral LEE. Yes, in that form.

Our conclusions are that the F–18 is designed to meet the projected threat. That it can perform both fighter and light attack missions. That it will have lower operating costs. That it will permit reduction in aircraft types aboard our aircraft carriers, which is a very

important goal for us, and it will be a lower cost complement to the F–14A, which we have been working and studying on for the last 4 years, as I pointed out in my opening set of slides.

That concludes my presentation.

Chairman McCLELLAN. Thank you, Admiral.

Now, do you have anything else?

Dr. CURRIE. General Evans has the description of the Air Force.

Chairman McCLELLAN. We will have to suspend for a moment. They have signaled for a vote. Will you excuse us, please.

[Voting recess taken.]

## Department of the Air Force

**STATEMENT OF LT. GEN. WILLIAM J. EVANS, DEPUTY CHIEF OF STAFF, RESEARCH AND DEVELOPMENT**

**ACCOMPANIED BY:**

**LT. GEN. JAMES STEWART, COMMANDER, AERONAUTICAL SYSTEMS DIVISION, WRIGHT-PATTERSON AIR FORCE BASE, OHIO**
**MAJ. GEN. ABBOTT C. GREENLEAF, DIRECTOR OF PROGRAMS, DEPUTY CHIEF OF STAFF, PROGRAMS AND RESOURCES**
**BRIG. GEN. BOBBY W. PRESLEY, DEPUTY DIRECTOR OF BUDGET, COMPTROLLER OF THE AIR FORCE**
**LT. COL. THOMAS O. MILLETT, CHIEF, AIRCRAFT PROGRAMING BRANCH, OFFICE OF THE DEPUTY CHIEF OF STAFF, RESEARCH AND DEVELOPMENT**
**GALE E. MYERS, DEPUTY COMPTROLLER, AERONAUTICAL SYSTEMS DIVISION, WRIGHT-PATTERSON AIR FORCE BASE, OHIO**

PREPARED STATEMENT

Chairman McClellan. General Evans, you may proceed.

General Evans. Mr. Chairman, in the interest of saving time, it may be appropriate for me to enter my prepared statement in the record, and we can proceed into General Stewart's briefing.

Chairman McClellan. Let that be done then. We will receive your statement in the record.

[The statement follows:]

Mr. Chairman and Members of the Committee:

It is a privilege to participate in this special hearing on fighter aircraft as it affords us the opportunity to discuss our plans for the tactical force structure and the fighter aircraft programmed for the Air Force inventory. We are aware of your particular interest regarding F-15 and F-16 cost and capability comparisons and believe it is to our mutual benefit that these sessions be as candid and informative as possible. Your questions are welcome at any time during the presentation. Immediately following my statement, we will present a briefing that summarizes our most recent F-15 and F-16 comparisons.

The Air Force currently has 26 organizationally structured wings. This 26 Tactical Fighter Wing structure and the associated command and control mechanism provides a force immediately ready to respond to world-wide commitments. Nominally, each of our fighter wings would be equipped with 72 aircraft. However, they currently are under-equipped and our plan is to gradually increase their unit strength, bringing them to full combat capability by 1981. The 26 active fighter wing level is below the objective force level recommended by the Joint Chiefs of Staff to meet the national strategy at a prudent level of risk. Considering current fiscal realities, however, the 26 wing level represents the best balance between combat capability and resource availability that the Air Force, the JCS, and the Department of Defense can achieve.

The Air Force fighter force is designed and structured to achieve specified objectives in the face of the current

and projected threat. Our potential adversaries are improving both the quality and quantity of their forces. They are currently numerically superior to the combined NATO tactical air forces by a factor of almost 2 to 1. Additionally, their force posture is becoming more offensively oriented. The Soviets are developing improved aircraft and munitions more closely attuned to that posture, and now routinely deploy their latest and most sophisticated weaponry as evidenced by the 1973 Mid-East conflict. Aircraft such as the variable geometry wing FLOGGER, the long-range FENCER and FITTER attack fighters, the Mach 3 FOXBAT and the newer models of the FISHBED are characteristic of the qualitative improvements in their forces. Many of the Soviet forces are forward deployed in Warsaw Pact countries. Thus we are required to maintain a sizable portion of our forces deployed and immediately available to the needs of the theater commander.

Warsaw Pact ground forces, which already possess perhaps the most modern and formidable armor capability in the world, are also increasing in numbers and improving in capabilities, thus presenting an even greater challenge to our ground attack capability. Another area in which the Soviets are improving their capabilities is air defense. An example of their achievements was demonstrated against the Israelis during the October 1973 Mid-East war. A highly mobile surface-to-air missile was employed against the Israeli tactical air forces. Although Israeli airpower was a key factor in the outcome of the war, enemy surface-to-air missiles and concentrated anti-aircraft guns were effective, and demonstrated impressive technological gains in Soviet built air defense weapons.

In sum, these documented developments illustrate a general trend toward upgrading the versatility and flexibility of combat forces possessed by our potential adversaries -- a step that most certainly represents an increased threat to the free world and US interests.

The Air Force plan to fully equip our designated 26 Tactical Fighter Wings is based on several important considerations. First, the clear indications that threat capabilities are increasing in both quality and quantity. Second, our prior investments in research and development can now provide air power of unprecedented deterrent power and fighting capability. Third, as a result of management efficiencies, the adoption of a high-low weapons system mix and the significantly improved operational efficiency and the lower life-cycle-costs of our newer aircraft, we can accomplish this expansion within manpower ceilings and projected fiscal constraints. Additionally, our non-combat essential resources are being reduced and converted to either fighting or direct support assets.

Our planned mix of tactical fighters will, in the main, emphasize individual aircraft capabilities in specific mission areas. We are developing aircraft specifically designed for optimum performance in a certain role or mission, which also enhances aircrew proficiency and performance in each mission area. This greater specialization of aircraft and training will result in signficant cost savings compared to the costs required to procure, operate, and maintain a force composed entirely of multipurpose aircraft. For example, the F-15 and, to a lesser extent, the F-16 need

not be equipped to perform all-weather or night ground attack to the degree of the F-111, and the A-10 need not have the attack radar of the F-15, F-16, F-4, or F-111. These savings in initial investment and life cycle costs can then be devoted to increasing the total number of aircraft and enhancing force modernization, flexibility and combat capability.

Also, the life cycle cost savings resulting from the employment of more reliable and efficient tactical fighters will free resources to maintain a larger force. For example, Operations and Support costs for the F-16 will be about 75 percent of that for an equivalent number of F-4s. These savings will accrue as we continue aircraft conversions to attain our desired "high-low" mix force.

The complementary high-low mix of forward deployed F-15s and F-16s will ensure the retention of the US qualitative advantage while partially offsetting the Soviet/Warsaw Pact quantitative advantage. The F-16 will be a versatile fighter which will effectively complement the other more specialized aircraft that will comprise our active tactical force in the 1980s. Armed with infrared missiles and an internal 20mm cannon, the F-16 will be exceptionally effective in the visual, close-in maneuvering air combat arena complementing the full spectrum capabilities of the F-15. The F-15 has greater top speed than the F-16, more rapid supersonic acceleration, longer range radar, a beyond visual range missile (AIM-7) kill capability, a greater air-to-air armament payload, and an advantage in maneuvering at high supersonic speeds. The F-15 has a broader systems capability for air-to-air combat and the ability to defeat enemy aircraft

in any environment regardless of weather conditions. On the other hand, the F-16 has slightly better subsonic, transonic, and low supersonic turning performance and a greater radius of action with its design payloads. The smaller size of the F-16 results in the tactical advantage associated with small visual and radar signatures. The F-16 will also have a night-adverse weather attack capability with its radar ground mapping feature, and can generate approximately [deleted] more combat sorties for an equal amount of fuel.

While the F-15 will provide the USAF with a qualitative edge over all known and projected threat aircraft, its relatively higher cost precludes us from reducing our quantitative deficiency. By virtue of its reduced sophistication and lower life cycle costs, the F-16 will permit the expansion as well as the continued modernization of our tactical fighter force. The F-16 ground attack capabilities will also complement the A-10 in close air support and the F-111 in the battlefield interdiction and counter air attack roles. Overall, the F-16 will enhance the achievement of air superiority and will be capable of exploiting that achievement by swinging rapidly to the ground attack role even under conditions of poor visibility.

Together, the F-15 and F-16 will provide a quantum increase in our air combat capability. When these two fighters are combined with AWACS, there will be an even greater increase in tactical force effectiveness. AWACS will be a highly survivable command and control system capable of surveillance of enemy air space and detection of low flying targets. It will provide early warning of impending attack,

positive identification of hostile aircraft, and vectoring of the F-15 and F-16 to positions of advantage. These aircraft have radar capabilities which will permit early autonomous control by the attacking fighters, thus increasing the effectiveness of AWACS by freeing it to concentrate on other threats within the battle area. This synergistic relationship between the F-15, F-16, and AWACS will assure the optimum utilization of their combat capabilities, and increase the force effectiveness and flexibility available to theater commanders.

Concurrent with the planned improvements in the active force, we are aggressively pursuing modernization of the reserve force, which is a major factor in our contingency planning. The Air Reserve Forces now train for and participate in most Air Force major mission areas. It is noteworthy that by [D] the reserve fighter attack force is programmed to be composed entirely of F-4s, A-7s, and A-10s. All of the A-10s and some of the A-7s will be new production aircraft and are indicative of the modern, fully capable equipment to be provided the Air Reserve forces. The 10 reserve wings will effectively complement the active force under conditions involving mobilization.

In summary, we plan to reach fully equipped 26 wing posture in the early 1980s while remaining within projected manpower and fiscal levels. Specifically, our objectives are to increase the quality, quantity, and readiness of our fighter forces, improve our command and control capabilities, remain within our active Air Force manpower ceiling, and meet the fiscal guidance levels projected by OSD. So structured, Air Force general purpose forces will be responsive to crisis

[D]=Deleted

and conflict situations worldwide through forward deployment, rapid reinforcement, and graduated alert and dispersal capabilities. They will be able to make a decisive contribution to the national strategy across a broad range of employment options and operating environments. While the general purpose force structure will remain short of our quantitative goal, it will significantly enhance our tactical capabilities worldwide.

Gentlemen, this concludes my prepared statement.

F–15 AND F–16 PERFORMANCE AND COSTS BRIEFING

Chairman McClellan. You may now proceed with your briefing.

General Evans. We have a briefing on the F–15 and F–16 performance and costs.

General Stewart is part of our Aeronautical Systems Division.

General Stewart. My briefing runs about 35 minutes. I have a prepared text which accompanies each chart, and I have provided copies to your staff.

## Statement of Lieutenant General James Stewart

F–15/F–16 PERFORMANCE COMPARISONS

General Stewart. Without further ado, let us make some performance comparisons of the F–15, as it is being manufactured today and the planned F–16.

[The information follows:]

F–15/F–16 Cost and Performance Comparisons

Performance comparisons.
Cost comparisons.
Miscellaneous related subjects.
- F–16 contract particulars.
- Foreign military sales items.
- Single-vs-twin attrition estimates.
- F–15 termination consequences.

F–15/F–16—Performance Comparisons

AIR-TO-AIR CONSIDERATIONS

Absolute overall comparisons difficult . . .

Maneuvering technical parameters: primary, thrust/weight and wing loading, secondary, maneuver flaps; AFT C.G.; etc.

Range/radius technical parameters: fuel fraction and specific fuel consumption.

Speed . . .

Armament; fire control system; etc.

F–15/F–16 MANEUVERING "YARDSTICK"

F–15 specific excess power: Three flight conditions at 10,000 ft., three flight conditions at 30,000/35,000 ft., with 50% internal fuel no missiles.

F–16 max sustained turns and acceleration: Turns at .9 and [deleted] mach at 30,000 ft., accel time .9 to [deleted] mach at 30,000 ft., fuel for 7 turns accel, [deleted] NM return.

