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Executive's Defense Budget Handbook
FY 69

R-9 DOD BUDGET HANDBOOK

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DEPARTMENT OF DEFENSE

BACKGROUND BRIEFING

FY 1970 BUDGET

January 14, 1969

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SPOKESMAN: Good afternoon. I would like to state the ground rules for this budget briefing. They will be the same as we have used in previous years.

All of the charts and all of the information that you receive here this afternoon are subject to the total embargo established by the White House for all of the information on the budget.

This means that none of the information made available at this briefing can be used directly or indirectly, paraphrased, alluded to or hinted at in stories prior to noon EST, Wednesday, January 15th.

Attribution here will be to Defense Officials only. And there will be no direct quotations. We shall try to be as helpful to you as possible. If there are some questions asked here for which immediate answers are not available, and for which answers can be provided, we shall do our best to get these facts to you as quickly as possible.

(Deleted) will have some opening explanatory remarks. We are hopeful that copies of these remarks will be reproduced in time to distribute to you at the end of this briefing and I have every confidence that Colonel Bankson and his people will succeed in that.

Following this run through, (deleted) will be available to answer your questions.

Because of his crowded schedule today, particularly as related to preparation for his departure for Brussels tomorrow to attend the NATO Defense Ministers meeting, it may be necessary for (deleted) to leave in the middle of the briefing, and I am sure you understand that. With those ground rules laid down the same as we have had before, (deleted).

Defense spokesman reads statement.

* * * * * * * * * *

SPOKESMAN: Thank you, Gentlemen, for being so patient.

QUESTION: How much would you ascribe the interest to inflation, this year over last year?

ANSWER: I think (deleted) could give you a more precise answer on that.

SPOKESMAN: Well, as you know, we have been tracking the effect of inflation from 1961 and the inflation is now starting with 1968 as a hundred, the inflation is 117 as we're looking at the budget and it was 113 as we moved into the review.

So we haven't actually attempted to price out the specific amount, quantitative amount of the dollars, but it's fairly readily applicable if you apply it to the procurement dollars.

QUESTION: I think in your posture statement of last year it showed that inflation represented $12 billion of the budget since 1961.

Do you have a current figure for that?

SECOND SPOKESMAN: We either have or I can give you one. It relates on the running posture statement total -- I don't know whether I have that sheet with me or not. I know the sheet you mean. It is on each of the years. Let us see if we can't get that figure for you.

QUESTION: Could you explain to us what the assumptions are on the basis of which Vietnam spending is going to decrease by $3.5 billion in 1970?

SPOKESMAN: The assumption is that the force levels in Southeast Asia will continue just as they are today. There will be no change in the 549,500 ceiling on manpower and no change in the deployments at all.

The budget is based upon the same theory that we have used in the past, funding out through the reorder lead time of the various items, six months beyond the end of the fiscal year for ammunition and 18 months by and large for aircraft procurement.

The main change accounting for the reduction is that this is based upon the experience of our consumption figures in the latter part of this year, post the October 31st speech, and there has been some reduction in the rate of expenditures, particularly ground ammunition, in the last few months and this projects a continuation of the current rate of these expenditures.

MORE

One further point and that is during 1969 we have built up our inventories to take care of the increase in the consumption rates which occurred after TET. We do not anticipate that it will be necessary to build up inventories in 1970.

QUESTION: Was any effort made to cost out resumption of bombing in Vietnam? Do we have any figure as to what we save by the bombing halt or what it would cost to resume it?

SECOND SPOKESMAN: Could I go back and give you the figures on the other and then I will pick up on this. I just happen to have the page. You will remember I said that the price index had gone to 117.

The quantitative translation of that is $7.2 billion in purchased goods inflationary, summary price inflation, and then typically we add as you know the pay rates, increase for military is 5.8, increase for civilian is 2.5.

So that we have a total due to price inflation of $16 billion.

QUESTION: From 61?

SECOND SPOKESMAN: 61, that is right.

Could I finish the answer to the other question? Ithink that the consumption level of ammunition projected from today's level into '70 shows the difference between the two years of about $1 billion 4. While there are some additional inventory increases, particularly in air ammunition and some decreases in ground munitions, by and large the difference, the answer to your question is about that figure, a billion four, a billion five.

QUESTION: How about aircraft equipment?

SECOND SPOKESMAN: In total, which is primarily aircraft attrition, the total is $800 million. There is some ground equipment in there but very little.

QUESTION: What does $800 million represent?

SECOND SPOKESMAN: Projection of lesser aircraft attrition based on today's attrition rates, combat losses, versus the peak of the three offensive period from which...

QUESTION: In other words, we're saving two point two billion dollars a year by not bombing in the north now? Is that an oversimplification?

SPOKESMAN: No, I would say it is a little bit more complex than that because this includes the lower attrition rate in South Vietnam of ground ammunition, in the South, not just North.

MORE

Because of the progress of the situation there, we haven't in recent months had the same kind of situation as we had during TET and the May offensive. Therefore our ground ammunition consumption is also less than it was during the TET and post TET.

QUESTION: Could we round this out and just finish out now, $2.2 billion, how do we get the rest of the $3.5 billion, between the $2.2 and $3.5?

SECOND SPOKESMAN: There are three other pieces. One small, some of the research programs which we are developing new technology out there have plateaued and decreased slightly.

Our construction program is rapidly coming to a close out there, has decreased sharply and as our activity, the intensivity levels decrease out there, the handling, packing, operation and maintenance levels, including contractual service for in-country transportation, for the intercoastal transportation, have significantly decreased from the peak levels.

These are all therefore projections of the lower level of activity we are experiencing today.

QUESTION: Does the decrease in construction affect the so-called McNamara anti-infiltration wall?

SPOKESMAN: No, it does not.

QUESTION: Would it be fair then to say this budget was drawn up on the assumption that there would not be a resumption of the bombing of the north?

SPOKESMAN: The way it was drawn up was that there would be a projection of the current situation indefinitely out into the future, that if things got better we would have too much money in the budget. If the situation deteriorated we are thoroughly protected by the top production basis so that a decision could be made later without in any way endangering the inventory situation.

So we are protected either way. But the actual budget estimate is based on a projection of the current level indefinitely.

QUESTION: Can you tell us what the cost of modernizing and re-equipping the ARVN will be in 1970, how it compares with FY 69?

SPOKESMAN: The amount that is in this budget for assistance to the Republic of Vietnam for military account is about the same as it was last year as I remember.

MORE

SPOKESMAN: That is right. The modernization figure for getting the consumption and support figure, the modernization figure runs between $300 and $400 million in each year.

QUESTION: Is this the first year in which the Defense Department has projected a decrease in Vietnam expenditures? As I recall in 1967, did you project an increase then?

SPOKESMAN: I don't think so. There was an entirely different situation. Rather than assuming that the war would continue not only through the fiscal year, but indefinitely, so that one would cover the lead time for forward procurement. At that time, I think the assumption was made as stated to the Congress that as a method of presenting the budget we could not very well project while this thing was building up exactly what would be necessary. The budget was based upon the assumption that the war would end at the end of FY 67. That was an entirely different assumption.

QUESTION: If we are keeping the level of expenditures for our aid to ARVN, the Republic of Vietnam, how are we also accelerating the re-equipment and modernization of this force which has been our policy in order to allow us to withdraw our own troops, particularly when you have inflation? What is the theory?

SPOKESMAN: Do you have the figures there?

SPOKESMAN: You appreciate when we are talking about the $300 to $400 million, we are talking in outlay terms or in program terms and in expenditure terms that which has been on order is coming in on delivery so that the program for modernization is following the generally accelerated trend.

What I am really saying is that the new investment -- there are two basic parts of the modernization program and we are still on the first part -- on the first phase of the modernization program and we are, of course, developing plans for the second phase.

But everything is pretty well on order for the first phase, what I am really saying.

QUESTION: You mean we are actually going to spend more money in this next year than last year?

SPOKESMAN: In terms of deliveries, but in terms of finishing the phase one program, the level of new orders is about the same.

QUESTION: There is a fairly sharp reduction in manpower spaces in both the Air Force and Army. Will you tell us what types of people will disappear in this reduction?

MORE

SPOKESMAN: It isn't that large as I remember. The Army figures, I think you will find them on page 12 of the figures which we submitted, the aggregate number of officers stays about the same, 171,000. 171,000, it's identical.

The number of enlisted men goes from 1,359,000 down to 1,332,000.

As the size of the Army has stabilized the requirement for training personnel and for people in the training pipeline has gone down slightly. This is the appropriate figure for the same sized Army but with somewhat smaller number of people in the training pipeline. Isn't that correct?

SPOKESMAN: Yes.

QUESTION: In the Air Force?

SPOKESMAN: That applies to the other Services as well.

QUESTION: There is in Southeast Asia a small increase of 5,000 troops between 69 and 70 and a larger number since mid-68 indicating that some substantial increase since mid-68 of about 16,000 men. What does that represent?

SPOKESMAN: This represents the continued programming against the March 31 figure, the 549,500 figures, just programming out. There is no change in figures.

QUESTION: You have not yet hit the 549?

SPOKESMAN: We have not yet hit the 549. It is programmed within living space, just slightly under in terms of 70.

QUESTION: Can you give us a breakdown in some of the leading aircraft appropriations, programs and amounts?

SPOKESMAN: I might just say a few words about some of the major programs.

QUESTION: It also includes AWACS in that and the .... interceptors.

SPOKESMAN: I thought it might be interesting to take a look at some of the major programs. The Sentinel program is going up from approximately $960 million in '69 to approximately $1.8 billion in 1970. That's a big increase.

QUESTION: TOA or what?

SPOKESMAN: TOA. That is in all accounts.

MORE

QUESTION: All research and development, construction.

SPOKESMAN: That is all the accounts that affect the Sentinel.

QUESTION: How much for Spartan?

SPOKESMAN: I don't have that broken down. But the POSEIDON is going up from approximately $1.1 billion to something over $1.2 billion. MINUTE MAN is going up from $1.1 billion to $1.16 billion. So that there is a substantial amount in the budget here for what we call program one forces.

QUESTION: Will you get all five squadrons of FB-111s in fiscal year 70? You show no squadrons in June 30, 1969, and five squadrons, June 30, 1970. Can you tell us what a squadron is?

SPOKESMAN: I am afraid I will have to refer that to (deleted).

QUESTION: Can you give us any indication of what the budget specifies space programming -- MOL?

QUESTION: Let us get these questions answered.

SPOKESMAN: We can give you the dollar amounts of the F-111 program if that will be helpful. In 1969 the FB-111 is $587 million.

QUESTION: Does that include the cut made to get the $3 billion cutback?

SPOKESMAN: I beg your pardon?

QUESTION: Does that include the cut?

SPOKESMAN: That is after reduction. And in 1970 that figure is $294 million.

QUESTION: A drop?

SPOKESMAN: A drop from the 587. And some of this, of course, has some advance procurement in for follow on procurement. And then the combination of the F-111, the "D," with advanced procurement, shows 631 -- I am adding figures together as I am giving them to you -- 631 in 1969 versus 518 in 1970. That is the order of magnitude of the F-111 program. Now someone asked about the MOL?

QUESTION: On the F-111, do those figures represent a stretch out of the plans, the long range plans on the F-111. Is there any intention here of reducing this planned force of the FB-111 A's and D's?

MORE

SPOKESMAN: The problems we are having with those kinds of questions, we have not yet given Congress the detail of the mix of the aircraft, in terms of the basic strength mix and the type mix. So we need to stay away, if we can from answering a specific question like that until we tell Congress, which will be over the next couple of weeks. There have been some adjustments in our force structure mix.

QUESTION: ... Cancelling of the F-111B. If so, by how much? What did it cost us to cancel the F-111B?

SPOKESMAN: You mean the termination charge of the F-111B?

QUESTION: Yes.

SPOKESMAN: Incidentally, that was a question that was in part of the 693 GAO. We will have to give it to you separately.

QUESTION: Before we go to MOL, I wonder if we can get a rundown of the other major aircraft procurement?

QUESTION: Could we again get a figure on the F-111B? Since you state five squadrons, there ought not to be any particular secrecy as to how many airplanes that represents.

SPOKESMAN: Perhaps not, but I think we probably ought to duck the specific number because of the unit equipment question versus the total training aircraft and so forth.

It is true, it isn't that we are being evasive, it is true we have not yet given Congress the specific mix of the aircraft. The squadron size is due, as you know, to --

QUESTION: I don't believe you have put out the complete figures on F-111 procurement, so perhaps you could tell us if you are going to do it faster or slower than previously planned. Many of the exact numbers in different categories have been given out anyway.

SPOKESMAN: You appreciate we did stretch, as a result of Public Law 93-64. So the answer is that we are slower than we were previously.

QUESTION: Can we get some figures on other aircraft?

SPOKESMAN: You know you do have procurement in your package, the two years in terms of total numbers.

QUESTION: Also the EA6B and the F4.

QUESTION: Service by service you gave us the major type.

SPOKESMAN: Dollars?

QUESTION: If you can do that.

SPOKESMAN: I can do that if you fellows want to listen to that.

QUESTION: Yes.

SPOKESMAN: I was afraid you would say that.

SPOKESMAN: I have to run, gentlemen. Thank you.

SPOKESMAN: If you are willing to listen I am willing to go through. I am going through a major shopping list by service. I will give you dollars.

SPOKESMAN: I think you ought to emphasize that these are current appropriations only.

SPOKESMAN: Yes. The RD and E would not be associated with what I am giving you.

QUESTION: Are these spending figures or TOA figures?

SPOKESMAN: TOA figures.

QUESTION: One of you said they are appropriations, the other said they are TOA. Are they the new obligation authority you are requesting or are they going to be the combination?

SPOKESMAN: We both said they were TOA which is the program total. We said they were not expenditures.

SPOKESMAN: I am going to pick the significant ones and if there's any that you know that you want that I am not picking, just yell out.

The UH1A, utility helicopter, the IROQUOIS, is going from $218 million in 69 to $49 million in 70. The AAFSS Cheyenne (AH56A) is going from $93 million in 69 to $302 million in 70.

QUESTION: 93 to what, sir?

SPOKESMAN: 93 to 320.

QUESTION: Are these 69 figures the ones that Congress ended up with or are these your requests of a year ago?

SPOKESMAN: These are the ones that are currently in the program. They would either be as Congress approved initially through the appropriation, or as authorized by reprogramming by the Congress. So, they are currently approved figures.

SPOKESMAN: Plus the supplemental. Plus the supplemental, that is right. There is a piece of aircraft in the 1.6.

SPOKESMAN: Someone asked earlier about the missile procurement under Sentinel. It goes from $37 million in 1969 to about $173 million in 1970.

QUESTION: Is this for individual missiles?

SPOKESMAN: SPARTAN and SPRINT, both of them. I am getting through some normal smaller procurements.

QUESTION: Can you tell me the distinction between the SPARTAN and SPRINT buy, how much you are spending for each?

SECOND SPOKESMAN: Yes, he says I can. SPRINT is going from, I hope these add up because I put some pieces together, from 13 to 33, and SPARTAN is going from 24 to 140. These are some other hundred thousands.

QUESTION: Does this increase represent more cities being covered?

SECOND SPOKESMAN: No, the program is still the same. This is just the normal next year's program.