VARIATIONS IN F–15 AND F–16

General Stewart. Absolute overall performance comparisons are extremely difficult for two aircraft designed for different speed-altitude regimes and different armaments. It is further complicated by recognition that potential improvements—for example, more internal fuel in the F–15—could be incorporated to improve performance in any one given area—occasionally, with little penalty in one or more other areas.

Maneuverability generally is a product of two primary technical parameters. These are thrust-to-weight ratio—in effect, horsepower

per pound—and wing loading—or weight in pounds per square foot of wing area. The F–15 has a slight edge in both of these areas.

Chairman McClellan. You are talking about the Air Force plane?

General Stewart. Yes, sir, I will compare the F–15 and F–16 in performance and cost.

Many secondary technical considerations can modify the impact of the primary parameters—for example, the maneuvering flaps, aft center of gravity, and speed brake effectiveness of the F–16.

The primary paramenters that determine range/radius are fuel fraction—the percentage of takeoff weight devoted to fuel weight—and specific fuel consumption, or fuel economy of the engine. The F–16 has an edge in fuel fraction.

Speed, of course, is important. Here, the F–15 has a considerable margin at medium and high altitudes, principally because its variable engine air inlets permit higher thrust at the higher supersonic speeds.

And finally, to assess capability, in addition to purely performance matters, appropriate consideration must be given to the armaments carried, the fire control system, and other factors such as high-G and high visibility cockpits.

F–15/F–16 MANEUVERING "YARDSTICKS"

The maneuver performance potential of the F–15 is reflected in the SAR as specific excess power in feet per second, at [deleted] flight conditions, with 50 percent internal fuel on board, and no missiles.

Positive excess power is a measure of the potential of the aircraft to initiate a climb, or an acceleration, or a turn or tighter turn. As might be expected, because of its slightly higher thrust-to-weight ratio, the F–15 has more specific excess power than the F–16 at [deleted] of the [deleted] points.

The maneuver performance of the F–16 is measured—and will be reflected in the future SAR—as maximum sustained turns in level flight at two conditions and acceleration time from 0.9 to [deleted] Mach. The F–16 shows a slight sustained turn advantage at both points.

In acceleration, the times are about the same from 0.9 to [deleted] Mach, with the F–15 having a slight edge; however, the F–15 clearly accelerates considerably faster from [deleted] Mach—a derivative of its higher maximum speed.

Rather than show you a bunch of meaningless numbers, I believe I can best illustrate the above with a composite speed, altitude, G envelope.

Chairman McClellan. From what you have said so far, the F–15 seems to be a better plane.

General Stewart. In some areas, it certainly is, no question.

F–15/F–16 Sustained Load Factor

(F–16 ground rules)

Legend: F–15 and F–16 [deleted].

COMPARISON OF F–15/F–16 MANUEVERABILITY

This chart compares maneuverability of the two aircraft throughout their speed and altitude limits. The [deleted] and [deleted] lines within

the envelope are really lines of zero excess power, or can be translated into level flight, constant speed, sustained turns at so many degrees per second. For example, [deleted] at mach [deleted] at 30,000 feet, translates into [deleted] degrees per second turn rate. The aircraft that can sustain more G's at a given speed and altitude has a maneuvering advantage.

What this chart says, in essence, is that the F–15 and F–16 are about equal in turning ability, with the F–16 having a slight edge up to about mach [deleted] in speed. Then, the F–15 designed for higher speed—mach [deleted] versus about mach [deleted] for the F–16—which is made possible to a large degree by its variable engine air inlets—begins to show an ever-increasing advantage until speed and altitude combinations are reached where only the F–15 can fly.

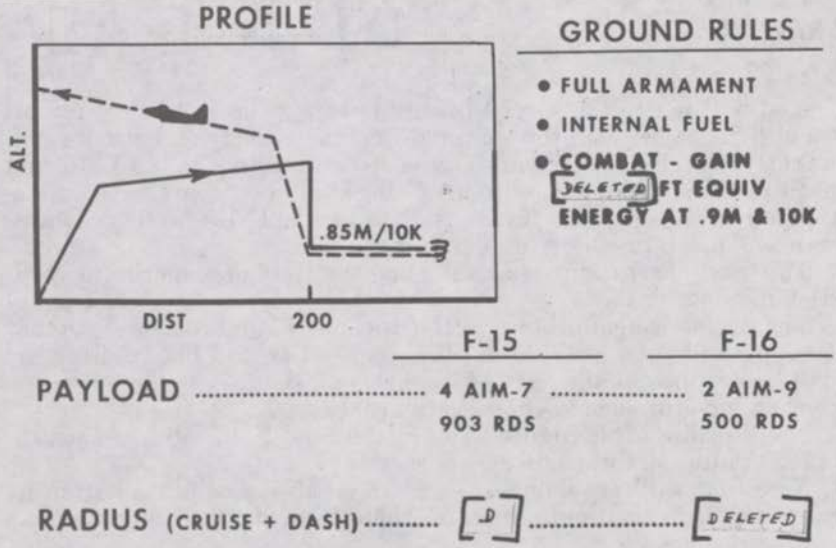
Chairman McClellan. Which has the advantage?

General Stewart. The solid line is the F–16. It shows a slight advantage in degrees per second that it can turn. Most of these altitudes up to about [deleted] mach, then we start reaching altitude and speed combination where only the F–15 will fly, the F–16 won't fly at all.

I gave you an example. I said up to about [deleted] mach the lines are very close together, with the 16 having a slight edge.

I think that is probably enough on maneuverability. Let's look at unrefueled radius of action using, first, the F–15 design criteria yardsticks and, next, the F–16 design criteria.

## AIR SUPERIORITY RADIUS
### (F-15 DESIGN MISSION)



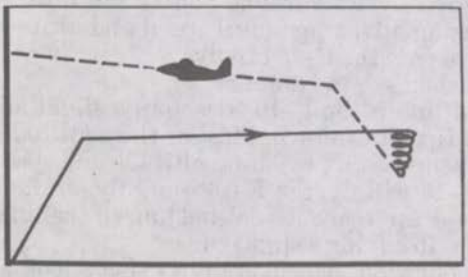

The block in the upper left shows the flight profile to be accomplished on internal fuel. Under the ground rules, the "gain of [deleted] feet of equivalent energy" in the combat area, for which no distance is credited, is simply a means of allocating fuel to be available for combat maneuvering.

52-800 O - 75 - 5

At the bottom, the design air-to-air weapon payloads of the two aircraft, missiles and rounds of 20-mm ammunition are shown, as well as the total radius of each. Here, the F–16 shows an advantage in radius because of its higher fuel fraction—recall that being fuel as a percentage of total weight at takeoff.

## AIR SUPERIORITY RADIUS
### (F-16 GROUND RULES)

PROFILE



GROUND RULES

- DROP EXTERNAL TANKS
- FIRE MISSILES & ½ AMMO
- COMBAT - 7 TURNS @ .9 & [D] M, ACCEL FROM .9 TO [D] M @ 30K
- RETURN FROM 20K

| | F-15 | F-16 |
|---|---|---|
| PAYLOAD | 2 AIM-7<br>500 RDS | 2 AIM-9<br>500 RDS |
| RADIUS | [D] | [DELETED] |

You will notice the spread of estimates for the F–16 thus reflects the difference between the contractor estimate today and a more conservative Air Force estimate. This small uncertainty in the F–16, and not the F–15, reflects the different stages of the programs—production hardware and much flight test data for the F–15; prototype hardware and much less flight test data for the F–16.

This next chart compares radii using the F–16 design criteria yardstick mission.

The profile is again shown in the upper left hand corner. Note that F–16 ground rules use external fuel tanks at takeoff but specify they will be dropped at the start of combat, and the rest of the mission—combat and cruise home—done on internal fuel.

And because of its higher fuel fraction, the F–16 shows an advantage in radius on this particular mission.

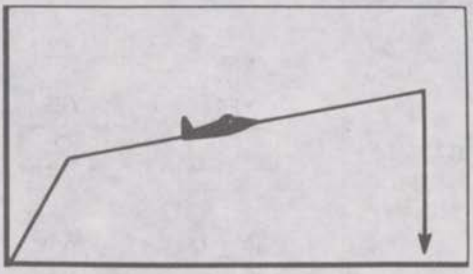
Note that we have reduced the F–15 AIM–7 missile load from its normal four to two, and rounds of 20mm from 903 to 500 for comparability purposes.

These radii are both about 20–25 miles more than we previously indicated to the Congress because of recent changes in both aircraft—200 pounds more internal fuel in the F–15, and slightly higher thrust in the F–16 above about mach [deleted] in speed. The latter increases

the F–16 radius because less time is used in the required acceleration from .9 to [deleted] mach, and thus more fuel is available for the cruise home leg.

## FERRY MISSION
### (F-16 GROUND RULES)

PROFILE



GROUND RULES

- NORM MAX T.O. WT
- RETAIN EXT TANKS
- 500 RDS 20MM; MISSILES OPTIONAL
- RESERVE: 20 MINS SEA LEVEL+5% INITIAL

| | F-15 | F-16 |
|---|---|---|
| CONFIGURATION | 3x600 EXT<br>500 RDS | 2x600 EXT<br>500 RDS<br>2AIM-9'S |
| UNREFUELED RANGE | [ ] | [DELETED] |

This chart companies the unrefueled ferry range of the two aircraft using the F–16 designed ground rules.

The results are shown at the bottom of the chart, with spread of F–16 estimates again reflecting the difference between current contractor estimates and a more conservative Air Force estimate.

We have flown an unrefueled F–15 further than any of these figures—last year, non-stop from Maine to England. In addition to its internal fuel and three 600 gallon tanks, that F–15 carried two experimental tanks on the side of the fuselage—called "fastpacks." We have not decided whether or not to procure some of these for the fleet.

In addition to climbing, turning, accelerating, radius and range, the respective fire control system, armament and defensive systems of the two aircraft should also be considered in assessing their relative air-to-air combat capabilities.

The F–15 has a clear advantage in this area with a more powerful, longer range radar, coupled with four all-weather longer-range AIM–7 missiles versus the normal two AIM–9 missiles in the F–16.

Chairman McClellan. What is that down range? There is quite a distance there.

General Stewart. Think of the plane in level flight, looking up away from the earth, and you are looking for a target against the sky, and looking down is toward the ground. Searching for an airplane against the ground clutter, you get shorter detection range.

# FIRE CONTROL SYSTEMS/ARMAMENT
## (AIR TO AIR)

| | F-15 | F-16 |
|---|---|---|
| **COMPUTE/RANGE GUN SIGHT** | YES | YES |
| **RADAR** | | |
| •HEAD UP/DOWN DISPLAY | YES | YES |
| •AUTO ACQUIRE/TRACK | YES | YES |
| •LOOK UP/DOWN RANGE *(N. MI.) | [ ] | [ ] |
| **ARMAMENT** | | |
| •VISUAL GUN | M-61 | M-61 |
| •CLEAR WX MISSILE | AIM-9 | AIM-9 |
| •ALL WX MISSILE | AIM-7 | — |
| **ECM** | ALL INTERNAL | INT + ECM POD |

*85% PROB DETECT; 5 SQ METER TARGET

Chairman McClellan. That is about [deleted] F–16 has only about [deleted] the range of the 15?

General Stewart. Yes, sir.

Chairman McClellan. It isn't the plane that detects a target, you mean visual detection, don't you?

General Stewart. We are talking about radar, I am sorry. I have a hard time seeing [deleted] miles even with my glasses.

[Deleted] radar range is not just important for firing missiles when the target cannot be seen, it frequently is important in visual combat in offering a positioning advantage to the aircraft with the [deleted] range radar.

This is helpful in visual combat as well as long-range blind missile firing.

Chairman McClellan. You don't think the 16 plane is greatly handicapped by that range, do you?