QUESTION: Moving now to Navy and Marine Corps aircraft procurement, the A-6A is going from $146 million in 69 to $65 million in 70. The A-7 ---

What model A-7?

SECOND SPOKESMAN: A-7-E, I am sorry. Is going from 415 in 69 to 104 in 70. The F-14-A, the new aircraft that the Secretary has mentioned, in total with advanced procurement is going to 239.

QUESTION: From what?

SPOKESMAN: Nothing.

QUESTION: Does that include the RB2?

SPOKESMAN: No, it does not, I am only talking about procurement dollars invested. The EA6B somebody mentioned before, the electronic warfare plane, is going in 1969 from $20 million to $248 in 70.

QUESTION: What was the first figure?

SPOKESMAN: 248.

QUESTION: The 1969 figure?

SPOKESMAN: The first figure was $20 million.

QUESTION: Is that a program stretched out earlier?

SPOKESMAN: Yes, it's been delayed for various reasons for a number of years.

QUESTION: Will this wind it up possibly then?

SPOKESMAN: No. This is the initial procurement.

QUESTION: Did you say from $20 million to 248?

SECOND SPOKESMAN: Yes.

QUESTION: Give the E2C?

SPOKESMAN: That is R and D only.

SECOND SPOKESMAN: I need to get the R&D on that. We will drop that in as he picks it up.

QUESTION: The F-4?

SECOND SPOKESMAN: The F-4, I need to add some pieces together, the F-4 is going from 232 in 1969 to 207 in 70.

QUESTION: Is that Navy and Marine?

SECOND SPOKESMAN: That is Navy and Marine Corps.

QUESTION: How about the Air Force?

SECOND SPOKESMAN: I have not gotten to the Air Force but there is a relatively sharp difference there. The Poseidon missile piece in the Navy is going from 356 million in 69 to 492 million in 70.

QUESTION: Is this conversion?

SECOND SPOKESMAN: No, this is not conversion. This is missile piece. I will give you the conversion when we get over there.

QUESTION: You gave us the 1.1 and 1.2 earlier.

SECOND SPOKESMAN: Yes. That is the total of the program. I hope it adds up when I give you the pieces.

SPOKESMAN: The E2C in RDT and E only, runs from 26 million in 69 to 66 million in 70.

QUESTION: No procurement.

SPOKESMAN: No procurement.

QUESTION: Can we get the RDT&E on the F14 A and B?

SECOND SPOKESMAN: Sure. Why don't I go ahead while Don looks that up.

QUESTION: In terms of the ship building program, it is only because of the way I have my papers, the Air Force aircraft program follows the ship building, the nuclear attack aircraft carrier in 1969 has a program level of 82 million and in 1970 has $377 million. Is this the NIMITZ, both carriers?

SECOND SPOKESMAN: This is the NIMITZ too.

QUESTION: Is that full funding?

SECOND SPOKESMAN: Full funding.

QUESTION: Did you say NIMITZ 2? How about the NIMITZ 1? Does that include the NIMITZ?

SECOND SPOKESMAN: The second NIMITZ. It is a carrier, yes.

QUESTION: You mean it is one then?

SECOND SPOKESMAN: Yes.

QUESTION: What is your present estimate of the cost of the second NIMITZ?

SECOND SPOKESMAN: I gave you a net figure. The cost is, and correct me if I say this wrong, the gross cost is $510 million.

QUESTION: It came down a little didn't it?

SECOND SPOKESMAN: I don't think. Not having been around too long it is hard to tell what the track record is.

QUESTION: There are funds in here for two NIMITZ class carriers somewhere or other?

SECOND SPOKESMAN: Not as new initiation in the 70. This is the 70 program for one.

QUESTION: You are estimating the new carrier for which you are asking authority in fiscal 70, will cost $510 million when completed.

Is that accurate?

QUESTION: Not the NIMITZ 1. The second carrier of the NIMITZ class.

SECOND SPOKESMAN: Yes.

QUESTION: How much is the currently building NIMITZ to cost?

SECOND SPOKESMAN: I don't know. We can get the figures for you, but I don't have it here with me at the moment. I could probably dig it out.

Going on, the nuclear submarines, and the reason I am subtracting out previous year advance procurement, I'm giving you net figures, but it is a net budget impact of 149 billion for submarines, the SSN's, in 69 and 505 million in 1970.

QUESTION: How many is that?

SECOND SPOKESMAN: I can't say, can I?

QUESTION: It is in the book.

SECOND SPOKESMAN: As soon as we come out with the unclassified posture statement, have we been putting the number of ships in the unclassified posture statement? I think it is the end of this week that it breaks out, it goes up to the Hill.

QUESTION: It is in the big budget document. It is in the budget document that everybody has.

SPOKESMAN: If you have it why do you ask the question? We don't have the big book yet.

SECOND SPOKESMAN: I don't remember that we broke down the 19 new -- are they in there by type?

QUESTION: Not the entire 19. There is 13 mentioned.

SECOND SPOKESMAN: This ties to the number you got there then. The DXGN, the missile frigate is nothing in 69 versus $196 million in 70. There is $343 million for the DX, the new destroyer in 70 from zero. And there is again the FDL.

QUESTION: How much is that?

SECOND SPOKESMAN: $187 million.

QUESTION: From zero?

SECOND SPOKESMAN: From zero.

QUESTION: How much did you originally ask last year before Congress acted?

SECOND SPOKESMAN: I think it is the same thing.

QUESTION: Is that three ships or one?

SECOND SPOKESMAN: Three.

SPOKESMAN: I think it was 160 something last year.

QUESTION: In other words, Congress has forced you up to the figure by the delay?

SECOND SPOKESMAN: No comment.

SPOKESMAN: There is a total conversion program, ship conversion program, which goes from $436 million to $625 million which is driven by or dominated by the SSBN, Poseidon conversion as you probably realize.

QUESTION: What was the first figure?

SPOKESMAN: 436 for 69 and 626 for 70.

QUESTION: Poseidon will cost how much?

SPOKESMAN: Poseidon in 69 is 146. Let me give you the two pieces together. It is 263 in 69 and 459 in 70.

QUESTION: Is that conversion of the Poseidon?

SPOKESMAN: Conversion, yes.

QUESTION: That is in addition to the missiles, right?

SPOKESMAN: Yes. Now I did give you the F-111 and the FB-111 of the Air Force previously. The A7 in the Air Force, the A7D goes from $186 million in 1969 to $375 million in 1970. The F4 goes from $425 million -- this is the F4E, goes from $425 million to $26 million.

QUESTION: How about the J?

SPOKESMAN: That is Navy. I did give you that.

QUESTION: What does the $26 million represent, actual aircraft or parts?

SPOKESMAN: The $26 million represents advanced procurement for the next year.

QUESTION: In other words there are zero aircraft.

SPOKESMAN: Well, not delivery, but zero new procurement.

QUESTION: That is all the models of the F4?

SPOKESMAN: Yes.

QUESTION: I mean for the Air Force?

SPOKESMAN: Yes.

QUESTION: Do you show anything for Air Force retrofit and modernization?

SPOKESMAN: There would be, but I don't have it here. It is lost in the total modernization and modification program.

QUESTION: How about the C5?

SPOKESMAN: Yes, how about that? We have a sheet over here on the C5, didn't we? For an all package program on the C5A, including RDT &E and procurement, including spares and so forth, the grand total is $763 million in 1969 and $1 billion 048 million in 1970.

SPOKESMAN: Again that includes RDT&E as well as procurement.

SPOKESMAN: That is right. It includes spares as well.

QUESTION: How many delivered airplanes does that represent?

QUESTION: Does this price represent your exercising the option on the C5?

SPOKESMAN: Again I am not ducking that. There is a hearing on it this week as you know. There is currently a lot of decision making going on in terms of what we are going to do and we are committed to advise Congress as to our decision. All I am telling you is what is in the budget and it does include as far as the budget is concerned, it does include the four squadrons, the next buy.

QUESTION: That is 58 plus --

SPOKESMAN: Don't get me around too many figures but your first figure was right in terms of what it was and the next is the next incremental buy.

QUESTION: You got the money to exercise the so called option B?

SPOKESMAN: The option, of course, could go further. This is what would normally be in the budget to allow the exercise or picking up of the option at the end of this month.

QUESTION: What do the C5 figures assume is the price you are going to pay for the C5A?

SPOKESMAN: You have to look at the total program because you have to separate RDT and E and you have to look at learning curve throughout the total. This again gets us into what the current negotiations are with the contractor that are going to be reported at the end of this week to Congress.

As you know, the aircraft depending upon the buy, the C5A aircraft in terms of the production buy, have been, depending on the buy you are looking at, between $20 and $30 billion. It depends on which lot you are looking at, ... And you have to take the spares out of this which I didn't break out for you. So, you have a tough unit figure to figure out here. I would prefer you would not push me on it because we are committed and there is a hearing set up on Thursday afternoon on this and I am sure most of you will be there, I guess it's an open hearing.

I don't think we ever did answer the MOL, did we?

QUESTION: No.

SPOKESMAN: Did we tell you the answer?

QUESTION: No. The A15 also.

SPOKESMAN: The AMSA is $25 million in 1969, $77 million in 1970. The MOL is $515 million in 1969 and $576 million in 1970.

QUESTION: That is total?

SPOKESMAN: Total, yes.

QUESTION: That is all research?

SPOKESMAN: That is right.

SPOKESMAN: The AWACS is $45 million in 1969 and $75 million in 1970.

QUESTION: What was that again for AWACS?

SPOKESMAN: 45 and 75.

SPOKESMAN: And the F15 or the FX is 45 in 1969 and 175 in 70.

QUESTION: That is all RDT&E?

SPOKESMAN: Yes.

QUESTION: How about Minuteman III?

SPOKESMAN: Minuteman III goes from $1.101 billion -- this is the total package again -- $1.101 billion in 69 to $1.164 billion in 70.

QUESTION: Is there advanced procurement involved in there?

SPOKESMAN: In this, yes, there is procurement.

QUESTION: How much of that is procurement?

SPOKESMAN: I guess I ought to add the mods together. The procurement piece is 681 in 69 and 814 in 70.

QUESTION: Is there anything in there for a new MINUTEMAN SILO hardrock?

SPOKESMAN: Yes, I don't know if I can put my fingers on that. I don't have that piece. There is money in here for it.

QUESTION: Is that included in the package or is it separate?

SPOKESMAN: I guess it is in the package. It is in that piece, but I can't really identify how much it is.

QUESTION: How about the Interceptor? How about the F106 and F12?

SPOKESMAN: Let me see if I can pick it up.

QUESTION: Could we get the RDT and E and F 14 A and B?

SPOKESMAN: Maybe Don can find the 106. The F14 RDT and E, the F14A has got 130 -- there is RDT and E, for the 14A, 130 in 69, 175 in 70. The "B" has got 30 in 69 and 50 in 70.

SPOKESMAN: I don't have the F106 numbers.

QUESTION: Let me ask you a question about this budget that I might not have asked if I had had an opportunity to study it more fully, but you have reduced the expenditures by about $3 billion in the current fiscal year under a mandate from Congress.

You have also managed to spend about $3 billion more than you expected to in the post-Tet thing, so you had to go for a supplemental.

This to me seems to add up to about 6. Now you are projecting a budget for fiscal 70 ---

SPOKESMAN: Could you explain that?

QUESTION: You have cut out $3 billion of expenditures. That is accurate, isn't it?

SPOKESMAN: Yes. Remember that is this year, against this year's appropriations.

QUESTION: That is right. Now you have to get a supplemental for another three which is not the same as what you have cut.

SPOKESMAN: But you are mixing two years there but go ahead.

QUESTION: I understand I am mixing two years because you are going to spend the supplemental next year. Yet you are projecting a budget next year for substantially the same level as this. My question is how much is your supplemental going to be next spring? It is inevitable, isn't it?

SPOKESMAN: No. As a matter of fact, there is nothing in either what we are saying or what we believe that contemplates a supplemental next spring.

QUESTION: I mean the spring of 1970, I am sorry.

SPOKESMAN: I honestly believe we are fully funded in Fiscal 70 as we are looking at it. What we are doing is bringing up to date the Presidential determination of southeast activity and force levels starting from last March. What we are doing in terms of our supplemental for this year is paying for the military personnel that were authorized at that time plus the additional munitions that were ordered through the May post-Tet but May and August offensive, and actually this puts our inventories in pretty good shape based on today's consumption.

So, I see no reason, unless things go to pot over there, for a supplemental, in 1970 and everything else is fully funded.

QUESTION: One more question, sir --

SPOKESMAN: Let me quickly qualify that. There again is a pay raise, a statutory pay raise in the 70 budget again in a one line which again will get us into a supplemental next year to fund that pay raise. You will remember that (deleted) said that of our $3 billion supplemental this year $1 billion 2 will be for the pay raise. We will be in exactly that situation again next year.

QUESTION: ... budget by the $3 billion cut are not being corrected if that is the right word in fiscal 70. You yourself said some of the stuff will creep back in over the years. Is it creeping back in yet or will it later on?

SPOKESMAN: I think to the extent that we depressed our non-Southeast Asia, which is where the cuts are placed, operational activity below what we would call normal levels of operational activity, 1970 represents a normalization of our operational activity. To that extent I think, sure, that the 70 budget does recoup a somewhat lower level of activity than we experienced in 69 in the non Southeast Asia area, but it wasn't a deferred expense, it is a true saving in 1969.

We are just moving up to a little higher level in 70, but aside from that, I really don't think that there is anything that is either a booby trap for a supplemental in the 70 budget or is under funded in the 70 budget. We think it is a pretty good budget.

QUESTION: During the campaign, Mr. Nixon made quite a point about the fact that he felt there was a security gap in our forces. Do you feel that the budget that we have been given today reflects the documents which Mr. Nixon said is your security gap? And if there is a security gap how much money will it take to remedy it?

SPOKESMAN: When did I stop betting my wife. Of course I am a comptroller. I honestly believe that based on the programs we were given that we have a good, well balanced budget. I think in such areas as you can see from your tables, research and development, new ship building programs, new aircraft programs, that we have a good balanced budget.

I am not the one to evaluate the overall international threat versus this program. This is a question for Mr. Laird starting next week, of course, and the rest of the team. I know that Secretary Clifford and Secretary Nitze believe that they are sending to the Hill a very well balanced budget and I think tonight we ought to hear President Johnson say those same words. As far as we are concerned we believe it.

QUESTION: Do you know if the Joint Chiefs have signed off on this one?

QUESTION: Could you answer a couple of non-hardware questions?

In the RDT and E category, would you give us a rundown on your 61,62, this basic research, the near basic research categories.

SPOKESMAN: What are we doing in it you mean?

QUESTION: Yes, 61, 62.

SECOND SPOKESMAN: Well, I can give you the figures and the line items, but I really can't explain it. I would guess that you ought to go to DDR and E more than to me. Let me give you as we quickly run through these the pieces of it in RDT&E Army, first of all.

In military sciences, we are going from 172 to 182 million dollars. For aircraft, we are going from $117 million to $132 million. All of this is RDT&E in the subcategories. Missiles and related equipment, we are going from $755 million to $883 million.

This is the Army still. We are going in ordnance, combat vehicles, and equipment, we are going from $171 million to $193 million.

Other equipment is staying about equal. In Navy, in military sciences, we are going from $153 million to $160 million. In aircraft, we are going from $396 million to $577 million. In missiles we are going from $714 million to $525 million.