General Evans. No, sir. We do not. We think that is an adequate radar on balance for what we are asking the F–16 to do in our inventory.

General Stewart. [Deleted.]

[Deleted.]

### Air to Ground Considerations

Absolute overall comparisons difficult.

Important technical parameters: Thrust/weight and wing loading, fuel fraction and specific fuel consumption, strength.

Size.

Armament; fire control system; etc.

AIRCRAFT COMPARISONS IN VARIOUS FIGHTER-BOMBER SCENARIOS

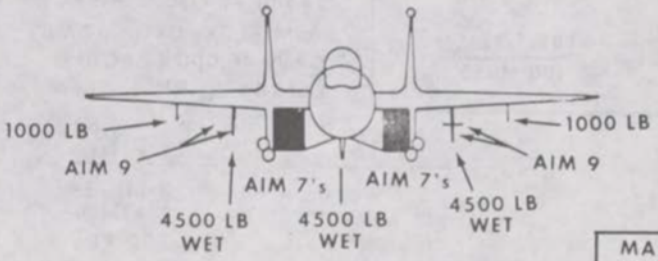
Switching from air-to-air combat for a few moments, let me next compare the two aircraft in various fighter-bomber scenarios.

The same cautionary notes I expressed earlier also apply here. Further, the same technical parameters important in air-to-air combat—thrust to weight, wing loading, fuel fraction, fuel consumption, and strength—are also significant in air-to-ground capability.

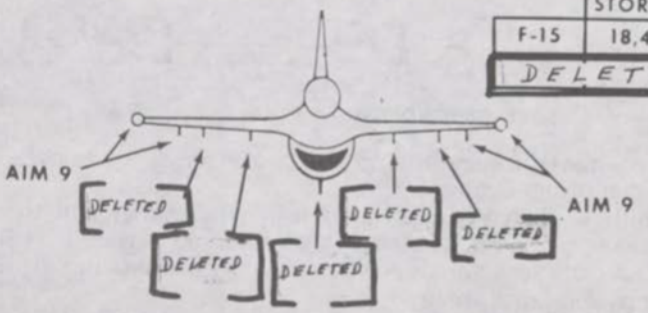
In addition, size difference is also important. The larger aircraft can carry a larger external payload. Further, the aerodynamic drag penalty of any given load usually impacts the radius of the larger aircraft less than the smaller one. On the other hand, there are advantages to being smaller—this pertains to air to air as well as air to ground. The smaller aircraft is more difficult to detect—radar or visual—and has less probability of being hit when it is fired at.

And finally, for an overall assessment of combat capabilities, factors other than flight performance must be considered.

## F-15/F-16 EXTERNAL STORES




| | MAX EXT STORES | MAX/W FULL INT FUEL |
|---|---|---|
| F-15 | 18,470 | 16,528 |
| DELETED | | |




These head-on drawings depict the points where external fuel, bombs, and missiles can be carried.

The various pound totals indicate the maximum load which can be carried at any one station. The word "wet" indicates fuel or bombs can be carried at those locations. Also shown are the normal locations for the four AIM–7's on the F–15 and the two AIM–9's on the F–16.

Note that the F–16 wing/pylon design is optimized somewhat more for the air-ground role than the F–15, with five relatively heavyweight stations to three for the F–15.

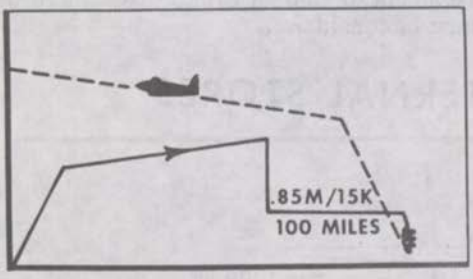
Chairman McClellan. I thought the F–16 was a two-engine plane?

General Stewart. The 15 is two, the 16 has one engine. The 17 is a two-engine plane.

The maximum external load that can be carried on the F–15 with full internal fuel is about [deleted] pounds more than you have seen before. We recently increased the allowable maximum takeoff weight as a result of test experience. Likewise, I predict the maximum external weight permissible on the F–16, with full internal fuel, will be increased by 1,500 pounds, or so, in the future as test results reveal just how much margin is in the design.

## AIR GROUND RADIUS
### (F-16 GROUND RULES)

PROFILE




GROUND RULES

DROP EXT TANKS

RETAIN MISSILES & AMMO

COMBAT - 1 TURN & GAIN 24000 FT EQUIV ENERGY @ .85M @ 5K; DROP BOMBS; GAIN 40,000 FT EQUIV ENERGY @ .9M @ 5K @ MAX POWER

| | F-15 | F-16 |
|---|---|---|
| PAYLOAD | 2 MK-84<br>2 AIM-9<br>500 RDS<br>ICS | 2 MK-84<br>2 AIM-9<br>500 RDS<br>1 ECM POD |
| RADIUS | [D] | [DELETED] |

AIR GROUND RADIUS

This graphic compares the radius of the two aircraft versus the F–16 design mission ground rules.

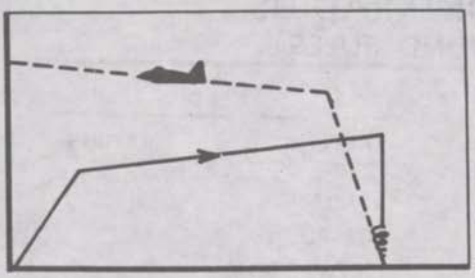
The flight profile is shown in the upper left hand corner and the ground rules in the upper right. Maneuvers are specified in the combat area, for which no distance is credited, as a means of allocating fuel for maneuvering in the target area.

The payloads are indicated at the bottom. Note that on the air-to-ground mission, the F–16 carries an external EMC pod. The letters "ICS" in the F–15 column stand for internal countermeasures system.

The F–16 shows a significantly higher radius in this profile with this payload. The reasons are twofeld: First, again, a higher fuel fraction; and second, the pylon capabilities on the F–15 restricts the external fuel which can be carried with two 2,000-pound bombs.

# AIR GROUND RADIUS
## (NATO GROUND RULES)

PROFILE



GROUND RULES

- DROP EXT TANKS
- RETAIN MISSILES & AMMO
- COMBAT - 5 MINS V-MAX @ SL IN NON-AB POWER

| | F-15 | F-16 |
|---|---|---|
| PAYLOAD | 2 AIM-7<br>500 RDS<br>ICS<br>+<br>2 MK-84 or 6MK-82 | 2 AIM-9<br>500 RDS<br>1 ECM POD<br>+<br>2 MK-84 or 6MK-82 |
| RADIUS | [ ] | [ DELETED ] |

Next, let us compare the two aircraft using the so-called NATO standard "yardstick" air-to-ground mission with two different bomb loads—in one example, two 2,000 pound Mark 84 bombs; and, in the other, six 500 pound Mark 82 bombs.

As before, the profiles and ground rules are shown at the top, payloads and radii at the bottom.

Note that the F-16 has a higher radius with two Mark 84's than it has with six Mark 82's. Let me explain why.

Although the total weight of bombs and adapter racks for the two payloads are about the same, the aerodynamic drag of six Mark 82's plus their adapter racks is much higher than two Mark 84's, thus the smaller radius for the F-16.

In the case of the F-15, however, more external fuel can be carried with the six Mark 82's, because of pylon capability and arrangement than with Mark 84's, and thus the radius increases significantly despite the added aerodynamic drag.

Finally, using F-16 air-to-ground rules again, which allocate more fuel for maneuvering in the target area than does the NATO profile, this chart compares radii of the two aircraft with various increasing numbers of external Mark 82 bombs, the 500 pound bomb.

This chart also illustrates the point of the much lesser penalty to the bigger aircraft, beyond a certain point, of the aerodynamic drag and weight of given external payloads. The footnote points out that

with 18 Mark 82's carried externally on the F–16, it would be necessary to carry external fuel in lieu of an ECM pod to have any radius at all.

## AIR-GROUND-RADIUS
### (F-16 GROUND RULES)

| F-15 | | F-16 | |
|---|---|---|---|
| PAYLOAD | RADIUS | PAYLOAD | RADIUS |
| 2 AIM-7<br>500 RDS<br>ICS<br>+ | | 2 AIM-9<br>500 RDS<br>1 ECM POD<br>+ | |
| 6 MK-82 | DELETED | 6 MK-82 | DELETED |
| OR | | OR | |
| 12 MK-82 | | 12 MK-82 | |
| OR | | OR | |
| 18 MK-82 | | 18 MK-82 | |

[DELETED]

You can figure out different payloads, Mr. Chairman, that just reverse the thing back and forth at times, and you need to look at more than one scenario.

In addition to payload and radius combinations, the fire control systems, diversity of armaments which can be carried, and defensive systems of the two aircraft must also be considered in assessing their relative air-to-ground capabilities.

Here the F–16 has the advantage, possessing a limited all-weather bombing capability by virtue of its planned beacon offset and more capable ground map radar, and in additional weapons it will be able to carry such as the Maverick missile.

F–15/F–16—COST COMPARISONS

Next, let me make some cost comparisons of the F–16 versus additional quantities of F–15's beyond those now contemplated in the DOD-approved F–15 program, airplanes beyond the 729 figure.

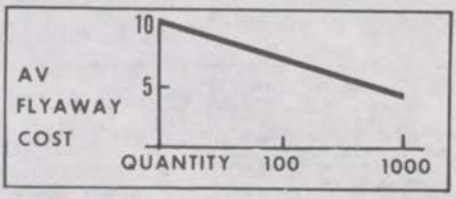
First, however, there are a few points to keep in mind. As with performance, because of program differences, it is also difficult to make a single overall cost comparison and have high confidence that it is the single overall correct answer.

# FIRE CONTROL SYSTEMS/ARMAMENT
(AIR TO GROUND)

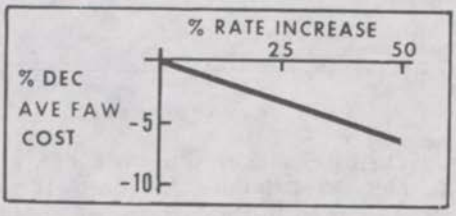
| EQUIPMENT | F-15 | F-16 |
|---|---|---|
| • INERTIAL NAV SET | YES | YES |
| • DIGITAL COMPUTER | YES | YES |
| • HEADS-UP DISPLAY | YES | YES |
| **RADAR** | | |
| • AIR-GROUND RANGING | YES | YES |
| • BEACON OFFSET | NO | YES |
| • GROUND MAP | NO | YES |
| **ARMAMENT** | | |
| • M-61 GUN | YES | YES |
| • MK-82, 84, ETC | YES | YES |
| • MAVERICK | NO | YES |
| **ECM** | ALL INT. | INT DELETED |

# COST CONSIDERATIONS

- QUANTITY INFLUENCE




- RATE INFLUENCE




- LIFE CYCLE COST
- GROUND RULES

In unit cost comparisons, where the two aircraft are on the manufacturing "learning curve" is important. That is illustrated in the upper righthand box. It depicts the average flyaway cost versus quantity relationship, in constant dollars, for high-performance fighters of the F–15, F–16 class. It is a logarithmic relationship. To illustrate, if the first one cost 10, the average flyaway cost of 100 units should be about 6.6; and the average flyaway cost of 1,000 units should be about 4.5.

Average flyaway cost is also influenced significantly by the rate of production. For example, in the lower box, if a typical plant were turning out about 10 fighters a month for an average unit cost of $x$, a 50-percent rate increase to 15 a month should decrease the average unit cost at least 6 percent.

It is apparent from the questions that the committee shares our belief that not just development and production, but total life cycle cost should also be considered in any comparisons; and I will show both as we proceed.