QUESTION: It is in here?

SECOND SPOKESMAN: That is all I am doing. I am just pulling from RDT&E.

QUESTION: Will you please tell me whether the pay raise is included here?

SPOKESMAN: The pay raise for pay to become effective July 1, 1969, or the pay raise that became effective July 1, 1968, has been traditionally put in a government wide contingency amount in the President's budget so that it is in the totals of the President's budget but it has not been distributed by agency until such time as the individual agencies will compute the more precise amounts that will be required by agencies, determine what amounts can be absorbed of the total pay raise and ask for the supplementals under their own individual appropriation accounts.

So that there is a provision in the total President's budget for the pay raise. It just is not included in the Defense Chapter for defense.

QUESTION: I want to ask one question if I may regarding military assistance.

In this book the budget is around $275 million for foreign military sales but it says this will finance more sales than the $296 million approved last year because a portion of this budget authority will guarantee private financing.

Can we get how much more in estimated sales this year over last year and whether special congressional authority is needed for this new guarantee?

SECOND SPOKESMAN: You are reading from the budget book. I am not trying to evade it.

SPOKESMAN: We don't have those numbers.

It is true that part of the money that is appropriated for foreign military sales is used to guarantee loans for sales so that it extrapolates into a higher sales program, depending upon how these loans can be arranged and how effective these guarantees can be made vis-a-vis the amount of money that the U. S. Government would have to commit for that purpose.

QUESTION: You don't have any figures?

SPOKESMAN: No, we do not on that subject. I would suggest that you contact the International Security Affairs.

SPOKESMAN: Would it be agreeable if we took several more questions and the rest we will just try and answer your queries individually as best we can.

QUESTION: -- is it possible to break out a figure for 69 and 70 for DOD support for project Apollo?

And the total space funding, also?

SPOKESMAN: I think the astronautics in RDT&E is in your table, I believe, which is what comes closest to our space. Military astronautics is in your table. Support of Apollo, I don't know whether we can break that number out or not. I think we would have to refer that to DDR&E.

QUESTION: Can you explain why the three military services together are practically standing still in expenditures projected for 70 whereas the Defense Department and Defense agencies are increasing by $715 million, which actually means that you are spending less on the three military services when you take inflation into effect?

Where is all that money going?

SECOND SPOKESMAN: The biggest piece of the defense agency outlay increase is in the normal each year increase in the retired population and therefore in the retired pay account, and this year that is augmented by the fact that there was a consumer price index impact which takes place February 1. So it is only a piece of this year. It is a full year next year.

In other words there is a disproportionate increase in 70 versus 69.

QUESTION: Does that account for most of the increase?

SECOND SPOKESMAN: It accounts for $400 million.

QUESTION: Thank you very much, sir.

Will you look in R and D and find out three things that were mentioned in the President's message?

SECOND SPOKESMAN: Have you read the President's message?

QUESTION: Yes.

SECOND SPOKESMAN: You are ahead of us again.

SPOKESMAN: You are referring to the Budget Message I take it?

QUESTION: Yes.

Thank you very much, sir.

Executive's Defense Budget Handbook
FY 69

R-9 DOD BUDGET HANDBOOK

GREEN FLASH BUDGET NEWS SUPPLEMENT

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9 January 1969

BUDGET FLASH.....

Not since 1961, when President Kennedy revamped the last Eisenhower defense budget to upgrade conventional warfare capabilities, has there been as much turmoil around and within a military budget as there has been with the current fiscal 1969 program.

(While LBJ's last budget request -- for FY 1970 -- goes to Congress on 13 January, to be followed in a few months by some Nixon-Laird modifications, the FY 1969 program is the one that remains in effect until June 30. And since no defense budget in recent years has been through the Congressional mill before August at the earliest, the FY 1969 budget levels will be of prime importance for some time after June 30 as well, since the practice has now become common to retain the previous fiscal year's levels on a week-to-week basis while Congress wrestles for several months into the new fiscal period on the exact figures to be approved.)

An important difference from 1961 and other years when there were major changes during the course of the year is that in FY 1969 the bulk of the changes are not the result of a different view of national security, or changes in the nature of the threat, or new technological developments; the major factor is economic -- budget austerity caused by the continued tremendous demands of the Vietnam War, concern over national economic stability, and mounting pressure for increased funding from other sectors of the economy. Budget changes based on this type of situation often wreak havoc with carefully-planned military programs.

Congress whacked $5 billion from the FY 1969 defense money request, and followed this up with the Revenue and Expenditure Control Act of 1968 requiring additional cuts. When Secretary of Defense Clark Clifford came up with his detailed bill of particulars recently on where the reductions were to be allocated, it came out to a shade over $5 billion in FY 1969 money requests and almost $700 million to be taken out of the hide of prior year appropriations not yet committed.

About 80% of the reductions are the direct reflection of Congressional directives to cut specific programs. But while there are many specific line-item reductions, in numerous other cases there is only the announced target of cutting a stated amount in "RDT&E program levels" or "more austere procurement of electronics equipment," and this is where a real crunch comes into play, in determining which projects get gigged the most to meet the quota. (Still to come is an expected "supplemental" appropriation for FY 1969 for Vietnam extra costs, for as much as several billion dollars.)

Budget Flash (2)

Of particular interest to readers of this series are these program reductions (note that these are reductions in authorized funds that would have been spent over several years, not merely FY 1969 expenditures):

ARMY:

.....Reduction in non-SEA Logistical Support Areas (supplies and materials, spare and repair parts, equipment maintenance), $368.2 million.
.....Reduction in non-SEA Major Equipment and Ammunition Procurement, $325 million.
.....Reduction in RDT&E Program Levels, based on both program status and reevaluation of priorities, $176.3 million.

NAVY:

.....Reduction in Logistics Support Requirements, Ship Operating and Overhaul Costs, $160.1 million.
.....Reduction in F-111B and Phoenix missile procurement, $530 million.
.....Reduction of General Purpose Communications and Procurement of Electronics Equipment, $106 million.
.....Reassessment of Priorities and Rephasing of Procurement to more austere levels, $219.6 million.
.....Deferment of Fast Deployment Logistics Ships, $183.6 million.
.....Deferment of General Purpose Destroyer (DX) Program, $221.0 million.
.....Cancellation of 2 AGOR's (ocean survey), $14 million.
.....Reduction in ocean-going minesweeper (MSO) program, $95.8 million.
.....Reductions and Reassessment of Priorities for RDT&E, $132.5 million.
.....Adjustment in Polarispto-Poseidon missile sub conversion program, $213.1 million.

AIR FORCE:

.....Reduction of Supplies and Materials, $25 million.
.....Reduction in other procurement areas, $93 million.
.....Reduction in FB-11 and F-111D procurement, $677 million.
.....Reduction in SR-71 reconnaissance aircraft procurement, $9 million.
.....Reduction in A-7 aircraft procurement, partially offset by increase in F-4E procurement, $6.9 million.
.....Reduction in aircraft rework and modification, $38 million.
.....Reduction and reassessment of priorities, $192.8 million.
.....Reduction in classified projects, $38.9 million.

DEFENSE AGENCIES:

.....Reduction in R&D programs, $30 million.
.....Reduction in DOD Emergency Fund for R&D, $75 million.

Note that the unallocated reductions in RDT&E, plus the cuts in specific programs still in the R&D stage (FDL, DX) come to more than $1 billion.

On the plus side, there has been a decided boost given the nation's undersea warfare program, after considerable pulling and hauling. An increase in FY 1969 funding of $52.8 million over the original budget request has been provided for by the SecDef, for nuclear submarines and spares, representing largely future development work to be done on the new high-speed attack sub and the electric drive "quiet" sub. Indicative of the long-range nature of these projects, only $1.7 million of that $52.8 million is earmarked to be actually spent during FY 1969.

It will also be noted that over $1 billion of the reduction represents cutbacks in production of various versions of the F-111, including complete cancellation of the Navy F-111B and substantial reduction in the USAF's planned buy of FB-111 bombers. For the Navy, this is partly made up by a $130 million add-on to the budget by Congress for hurry-up work in developing the successor VFX-1, now known as the F-14. But whether all of that will be made available to the Navy when desired is still a moot question -- even after Comptroller Robert Moot leaves the Pentagon.

The VFX-1 money breaks down like this: $30 million for Contract Definition, $22 million for avionics development, $18 million for further engine development, and $60 million for airframe development. In a move to avoid another "TFX" contract award situation, Congress stipulated that none of the development money can be obligated until after Capitol Hill gets the word on "the cost and design characteristics of the aircraft selected."

USAF's Manned Orbiting Laboratory program, it is widely indicated, is due for increased emphasis under the incoming Nixon Administration. MOL in FY 1969, however, is scheduled to take its lumps along with most everything else -- the Air Force reduction in RDT&E contemplates a schedule stretch-out for MOL resulting in delay of about 4 months in the expected 1971 first manned test flight.

Many of the reductions being made in FY 1969 are deferrals rather than outright program reductions -- some are formally acknowledged as such, others are informally understood to be in this category. Thus the pressure that has been building up in efforts and programs deferred because of the drain of the Vietnam War is upped several more notches. As Vietnam spending declines, there will be more claimants for the funds released than there will be extra funds available, and the in-fighting is expected to be severe. There is not the slightest expectation, however, that defense budgets after Vietnam will retreat to their pre-Vietnam $50 billion level.

A Brookings Institution study by former Budget Director Charles Schultze, for example, prepared for President-elect Nixon, indicates a defense spending level of about $70 billion in FY 1971, and $76 billion by FY 1974. Part of this

increase reflects the inevitable upcreep of wages and prices; but much of it will result from the coming to fruition of major new weapon systems now in their earliest stages of development, or whose planned growth is temporarily stunted because of budget restrictions.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
FISCAL YEAR 1969 BUDGET REQUEST

OUTLOOK

The Administration has asked Congress for authority to spend $4.6 billion for the National Aeronautics and Space Administration during the next fiscal year, about $230 million below 1968. This is $850 million below 1967 and over $1.3 billion less than in 1966. The request is the lowest in six years, but all is not as bleak as one would suppose from first glance.

President Johnson has reaffirmed the hope that Americans would reach the moon next year and has pledged not to "abandon the field of planetary exploration."

Such cuts last year virtually left the nation without a planetary exploration program. Mr. Johnson's request, however, is much more scaled down from the one rejected in 1967.

The budget request by the President at least keeps alive plans for some exploration of the moon after the initial landings and will permit scientists to begin scouting Mars in 1969, 1971 and 1973; hopefully in preparation for manned flights to that planet ten years or more from now.

The major reduction, exceeding $500 million, is in money requested for the Apollo lunar landing program in fiscal year 1969. Congress is being asked for $4.37 billion in new funds, about $220 million less than it appropriated last year after making cuts of half a billion dollars.

Congress has served words that even further cuts will be made this year, perhaps several millions, and they may

fall in the same area of lunar exploration following the first landings and earth-orbit flights in the Apollo Applications Program. Planetary exploration plans are still candidates for cuts.

The $4,370,400,000 of new obligational authority is broken into a request of $3.677 billion for research and development; $45 million for construction of facilities; and $648 million for administrative operations.

This means that R&D is down about $233 million from 1968 and about $557 million from 1967; construction of facilities is up a little from 1968, from $37.8 million to $45 million, but about $40 million below what it was in 1967. Administrative operations is at $648.2 million as compared to $640.4 million.

NEW RESEARCH AND DEVELOPMENT PROGRAMS AND PROJECTS

The fiscal year 1969 budget contains $38,000,000 for these new research and development projects:

Lunar and Planetary Exploration Program

Mariner Mars 1971 ($18,000,000)

The Mariner Mars 1971 project objectives are to place two spacecraft in orbit about Mars to measure the physical, chemical, and thermal properties of its surface and atmosphere and the variations of these properties with the season and time of day. This project should advance spacecraft technology for orbital missions about the planets. The scientific instruments for the Mariner 1971 missions will be similar to those carried by Mariner 1969. However, the 1971 mission is an advancement because orbital operations will make

measurements closer to the surface, and for longer periods of time than the Mariner Mars 1969 flyby mission.

The Mariner Mars 1971 spacecraft will be similar to the Mariner Mars 1969 spacecraft and will use the spare components and proof test model from that project. The funds requested for FY 1969 will provide a detailed system design, procure additional Mariner Mars 1969 subsystems, modify Mariner Mars 1969 hardware, and develop and test prototypes of critical subsystems.

Titan Mars 1973 ($20,000,000)

The Titan Mars 1973 project will continue to measure the physical and chemical properties of Mars from orbit and send a survivable lander through the atmosphere to the Mars surface. These measurements will increase the topographic and thermal mapping information; establish the absence or the presence and distribution of water on the surface; measure the trace constituents of the atmosphere; determine ionosphere properties and distribution -- if any; and obtain density, temperature, and composition profiles of the atmosphere by direct measurements. The orbiter spacecraft will be used for future planetary missions. Technologies and sterilization techniques will be developed for systems to be landed on Mars in later missions. There will be a small survivable orbiter and a lander launched on a Titan vehicle in 1973. Funds requested for 1969 will provide functional specifications; start of detailed system designs; and development, fabrication, and testing of engineering models of critical subsystems for both the orbiters and probes.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
FISCAL YEAR 1969 BUDGET REQUEST

DETAILED BACKGROUND

The National Aeronautics and Space Administration was established on October 1, 1958, according to the National Aeronautics and Space Act of 1958, approved on July 29, 1958. The Act states that the policy and purpose of the United States activities in space will be: to conduct space and aeronautical activities for peaceful purposes for the benefit of all mankind. These activities should contribute materially to: the expansion of human knowledge in the atmosphere and space; the improvement and usefulness of aeronautical and space vehicles; the development and operation of space vehicles; the establishment of long-range studies, the preservation of United States leadership in aeronautics and space technology and utilization; the dissemination of pertinent information gained in the program to civil and military agencies; the cooperation with other nations in aeronautics and space activity pursuant to peaceful interests; and the effective utilization of scientific and engineering talents and facilities of the nation.

A total funding program of $4,370,400,000, to be financed by new obligational authority, is requested to support current and proposed programs.

The industrial community, under contracts with the NASA, will continue to carry forward the prime design, development, and fabrication effort of the NASA program. However, only about 85 to 88 cents of every R&D dollar is expected to go to industry compared with 94 percent last year. Specific

elements of the activity will continue to be pursued within NASA installations, other government agencies, universities, and research contractors which have the necessary level of expertise in special areas of engineering and science. The major elements of the program fall within the following categories:

Manned Space Flight: A program for the continued development and demonstration of a capability for manned space operations and exploration; to maintain progress in manned space flight; and to provide information required for future decisions concerning follow-on space programs.

Space Science and Applications: A program of unmanned space flight involving: (1) scientific investigations of the earth, solar system, stars and space environment; compiling new knowledge in astronomy; planetary and interplanetary studies and experiments on the affects of space environment on living organisms; and (2) the adapting of space technology so acquired for the direct benefit of mankind in areas such as weather, communications, navigation, traffic control, geodesy, meteorology, and earth resources.

Advanced Research and Technology: A continuing program to provide the technological base for significant future aerospace missions.