And finally, cost comparisons, and conclusions therefrom, are quite often sensitive to ground rules. I will try to keep clear the ground rules and assumptions used in the following comparisons:

F–16 COST ESTIMATE (FY 1975 DOLLARS IN MILLIONS)

| | |
|---|---|
| AF cost estimate: | |
| Full-scale development, 8 A/C | 496 |
| Production, 650 A/C | 3,663 |
| 15 years OPN and support | 4,539 |
| Total | 8,698 |
| SAR cost definitions: | |
| Recuring unit flyaway | 4.63 |
| Production unit | 5.63 |
| Program unit | 6.32 |

F–15/F–16 O. & S. COST COMPARISON

[Fiscal year 1975 dollars in millions]

| Squadron (24 A/C/year | F–15 | F–16 |
|---|---|---|
| Spares and depot maintenance | 5.43 | 3.51 |
| Fuel | 2.85 | 1.84 |
| Equipment/materiel support | 1.66 | 1.14 |
| Pay/people support | 7.82 | 6.94 |
| Munitions | .79 | .79 |
| Total | 18.55 | 14.22 |
| Per aircraft/year | .77 | .59 |

F–16 COST ESTIMATE IN JANUARY 1974 DOLLARS

General Stewart. This is the Air Force cost estimate, in constant January 1974 dollars, for the F–16 program. It is essentially the cost estimate used in the air combat fighter source selection, adjusted only for minor program changes since then.

The full-scale development program includes static and fatigue test articles in addition to six single-place and two two-place test aircraft.

The production program includes the appropriate nonrecurring costs, 650 aircraft, plus peculiar support—AGE, DATA, training, and initial spares.

The operational and support area accounts for the direct field and depot costs of 540 aircraft in operational units for 15 years.

For reference purposes, in SAR terms, recurring unit flyaway, production unit, and program unit costs are indicated on the lower half of the chart.

F–15/O. & C. COST COMPARISON (FY 75 DOLLARS IN MILLIONS)

First, let us look at the annual direct cost, in constant January 1975 dollars, of operating a squadron of F–15's versus a squadron of F–16's

Chairman McClellan. How many planes are in the squadron?

General Stewart. In a fighter squadron—24.

Chairman McClellan. How many in a wing?

General Stewart. In a wing there are normally 72, three squadrons, normally.

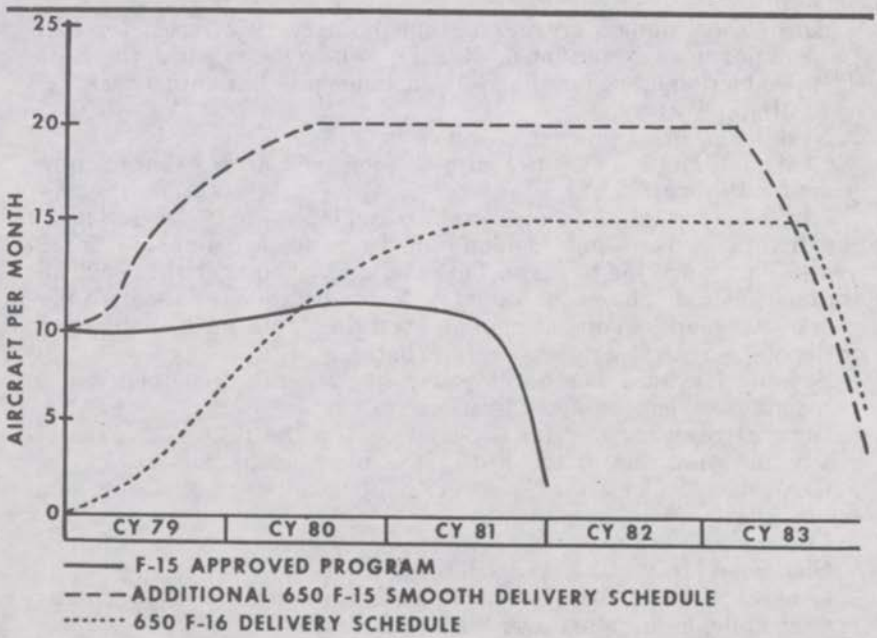
These were estimated using F–16 source selection ground rules for flying hours and munition expenditures for comparison purposes. At the bottom, for your convenience, is the direct operating and support cost per aircraft per year.

I'll let you look these over for a few seconds.

I divided the totals on that.

Senator Hruska. Why the big difference on spares and maintenance?

General Stewart. Two engines, more fire control system, a lot of the things would be very similar, brakes don't differ much, or hydraulic pumps, you have a bigger engine and bigger radar, that is the big difference, two engines versus one, but it doesn't automatically work out at twice the amount of fuel.



One last item before comparing the costs of additional F–15's versus F–16's, let me show you the delivery schedules—in rates per month versus calendar year—on which our estimates are based.

The solid line represents the final years of the presently approved 729 aircraft F–15 program. The dotted line represents the planned delivery rate per month for the 650 aircraft F–16 program. And the dashed line represents total F–15 production rates for the basic program plus possible additional F–15's.

F–16/F–15 (INCREMENTAL) COST COMPARISONS

| | F–16 | F–15[1] | |
|---|---|---|---|
| | | Add-on | Follow-on |
| Quantity | 650 | 520 | 650 |
| Cost: | | | |
| Full scale development | 496 | 0 | 0 |
| Production | 3,663 | 3,948 | 4,932 |
| 15 years O. & S. | 4,539 | 4,752 | 5,942 |
| Total | 8,698 | 8,700 | 10,874 |

[1] Buys to 729 A/C SAR program.

LIFE CYCLE COST OF BASIC F–16

This table compares the life cycle cost of the basic F–16 program versus add-on/follow-on quantities of F–15's.

The first column has the F–16 totals shown earlier. The middle column represents an equal life cycle cost quantity of 520 additional F–15's delivered on the schedule shown on the previous chart. The last column represents the direct life cycle cost of 650 add-on/follow-on F–15's.

All of these dollars are in constant January 1975 terms for comparison purposes. Note that no R. & D. costs are charged to the F–15. The production costs for the F–15 includes peculiar support as well as recurring flyaway.

Next, let me break down into unit costs.

Chairman McClellan. Is that $8 billion the cost of the whole program for 15 years?

General Stewart. This operates 520 airplanes for 15 years. That is the direct cost of people, fuel, and hardware for 520 airplanes for 15 years. This is 520 for 15 years. This would fly about 430 of the 520 additional F–15 airplanes for 15 years. Normally we have about 75 percent of our planes in operational and training units and the others are in depots, in reserve, or purposes like that.

Senator Hruska. The development has already been incurred, so you don't take that into consideration?

General Stewart. As I will show you on the next chart, that is really marginal cost of the F–15. It is incremental add-on.

Chairman McClellan. I'm sorry, gentlemen, but we are being summoned to vote again.

[Voting recess taken.]

Chairman McClellan. We will resume.

General Stewart. Mr. Chairman, let me—we just finished at a delivery schedule, let me start over with this chart.

SOME UNIT COST COMPARISONS

[Fiscal year 1975 dollars in millions]

| | F-15 | | |
|---|---|---|---|
| | SAR | Additional | F-16 |
| Quantity | 729 | 520 | 650 |
| Average unit cost: | | | |
| Flyaway | 8.40 | 6.50 | 4.69 |
| Pec supply and initial spares | 1.72 | 1.09 | .95 |
| 15 years opn and supply | [1] 9.14 | 9.14 | 6.98 |
| Total | 19.26 | 16.73 | 12.62 |
| Including F-16 FSD | | | 13.38 |

[1] O. & S. computed on F-16 ground rules.

UNIT LIFE CYCLE COSTS

This table compares the average unit life cycle costs of 520 add-on/follow-on F–15's, in the center column, with the F–15 SAR program in the left hand column, and the planned F–16 program in the right hand column. The production program is broken down into flyaway and peculiar support and initial spares.

For comparison purposes with the preceding table, in the lower right hand column, we have also added the prorated share of F–16 full scale development to the unit cost of the 650 production aircraft.

I will let you digest this for a moment.

Chairman McClellan. This is for operating the F–15.

General Stewart. An equal quantity of F–15's, equal time and these are incremental F–15's on the program.

Chairman McClellan. In order to make a proper comparison we need to know the capability of the two planes as far as firepower, weaponry, whatever purposes.

Senator Hruska. Quality of performance.

General Stewart. The total performance.

Chairman McClellan. In other words, how much more benefit do you get by operating the more costly plane, in terms of damage to the enemy?

General Stewart. I won't evade. Tell me what war you want to fight and I can answer the question.

Chairman McClellan. Didn't you say it cost about 15 percent more?

General Stewart. Yes, sir.

BATTLE EFFECTIVENESS OF F–15

Chairman McClellan. You are talking about cost effectiveness. I am talking about battle effectiveness. Do you get 15 percent more effectiveness from the F–15 than the F–16?

General Stewart. We mentally wrestled with that one.

Chairman McClellan. That would be the question, it seems to me.

General Stewart. Once again you need to look at many different scenarios. I can devise a scenario where the F–16 is the better buy. I can devise another scenario where the F–16 can't even operate, and it isn't a question of which is better, one is zero effectiveness. It is a question of which is the better buy.

Chairman McClellan. One thing I have considered a problem all these years is that we have to have so many different types of planes. Isn't there any way to get this resolved down to four or five types of planes to do all of the missions we need?

General Evans. Yes, sir. I think when you come up with a force structure you want to have fighter aircraft, you want a mixture of specialized aircraft, specialized in air to air and air to ground, but also you want a flexible element in there, an element of aircraft that can do either the air to air and air to ground and complement the specialized aircraft. We want quality in our Air Force, yet we want quantity in our Air Force.

We look in Europe at the Warsaw Pact enemy forces, we see a definite quantitative deficiency there between the United States and Warsaw Pact forces. We want to overcome that deficiency by adding more into our force structure, more quantity, more aircraft. Yet we don't want to up the cost of maintaining that force, so we are looking for a cheaper aircraft. I shouldn't say cheaper, I should say more economical aircraft that still has the level of capability that can meet the threat.

The F–16 is that aircraft. It is the swing force in our force structure in the 1980's.

Chairman McClellan. You are going to finally convince us this airplane is the solution.

General Evans. I think that would be a good way to represent the aircraft.

What we are looking to show you is the F–16 and F–15 capabilities complement one another very well, and the lower cost of the F–16 allows us to buy more of those and thereby help us overcome that quantitative deficiency we face in Europe.

General Stewart. This one compares the average unit life cycle cost of 520 add-on/follow-on F–15's, and those are in the center column with the F–15 SAR program in the left-hand column, and the planned F–16 program in the right-hand column. The production program is broken down into a flyaway and peculiar support and initial spares.

For comparison purposes with the preceding table, in the lower right-hand column, we have also added the prorated share of F–16 full-scale development to the unit cost of the 650 production aircraft.

I will let you digest this for a moment.

Senator Stevens. What does the FSD mean in the last line?

General Stewart. Full-scale development prorated against the 650 airplanes.

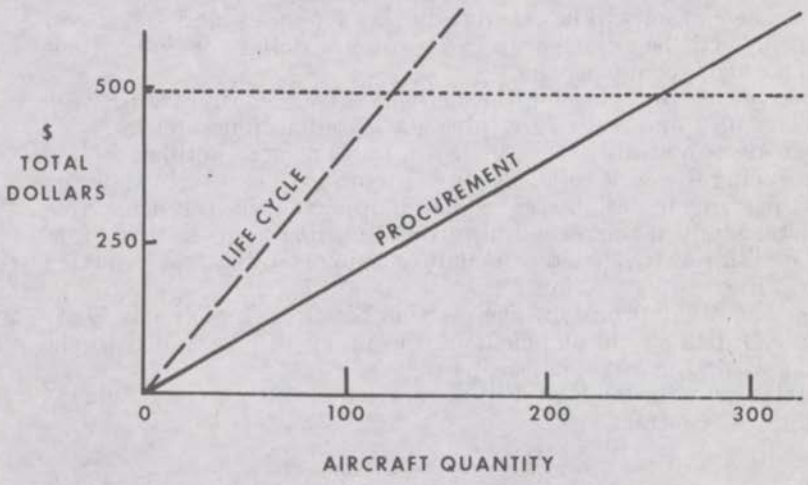
One of your questions was that based on the planned F–16 buy, how long would it take to save the F–16 R. & D. costs versus the costs of additional F–15's?

Plotted on the left is total January 1975 dollars, with the dotted line at the $496 million level, the F–16 full-scale development program. Shown here are two cross-over points derived using the previous table.

The two diagonal lines represent the unit cost difference—for the production program, and for life cycle cost—between an average add-on/follow-on F–15 and an average F–16.

Based on procurement unit costs, what this says is that at about 255 F–15's or 255 F–16's, the higher cost of the F–15 has amortized the F–16 R. & D. costs. Based on life cycle costs, the crossover occurs at about 120 aircraft.

# FULL SCALE DEVELOPMENT CROSS-OVER




I think Dr. Currie mentioned 100 to 200 aircraft as a crossover.

GENERAL OBSERVATION

From preceding, without considering any already-sunk development costs, it is clear that an add-on buy of F–15's is more costly than a basic buy of F–16's. . . . How much more depends on what is compared.

I think the following is kind of self-evident. With regard to the last line you can generate a wide variety of how much more can be generated. For example, the average unit life cycle cost of 520 additional F–15's is 25 percent more than the average unit life cycle cost of the planned 650 aircraft F–16 program. The average unit flyaway cost of 520 additional F–15's is 38 percent more than the average unit cost of 650 F–16's.

I do not find any reasonable comparisons less than 19 percent. And percentages higher than 38 can be derived by considering average F–15 unit costs or by comparisons with the F–15 SAR program.

MISCELLANEOUS—F–15/F–16 MATTERS

Next, let us move on to my third and last area—brief discussions of those miscellaneous subjects listed on the briefing outline at the beginning.

F–16 AIRFRAME FSD CONTRACT

Fixed price/incentive fee.
Actual escalation provisions.
Deliver 8 FSD aircraft.
Includes two award fees.
Radar to be added in FY 1976.

FEATURES OF F–16 FULL SCALE DEVELOPMENT

Here are some significant features of the F–16 full scale development contract with General Dynamics, the airframe contractor.

Because of the experience and information gained from the prototype program, a fixed price, incentive fee contract was let for the full scale development portion of the F–16 program.

Actual escalation will be calculated every 6 months, and target cost and ceiling will be adjusted up or down on a dollar-for-dollar basis from a norm of about 6 percent.

The contract provides for the delivery of eight aircraft between December 1976 and July 1978, plus static and fatigue articles.

There are two award fees included in the contract—both associated with reducing life cycle costs. The first, up to $800,000 at critical design review, pertains to design cost reduction opportunities resulting from contractor studies; the second, up to $2.4 million prior to first flight of the FSD aircraft is based primarily on supportability cost reduction opportunities.

After the radar prototype competition between Hughes and Westinghouse, full scale development of the radar will be added to the airframe R. & D. contract in fiscal year 1976.

F–100 engines for the F–16 FSD aircraft are being purchased via the existing F–15 contract.

F–16 PRODUCTION OPTIONS

*Airframe*: Options for first 3 years for USA. only and USA. consortium PGM; fixed price/incentive fee; actual escalation and quantity/slide provisions; award fee; offset terms for USA. consortium PGM.

Engine: Joint F–15/16 buy; otherwise generally same.

NOTE.—Radar not yet on contract.

AIRFRAME FSD CONTRACT

The airframe FSD contract includes two sets of production options for the first 3 years of production. One set of options covers the first 301 aircraft of a United States-only program of 650 production aircraft. The second provides for the first three years production of a joint United States consortium program— 301 United States aircraft and 141 aircraft respectively—of a planned total of 650 U.S. aircraft and 350 consortium aircraft.

These fixed price/incentive fee contract options are based on January 1975 dollars, and—like the R. & D. program— will be adjusted for actual escalation as time moves along. Provisions for variations in annual buys and slips of the option exercise dates are also included. An award fee of up to $8.4 million will be considered, several years downstream, based on contractor-demonstrated supportability in the field of a selected group of major components.

The production options for the joint program also include the provisions of how much manufacturing and assembly will be done in Europe. I will discuss those provisions later.

The engine production options, except for the fact that they are a joint F–15/F–16 buy, contain generally the same provisions as the airframe production options.

FMS GUARANTEE

[Deleted.]

Your committee inquired as to any price guarantee provided foreign governments, and in the event ceilings were exceeded, who pays.

We have made no cost of program guarantees, per se, and have repeatedly explained to the consortium that the DOD could not so commit the U.S. Government. As noted earlier, there are 3 years of production options available for 141 consortium aircraft, with ceiling prices in January 1975 dollars; however, those pertain only if the cost of the 40 percent of their own aircraft the consortium would build is reasonably competitive.

Earlier this year, DOD representatives to the consortium estimated a not-to-exceed average flyaway cost, in January, 1975 U.S. dollars, of $6.09 million. This was based on the ceiling prices for the first 141 consortium aircraft contained in those three production options, estimated average NTE's for 350 aircraft in those options, and estimated FMS-like charges and estimates of Government furnished equipment—including the radar.

THIRD-COUNTRY SALES

Also offered the consortium, in any joint production venture, was the equivalent manufacturing in their countries of 10 percent of the cost of U.S. aircraft, 40 percent of the cost of consortium aircraft, and 15 percent of the cost of third-country sales.

Chairman McClellan. May I interrupt one moment. As I understood your statement this morning, 10 percent of the planes that we get for ourselves will be manufactured in those nations of the consortium.

General Stewart. Yes, sir.

Chairman McClellan. And for the planes that they get, 40 percent will be built in their country.

General Stewart. Yes, sir.

Chairman McClellan. Why do we have to have 10 percent of our planes built over there?

General Stewart. Let me back up a moment. We offered to let them build 10 percent of the cost of our planes in their country, 40 percent of their own in their country, and then to participate with us in third-country sales to up to 15 percent of the cost of those airplanes.

Maybe Dr. Currie can help me out.

Chairman McClellan. Tell me why we have to give them 10 percent of what we are going to keep for ourselves.

Dr. Currie. This was an inducement to make the deal in the first place. It was a negotiated arrangement to at least partially meet the offer of the French who are selling their F–1, the Mirage fighter plane.

Senator Hruska. Was this in competition with a similar proposal by the French?

Dr. Currie. The French offer to the consortium was much more liberal.

General Evans. It was a negotiating point. If you will notice we build 60 percent of their aircraft, so if you look at the tradeoff, 10 percent of ours is 65, and 65 percent of theirs is 215, so the balance there is definitely with the United States.

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Chairman McClellan. We will build the plane, will we not?

General Evans. We will build our aircraft totally. We don't have to depend on them to build specific parts for our aircraft.

Chairman McClellan. That is why I don't understand why we gave it to them.

General Evans. We have the capability, but it was an inducement to get them to buy our aircraft.

Chairman McClellan. Are we certain they are going to buy them?

Dr. Currie. At this point we are not certain. If they do, there is the R. & D. recoupment in that $6 million.

Chairman McClellan. Do you have anything further?

General Stewart. I have a few minutes more, or I can come back at your option.

Chairman McClellan. All right. We will go vote and come right back.

[Voting recess taken.]

Chairman McClellan. All right. We will continue.

FMS Potential (FY 75 Dollars)

McD esimates F–15 market of 695–1055 A/C.
AF/OSD ests F–16 market of 850–2000+A/C.
F–16 potential return on investment: FMS charges, reduced cost U.S. buy, increased standardization in NATO.
Example of F–16 bal of payments potential: 1350 FMS sales, +$5.1B.

FOREIGN MILITARY SALES POTENTIAL

General Stewart. Let us consider foreign military sales potential. First the F–15.

Much interest has been expressed for foreign sales of the F–15, however, thus far, a formal letter of offer has only been made to Iran some time ago, and it was declined in favor of the F–14. A recent McDonnell Douglas survey estimated the market at from 695 to 1,055 aircraft, with the 695 classified as a "better than 50 percent chance" of capturing those markets.

Likewise, much interest has been expressed for foreign sales of the F–16, however, thus far, discussions have been limited to the consortium nations. Air Force, contractor, and OSD estimates range from a low of 850 to more than 2,000 foreign sales—in addition to the planned 650 aircraft USAF program.

Chairman McClellan. You mean you have a potential market for 2,000 F–16 planes?

General Stewart. Yes, sir. The pessimistic ones are 1,000 in addition to the 650, and the real optimists are like 2,000.

Senator Hruska. In addition to our 650?

General Stewart. Yes, sir. My 650 to 2,000 is in addition.

Chairman McClellan. What will they sell for?

General Stewart. They will sell to us—

Chairman McClellan. No, over there.

General Stewart. Probably close to $6 million.

Chairman McClellan. That would be a pretty good tradeoff there.

General Stewart. Yes, sir.

The F–16 potential return on investment and favorable effect on U.S. balance of payments is good in terms of FMS charges payable to the U.S. Government, the reduced cost of U.S. aircraft from any increased production rates for foreign sales, and the direct and indirect benefit of increased NATO standardization.

As an example, apart from consortium considerations, we estimate that foreign sales of 1,350 F–16 aircraft would provide a favorable balance of payments for the United States of at least $5 billion in January 1975 dollars.

SINGLE-VS-TWIN ATTRITION ESTIMATES

Comprehensive USAF study:
Concluded: Destroyed aircraft and engine-caused best measure; annual rates/trends best indicators.
Noted: SE and TE accident rates/trends last 5 and 10 years; safety features of modern fighters; F–100 maturity at F–16 introduction.
Concluded: Start at 7/100,000 and 5+/100,000 hours, respectively; SE average 1.6+/100,000 hours more than TE.

AIR COMBAT FIGHTER SOURCE SELECTION

As part of the air combat fighter source selection, the Air Force accomplished a comprehensive study of probable attrition rates of modern single- and twin-engine fighter aircraft. Although the study was aimed principally at the proposed F–16 and F–17, the F–17 estimates are applicable to the F–15.

To summarize a very long story in a few minutes: One, we focused in on destroyed aircraft—rather than repairable, and engine-caused—rather than engine-related accidents as the best yardsticks for our purposes. We also concluded that annual rates and trends were better indicators than cumulative statistics for future prediction.

Two, the annual rates of single- and twin-engine destroyed aircraft accidents are now approaching [deleted] and [deleted] per 100,000 flying hours, respectively, of which engine-caused accidents are about [deleted] per 100,000 flying hours.

Chairman MCCLELLAN. That is a loss of the planes.

General STEWART. Yes, sir, a crash of the plane. [Deleted] are single-engined fighters, and [deleted] for the twin-engined airplanes.

Chairman MCCLELLAN. That is one about every 14,000 hours?

General STEWART. 14,000 hours, 20,000 hours. Yes, sir. Of that [deleted] engine-caused accidents are about [deleted] out of the single-engine plane, and they are about [deleted] out of the twin.

Also considered in our estimate were the safety features of the F–15, F–16, and F–17 era—higher thrust-to-weight ratios, lower wing loadings, outstanding flying qualities and so forth—as well as the fact that the F100 would be a mature engine by the time the F–16 was introduced into operational service, starting in early 1979.

Three, we predicted that the single- and twin-engined fighters would start out at about [deleted] aircraft-destroyed accidents per 100,000 hours, and that the single engine would average 1.6–1.8 more aircraft destroyed per 100,000 hours than the twin over the next 10–15 years.

AIR CREW FATALITY

One item of interest, there is no difference, of any significance, of aircrew fatality/pilots killed rates between single- and twin-engined fighter aircraft.

Chairman McCLELLAN. Do you mean they escape more readily from twin engined than single engined?