Tracking and Data Acquisition: A program for providing the support required by the world-wide NASA manned and unmanned space flight programs.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 BUDGET REQUEST

SUMMARY OF APPROPRIATIONS

(In thousands of dollars)

Appropriation	P.L. 89-555 Fiscal Year 1967	P.L. 90-131 Fiscal Year 1968	Fiscal Year 1969
Research and Development	$4,245,000	$3,925,000	$3,677,200
Construction of Facilities	83,000	35,900	45,000
Administrative Operations	640,000	628,000	648,200
TOTAL	$4,968,000	$4,588,900	$4,370,400

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 BUDGET REQUEST

SUMMARY OF APPROPRIATIONS (ADJUSTED)

(In thousands of dollars)

	Total	Research and Development	Construction of Facilities	Administrative Operations
FISCAL YEAR 1967				
Independent Offices Appropriation Act 1967 (80 Stat. 675). . . .	$4,968,000	$4,245,000	$83,000	$640,000
NASA Appropriation Transfers (80 Stat. 676)	---	-9,900	2,000	7,900
Transfer to "Operating expenses, Public Buildings Service," General Services Administration (80 Stat. 674).	-417	---	---	-417
Appropriation (adjusted). .	$4,967,583	$4,235,100	$85,000	$647,483
FISCAL YEAR 1968				
NASA Appropriation Act, 1968 (81 Stat. 384-385)	$4,588,900	$3,925,000	$35,900	$628,000
NASA Appropriation Transfers (81 Stat. 385)	---	-14,400	1,900	12,500
Transfer to "Operating expenses, Public Buildings Service," General Services Administration (81 Stat. 348).	-127	---	---	-127
Appropriation (adjusted). .	$4,588,773	$3,910,600	$37,800	$640,373
FISCAL YEAR 1969				
Appropriation request.	$4,370,400	$3,677,200	$45,000	$648,200

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 BUDGET REQUEST

SUMMARY OF BUDGET PLAN BY APPROPRIATION BY BUDGET ACTIVITY

(In thousands of dollars)

APPROPRIATION TITLE	TOTAL	MANNED SPACE FLIGHT	SCIENTIFIC INVESTI-GATIONS IN SPACE	SPACE APPLI-CATIONS	SPACE TECHNOLOGY	AIRCRAFT TECH-NOLOGY	SUPPORT-ING ACTIVITIES
Fiscal Year 1967	$4,908,096	$3,393,516	$564,394	$110,205	$387,769	$105,376	$346,836
Research and development	4,175,100	3,024,000	481,294	91,486	235,570	35,900	306,850
Construction of facilities	86,411	45,057	4,688	---	8,590	21,010	7,066
Administrative operations	646,585	324,459	78,412	18,719	143,609	48,466	32,920
Fiscal Year 1968	$4,648,773*	$3,158,608	$508,695	$134,303	$398,868	$122,681	$325,618
Research and development	3,970,600*	2,809,200*	433,523	114,337	256,890	66,800	289,850
Construction of facilities	37,800	25,665	3,595	---	2,115	3,170	3,255
Administrative operations	640,373	323,743	71,577	19,966	139,863	52,711	32,513
Fiscal Year 1969	$4,370,400	$2,824,812	$479,530	$147,733	$410,061	$131,435	$376,829
Research and development	3,677,200	2,483,400	405,522	127,338	265,240	76,900	318,800
Construction of facilities	45,000	18,659	1,200	---	386	---	24,755
Administrative operations	648,200	322,753	72,808	20,395	144,435	54,535	33,274

*Includes $60 million of prior year funds applied to FY 1968 budget plan.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 REQUIST

SUMMARY OF BUDGET PLAN

OFFICE OF MANNED SPACE FLIGHT PROGRAMS

	(Thousands of dollars) 1967	1968	1969
Research and Development	$3,024,000	$2,809,200	$2,483,400
Gemini	15,200	---	---
Apollo	2,922,600	2,556,000	2,038,800
Apollo applications	80,000	253,200	439,600
Advanced missions	6,200	---	5,000
Construction of Facilities	45,057	25,665	18,659
Kennedy Space Center	34,157	23,745	13,209
Manned Spacecraft Center . . .	10,200	750	3,100
Marshall Space Flight Center .	---	745	---
Michoud Assembly Facility. . .	700	425	400
Various locations	---	---	1,950
Administrative Operations	317,102	312,957	312,984
Kennedy Space Center	92,742	93,831	97,710
Manned Spacecraft Center . . .	95,659	95,908	97,096
Marshall Spaceflight Center .	128,701	123,218	118,178
TOTAL, MANNED SPACE FLIGHT	$3,386,159	$3,147,822	$2,815,043

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 REQUEST

SUMMARY OF BUDGET PLAN

OFFICE OF SPACE SCIENCE AND APPLICATIONS PROGRAMS

OFFICE OF UNIVERSITY AFFAIRS PROGRAM

	(Thousands of dollars)		
	1967	1968	1969
SPACE SCIENCE AND APPLICATIONS PROGRAMS AND PROJECTS			
Research and Development	$576,100	$552,850	$538,200
Physics and astronomy	129,800	142,950	141,900
Lunar and planetary exploration	184,150	141,500	107,300
Launch vehicle development. .	31,200	---	---
Launch vehicle procurement. .	117,650	127,100	128,300
Bioscience	42,000	41,800	48,500
Space applications.	71,300	99,500	112,200
Construction of Facilities	4,688	3,595	1,200
Goddard Space Flight Center .	---	565	---
Jet Propulsion Laboratory . .	350	---	---
John F. Kennedy Space Center, NASA	1,213	2,290	700
Various locations	2,920	---	---
Wallops Station	205	740	500
Administrative Operations	80,798	77,392	79,502
Goddard Space Flight Center .	71,069	68,525	70,594
Wallops Station	9,729	8,867	8,908
TOTAL, SPACE SCIENCE AND APPLICATIONS.	$661,586	$633,837	$618,902
UNIVERSITY AFFAIRS PROGRAM			
Research and Development			
Sustaining university program	$31,000	$10,000	$10,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 REQUEST

SUMMARY OF BUDGET PLAN

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY PROGRAMS

OFFICE OF TRACKING AND DATA ACQUISITION PROGRAMS

OFFICE OF TECHNOLOGY UTILIZATION PROGRAM

	(Thousands of dollars)		
	1967	1968	1969
ADVANCED RESEARCH AND TECHNOLOGY PROGRAMS AND PROJECTS			
Research and Development	$268,150	$318,700	$336,800
Basic research	21,401	21,465	22,000
Space vehicle systems.	33,909	35,000	35,300
Electronics systems.	33,597	39,200	39,400
Human factor systems	16,265	20,985	21,700
Space power and electric propulsion systems.	40,440	44,000	44,800
Nuclear rockets.	53,000	54,000	60,000
Chemical propulsion.	33,638	37,250	36,700
Aeronautical vehicles.	35,900	66,800	76,900
Construction of Facilities	29,600	5,285	386
Ames Research Center	---	3,170	386
Electronics Research Center. .	7,500	---	---
Langley Research Center. . . .	6,100	---	---
Lewis Research Center.	16,000	2,115	---
Administrative Operations	188,128	188,882	195,108
Ames Research Center	33,824	33,563	33,975
Electronics Research Center. .	12,219	15,467	19,079
Flight Research Center	9,488	9,439	9,728
Langley Research Center. . . .	64,337	62,095	62,765
Lewis Research Center.	66,280	66,220	67,352
Space Nuclear Propulsion Office	1,980	2,098	2,209
TOTAL, ADVANCED RESEARCH AND TECHNOLOGY.	$485,878	$512,867	$532,294

(cont.)

	(Thousands of dollars) 1967	1968	1969
TRACKING AND DATA ACQUISITION PROGRAMS AND PROJECTS			
Research and Development			
Tracking and data acquisition .	$270,850	$275,850	$304,800
Construction of Facilities	1,700	1,900	21,755
Goddard Space Flight Center . .	710	---	---
Jet Propulsion Laboratory . . .	---	1,900	---
Various Locations	990	---	21,755
TOTAL, TRACKING AND DATA ACQUISITION	$272,550	$277,750	$326,555
TECHNOLOGY UTILIZATION - Research and Development	$5,000	$4,000	$4,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 REQUEST

NUMBER OF PERSONNEL POSITIONS

	Fiscal Year 1967	Fiscal Year 1968	Fiscal Year 1969
MANNED SPACE FLIGHT			
John F. Kennedy Space Center, NASA	2,720	2,931	2,931
Manned Spacecraft Center . . .	4,704	4,579	4,579
Marshall Space Flight Center .	7,086	6,386	6,386
SPACE SCIENCE AND APPLICATIONS			
Goddard Space Flight Center. .	3,782	3,686	3,841
Wallops Station.	518	497	497
ADVANCED RESEARCH AND TECHNOLOGY			
Ames Research Center	2,173	2,092	2,092
Electronics Research Center. .	700	816	966
Flight Research Center	590	566	566
Langley Research Center. . . .	4,161	3,990	3,990
Lewis Research Center.	4,676	4,485	4,485
Space Nuclear Propulsion Office	117	115	115
SUPPORTING OPERATIONS			
NASA Headquarters.	2,499	2,279	2,279
TOTAL PERMANENT POSITIONS	33,726	32,422	32,727
POSITIONS OTHER THAN PERMANENT	2,182	2,182	2,182
TOTAL POSITIONS	35,908	34,604	34,909

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 BUDGET REQUEST

RESEARCH AND DEVELOPMENT

Program and Financing (In thousands of dollars)

	Budget Plan			Costs to this appropriation		
	1967	1968	1969	1967	1968	1969
Program by activities:						
Direct program:						
1. Manned space flight:						
(a) Gemini.	15,200	---	---	100,383	6,100	---
(b) Apollo.	2,922,600	2,556,000	2,038,800	2,845,089	2,509,700	2,132,700
(c) Apollo applications . .	80,000	253,200	439,600	62,805	179,800	435,000
(d) Advanced mission studies	6,200	---	5,000	10,011	6,000	4,300
2. Scientific investigations in space:						
(a) Physics and astronomy .	160,837	175,817	175,922	202,071	184,100	176,100
(b) Lunar and planetary exploration.	201,005	150,666	113,900	234,081	163,000	118,000
(c) Bioscience.	42,000	45,700	54,400	46,031	46,500	52,200
(d) Launch vehicle development	77,452	61,340	61,300	95,069	72,900	62,200
3. Space applications	91,486	114,337	127,338	107,871	112,200	127,100
4. Space technology.	235,570	256,890	265,240	246,384	252,200	273,400
5. Aircraft technology	35,900	66,800	76,900	41,089	50,000	67,800
6. Supporting activities:						
(a) Tracking and data acquisition.	270,850	275,850	304,800	317,914	306,100	304,400
(b) Sustaining university program.	31,000	10,000	10,000	36,184	35,800	27,000
(c) Technology utilization.	5,000	4,000	4,000	4,166	4,700	4,200
Total direct program costs, funded	4,175,100	3,970,600	3,677,200	4,349,148	3,929,100	3,784,400

cont.

RESEARCH AND DEVELOPMENT

Program and Financing (In thousands of dollars) - Continued

	Budget Plan			Costs to this appropriation		
	1967	1968	1969	1967	1968	1969
Reimbursable program:						
1. Manned space flight:						
(a) Gemini	1,257	---	---	1,369	3,946	---
(b) Apollo	373	175	175	631	607	175
(c) Apollo applications. .	---	400	400	---	273	400
2. Scientific investigations in space:						
(a) Physics and astronomy.	12,464	7,477	7,673	6,231	8,177	7,673
3. Space applications.	49,415	17,500	31,500	27,179	53,757	31,500
4. Space technology.	39,796	40,579	45,252	40,116	40,701	45,252
5. Aircraft technology	2,147	5,750	2,000	2,207	8,463	2,000
6. Supporting activities:						
(a) Tracking and data acquisition	1,000	619	500	1,657	1,031	500
(c) Technology utilization	139	---	---	150	1	---
Total reimbursable program costs. . . .	106,591	72,500	87,500	79,540	116,956	87,500
Total program costs, funded	4,281,691	4,043,100	3,764,700	4,428,688	4,046,056	3,871,900
Change in selected resources1/ .	---	---	---	-99,046	153,159	-107,200
Total.	4,281,691	4,043,100	3,764,700	4,329,642	4,199,215	3,764,700

cont.

RESEARCH AND DEVELOPMENT

Program and Financing (In thousands of dollars) - Continued

		Budget Plan			Costs to this appropriation		
		1967	1968	1969	1967	1968	1969
10	Total	4,281,691	4,043,100	3,764,700	4,329,642	4,199,215	3,764,700
	Financing:						
	Receipts and reimbursements from:						
11	Federal funds.	-93,717	-68,425	-75,425	-93,717	-68,425	-75,425
14	Non-Federal sources[2]	-12,874	-4,075	-12,075	-12,874	-4,075	-12,075
21	Unobligated balance available, start of year:						
	For completion of prior year budget plans.	---	---	---	-203,665	-156,715	---
	Available to finance new budget plans.	---	-60,000	---	---	-60,000	---
22	Unobligated balance transferred from other accounts .	---	---	---	-1,002	---	---
23	Unobligated balance transferred to other accounts . .	---	---	---	---	600	---
24	Unobligated balance available, end of year:						
	For completion of prior year budget plans.	---	---	---	156,715	---	---
	Available to finance new budget plans.	60,000	---	---	60,000	---	---
	New obligational authority.	4,235,100	3,910,600	3,677,200	4,235,100	3,910,600	3,677,200

cont.

RESEARCH AND DEVELOPMENT

Program and Financing (In thousands of dollars) - Continued

	Budget Plan 1967	Budget Plan 1968	Budget Plan 1969	Costs to this appropriation 1967	Costs to this appropriation 1968	Costs to this appropriation 1969
New obligational authority:						
40 Appropriation	4,245,000	3,925,000	3,677,200	4,245,000	3,925,000	3,677,200
41 Transferred to other accounts	-9,900	-14,400	---	-9,900	-14,400	---
43 Appropriation (adjusted). .	4,235,100	3,910,600	3,677,200	4,235,100	3,910,600	3,677,200
Relation of obligations to expenditures:						
10 Total obligations				4,329,642	4,199,215	3,764,700
70 Receipts and other offsets (items 11-17).				-106,591	-72,500	-87,500
71 Obligations affecting expenditures.				4,223,052	4,126,715	3,677,200
72 Obligated balance, start of year.				1,837,620	1,573,457	1,695,672
74 Obligated balance, end of year.				-1,573,457	-1,695,672	-1,521,572
90 Expenditures.				4,487,215	4,004,500	3,851,300
Expenditures are distributed as follows:						
01 Out of current authorizations				2,868,570	2,555,400	2,448,200
02 Out of prior authorizations				1,618,645	1,449,100	1,403,100

cont.

RESEARCH AND DEVELOPMENT

Program and Financing (In thousands of dollars) - Continued

	1966	1967 Adjust-ments	1967	1968	1969
[1]Selected resources as of June 30 are as follows:					
Stores	35,257	2,368	39,097	39,097	39,097
Unpaid undelivered orders	1,147,462	---	1,043,395	1,196,554	1,089,354
Advances	6,563	---	10,112	10,112	10,112
Total selected resources	1,189,282	2,368	1,092,604	1,245,763	1,138,563

[2]Reimbursements from non-Federal sources are receipts for services performed on Communications Satellite Corporation projects (42 U.S.C. 2473).