General STEWART. They say there is more difference in takeoff. They say an aircraft crew has more time to get out of the planes. Accidents where people fly into the ground, they don't get out. With most accidents it means people have to have time to get out of the plane. They control it.

Chairman McCLELLAN. I don't see why they have more time to abandon in a single engine than a twin engine.

General STEWART. I am talking of the ones that have more time.

General EVANS. That is independent of the pilots lost. You lose more aircraft in the single-engine category than the twin engine due to engine failure. But of those aircraft destroyed, the pilots will escape equally.

Chairman McCLELLAN. I see.

[Dollar amounts in billions]

| PGM | Loss of operational capability | |
|---|---|---|
| | Total investment | OPNL A/C |
| Return on investment: | | |
| Complete fiscal year 1973 | $3.2 | 30 |
| Complete fiscal year 1973-74 | 3.5 | 92 |
| Employment impact: | | |
| 10,000 at McAir laid off. | | |
| 20,000-25,000 laid off elsewhere. | | |
| Increased prices F-4, F-16, etc. | | |

F-15 TERMINATION CONSEQUENCES

General STEWART. Finally, your committee expressed an interest in the consequences of F-15 program cancellation. Here are four points that come to mind immediately.

The most important is at the top. There would be a significant decrease in operational capability. In particular, the USAF would lack adequate fighter capability to cope with those threat aircraft that can perform outside the F-16 flight envelope and/or are capable of all-weather operations.

The return on investment clearly would be very poor. If the program were canceled immediately, and only the fiscal year 1973 production buy were completed, the United States would have invested about $3.2 billion for 30 operational aircraft. A more reasonable cancellation, if necessary, would be to complete the fiscal year 1974 buy and deliver 92 operational aircraft for the indicated cost.

Chairman McClellan. There isn't any proposal to cancel the F–15, is there?

General Evans. The question was asked, if we did, what would be the consequences? Your staff asked that.

General Stewart. I hope there is no serious consideration of canceling the F–15.

General Evans. The question was what would the impact be if we did.

General Stewart. McAir employment in St. Louis would reduce by some 10,000 employees within a year, at most.

Employment at F–15 suppliers in other parts of the country would reduce by an estimated 20,000 to 25,000.

There would be price increases in other programs. Other McAir programs, such as the F–4, and the new F–18 program, would be affected by the reduced business base. The average price of the F–100 engine in the F–16 would increase due to decreased quantities and manufacturing rates.

Mr. Chairman, that completes my briefing.

General Evans. In summary, Mr. Chairman, I think between the information in my statement and what General Stewart has presented in his briefing we have shown that a mixture of F–15's and F–16's in the Air Force inventory permits continuing modernization of our fighting force and increases the quantity of our fighters to fully equip our 26 wings and operate them within the projected fiscal constraints we foresee into the 1980's.

The F–15 and F–16 performances are complementary, and provide the capabilities that we need in a balanced force to meet the wide spectrum of tactical fighter missions.

Finally, the operational flexibility and the life cycle cost economies in the F–16 fully justifies its place in our inventory.

That completes our presentation, sir.

Chairman McClellan. Any questions, Senators?

Well, I hope we have asked the right questions to elicit the answers that this committee and the Congress ought to have. We have done our best.

QUESTIONS SUBMITTED BY CHAIRMAN M'CLELLAN

We will have the staff working with your staff. After reviewing your testimony, they will prepare some questions for you to answer for the record. If you will, you may submit these for inclusion in the record.

[The questions and answers follows:]

LIGHTWIEGHT FIGHTER AIRCRAFT FUNDING REQUIREMENTS THROUGH 1985

Chairman McClellan. Provide, in the standard Congressional Data Sheet format, the estimated funding requirements for the Navy Air Combat Fighter through 1985.

Admiral Houser. The funding information is as follows.

## F-18 CONGRESSIONAL DATA SHEET (FY-75 $M)

| | FY 76 | FY7T | FY 77 | FY 78 | FY 79 | FY 80 | FY 81 | FY 82 | FY 83 | FY 84 | FY 85 | 86-88 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Procurement - Qty | | | 11 1/ | | 15 | 30 | 72 | 108 | 108 | 108 | 108 | 251 | 811 |
| Cost | | | | | 372.3 | 451.1 | 755.5 | 844.4 | 760.9 | 740.9 | 623.1 | 1375.6 | 5923.8 |
| Less Adv. Proc. | | | | | - 8.0 | -12.0 | -24.0 | -30.0 | -30.0 | -30.0 | -30.0 | -70.0 | -234.0 |
| Net | | | | | 364.3 | 439.1 | 731.5 | 814.4 | 730.9 | 710.9 | 593.1 | 1305.6 | 5689.8 |
| Add Adv Proc. C.Y. | | | | 8.0 | 12.0 | 24.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 40.0 | +234.0 |
| Weapons System Cost | | | | 8.0 | 376.3 | 463.1 | 761.5 | 844.4 | 760.9 | 740.9 | 623.1 | 1345.6 | 5923.8 |
| Initial Spares | | | | | 52.4 | 74.2 | 46.1 | 48.6 | 32.3 | 37.4 | 28.6 | 94.7 | 414.3 |
| Procurement Cost | | | | 8.0 | 428.7 | 537.3 | 807.6 | 893.0 | 793.2 | 778.3 | 651.7 | 1440.3 | 6338.1 |
| Procurement Unit Cost | | | | | 28.6 | 17.9 | 11.2 | 8.3 | 7.3 | 7.2 | 6.0 | 5.7 | 7.9 |
| RDT&E 2/ | 101.0 | 20.7 | 289.6 | 500.0 | 313.4 | 126.8 | 50.1 | 11.8 | | | | | 1433.4 |
| MILCON | | | | | | | | | | | | | |
| Program Acquisition Cost 2/ | 101.0 | 20.7 | 289.6 | 508.0 | 742.1 | 664.1 | 857.7 | 904.8 | 793.2 | 778.3 | 651.7 | 1440.3 | 7771.5 |
| Program Unit Cost (Cumulative) | | | | | 64.7 | 41.9 | 25.0 | 17.4 | 14.2 | 12.6 | 11.3 | 9.6 | 9.6 |

1/ RDT&E Aircraft
2/ $20M FY 1975

LIGHTWEIGHT FIGHTER AIRCRAFT RESEARCH AND DEVELOPMENT COSTS

Chairman McCLELLAN. How much R&D will be required for the Navy Air Combat Fighter? If you had the same dollars, could you get a better A–7 replacement? How would it compare in combat effectiveness to the A–7E?

Admiral HOUSER. Current Navy estimates of the R&D cost for the F–18, including engine and avionics development and testing, are estimated to be $1.43B expressed in 1975 dollars. Without a full scale competition it cannot be stated precisely whether or not, for the same dollars, a better A–7 replacement could be obtained. However, the major requirements of an advanced attack aircraft design are fulfilled in the F–18 attack configuration.

The Navy has assessed that the attack mission configuration of the F–18 will make an excellent A–7 replacement, essentially as good as can be obtained for the dollars required to develop the F–18. The combat effectiveness of another design would not be expected to be substantially better than the F–18 in the attack role.

LIGHTWEIGHT FIGHTER AIRCRAFT PROGRAM COSTS FOR NEXT 10 YEARS

Chairman McCLELLAN. What are the program costs for the next ten years (including R&D as appropriate) to acquire and maintain an operating inventory of two F–14 and two A–7 squadrons per carrier versus one F–14 and three Navy Air Combat Fighter squadrons per carrier?

Admiral HOUSER. Through 1985 the total cost to the Navy to procure and operate a Department of the Navy force to support two F–14 and two A–7 squadrons per carrier is estimated at $17.33B in 1975 dollars. This includes all costs attributable to those forces. Phasing in the F–18, eventually to provide a force to support one F–14 and three F–18 squadrons per carrier, is estimated to require $18.02B or about 4% (or $700 million) more by 1985. With realistic build up and production rates for the F–18, the Navy would not expect to attain the F–18s required to support three F–18 squadrons on all 12 carriers until about 1990, by which time substantial savings for procurement, operating and support costs could be realized. Depending upon F–18 production rates authorized, the "cross-over" point in annual costs for the two alternatives would be between 1985 and 1988 and a modernized force would exist.

The cost of the first alternatives (2 F–14 and 2 A–7 squadrons per carrier) does not include funds which would be required to develop an A–7E replacement in the [deleted]. By [deleted] the A–7E design will be [deleted] years old.

LIGHTWEIGHT FIGHTER AIRCRAFT COMBAT EFFECTIVENESS

Chairman McCLELLAN. Please compare the overall combat effectiveness of the Navy Air Combat Fighter versus the F–14A in the fighter role and the Navy Air Combat Fighter versus the A–7E in the attack role.

Admiral HOUSER. In comparing the F–18 with the F–14A, the F–14A has higher maximum speed ([deleted] Mach vs [deleted] Mach), longer radar detection range [deleted] n.m. vs. [deleted] n.m.) and the ability to track 24 targets at one time, higher fighter escort radius ([deleted] n.m. vs. [deleted] n.m.), increased missile capability [deleted], and lower carrier landing speed ([deleted] knots vs. [deleted] knots). The F–18 exceeds the F–44A in maximum structural "G" limit [deleted], higher sustained load factor, faster acceleration [deleted] sec vs. [deleted] sec from [deleted] Mach to [deleted] Mach at [deleted] and smaller size. In a summary comparison then, the F–14A is overall a superior fighter because of its two-man crew, more capable and versatile avionics system, and wider selection of weapons. The F–18 is smaller, should excel in aeronautical agility and thus in individual air combat. The F–18 should provide an excellent lower cost complement to the F–14A.

In comparing the F–18 and A–7E for light attack missions, the A–7E has about five percent greater strike radius and can be configured to carry about 20 percent more conventional bombs than the F–18. The F–18 can carry an adequate load of ordnance [deleted] and is expected to employ larger numbers of precision guided munitions than in the past. The F–18 has much better aerodynamic agility and performance, including about [deleted] the sustained buffet-free load factor, much greater specific excess power and much faster acceleration. The F–18 also possesses a supersonic dash capability which the A–7E does not have.

In overall light attack mission effectiveness the attack configuration of the F–18 is expected to exceed the A–7E. Of price importance in this assessment is the greater survivability against enemy defensive systems estimated for the F–18 because of its higher speed, superior aerodynamic performance and defensive weapons capability.

### Lightweight Fighter Aircraft Contractor Estimates

Chairman McClellan. Did the Navy and Air Force agree with the contractor estimates? If not, what was the basis for disagreement and was there an attempt to reconcile disagreements?

Admiral Lee. Navy independent estimates did not agree with contractor estimates. Differences between the contractor and Navy estimates were due to (1) the Navy technical evaluation as opposed to the contractor's technical proposals, (2) the interpretation and application of historical data and factors, and (3) projections of future economic levels. All differences essential to conclude source selection were reconciled.

### Method of Computing Flyaway Cost

Chairman McClellan. Was the method of accounting for unit flyaway cost the same for all versions of Air Combat Fighters?

Admiral Lee. The method of accounting for flyaway cost is essentially the same for all versions of Air Combat Fighter. This cost includes airframe/CFE, allowance for engineering changes, engines, and other government furnished equipment plus any nonrecurring costs, i.e. rate tooling required for aircraft acquistion.

### Evaluation of Designs

Chairman McClellan. It is apparent that for all versions of the Air Combat Fighters, their evaluation was based on paper capabilities of the expected production aircraft rather than the prototypes or original contractor submission. In what way were the technical characteristics considered by the Air Force and Navy different for the several variants?

Admiral Lee. The evaluation of the Air Combat Fighter proposals was not based solely on paper capabilities. Estimates by the Naval Air Systems Command accounted for rather extensive engineering data from flight tests of the YF–16 and YF–17 prototypes and wind tunnel tests to determine effects of differences between the prototypes and the NACF.