	1967 actual	1968 estimate	1969 estimate
Note.--Reconciliation of budget plan to obligations:			
Total budget plan	4,281,691	4,043,100	3,764,700
Deduct portion of budget plan to be obligated in subsequent years	113,369	---	---
Add obligations of prior year budget plans	161,320	156,115	---
Total obligations	4,329,642	4,199,215	3,764,700

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1969 BUDGET REQUEST

SUMMARY OF RESEARCH AND DEVELOPMENT BUDGET PLAN

BY PROGRAM BY COGNIZANT OFFICE

(In thousands of dollars)

BUDGET ACTIVITY	OFFICE/PROGRAM	Fiscal Year 1967	Fiscal Year 1968	Fiscal Year 1969
	MANNED SPACE FLIGHT	$3,024,000	$2,809,200	$2,483,400
1a	Gemini.	15,200	---	---
1b	Apollo.	2,922,600	2,556,000**	2,038,800
1c	Apollo applications . . .	80,000	253,200	439,600
1d	Advanced mission studies.	6,200	---	5,000
	SPACE SCIENCE AND APPLICATIONS.	576,100	552,850	538,200
2a	Physics and astronomy . .	129,800	142,950	141,900
2b	Lunar and planetary exploration	184,150	141,500	107,300
2d	Launch vehicle development	31,200	---	---
*	Launch vehicle procurement	117,650	127,100	128,300
2c	Bioscience.	42,000	41,800	48,500
3	Space applications. . . .	71,300	99,500	112,200
	UNIVERSITY AFFAIRS.			
6b	Sustaining university program	31,000	10,000	10,000
	ADVANCED RESEARCH AND TECHNOLOGY.	268,150	318,700	336,800
4	Basic research.	21,401	21,465	22,000
4	Space vehicle systems . .	33,909	35,000	35,300
4	Electronics systems . . .	33,597	39,200	39,400
4	Human factor systems. . .	16,265	20,985	21,700
4	Space power and electric propulsion systems. . .	40,440	44,000	44,800
4	Nuclear rockets	53,000	54,000	60,000
4	Chemical propulsion . . .	33,638	37,250	36,700
5	Aeronautical vehicles . .	35,900	66,800	76,900
6a	TRACKING AND DATA ACQUISITION	270,850	275,850	304,800
6c	TECHNOLOGY UTILIZATION. . .	5,000	4,000	4,000
	TOTAL BUDGET PLAN	$4,175,100	$3,970,600**	$3,677,200

*Funds for the procurement of launch vehicles are statistically distributed to unmanned flight programs (e.g., Physics and Astronomy, Space Vehicle Systems).

**Includes $60 million of prior year funds applied to FY 1968 budget plan.

RESEARCH AND DEVELOPMENT
FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF MANNED SPACE FLIGHT
APOLLO PROGRAM

The Apollo program is the creation of a strong manned space flight capability to achieve a position of leadership in space for the United States.

However, the program, while aimed at a manned lunar landing and return, it is not solely directed toward this goal. Apollo represents an extensive operational capability, including not only lunar exploration, but also a variety of other manned operations in space.

The Apollo program's problems and progress during the past year are mirrored in two events. On January 27, 1967, during a countdown simulation at Cape Kennedy, a flash fire occurred in the Apollo spacecraft, causing the deaths of the astronaut crew. The accident delayed progress toward accomplishing Apollo's objective of a successful manned lunar landing and return before the end of the decade, and forcefully focused full national attention on the ever-present realities of the hazards inherent in the exploration of space. The command module fire has delayed this first manned flight by over one year as design changes and modifications are made to the spacecraft. These modifications represent a concentrated effort to eliminate the possibility of a fire or to preclude its propagation.

Momentum was re-established on November 9, 1967, with the successful all up test of the first Saturn V launch vehicle.

This "all up" test produced a substantial number of "firsts" for the Apollo program. It was the first launch of the S-IC and S-II stages of the vehicle, the first flight of the powerful F-1 engine which produces over 1.5 million pounds of thrust, the heaviest weight (nearly 140 tons) ever placed into orbit, the initial qualification of the Apollo heatshield to withstand the 25,000 mph speed and 4,500^{o}F. temperatures of re-entry from lunar distances, and the recovery of a payload from the greatest distance in space -- over 11,000 miles. The test also demonstrated the ability of the S-IVB stage to restart in earth orbit. Each is an essential part of the manned lunar landing mission.

On the lunar mission, the spacecraft, with the Saturn V 3rd (S-IVB) stage still attached, will be inserted into a 100 nautical mile earth-parking orbit. After detailed checkout, the Apollo astronauts will separate the command, service, and lunar modules from the S-IVB stage. Necessary mid-course corrections, using the service module propulsion system, will keep the spacecraft on the correct path to the moon. As the Apollo spacecraft nears the moon, the service module propulsion system will again be fired to inject it into lunar orbit. After a checkout of all systems, two of the three astronauts will transfer from the command module to the lunar module, separate from the command craft, which will remain in lunar orbit, and land on the moon. After a stay of up to one day, during which the two astronauts will conduct observations, implant experiment equipment and instrumentation, and collect lunar samples, the astronauts will return to the orbiting command module and reenter it. The ascent stage of the lunar module will be left in lunar orbit. The astronauts will then restart the service module propulsion system to excape from lunar orbit. After a

coasting period, the service module propulsion system will be restarted for the final time to place the command module into the re-entry corridor. The service module will then be jettisoned and the command module will re-enter the earth's atmosphere.

During 1969, five manned Saturn V launches are scheduled and represent progressive steps toward the manned lunar landing. FY 1969 funding is required to support this flight schedule and the accomplishment of the national goal.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Spacecraft	$1,310,600	$1,095,000	$ 820,100
Saturn IB	225,626	146,600	69,100
Saturn V	1,098,154	998,900	818,200
Engine development . . .	49,800	18,700	---
Mission support.	238,420	296,800	331,400
Total	$2,922,600	$2,556,000	$2,038,800

WHY FUNDS REQUIRED:

Spacecraft ($820,100,000)

The Apollo spacecraft is composed of three modules: the command module, the service module, and the lunar module. The command module, which is the recoverable portion of the Apollo spacecraft, houses the three astronauts in a controlled environment. The service module contains the propulsion system used for making trajectory correlations and electrical and other utility systems supporting the command module. The lunar module is a self-contained vehicle consisting of a descent stage with

landing legs and an ascent stage with a habitable two-man cabin.

Funding during FY 1969 provides for continued production and test of the command and service modules, launch support, and post-flight analysis. Six command and service modules are scheduled for delivery. Integration and checkout will proceed on eleven others. Nineteen Block II flight command and service modules are included in the Apollo program.

Fiscal year 1969 funding also provides for continued manufacturing, test launch preparation of the lunar module, post-flight analysis, and associated hardware for experiments to be conducted on the lunar surface. Six flight LM's will be delivered in FY 1969. The six remaining LM's will be in the process of assembly, systems integration, and checkout at Grumman Aircraft. Funds are also provided for test operations, crew equipment, including space suits, logistics, instrumentation, and scientific equipment.

Saturn IB ($69,100,000)

The Saturn IB is a two-stage launch vehicle with a capability of placing approximately 20 tons of payload into a low earth orbit, and is used to demonstrate the initial operational capability of the Apollo spacecraft. The first stage, powered by eight H-1 engines, produces about 1.6 million pounds of thrust. The Apollo program includes development of twelve Saturn IB vehicles which will continue this year.

Saturn V ($818,200,000)

The Saturn V, the most powerful member of the Saturn family of launch vehicles, is composed of three propulsion stages and an instrument unit. The vehicle is designed to boost payloads up to 140 tons into low-earth orbit and to send payloads up to

50 tons on lunar missions.

The Saturn V schedule provides for 15 launch vehicles for unmanned qualification flights, manned lunar mission simulations, and manned lunar missions. Nine of these vehicles are scheduled to be launched before the end of the decade. Two vehicles were delivered in FY 1967, the first of which was used on November 9, 1967, in the very highly successful demonstration of the "all up" concept of space vehicle development. Two additional unmanned qualification tests and the first manned flight are scheduled for 1968. For 1969, the Apollo schedule includes five manned Saturn V flights, moving toward a manned lunar landing and return by the end of the decade. Major production activity continued over the last year, with the undelivered vehicles in the process of manufacturing, checkout or test.

Mission Support ($331,400,000)

Mission support funds provide for the areas of launch, flight crew, and recovery operations and for the program-wide systems engineering and supporting development necessary for the accomplishment of manned space flight.

There are two centers of operations activity - one at the Kennedy Space Center in Florida, where the launchings take place and the other at the Manned Spacecraft Center in Texas, where crew training and flight and recovery operations are conducted and directed.

Funding for the Kennedy Space Center covers the operation of checkout, launch and instrumentation facilities, including those contractor services and equipment and materials supplied by the Air Force Eastern Test Range for which the National Aeronautics and Space Administration reimburses the Department of Defense.

Funding for effort conducted and directed by the Manned Spacecraft Center includes the operation and maintenance of the complex mission control center and the training of astronaut crews through the use of mission simulators and high performance aircraft. Manned Spacecraft Center operations activities also include the direction and funding of recovery operations and important mission planning requirements.

Systems engineering provides for integrated technical support, review, and analysis of manned space flight programs.

Supporting development consists of individually selected engineering efforts which back up an on-going mainstream program with alternate or improved hardware or which provide a firm basis for specific hardware decisions which must be made in the relatively near-term future.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF MANNED SPACE FLIGHT

APOLLO APPLICATIONS PROGRAM

This program will increase the effectiveness of manned space flight operations as well as the performance of experiments and other in-flight activities. The program will maintain progress in manned space flight and provide the information required to permit knowledgeable decisions concerning potential future space programs within a severely limited budget.

Missions are built upon a strong base of flight experience, ground facilities, and trained manpower developed in the Gemini and Apollo programs. Maximum economy will be achieved by using, modifying, and expanding the capabilities of present Apollo systems rather than moving toward wholly new developments.

The flight missions are of two categories: earth orbital missions using both the Saturn IB and the Saturn V, and lunar missions using Saturn V vehicles and spacecraft modified to provide limited extension of Apollo mission staytimes on the moon.

During fiscal years 1968 and 1969 funding will provide continuation of production of Saturn launch vehicles at a minimum rate and development and fabrication of the equipment and experiments for the orbital workshop, the solar astronomy experiment, and the revisit missions. In addition, definition effort will be underway to determine the equipment and experiments necessary for the most effective exploration of the moon in the post-Apollo period. These activities support the following missions in the Apollo Applications program:

Orbital Workshop Mission - The first orbital workshop operations are planned for 1970. The orbital workshop will be set-up inside the empty hydrogen tank of a spent S-IVB stage, after the stage is used as a launch vehicle.

This mission requires the launch of two Saturn IB vehicles to begin operation of a large volume workshop in earth orbit. An unmanned flight, consisting of a Saturn IB with an air-lock module, and a docking adapter, will be launched first. A second Saturn IB launch occurring approximately one day later, will be manned and will rendezvous with the S-IVB stage from the first flight.

The crew will transfer from the command module through the docking adapter and the airlock module into the orbital workshop, and complete preparations for the crew quarters.

The experiments planned on this mission are chiefly devoted to determining and evaluating tank performance of men in space over extended periods of time. The planned mission duration for the crew will be 28 days. After completion of the mission, the equipments in the workshop, airlock and docking adapter will be placed in a standby mode for reuse in future missions.

Workshop Revisit Mission - The first workshop revisit mission uses a single Saturn IB launch of a three man Command and Service Module to rendezvous and dock with the orbital workshop placed in orbit during the previous mission. Its planned duration is 28 days to 56 days. The primary inflight experiment emphasis will be in the medical area. This will be the first mission with a medical doctor as a member of the crew.

Solar Astronomy Mission - The third mission, planned for 1971 uses the orbital workshop as a base of operations for a manned solar observatory. One Saturn IB will launch a three man Command and Service Module configured for a 56 day mission;

a second Saturn IB launches the unmanned Apollo Telescope Mount (ATM) with its payload of solar instruments. It is expected that an astronomer astronaut will be a member of the crew.

Workshop/Observatory Revisit Mission - A series of three additional revisits to the orbital workshop is planned in 1971. These will use the same configuration of the Command and Service Module being developed to support the first revisit to the workshop and the Apollo telescope mount missions, with a nominal duration of 56 days.

Inital Space Station - Over the past several years NASA, with supporting effort from many contractors, has conducted a series of studies of the configuration and utilization of an orbital workshop or initial space station launched on a Saturn V. The ability of the Saturn V to orbit a workshop outfitted on the ground before launch, significantly enhances the effective use of manned operations in earth orbit.

This initial space station is a natural progression from the Saturn IB workshop, as well as from the Mercury, Gemini, and Apollo programs. It will enable astronaut crews to conduct major scientific and engineering investigations for a period of a year or more.

Effective evolution and utilization of the space program and its capabilities require that the specific approach to the Saturn V workshop be determined within the next year. This definition effort will be directed toward the workshop; its scientific, engineering, and medical payloads; and operations plans.

Lunar Missions - Following the first Apollo landings, NASA will continue exploring the moon and gain the capability to conduct extended operations on the lunar surface. In analyzing the requirements for the post-Apollo missions three important

extensions to the projected Apollo surface mission capability have been identified:

1. Extension of staytime for the astronauts.
2. Increase in exploration radius about the landing site.
3. Increase in landed payload for mission support.

Missions in 1971 and 1972 can be planned with a surface staytime for two astronauts of three or more days during which time they will be able to explore within a five to ten kilometer radius of the landing point.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Space vehicles	$37,700	$ 86,000	$201,300
Experiments	37,600	139,000	190,300
Mission support	4,700	28,200	48,000
Total	$80,000	$253,200	$439,600

WHY FUNDS REQUIRED:

Space Vehicles ($201,300,000)

This funding through FY 1969 is limited to the procurement of Saturn IB and Saturn V launch vehicles and to the design, development production and installation of Apollo spacecraft systems that require modifications to meet the long duration objectives.

To minimize expenditures, delivery of Saturn IB launch vehicles has been rescheduled to two per year beginning in calendar year 1970.

Production of Saturn V launch vehicles is also scheduled at two per year with the first delivery of a post-Apollo vehicle planned for 1971.

The long-duration characteristics of the program require that spacecraft systems be modified to support these extensions in flight time. The Apollo spacecraft has been designed and produced to provide a 14 day operational capability and must be modified to accommodate the 56 day missions that are incorporated in the Apollo Applications program.

Funding during FY 1969 provides for the fabrication, check-out, and test of the necessary modifications and their initial installation in the first modified Block II command and service modules.

Feasibility studies directed toward modifying the lunar module to operate on the moon for a staytime of three days were performed during FY 1967, with preliminary design of the modifications being initiated during FY 1968.

FY 1969 funding provides for the continuation of design and preparation of vehicle and test specifications and the initial procurement of long lead hardware.

Experiments ($190,300,000)

Apollo Applications experiments cover a wide range of objectives in the fields of space medicine, science, applications, technology, and engineering. The definition and development of experiment payloads to meet these objectives will include activity by elements of NASA, other government agencies and the scientific and industrial communities. Unlike preceding manned space flight projects, in which the successful demonstration of the basic systems capability was the principal objective, Apollo Applications must achieve its objectives primarily through the judicious selection and carefully planned accomplishment of specific experiments. The measure of success will be the degree to which these experiments meet the overall objectives of investigating, demonstrating, and utilizing man's effective-

ness in space, extending his useful staytime, and contributing to this basic understanding of natural phenomena. Each of the experiments currently included in the program will contribute substantially to one or more of these objectives.

Contractor development effort is currently in process on the systems and components required for most of the major experiments. The basic pieces of hardware required for the workshop are well into their development phase. The airlock module is currently under development. Initial fabrication has begun on the first flight article, which will be ready for delivery to Cape Kennedy in late 1969.

The multiple docking adapter is being developed and fabricated in-house by NASA at the Marshall Space Flight Center. Manufacture of the initial flight unit will begin in 1969 and will be completed early in FY 1970.

Work is also in process on the ATM at the Marshall Space Flight Center, with major subsystem development having been underway for a year. Five specific experiments comprised of thirteen major instruments have been selected for the ATM and are currently in the process of fabrication.

Mission Support ($48,000,000)

Funds will support the payload integration activity and requirements for actual flight operations. Payload integration includes mission payload analysis and preliminary engineering aspects of integrating experiment payloads into spacecraft. It also provides support equipment hardware definition and preliminary design; performance and design test specifications; experiment interface specifications; and development of requirements, plans, and program data for accomplishing payload integration. Operations include efforts at the Kennedy Space Center and the Manned Spacecraft Center that are directly concerned with pre-launch, launch, flight, crew and recovery activity.

RESEARCH AND DEVELOPMENT
FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF MANNED SPACE FLIGHT
ADVANCED MISSIONS PROGRAM

This program will examine advanced manned space flight mission concepts in support of timely decisions with regard to future programs. Included are: logical extensions of the NASA space program through analysis of present hardware systems for growth potential; development of requirements for future systems; guidance for research and technology activities; provision of technical information and cost data upon which future program decisions can be based; and initiation of the definition, preliminary design and specification of probable future missions.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Advanced missions studies . . .	$6,200	---	$5,000
Total	$6,200	---	$5,000

WHY FUNDS REQUIRED:

Advanced Missions Studies ($5,000,000)

Advanced studies have in past years encompassed a wide spectrum of missions and related hardware. They were grouped into the categories of Earth Orbital Studies, Planetary Mission Studies, and Flight Vehicle Studies. The advanced missions program office in the Office of Manned Space Flight was organized along lines that reflected this categorization. Recently, however, the Advanced Manned Missions program office was realigned to concentrate on the immediate task of the manned earth orbital space flight program both with respect to direct support of the

later plases of the Apollo Applications program and to the long term implications of these plans. As a result of manned space flight experience to date and of a series of studies conducted over the past several years, there has developed a strong conviction among space planners that a space station is logical, practical, and necessary in development and use of our national capability for manned space flight. Such a station, with its supporting equipment and expendables, could be launched with a Saturn V. It would make use of equipment and experience developed for Apollo, the orbital workshop and other projects such as MOL, to the extent practical. Once in orbit, it would serve as a semipermanent base of operation for astronomical and other scientific observations, earth resources studies, biomedical research, technological developments, and for operational research and development to further enhance our national capability for manned space flight. By utilizing a modular approach, with a capability to operate in conjunction with automated but man tended spacecraft in the near vicinity, great operational flexibility can be achieved. This flexibility should make the space station system capable of meeting a wide variety of national needs.

A further aspect of the flexibility envisaged for the system, is that its occupancy and use could be varied from full crew/full time to a part time or standby operation, depending on requirements of users, funding availability or other factors. The space station would constitute a continuing capability, in being, in orbit to serve national needs in accordance with future decisions on specific objectives and on resources to be allocated.

Space Station Studies

Most of the funds requested for FY 1969 will be expended on

efforts to define an initial space station to be launched by a Saturn V following the completion of the current Apollo Applications program in the early 1970's. NASA says lead times are such that this work cannot be deferred if it is to maintain a national capability for a continuing manned space flight program in earth orbit. The preliminary design and definition effort will build on previous work and will include all aspects of space station missions and configurations, including the related logistics transportation system.

Intermediate Vehicles

A portion of the space station study funds will be allocated to determine the need for a launch vehicle intermediate in payload capability between the Saturn IB/Titan III and the Saturn V. It is possible that such a need will emerge from considerations of the logistics transportation system required to support the station. The determination of need for an intermediate vehicle is part of a larger picture, however, since other programs and agencies may also have requirements for such a vehicle. In particular, NASA will join with DOD in evaluating possible future space flight systems and the extent to which future requirements can be best met with NASA hardware, DOD hardware, or jointly developed systems.

Other Advanced Studies

In addition, it is planned in FY 1969 to continue some advanced studies of other missions and vehicles, particularly those applicable to lunar exploration. The latter will concentrate on alternate and contingency systems and operational modes for the mid-1970's.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF SPACE SCIENCE AND APPLICATIONS

PHYSICS AND ASTRONOMY PROGRAM

This program is directed toward the increase of our knowledge of the earth, sun, the interplanetary medium, and the nature of the universe. The program is a coordinated effort for national participation in research which involves: the space environment of the earth, the sun, and the solar relationship to the earth's environment and to interplanetary space, interplanetary dust, meteors, comets, stars, nebulae, galaxies, interstellar and intergalactic phenomena, and the basic nature of the universe. The program uses a variety of tools including automated observatories, manned spacecraft, interplanetary spacecraft, explorers, sounding rockets, balloons, aircraft, ground-based observatories, and laboratory and theoretical research.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting research and technology/advanced studies . . .	$ 20,365	$ 23,050	$ 25,300
Solar observatories	10,106	12,100	12,000
Astronomical observatories. . .	27,700	40,400	35,200
Geophysical observatories . . .	24,770	20,200	13,200
Pioneer	6,900	7,000	6,000
Explorers	18,224	17,300	23,200
Sounding Rockets.	20,000	20,000	22,000
Data Analysis	1,735	2,900	5,000
Total	$129,800	$142,950	$141,900

WHY FUNDS REQUIRED:

Supporting Research and Technology ($25,300,000)

This project, NASA supports the basic research required to provide for a firm foundation for the Physics and Astronomy program. It is in this program that development of new instruments is initiated. Laboratory, balloon, and aircraft data are provided as a basis for evaluation of flight results. Computer support for spacecraft operations, analysis of data and theoretical research is also provided.

The advanced studies funded are aimed at providing the technological advances, the establishment of concepts, characteristics and feasibility of future missions necessary to continue a viable Physics and Astronomy Program.

Solar Observatories ($12,300,000)

The objective of the Orbiting Solar Observatory (OSO) project is to provide the capability to advance man's understanding of the sun's constitution and behavior and to determine the fundamental physical processes by which the sun influences the earth and its space environment. The OSO makes available regions of the electromagnetic spectrum that are not available to ground-based instruments. The experiments on the OSO series of flight missions will determine the rapid changes, as well as the long-term changes in solar radiation, during the major portion of the eleven-year solar cycle. The first and second solar observatories obtained significant scientific data in the 1962 and 1965 time period during the period when solar activity was close to a minimum. A third OSO spacecraft failed to achieve orbit when it was launched in 1965. In 1967 two more OSO missions were launched that are providing more detailed knowledge of the sun and its environment at the time that solar activity is

increasing. Three more OSO missions will continue studies of the sun into the period of maximum solar activity. Fiscal year 1969 funds will provide for publication of data from OSO III and OSO IV; support pre-launch, launch, and in-orbit operations of the sixth OSO; and continue hardware effort on the seventh and eighth OSO's.

Astronomical Observatories ($35,200,000)

The Orbiting Astronomical Observatory (OAO) project is designed to develop and use an accurately stabilized automated space observatory system for telescopic observations of celestial objects in the electromagnetic spectral range from the x-ray region through the ultraviolet into the visible region. The primary experiments for the approved OAO series have been selected to initially perform exploratory sky mapping surveys and progress to high resolution viewing of faint objects. The first mission, which was launched in 1966 by an Atlas Agena vehicle, failed before any scientific data were obtained. The second flight was delayed about 21 months in order to thoroughly review and correct the weaknesses in the OAO system. Launches for the remaining approved missions are now scheduled in 1968, 1969, and 1970, using the Atlas Centaur vehicle. Fiscal Year 1969 funds will provide for completion of the OAO-A2 observatory tests and simulated operations, as well as support for launch, in-orbit operations, and data processing and analysis from the two scientific experiments. Funds will also be used for the acceptance tests of the OAO-B experiment hardware and development of flight hardware; modification, fabrication, integration and test initiation of the OAO-B spacecraft; and fabrication and test of the subsystems for the OAO-C spacecraft.

Geophysical Observatories ($13,200,000)

The Orbiting Geophysical Observatory (OGO) project has as a primary objective the accomplishment of a series of scientific measurements for study of the near-earth environment and for correlation of geophysical phenomena with the effluent activity of the sun and with phenomena in interplanetary space. Geophysical observatories have been launched at approximately one year intervals, starting with OGO-I in 1964. These missions and the planned OGO-E and OGO-F missions cover the period from minimum to maximum activity of the current sunspot cycle, and provide for widely-spaced measurements within the interplanetary and magnetospheric medium. OGO-I and III are transmitting data and are spin stabilized. OGO-IV, launched July 28, 1967, has been in the three-axis stabilization mode for over 150 days. Operations of the OGO-II satellite were discontinued after two years in orbit. Fiscal Year 1969 funds provide for launch of OGO-F and data analysis for OGO-IV, -E, and -F.

Pioneer ($6,000,000)

Pioneers in orbit around the sun are investigating the interplanetary environment and the propagation of solar and galactic phenomena through this medium. Data from three Pioneers and similar measurements made near earth provide simultaneous observations at widely separated points in space. Pioneer VI was successfully launched in December 1965, and Pioneer VII was successfully launched in August 1966. Both continue to return useful data from deep space. Pioneer VIII was successfully placed into orbit December 13, 1967. Two additional Pioneer missions are scheduled for missions approaching as close as 0-7 AU and going out as far as 1.2 AU from the sun (1 AU is equal to the mean earth to sun distance 92,900,000 miles).

NASA wants to initiate the development of two additional spacecraft, Pioneers F&G, to be launched into trajectories that will carry them out beyond the orbit of Mars, through the asteriod belt, and toward the orbit of Jupiter. Objectives are to obtain information on the hazardous region of the asteriod belt and gain knowledge of the gradient of the sun's influence on interplanetary space and the penetration of galactic cosmic radiation into the solar system. The new trajectory will require modifications to be incorporated in the spacecraft to compensate for the lessening of solar radiation as a power source and the more demanding communications and thermal conditions. New experiment instrumentation will also be required. These spacecraft will be launched in the 1973-74 time period by Centaur launch vehicles. The change from the Delta launch vehicles used on earlier missions is required to provide the velocity for this new trajectory.

Funds requested for FY 1969 will continue to support the post-launch operations for Pioneer VI, VII, and VIII, final testing and launch of the fourth spacecraft, and initial integration and testing for the fifth spacecraft. These funds will also provide for the initial procurement of experiments and long lead time spacecraft components for Pioneer F&G.

Explorers ($23,200,000)

NASA proposes to initiate development of two new atmosphere Explorers in FY 1969 to extend exploration by satellites into the 75 to 150 mile region above the earth, which has previously only been sampled by sounding rockets. Exploration of the ionosphere will be continued through NASA's cooperative ISIS project with Canada. Work on IMP and small scientific satellite Explorers for magnetospheric exploration, which is being deferred

in FY 1968 because of budget and manpower limitations will be pursued again in FY 1969 in an effort to compensate in some degree for the phaseout of geophysical exploration by OGO missions. The small interplanetary Explorer called Sunblazer, which was deferred in FY 1968, will be placed in full scale development in FY 1969. Development of Explorers for astronomy missions will continue, including missions for radio, X-ray and gamma-ray surveys.

These actions will cause the level of effort in Explorers to increase in FY 1969, reflecting NASA's increased reliance on this class of spacecraft for geophysical and interplanetary explorations.

Sounding Rockets ($22,000,000)

These rockets are relatively small, inexpensive vehicles capable of carrying a wide variety of instrumentation to conduct studies in planetary atmospheres, the ionospheric physics, energetic particles, astronomy, and solar physics. Sounding rocket flights have been extremely useful in developing instrumentation for later use on satellites. The usefulness of sounding rockets for astronomical observations of the sun and stars in the X-ray and ultraviolet regions of the spectrum has been greatly increased by the development of accurate attitude control systems capable of spatial pointing accuracies on the order of an arc second.

The increase in the funding requirements for the sounding rocket program in FY 1969 is largely due to the development and increased use of improved attitude control systems for astronomical observations; and to the increased use of larger, more expensive vehicles to carry stabilized heavier payloads.

Data Analysis ($5,000,000)

The primary objective of this project is to carry out NASA's obligation to make the scientific information gained from space projects available to the public. Data accumulated from NASA's earth orbiting spacecraft, sounding rockets, and space probes are being reduced and placed in the National Space Science Data Center located at the Goddard Space Flight Center. Here it is cataloged and distributed to interested researchers. The expansion of funding in FY 1969 reflects the increased activity at the National Space Science Data Center, a concerted effort to complete data analysis and preparation of data records for experiments no longer supported under flight projects, and support of the increasing interest in research using data from a number of experiments.

RESEARCH AND DEVELOPMENT
FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF SPACE SCIENCE AND APPLICATIONS
LUNAR AND PLANETARY EXPLORATION PROGRAM

The Lunar and Planetary Exploration program carries out the scientific exploration of the solar system by means of earth-based research and automated spacecraft. The immediate objectives are the exploration of the Moon, the planets Mars, Venus, and Mercury, and the intervening interplanetary space. Long range objectives include eventual exploration of the outer planets and their moons, comets, asteriods, and the interplanetary medium enroute to these bodies to better understand the origins and history of our solar system, the mechanisms by which it developed, and knowledge about the origin of life.

The initial scientific exploration of the moon was performed with automated spacecraft and has lead the way for the more detailed investigations to be carried out later by man. The Ranger, Surveyor, and Lunar Orbiter projects have provided three major accomplishments: First, they demonstrated the technological capability of performing significant exploration of another planet with automated spacecraft. Second, they indicated that the moon is a complex and significant body worthy of further exploration by man. Third, they paved the way for the first manned landing.

Ranger provided visual data about the moon which was 1,000 times better than any photographs through earth-based telescopes. Surveyor significantly contributed to the certification of four

sites of the Apollo zone, obtained scientific data about the moon's bearing strength and soil mechanics, surface texture, topography and morphology, radar reflectivity, thermal characteristics, and chemical composition. The Lunar Orbiters have successfully photographed the entire surface of the moon; inspected for hazards as small as several feet in size at candidate manned landing sites, and increased knowledge about the near edges of the moon.

The FY 1969 program will provide for the data analysis required to finish up the work and prepare the scientific reports on the information obtained from these successful projects.