Technical characteristics of the NACF differed from the ACF in the following:

(a) NACF fighter take-off weight was greater than the ACF by 8142 pounds for the MCAIR design, by 11324 pounds for the LTV/GD Model 1600, by 6677 pounds for the LTV/GD 1601, and by 12773 pounds for the LTV/GD Model 1602.

(b) Because of the higher weight, the NACF designs were physically larger. They compare as follows:

| | F–16 | LTV/GD 1600 | LTV/GD 1601 | LTV/GD 1602 | F–17 | MCAIR 267 |
|---|---|---|---|---|---|---|
| Length (ft) | [Deleted.] | | | | | |
| Wing span (ft) | | | | | | |
| Wing area (ft²) | | | | | | |
| Horizontal tail area (ft²) | | | | | | |
| Vertical tail area (ft²) | | | | | | |

Note: Primary air-to-air weapons of the NACF were [deleted]. The ACF carries only the [deleted].

(c) Technical characteristics of the engines differed as follows:

| Aircraft model | Engine model | Sea level static max A/B thrust |
|---|---|---|
| F–16 | F–100–PW–100 (3) | [Deleted.] |
| LTV/GD 1600 | F–401 (JTF22A–26C) | |
| LTV/GD 1601 | F–100 (JTF 22B–25) | |
| LTV/GD 1602 | F–401–GE–400 | |
| F–17 | J–101–GE–100 | |
| MCAIR 267 | J–101/J7AS (redesignated F–404–GE–400) | |

Chairman McCLELLAN. Were the contractors kept informed as the evaluations progressed as to any differences that might exist between the contractors' estimates and what was being accepted by the Air Force and Navy? Explain any differences. Were all differences reconciled before the selections were made?

Admiral LEE. On 10 Jan 1975, management representatives of both MCAIR and LTV/GD were debriefed on the results of the initial NAVAIR assessment of their respective design proposals for NACF. On 15 Jan (MCAIR) and 16 Jan (LTV/GD) more detailed briefings were given to offerers technical personnel. In these briefings, the offerers were appraised of deficiencies in their designs, results of NAVAIR initial analysis, and the reasoning which led to these conclusions. Subsequently, on 27 Jan 75 (LTV/GD) and 3 Feb 75 (MCAIR) revised designs were submitted and evaluated. The contractors received cost as well as technical debriefings during the competition. In addition, correspondence addressing questions of clarification concerning cost was exchanged between the contractors and the Navy. Deficiencies in these designs were submitted to both offerers in correspondence on 4 April 75 for their consideration in submittal of their "best and final offer". Differences between NAVAIR and the offerers were understood but not reconciled before selections were made. The variations between government and contractor claims were due to difference in the Navy technical evaluation as opposed to the contractor's technical proposals, (b) the interpretation and application of historical data and factors, and (c) projections of future economic levels. All differences essential to conclude source selection were reconciled.

### COST OF DUPLICATE TOOLING AND FACILITIES

Chairman McCLELLAN. Dr. Currie, you state that existing plants will be utilized to build the European share of the F–16. Nevertheless, new production tooling for the prime and subcontractors will be required. How will these expenditures be amortized? Won't the extra cost of duplicate facilities increase the cost of the U.S. portion of the procurement?

Dr. CURRIE. These expenditures will be included as part of the selling price of their products which we have not yet received. The cost of the U.S. portion of the procurement can only be determined after these prices are analyzed.

### FOREIGN SALES POTENTIAL

Chairman McCLELLAN. You estimate up to 2,000 units of foreign sales. What countries might buy the 2,000 F–16's? What is your estimate of the probability that any individual country might purchase the F–16?

Dr. CURRIE. In addition to the consortium countries of Belgium, Norway, Denmark, and the Netherlands; the following countries have shown an interest in the F–16: [Deleted]. This list is extremely sensitive and its publication at this time could impact on potential sales. The probability of purchase is very high in the case of [deleted] who is ready to order when the present consortium negotiations are concluded, and ranges to essentially zero for [deleted] because of internal resistance to buying abroad.

### CONTRACTOR ESTIMATES

Chairman McCLELLAN. In fiscal year 1975 dollars, what quotes for the target price and ceiling price did DOD receive from all contractors for the Air Force F–16 and the F–17 and for the various versions of the Navy F–16 and F–17/18? Were these quotes at the same point in the learning curve? Explain any inconsistencies.

Dr. CURRIE. The production prices proposed by the contractors for the Air Force F–16 and F–17 follow. These are average prices for the first 3-year option and include 301 aircraft in the case of General Dynamics and 249 aircraft by Northrop.

[In millions of dollars]

| | Fiscal year 1975 dollars | | | |
|---|---|---|---|---|
| | F–16 (301 aircraft) | | F–17 (249 aircraft) | |
| | Target | Ceiling | Target | Ceiling |
| Average cost | [Deleted.] | | | |

The contractors did not quote production target or ceiling prices for Navy versions of the F–16 and F–17/18. The Navy analysis of costs and flight performance established the selected contractor as having the most credible proposal. The contractor did, however, provide the following R. & D. quotes.

[In millions of dollars]

| | R. & D. target price | |
|---|---|---|
| | Then-year dollars | Fiscal year 1975 dollars |
| F–16: | | |
| Model 1600 | [Deleted.] | |
| Model 1601 | | |
| Model 1602 | | |
| F–17/18 model 267 | | |

MIX OF FIGHTERS VERSUS SINGLE AIRCRAFT TYPE/ESTIMATE LOGISTIC AND PERSONNEL SAVINGS

Chairman MCCLELLAN. Consider the possibility of a mix of fighter types vis-a-vis the single aircraft type. Please provide an estimate of the logistic and personnel commonality savings potential of the single aircraft type force over the mix for a representative 10-year operating period.

General EVANS. Almost $4.2 billion has been appropriated for 184 F–15's, which is approximately 38 percent of the total program. Therefore, were we to consider a fighter force consisting of a single type of aircraft as opposed to a mix, that fighter would be the F–15. The current planned buy is for 650 F–16 aircraft (6 wings) plus 6 wings of F–15 aircraft for a 12-wing mixed force. The 15-year costs of this 12-wing force could procure and operate 10 wings of F–15's, a net reduction of 2 operational wings from a mixed F–15/F–16 force. The principal objective of a hi-lo aircraft mix is to provide greater numbers of aircraft within current fiscal constraints for increased mass and deployment flexibility. A smaller number of wings would constitute a force clearly not meeting the requirement for greater numbers of fighters.

The operating and support cost savings for a six-wing force of F–16 aircraft (plus training squadrons) versus a six-wing force of F–15 aircraft (plus training squadrons) is approximately $93 million annually or $1.4 billion over a 15-year operating period. This cost saving can be broken down to logistics cost savings of approximately $1.2 billion and personnel savings of approximately $0.2 billion. This equates to a logistic and personnel cost saving of roughly $173,000 per aircraft per year, thus permitting a force expansion by using a mixed force.

There is a great need for six wings of F–15's with its all weather long-range interceptor capability. But, beyond this number there is a need for a complementary aircraft without the more expensive long-range radar/missile capability, and the F–16 fills that role.

It should be noted that the F–15 and F–16 will share the same engine as well as other components associated with the armament and avionics systems, thereby offering commonality savings within a mixed force. Additionally the F–15 and F–16 offer a good hi-lo mix for foreign military sales with the less sophisticated, lower procurement and operating costs of the F–16 being attractive to some countries and the F–15 providing the complete all weather air-to-air capability in which other countries have shown an interest. Therefore, by buying F–16's beyond the presently planned 729 F–15 force, we will achieve additional savings through commonality with our allies.

Chairman MCCLELLAN. Will the Air Force establish overhaul facilities for the F–16 in Europe for common use by Air Force and European countries? If so, will the European countries share in the cost of establishing and operating the facilities? Would the Air Force establish the same overhaul facilities in Europe without the consortium program; if so, how much larger will the facilities be?

General EVANS. DOD has tentatively agreed to use depot level maintenance and overhaul facilities established and funded by the European participating countries and industry maintenance facilities in these countries on a mutually agreed basis for maintenance and overhaul of USAF F–16 aircraft operated in Europe. The mutually agreed basis is to include a judgment of the competive-

ness of such European facilities with similar U.S. Air Force and U.S. industry facilities.

The Air Force does not intend to establish U.S.-owned and funded overhaul facilities in Europe for European based USAF F–16 aircraft. In the event that the consortium countries do not select the F–16, any required depot level maintenance and overhaul of European based USAF F–16 aircraft will be performed using existing U.S. facilities.

PRODUCTION FACILITIES/F100 ENGINE

Chairman McCLELLAN. Will a combined U.S. Air Force and consortium F–16 program result in the need for additional engine (F100) prime and subcontractor production facilities? If so, what would the cost be, and to what extent would additional cost be allocated to the consortium program?

General EVANS. Should the European consortium select the F–16 and the co-production program be implemented as currently envisaged, there would be no new production facilities required. The European subcontractors would use their existing facilities, and the U.S. Government would be reimbursed to the extent that any duplicate manufacturing tooling or services might be required.

REPRICING F100 ENGINE/IMPACT ON F–16

Chairman McCLELLAN. What impact will repricing the F100 engine have on the F–16 program cost?

General EVANS. We anticipate no impact since our existing engine contract contains pricing for both the F–15 and F–16 for fiscal years 1977 through 1979. We believe the F–16 engine procurement budget to be adequate, unless quantities are changed.

INCREMENTAL FLYAWAY COST BY MAJOR COMPONENT GROUP

Chairman McCLELLAN. What would be the incremental unit flyaway price by major component group, for example, airframe, avionics engines, et cetera, for an additional 650 F–15A aircraft? What would the price be for lesser quantities?

General EVANS. The unit flyaway price of 650 additional F–15A aircraft is estimated to be $6.45 million in fiscal year 1975 dollars. This figure divides into: $2.69 million for the airframe, $2.71 millon for engines and $1.05 million for avionics. The corresponding figures for 520 additional F–15A's are: Flyaway—$6.50 million; composed of airframe—$2.72 million, engines—$2.73 million and avionics $1.05 million.

COUNTRIES WHICH MIGHT BUY F–16's

Chairman McCLELLAN. You estimate up to 2,000 units of foreign sales. What countries might buy the 2,000 F–16's? What is your estimate of the probability that any individual country might purchase the F–16?

General EVANS. Basing our assessment purely on the F–16 replacing F–104's, almost 2,500 F–104's have been built and over 2,200 were distributed to foreign air forces. Almost every major allied air force in the world has possessed the F–104. All of these aircraft could conceivably one day be replaced by the F–16. If the allied air forces' F–4's are added to this total, approximately [deleted] aircraft, the possible replacement potential over the long term is in excess of [deleted] aircraft. It is premature at this time to identify specific countries, however, 10 allied countries have shown initial interest in the F–16.

CHANGES BETWEEN F–16A AND F–16B—COST OF PRODUCTION OPTIONS

Chairman McCLELLAN. What changes does the Air Force anticipate making in the F–16A and F–16B? Does the Air Force have a detailed breakdown of the cost associated with the General Dynamics firm production options for 301 F–16 aircraft? If not, how does the Air Force plan to negotiate prices for modifying the F–16?

General EVANS. We expect to make no changes of consequence to the aircraft although, of course, there have been and will be refinements to the design as our full scale development program progresses. Such refinements will be made only if sufficient information is available to clearly justify the change. For example, we have found that by slightly lengthening the fuselage of the single seat model—

10 inches—and adding a small amount of wing area—about 7 percent—a number of advantages accrue. Manufacturing costs decrease as a result of being able to utilize common fuselage tooling for both the single- and two-place model. The internal placement of components is now common between the two models resulting in manufacturing and maintenance standardization and additional cost savings.

The Air Force does have detailed cost breakdowns from General Dynamics which support cost tracking for the purpose of negotiating such changes.