The planets present a scientifically attractive opportunity for exploration because they all differ markedly from our earth. In these differences may lie the clues to the nature, origin, and evolution of our solar system and of life itself. Objectives of the Mariner program are to explore the planets, their moons, and interplanetary space with the light weight Mariner systems. Mariner II acquired interplanetary and planetary data on a flyby mission to Venus in 1962. Mariner IV flew past Mars in 1965. It acquired data on the interplanetary medium, the atmosphere of the planet and transmitted to earth 22 pictures of the surface of the planet. Mariner V flew by Venus in October 1967. It acquired data on the interplanetary medium and planetary atmosphere which improved and augmented significantly the data acquired five years earlier by Mariner II and will provide a basis for future exploration of Venus.

The Titan Mars 1973 program will initiate a baseline orbiter/lander configuration applicable to future exploration of the planets. The program will establish a step-wise approach to

increase the performance capability of each succeeding mission opportunity from extended orbital missions (3-6 months) with simple landers to long life orbital missions (6-12 months) with surface laboratories and later to mobile automated laboratory landers. The Titan Mars 1973 approach provides maximum flexibility to implement future mission options depending upon the national interest and economic support for planetary exploration.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting research and technology	$ 22,350	$ 19,800	$ 30,000
Advanced planetary missions technology	---	12,000	6,700
Data analysis	---	600	2,600
Mariner.	43,188	63,000	48,000
Titan Mars 1973.	---	---	20,000
Lunar Orbiter.	26,000	9,500	---
Surveyor	79,942	35,600	---
Voyager.	12,670	1,000	---
Total.	$184,150	$141,500	$107,300

WHY FUNDS REQUIRED:

Supporting Research and Technology ($30,000,000)

This provides support for flight missions by conceiving and developing science experiments and engineering capabilities and by conducting studies that define the objectives and requirements of various long-range flight mission possibilities. Data obtained from ground-based activities supported by this program

are combined with flight results to yield advancement in knowledge of the solar system. The advanced technical development part of this program is oriented toward initiating technological development of future subsystems, components, techniques and processes that may have application to long range spacecraft concepts and providing the laboratory research required to determine the feasibility of alternative design concepts for future, more complex missions to the moon and planets.

Areas of interest are new telecommunication and data automation techniques and concepts and increased reliability and lifetime of components. The advanced studies program identifies and evaluates long range potential missions in terms of new information to be gained from the moon and the planets.

During FY 1969 efforts in the planetary area will continue at about the same level of funding as FY 1968. Efforts in the lunar area will be increased with an emphasis on scientific support for Apollo and post-Apollo missions based on the results of the Ranger, Surveyor and Lunar Orbiter programs, and on technical development of new methods and instruments for the optimization of existing mission plans and future plans for lunar exploration.

Advanced Planetary Missions Technology ($6,700,000)

This program was begun in FY 1968 in view of the conclusion of the Mariner V, Lunar Orbiter, and Surveyor programs and the deferral of Voyager after the Phase B completion. This effort is maintaining a nucleus of the scientific, technical, and management competence made available by the completion of these successful programs to conduct the necessary mission design studies to shorten lead time requirements for future missions,

to accelerate specific technology tasks in advanced subsystem development essential for executing missions in the early 1970's and to advanced scientific instrumentation development associated with probes and landers. Mission design studies include computing trajectories, formulating mission profiles, carrying out preliminary engineering studies and generating operational requirements and plans to establish feasible design concepts for these missions. The advanced subsystem research and development effort supports these studies by providing increased subsystem performance specifications obtained from laboratory research. In addition, this effort ensures through focussed attention and scheduled achievements that the critical subsystems will be sufficiently developed for use in the appropriate spacecraft. Currently being developed are propulsion, aerodynamic entry and guidance subsystems. The science definition and instrument development effort defines the scientific instrumentation and ensures its development for these early missions to Mars, Venus, and Mercury. These efforts serve to organize science teams to develop advanced scientific instrumentation which must operate in conjunction with other flight instruments to ensure maximum scientific return from each mission.

Data Analysis ($2,600,000)

With the completion of the Surveyor project and the already completed Lunar Orbiter, Mariner IV, and Mariner V projects, analysis of the scientific and engineering data will be continuing activities. To consolidate these activities, the Data Analysis project has been established. This project will provide for the preparation of reports, support experiments, and provide for the final acquisition of engineering and scientific data of all

these missions. The funds requested in FY 1969 will provide for continuation of the analysis of and reporting on the vast amount of scientific and engineering data obtained from the Surveyors, Lunar Orbiters, and Mariners IV and V.

Mariner ($48,000,000)

The objective is to conduct the early exploration of the planets with automated spacecraft in the medium weight class, about 400 to 1,200 pounds. These spacecraft carry out the precursory missions to Mars, Venus, Mercury, the major asteroids, and the comets.

Mariner Mars 1969 is designed to fly by Mars to carry out improved experiments that will yield high resolution topographic information about the Martian surface, provide atmospheric profile measurements by means of the occultation technique, and identify some atmospheric constituents with new spectrographic instruments. These instruments will be detecting the presence of polyatomic molecules that suggest biochemical processes, the presence of an oxidizing or a reducing atmosphere, molecular nitrogen, nitric oxide, carbon monoxide, cyanogen and water.

Mariner Mars 1971 will continue the exploration to Mars with two Atlas/Centaur launched spacecraft. The Mariner Mars 1971 spacecraft configuration will be based on the Mariner Mars 1969 design modified to permit placing the spacecraft in orbit about the planet Mars. The conversion of this spacecraft from a flyby to an orbiter will enhance the accomplishment of scientific measurements by allowing the spacecraft to transmit data from close to the planet for approximately ninety days.

The FY 1969 funds requested will provide for the completion of flight spacecraft testing, launch operations, and inflight

mission operations for Mariner Mars 1969; and the completion of detailed system design, procurement of subsystems and the development and test of prototypes of critical subsystems for Mariner Mars 1971.

Titan Mars 1973 ($20,000,000)

The orbital reconnaisance of Mars initiated in 1971 will be continued in 1973. In addition, the initial direct measurements of the atmosphere and on the Martian surface will be made by means of a small survivable lander. The Titan Mars 1973 project will, therefore, capitalize on the technology developed by Lunar Orbiter, Surveyor, Mariner, and the earlier Voyager concepts. Two launches of Titan class launch vehicles are planned in 1973. Each launch will contain an orbiter and a small survivable lander.

The orbiter will carry instruments that will photograph the surface and measure the planet's thermal radiation, surface and atmospheric composition, magnetic fields, and trapped radiation. The lander will directly measure during entry through the atmosphere the density profile and the atmospheric temperature, pressure, and composition. The landed package will also contain instruments for measuring moisture, soil composition, and atmospheric properties on the surface. A limited photographic capability from the surface is planned.

The orbiting spacecraft will offer the advantage of observing the planet for a period of several months thus permitting the study of the Martian diurnal, seasonal, and synoptic characteristics during a single mission. The survivable lander will provide the opportunity for the first direct measurements in the atmosphere and on the Martian surface.

The funds requested in FY 1969 will provide for the establishment of functional specifications, initiation of detailed system designs, and the development, fabrications, and testing of engineering models for both the orbiter and lander.

Surveyor, Lunar Orbiter and Voyager (No funds)

Due to the completion of Surveyor and Lunar Orbiter, and the termination of Voyager, no funds are requested for these projects in the FY 1969 budget.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF SPACE SCIENCE AND APPLICATIONS

LAUNCH VEHICLE DEVELOPMENT PROGRAM

The Launch Vehicle Development program provided for the development of new vehicles and vehicle stages to support mission requirements. During FY 1967, the program consisted of Supporting Research and Technology, Advanced Studies, and Centaur Development. Development of the Centaur vehicle was completed in FY 1967. During FY 1968 and FY 1969 Supporting Research and Technology and Advanced Studies are budgeted under Launch Vehicle Procurement.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF SPACE SCIENCE AND APPLICATIONS

LAUNCH VEHICLE PROCUREMENT PROGRAM

The objective of this program is to provide launch vehicles and related services to support mission requirements and to accomplish minor development activities necessary to support future mission needs.

The operational vehicles currently being procured are: Scout, Delta, Thor Agena, Atlas Agena, and Centaur.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting research and technology/advanced studies . . .	---	$ 4,000	$ 4,000
Scout	$ 9,400	10,200	16,500
Delta	23,835	30,300	30,800
Agena	29,396	14,400	14,000
Centaur	55,019	68,200	63,000
Total	$117,650	$127,100	$128,300

WHY FUNDS REQUIRED:

Supporting Research and Technology/Advanced Studies ($4,000,000)

This project was presented under the Launch Vehicle Development program until FY 1967 when the development of the Centaur vehicle was completed. The objective of the Advanced Studies effort is to define vehicle requirements for future missions

and to establish the methods by which performance in excess of current capabilities can best be developed. Supporting Research and Technology tasks are directed toward developing new technology and techniques for which a need has been demonstrated by the Advanced Studies. In FY 1967 and FY 1968 Advanced Studies efforts were directed toward very high velocity launch vehicles. In FY 1969 studies will be concerned with mission analyses, vehicle and stage alternatives, and program planning. Fiscal year 1968 Supporting Research and Technology tasks are being conducted on strapdown guidance systems and a variety of other tasks important to the future of the launch vehicle program. In FY 1969 development of strapdown guidance systems will continue and effort will also be directed toward a variety of tasks including improvement of a small solid propellant motor and investigation of advanced pressurization systems.

Scout Procurement ($16,500,000)

In FY 1969 funds for Scout Procurement will be utilized for the production, assembly, and launch of the Scout vehicle. In addition, Sustaining Engineering and Maintenance funds will be required for maintenance of ground support equipment at the Scout launch sites, for management and engineering support, and for minor improvements to the Scout vehicle.

Delta Procurement ($30,800,000)

During FY 1969 funds will be utilized to complete purchase of fourteen first and second stage vehicles initially funded in FY 1968, to initiate purchase of ten additional vehicles and to procure associated vehicle hardware, launch services and other supporting services. Sustaining Engineering and Maintenance funds will be utilized for the maintenance of ground support

equipment, for engineering support, for minor improvements including modification of the FW-4 motor nozzle and conversion to S-band telemetry, and for completion of improvement efforts started in FY 1968.

Agena Procurement ($14,000,000)

The Agena project includes the Thor Agena and the Atlas Agena launch vehicles. In FY 1969 funds for Agena Procurement will be required for Agena upper stages, Thor boosters, mission modifications, and supporting activities. Sustaining Engineering and Maintenance funds will be needed for maintenance of ground support equipment, engineering services, and minor improvements.

Centaur Procurement ($63,000,000)

In FY 1969 funds will be required to continue funding for the Orbiting Astronomical Observatory, Applications Technology Satellites, and Mariner Mars 1969 vehicles. Funds will also be required to initiate purchase of vehicles for the Mariner Mars 1971 mission and future Applications Technology Satellite missions. In addition, FY 1969 funds will be required for Sustaining Engineering and Maintenance which will include efforts to improve the reliability of the Centaur vehicle.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF SPACE SCIENCE AND APPLICATIONS

BIOSCIENCE PROGRAM

The Bioscience program has two principal objectives. The first, to determine the effects of the space environment on terrestrial organisms, includes work on ground-based experiments, the Biosatellite flight program, and the development of flight experiments for other missions.

The second objective, to determine the location, origin, nature, and level of development of extraterrestrial life, includes laboratory research and space flight missions to investigate conditions in the space environment and on the planets which may relate to the question of the existence of extraterrestrial life.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting research and technology	$10,050	$11,800	$16,000
Biosatellite	31,950	30,000	32,500
Total.	$42,000	$41,800	$48,500

WHY FUNDS REQUIRED:

Supporting Research and Technology ($16,000,000)

Research in Environmental Biology is concerned with the response of living terrestrial systems to the variables of the

space environment. One of the greatest scientific challenges today for biologists is to understand the role gravity plays in the origin, nature, and function of highly organized life. Gravity (and its variation) has not, until recent years, been a matter of great concern to biologists because of its constancy here on Earth. In addition to the obvious need to understand its effect on living systems for the purposes of space flight, many practical implications follow from a deeper understanding of the effects of altered gravity.

In Behavioral Biology research, experiments are being conducted to assess the general problem of visual-motor coordination in animal and man, particularly as it may be affected by alterations in gravity and the consequent changes in feedback from the muscles. The implications of such work are broad. As basic research, this and related investigations should lead to a better understanding of brain-behavior relationships and of certain illnesses. As applied research, more information is being obtained on the relation of the research results thus far obtained to long term behavior, such as would be encountered on any long term space flight mission.

The Physical Biology effort includes work in bioinstrumentation, comparative physiology, and molecular biology. Stable, accurate, and long-lived implantable telemetric devices have been developed for recording temperature changes indicative of cyclic (circadian) biological phenomena. Such devices have been applied to the design of Biosatellite experiments and by several researchers studying biological rhythms. Work is continuing on development of a low cost, multichannel, implantable transmitting device weighing no more than 3.5 grams and not exceeding two

cubic centimeters in volume that would be capable of efficient operation over two years.

The Exobiology research program continues, with its dual objectives of understanding the controlling factors in the origin of life and determining the uniqueness of life here on Earth. The research ranges from the analysis of fossil remains and simulation of planetary atmospheres and other environmental extremes, to the development of automated life detection equipment intended to increase the reliability of the data by broadening the basis for analysis of individual samples. In addition to data previously reported on Mars as a candidate planet for investigation, laboratory experiments now suggest that organic synthesis may be occurring on Jupiter which has a primitive reducing atmosphere. These studies point to Jupiter as a most interesting planet from the point of view of chemical evolution.

Earlier Planetary Quarantine efforts were directed toward reducing and assaying the biological contamination on spacecraft and toward defining sterilization procedures needed to reduce that contamination to an acceptable level. Two areas of research are proving to be especially fruitful. The use of laminar downflow air, combined with high efficiency filters, is producing excellent results in limiting contamination in the spacecraft assembly areas. Additionally, examination of the sterilization requirements and studies of the probability of growth of organisms in planetary environments, are tending to significantly reduce the severity of sterilization requirements. Modest investments in research of this nature could pay handsome dividends in spacecraft manufacture and assembly costs.

Biosatellite ($32,500,000)

Biosatellite II was launched from the Eastern Test Range on September 7, 1967, and was recovered over the Pacific Ocean on September 9, 1967. The capsule was recovered one day earlier than planned because a severe storm was predicted for the recovery area the following day. Biosatellite II experiments investigated the effects of the space environment on simple forms of life, seedlings, and plants, especially with reference to the interaction of weightlessness with a known intensity of ionizing radiation.

Flights D and F, the two 30 day primate flights, which are scheduled for 1969, are the most demanding of all Biosatellite payloads in terms in instrumentation and life support. The principle areas of scientific investigation are: (1) the central nervous system, (2) the cardiovascular system, (3) general metabolism, and (4) performance and behavior.

The 21 day missions, flights C and E, are scheduled for 1970 and 1971, respectively. Two basic experiments will be performed on rats: (1) studies of changes in gross body composition as a result of weightlessness, and (2) a study of metabolic rhythms under conditions of weightlessness, compared with Earth controls, to test differences in rhythmicity of animals which have been removed from Earth's 24 hour periodicity. Other experiments include the influence of weightlessness on human liver cells and on plant development.