### Competition Existing—Selection of F–16/F–17

Chairman McClellan. To further clarify the amount or lack of competition for the selection of the air combat fighter designs, please furnish for the record the following information:

What type of competition existed at the time of the original selection of the F–16 and F–17 as prototype developments?

General Evans. In January 1972, a request for proposal—RFP—to perform a prototype development of the lightweight fighter aircraft was released. Nine sources were solicited and in February 1972, five companies responded with six proposals. Northrop Corp. responded with two proposals and the following four companies responded with one each: Boeing, General Dynamics, Lockheed, and LTV Aerospace. Evaluation of the six proposals was completed in March 1972 with Northrop and General Dynamics announced as the winning competitors. The lightweight fighter contracts were released in April 1972.

### Numbers of Attack Aircraft Replaced

Chairman McClellan. Admiral Lee, you point out savings resulting from procurement of the F–18 rather than F–14 for the Navy fighter force. By the same token, the F–18's which replace the Navy attack aircraft, the A–7, A–4, and A–6, are more costly than the replaced aircraft. What numbers of attack aircraft will the difference in cost be to replace the attack aircraft with F–18's rather than, say, A–7E's?

Admiral Lee. It is programed that the F–18 will replace only the A–7's, not the A–4's or A–6's. The inventory objective for A–7's is about 491 aircraft. The flyaway unit cost, in fiscal year 1975 dollars, of the A–7E is $4.5 million, compared to the recurring flyaway unit cost of $5.8 million for the F–18. However, the A–7E cost figure does not include the funds which would be required to develop an A–7E replacement in the [deleted].

## Questions Submitted by Senator Young

Senator Young. Mr. Chairman, I have some additional questions that I would like answered for the record.

Chairman McClellan. Without objection, those questions and appropriate responses will be inserted at this point in the record.

[The questions and answers follow:]

### Total Program Cost of Fighter Aircraft

Senator Young. What is the total program cost of the F–14, F–15, F–16 and F–18?

Dr. Currie. The total program cost of the F–14 for 12 R&D and 378 production aircraft is $7.4B in FY–75 dollars and $7.3B in then years dollars (F–14A only). The total program cost of the F–18 for 11 R&D and 800 production aircraft is $7.8B in FY–75 dollars.

The total program cost of the F–15 for 20 R&D and 749 production aircraft is $9.28B in FY–75 dollars and $10.94B in then year dollars. The total program cost of the F–16 for 8 R&D and 650 production aircraft is $4.16B in FY–75 dollars and $5.82B in then year dollars.

### Unit Cost of Fighter Aircraft

Senator Young. What is the program unit cost of each of the above aircraft?

Dr. Currie. The program unit cost of the F–14 for 12 R&D and 378 production aircraft is $18.8M in then year dollars and $18.9M in FY–75 dollars. The program

unit cost of the F–18 for 11 R&D and 800 production aircraft is $9.6M in FY–75 dollars.

The program unit cost of the F–15 for 20 R&D and 749 production aircraft is $14.6M in then year dollars and $12.4 in FY–75 dollars. The program unit cost of the F–16 for 8 R&D and 650 production aircraft is $8.85M in then year dollars and $6.32M in FY–75 dollars.

### Acceleration of F–16 Decision

Senator Young. What was the reason for accelerating the Air Force's decision versus waiting for the Navy decision?

Dr. Currie. It was evident that the cost savings to the Air Force in going with their F–16 selection were such that, regardless of the eventual Navy selection, there would be no appreciable cost advantage to the government by the Air Force adoption of the F–17 derivative in the event this was the Navy choice. This was supported by the Chairman of the OSD Cost Analysis Improvement Group and by the DSARC Principals.

### F–16 Foreign Sales Potential

Senator Young. What is the estimated potential foreign sales for these aircraft?

Dr. Currie. Basing our assessment purely on the F–16 replacing F–104's, almost 2500 F–104's have been built and over 2200 were distributed to foreign air forces. Almost every major allied air force in the world has possessed the F–104. All of these aircraft could conceivably one day be replaced by the F–16. If the allied air force's F–4 fleet is added to this total, an additional [deleted] aircraft, the possible replacement potential over the long term is on the order of [deleted] aircraft. It is premature at this time to identify specific countries, however, ten allied countries have shown initial interest in the F–16.

### High Cost/Low Cost Fighter Force Savings

Senator Young. How does the Defense Department compute the savings of a fighter force consisting of high cost and low cost aircraft?

Dr. Currie. In making such a computation, consideration is given to the "life cycle cost" of a force mix of high and low cost aircraft. This "life cycle cost" is the sum of all the variable costs incurred by developing, procuring, operating, and supporting weapon systems over a specific time frame (usually ten to fifteen years). The operating and support cost buildup begins when the first production aircraft enters the force structure and continues through a period after the full operational aircraft complement is obtained and operated. Fixed operating and support costs that are independent of the type of new system being acquired are explicitly excluded from "life cycle costs" as these costs would not impact on decisions between high and low cost fighters.

### Cost to Develop F–16

Senator Young. What will be the cost of development of the new F–16 lightweight fighter?

General Evans. Our earlier estimate of the development program, as reflected in the FY 76 President's Budget, was $1062.5 million in "then year" dollars. That program included fifteen DT&E aircraft and also included provisions for J101 engine development which would have been required had the YF–17 been selected. Elimination of the need for J101 engine development funds resulting from the selection of the F100 engine powered F–16 and a restructuring of the F–16 development program to eight DT&E aircraft, permitted by configuration refinements made to the F–16 design, reduced the development estimate to $580 million in "then year" dollars or $476 million in fiscal year 1975 dollars. Implementation of the revised development program is awaiting OSD approval.

Senator Young. What will be the radar and missile capability of the F–16? How do these capabilities compare with the F–15?

General Evans. Addressing the F–15 first, its radar and missile combination provides our fighter force with the long range, night/adverse weather look-down shoot-down all aspect air-to-air capability which is indispensable against similarly equipped fighters in achieving air superiority. The F–15/AIM–7F radar

missile combination has the capability to successfully defeat both the high speed, high altitude and low speed, low altitude threat. But this capability requires avionics and missile sophistication that is comparatively expensive, both to acquire and operate. As such, we have found that we must mix that capability into a total fighter force that is affordable and, while retaining acceptable quality, a force that is quantitatively more adequate in comparison with the Soviet Fighter Force of the 1980s.

Hence, the F–16. Its avionics are configured without the long range, all-weather, radar and missile of the F–15. The F–16's radar capabilities have been [deleted] to exploit the F–16's exceptional acceleration and maneuvering capability.

This allows the F–16 to enter the engagement against a lesser equipped fighter from an offensive rather than a defensive position. This ability to "see" the enemy fighter beyond visual range has been demonstrated in actual flight tests to be a dominate factor in air combat.

The Air Force has determined that this close-in air combat radar cost/capability balance varies primarily with radar detection ranges. With today's proven radar technology this balance approaches optimum at about [deleted] miles lookup and [deleted] miles look-down detection range. This is the F–16's radar design point and is about half existing, in the F–15.

Both the F–16 and F–15 utilize the M–61 20mm cannon and the [deleted] missile. This missile is the best existing U.S. missile for clear air, close-in air combat. In addition the F–15 carries the long range, all-weather, all aspect capable [deleted] missile.

### F–16 Capabilities In Air-to-Ground Mission

Senator Young. What will be the F–16 capabilities in the air-to-ground mission?

General Evans. The characteristics of the F–16 which make it a superb close-in air combat aircraft have been exploited—but not compromised—in the formulation of its air-to-ground configurations. While retaining its air-to-air armament, a large variety of conventional and guided ground attack munitions can be employed with state-of-the-art accuracies. A limited [deleted] capability is also available by utilizing a facet of the air-to-air radar.

### F–16/Capable of All Weather Operations

Senator Young. Will the F–16 be capable of all-weather operations in the air-to-air or air-to-ground missions?

General Evans. The F–16's radar provides some combat capability in weather conditions, particularly for ground attack missions. But there is no design intent to provide an all-weather air-to-air capability in the F–16—indeed the 20mm cannon and [deleted] missiles are useable only in reasonably good weather conditions. Cost corsiderations relegate the all-weather air-to-air capabilities to F–15.

### Aircraft Retired as F–15 and F–16 Phased In

Senator Young. What types of fighter/attack aircraft will be retired as the F–15 and F–16 are phased into the Air Force?

General Evans. As the F–15 and F–16 are introduced into the inventory, the Air Force plans to retire all F–100, F–105, and some F–4C aircraft.

Senator Young. How does the Navy requirement differ from the Air Force requirement for a low cost fighter?

Admiral Houser. The Navy requirement in the fighter version of the F–18 is for a lower cost complement to the F–14. Because of the reduced number of F–14s now approved for procurement, 390, compared to the planned program, 722, the F–18 will be required to complement the F–14 in maritime air defense, fighter escort, and air-to-air fighting. An all weather missile/radar system will be incorporated in the F–18. The F–16 on the other hand is a supplement to the full F–15 program of 749 aircraft. The F–16 therefore will be used to increase the total tactical capabilities of the Air Force. It also has been designed to operate with the F–15 where the greater capabilities of the latter will be used to increase the effectiveness of the F–16.

Other differences are that the Navy intends to use the F–18 in an attack configuration with avionics slightly modified to optimize for air-to-ground missions. The Navy also is investigating the use of the F–18 as a reconnaissance airplane.

There are structural and aerodynamic differences between the F–18 and F–16 to enable the former to operate successfully from carrier decks.

### Radar and Missile Capability

Senator Young. What will be the radar and missile capability of the F–18 fighter? How does this compare with the F–14?

Admiral Houser. The final configuration for the fighter version of the F–18 will be developed during the next several months. However, the operational requirement for the F–18 states a weapons requirement of [deleted] plus [deleted] missiles for the fighter version. The radar requirement was for a lookdown detection capability against a [deleted] target of [deleted] n.m. minimum. The F–14 has a capability of up to [deleted] and [deleted] missiles. The F–14 comparable radar detection capability is [deleted] n.m.

### Modification of F–18

Senator Young. Could the F–18 be modified for land based operations only to satisfy foreign sales requirements? Would such an aircraft cost less than the Navy version?

Admiral Houser. The Navy has not obtained proposals for a land-based only version of the F–18, nor has such a version been analyzed within the Navy.

Senator Young. Does the Navy propose to develop several versions of the F–18 aircraft? If so, for what purposes will they be used?

Admiral Houser. The F–18 will be developed in a single airframe/engine design. However, the avionics system will be optimized for either a fighter configuration (F–4 replacement) or an attack configuration (A–7 replacement). Another possible employment of the F–18 is as a reconnaissance airplane.

### F–18 Capabilities

Senator Young. Will the F–18 have an all-weather air-to-air and air-to-ground capability?

Admiral Houser. The SPARROW missile provides an all-weather air-to-air capability for the F–18 although limited in comparison to the two-seat F–14 with PHOENIX or SPARROW. The F–18 attack configuration will be optimized for visual attack, although it will have as a fallout a limited all-weather capability against radar significant targets.

### New Aircraft Purchases

Senator Young. How many aircraft does the Air Force and Navy plan to buy of the F–16 and F–18 respectively?

Dr. Currie. The Air Force plans to procure about 650 F–16 aircraft and the Navy plans to procure 800 F–18s.

### Development Cost of F–16

Senator Young. What is the estimated development cost of the F–16?

General Evans. Since source selection, the program has undergone a cost savings review which has led to a development estimate of $580.3 million in then year dollars—a reduction of just under $130 million. Approval for this program with some modifications has been received from the OSD DSARC.

The cost impact of these modifications and other recently identified program tasks are currently under review. The impact on the $580.3 million development cost is not expected to be large.

### Subcommittee Recess

Chairman McClellan. Thank you very much for your cooperation. The subcommittee will stand in recess, subject to call.

[Whereupon, at 5:30 p.m., Tuesday, May 6, the subcommittee was recessed, to reconvene at the call of the Chair.]

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