RESEARCH AND DEVELOPMENT
FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF SPACE SCIENCE AND APPLICATIONS
SPACE APPLICATIONS PROGRAM

The objectives of the Space Applications Program are to: (1) expand the knowledge of atmospheric and space phenomena; (2) conduct a broad program of research and technical development oriented toward the application of space techniques for the benefit of mankind; (3) develop and test procedures, instruments, subsystems, spacecraft, and interpretive techniques for various applications; (4) fulfill NASA's responsibilities under the Communications Satellite Act of 1962; (5) develop and implement for the Environmental Science Services Administration (ESSA), Department of Commerce, the operational meteorological satellite system; and (6) cooperate with other government agencies in the study and development of space technology which will lead to the early realization of practical benefits in areas of agriculture/forestry, hydrology/oceanography, geography/cartography and geology/mineralogy through periodic systematic surveys of earth resources.

The Space Applications Program effort is directed toward research, development, and flight test in the areas of: applications technology, communications, earth resources, geodesy, meteorology, and navigation and includes implementation of operational systems with appropriate user agencies. Current flight projects include TIROS, Nimbus, Applications Technology, Geodetic Satellites, and a number of Meteorological Sounding Rockets.

Fiscal year 1969 endeavors will also include initial studies of an Earth Resources Technology Satellite. Application Technology Satellites offer great potential to mankind by developing and extending the technology common to many applications. Communications Satellites provide an economical method for worldwide communication, and can be used to relay to ground stations data obtained by earth resources, meteorology, geodetic, and scientific spacecraft. Earth Resources satellites can obtain valuable data in such areas as agriculture/forestry, geology/mineralogy, hydrology/oceanography, and geography/cartography. Geodetic satellites can help determine the size and shape of the Earth and the vector properties of its gravitational field. Meteorological satellites provide the capability to improve weather prediction on a global basis, and increase knowledge of the atmosphere. Navigation satellites provide location, traffic control, search and rescue, and communications systems for aircraft and ships.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting research and technology/Advanced studies . .	$11,030	$19,300	$23,800
TIROS/TOS Improvements. . . .	1,292	9,100	5,800
Nimbus.	24,410	33,700	32,100
Meteorological Soundings. . .	2,855	3,000	3,000
International Applications Satellite	100	100	100

cont.

	1967	1968	1969
Applications Technology Satellites	$30,013	$25,600	$ 31,200
Geodetic Satellites.	1,600	3,400	4,000
Earth Resources Survey . . .	---	5,300	12,200
Aircraft Program	(---)	(5,300)	(10,200)
Earth Resources Technology Satellite.	(---)	(---)	(2,000)
Total.	$71,300	$99,500	$112,200

WHY FUNDS REQUIRED:

Supporting Research and Technology ($23,800,000)

The objectives of Supporting Research and Technology are to: (1) conduct studies; develop and test new concepts, techniques, materials, components, sensors, subsystems and data handling systems which have application to future satellite flight programs and (2) improve the space technology related to materials, components, sensors and subsystems to achieve greater reliability and longer life in space. These efforts are applied to the following disciplines: applications technology, communications, earth resources, geodesy, meteorology, and navigation. Selected advanced studies will be conducted in these disciplinary areas to determine feasibility, concepts, and design of future missions.

Fiscal Year 1969 funds are requested to maintain the current level of Supporting Research and Technology efforts in the six discipline areas, and to increase efforts by means of specialized studies, comparative analyses, and research activities in areas

that have indicated special promise for early benefits. Also, in FY 1969, additional support will be provided to user agencies to determine the potential value of remote sensing technology in detecting, measuring and mapping earth resources phenomena from space and the related associated data handling systems.

TIROS/TOS Improvements ($5,800,000)

The objectives of this project are to: (1) conduct research and development leading to improvements in the operational meteorological satellite system, (2) observe cloud cover and patterns and measure the earth-atmosphere heat balance, (3) measure emitted infrared and reflected solar radiation in selected spectral regions and, (4) provide data for operational use in weather analysis and forecasting. Nine TIROS spacecraft, and seven TIROS Operational system (TOS) spacecraft, based on the TIROS configuration, have been launched. One additional spacecraft, designated TIROS M is currently being developed for launch in calendar year 1969. This spacecraft will carry two advanced vidicon camera systems (AVCS), two automatic picture transmission systems (APT) and two high resolution radiometers (HRR), in a single spacecraft. Data will be utilized by Goddard Space Flight Center, ESSA, and cooperating government and non-government meteorological organizations.

Fiscal year 1969 funds are requested to complete the TIROS M spacecraft and sensors; for integration, test and launch of the TIROS M spacecraft; and to continue to TOS improvement efforts.

Nimbus ($32,100,000)

The objectives of Nimbus are: (1) to develop an advanced meteorological satellite to provide data for use by the scientific

community, (2) to carry out flight tests to prove the applicability of the instrumentation, (3) to fulfill special data requirements of the atmospheric sciences research community which can be provided uniquely by this instrumentation functioning as a space meteorological observatory, and (4) to provide the basis for further significant technological advances in meteorological satellites for scientific and operational uses.

The project consists of six spacecraft of which two have been launched, Nimbus I, August 28, 1964, and Nimbus II, May 15, 1966. These launches have validated the Nimbus concept of testing a variety of advanced sensors on a stabilized earth oriented spacecraft. Nimbus B and D are currently under development for launch in 1968 and 1970, respectively, to test a variety of additional advanced meteorological experiments. Effort is being initiated in FY 1968 on development of Nimbus E and F scheduled for launch in 1971 and 1973, respectively, to test additional experiments and to further extend the technology advancements in meteorological satellites for scientific and operational purposes utilizing spacecraft of greater weight and power capability. Sensors to be flight tested include radiometers, spectrometers, cameras, and data handling systems to obtain a variety of atmospheric data such as cloud cover, temperatures, water vapor and pressure at various altitudes from the earth's surface to upper atmosphere levels.

FY 1969 funds are required to continue the development of Nimbus D, E and F spacecraft and experiments and continued data handling for missions in orbit.

Meteorological Soundings ($3,000,000)

The objectives of the meteorological soundings project are

to: (1) determine the structure and characteristics of the atmosphere in the region 20 to 60 miles above the earth through the use of research and development type sounding rockets, and (2) develop a meteorological sounding rocket system amenable to research, range support, and supporting operational requirements. Three areas of effort are involved: (1) development and use of large sounding rockets to explore atmospheric characteristics in the region 30 to 60 miles above the Earth, (2) design and test small sounding rocket systems to obtain data from the region 20 to 40 miles above the Earth, and (3) participate in conducting sounding rocket experiments in cooperation with other countries on a cost sharing basis.

FY 1969 funds are requested to launch about 50 research sounding rockets to continue study of the relationship of the atmospheric structure in the arctic, sub-arctic mid-latitude, and the tropics during various seasons; for launch of about 150 operational development sounding rockets, conduct research to improve rocket performance, and the continuation and development of the field experiment projects with other cooperative countries.

International Applications Satellite ($100,000)

This project was entitled French Satellite in the FY 1968 budget. It is a cooperative meteorology experiment involving the use of free-floating balloons to obtain the velocity of air masses at various altitudes and an orbiting satellite to collect and relay data to ground stations. France will provide the balloons and spacecraft and furnish ground operational support; NASA will provide the launch vehicle and back-up if required, launch support services, technical assistance and will assist

in data acquisition and analysis.

FY 1969 funds are requested for continued spacecraft and balloon subsystem studies and analysis.

Applications Technology Satellites ($31,200,000)

The objectives of the applications technology satellites project are to design, develop, flight test, and evaluate a variety of experiments in the space applications disciplines by use of a series of spacecraft, most of which are launched into synchronous orbits. Seven spacecraft are in the series, of which three have been launched to date, one into medium altitude and two spin stabilized spacecraft into synchronous orbit. Four additional spacecraft are scheduled for launch in the 1968-73 period on Atlas Centaur launch vehicles. The launch of ATS-II into medium altitude was unsuccessful due to failure to obtain the circular orbit required. ATS-I and III have successfully demonstrated the feasibility of a variety of experiments at synchronous altitude such as black and white and color cloud cover pictures from synchronous altitude, very high frequency communication experiments with aircraft, and a number of environmental measurement experiments. ATS-D and E are scheduled for launch in 1968 and 1969, respectively, and will test new and additional space applications experiments at synchronous altitude using gravity gradient stabilized spacecraft. ATS F and G are scheduled for launch in the 1972-73 period to flight test a 30 foot space erectable parabolic antenna; and accurate, lone-life stabilization system; precision radio-interferometer, and other applications and scientific experiments to be selected.

FY 1969 funds are required to continue development of the three spacecraft (E through G), experiments, and ground operational support of the missions in orbit.

Geodetic Satellites ($4,000,000)

The objectives of this project are to conduct geodetic experiments from space on a global basis which in combination with astro-geodetic, surface baseline and gravity data from other sources will provide: (1) establishment of a unified world datum in a geocentric coordinate system to which the major world datums could be connected, (2) definition of the structure of the Earth's gravitational field, and (3) improvement in the positioning accuracy of tracking sites and locations of features of the Earth surface.

The geodetic-satellite project consists of four missions, including PAGEOS-I successfully launched June 23, 1966, GEOS I successfully launched November 6, 1965, GEOS B scheduled for launch early in 1968 and GEOS C scheduled for launch in 1969. Fabrication of the GEOS C spacecraft will draw heavily on hardware currently supporting the GEOS B mission.

GEOS B will contain flashing lights, minitrack beacon, doppler beacon transmitters, range and range rate, SECOR and C-band transponders, and optical reflectors for laser tracking. GEOS C will be launched at an inclination and altitude required to supply the data to complete a unified world datum, improve the location of the tracking stations, and for evaluating the several observational networks.

FY 1969 funds are requested for continued GEOS B and PAGEOS-I data acquisition and analysis and for GEOS C spacecraft development and operational support.

Earth Resources Survey ($12,200,000)

This project consists of two activities in the earth resources discipline, as follows: (1) an aircraft program to

develop and test remote sensing techniques, sensors, and data handling systems, and (2) feasibility, definition, and design studies pertaining to an earth resources technology satellite.

The objectives of the aircraft program are to: (1) conduct feasibility studies and program definitions on testing of sensors and data collecting techniques for earth resources, (2) design, develop, and flight test these equipments, and (3) conduct aircraft flights over selected test sites to evaluate the performance of the sensing equipment and to obtain significant data in the discipline areas of agriculture/forestry, geography/cartography, oceanography/hydrology, and geology/mineralogy. The objectives of the earth resources technology satellite (ERTS) effort are to conduct feasibility, definition, and design studies of a satellite containing a variety of sensors capable of obtaining fundamental experimental data in the earth resources disciplines. Analysis of these data would locate, identify, and assess many earth resource phenomena. In agriculture and forestry for example, crop growth area, forest area, brush range land interface, crop yield, and damage assessment data could be obtained by an ERTS. The Departments of Agriculture, Commerce, Interior and the U.S. Naval Oceanographic Office have participated in a cooperative program with NASA to identify uses and assess the value of space acquired data when applied as improvements to functions for which they have responsibility.

Fiscal Year 1969 funds are required for instrumentation development for a high-altitude aircraft; operational support for two P3A and the high altitude aircraft; and for data acquisition, analysis, and utilization, in the aircraft program; and in earth resources technology satellite activity to conduct feasibility, definition, and design studies for a satellite system. These endeavors will be coordinated with user government agencies.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF UNIVERSITY AFFAIRS

SUSTAINING UNIVERSITY PROGRAM

NASA depends upon universities to supply research expertise and competence essential to the space effort, and the particular needs of the Agency. University scientists conceive and develop experiments contributing to new scientific knowledge; do research in areas directly related to manned and unmanned space science; serve on space advisory planning and evaluation groups; and train scientists, engineers and managers for the space program.

By their participation, universities gain new knowledge and experience necessary to their own advancement and the advancement of non-space related technology. Most of NASA support to universities is through the Agency program offices and centers which deal directly with university scientists and engineers in carrying out specific research and development projects. However, many needs fall outside the interest of these offices and are met by the Sustaining University Program. These include sustaining research on subjects broader in scope than the responsibilities of any other NASA office, training of graduate students in disciplines which represent particular NASA needs, special training for senior faculty members in space research and engineering systems design.

RESOURCES REQUIRED:

	(Thousands of dollars) 1967	1968	1969
Training	$16,000	$3,000	$3,000
Research	11,000	7,000	7,000
Research facilities.	4,000	---	---
Total.	$31,000	$10,000	$10,000

WHY FUNDS REQUIRED:

Training ($3,000,000)

As the national space effort attains its mission objectives, training activities under NASA's Sustaining University Program are continuously reviewed and reassessed to insure compatibility with new conditions and tasks the Agency will encounter in ensuing years.

In FY 1969, $3 million is requested for training, $1.5 million of which will be allocated to predoctoral training in systems engineering design and public administration and the other $1.5 million to special summer training programs. The predoctoral training programs have been established so that senior faculty members and graduate students may use NASA installations in which to study problems which are relevant to NASA needs while helping to strengthen the graduate programs at their universities.

NASA's special training opportunities include a Summer Faculty Fellowship Program which helps young faculty members keep abreast of the latest developments in science and engineering; a faculty fellowship program in systems engineering design which brings together faculty members from different engineering disciplines to work on broad space related problems requiring

a team approach; summer institutes for upper division undergraduates to familiarize them with space science and engineering problems; and post-M.D. training to aerospace medicine for a few very select medical doctors in preparation for direct or supporting careers in manned space flight activities.

Research ($7,000,000)

Through the research element of the Sustaining University Program, NASA is able to support high priority programs that are broader and longer range than mission oriented project research. Here a multidisciplinary approach to research is stressed and the participating universities have authority and flexibility to assess and meet Agency needs. Particular emphasis is placed on multidisciplinary studies in social, economic, and public policy aspects of scientific and technical developments and projects closely related to NASA center research. This program balances and complements NASA's project research and flight experiments.

With a budget of $7 million in FY 1969, the research element of the Sustaining University Program will support multidisciplinary programs at 35 universities. This number is down from the 44 institutions funded in FY 1968 and 50 universities in the program in FY 1967.

Research Facilities (None)

Under a period of declining budget, no FY 1969 funds are requested for construction of university research laboratory facilities on university campuses.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

BASIC RESEARCH PROGRAM

The Basic Research Program supports fundamental research in the physical and mathematical sciences. It is aimed at providing an understanding of the physical phenomena pertinent to other NASA programs concerned with current and future aircraft and space activities. This basic research is carried out principally in NASA's Research and Flight Centers with some contract assistance by universities, industrial research laboratories, and other Government research centers. Fundamental understanding of physical phenomena in many fields of science is required to develop the technology for NASA's programs and basic research in NASA encompasses a wide spectrum of disciplines. It ranges from very fundamental studies into the nature and properties of atoms and molecules to the more applied research areas of determining the best materials for the supersonic transport airplane.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting research and technology	$21,401	$21,465	$22,000
Total.	$21,401	$21,465	$22,000

WHY FUNDS REQUIRED:

The Basic Research Program is divided into four broad disciplines: Fluid Physics, Electrophysics, Materials, and Applied Mathematics.

Fluid physics research concentrates in the areas of aeronautical fluid dynamics, entry fluid physics and internal fluid mechanics of propulsion and power systems. Aeronautics research investigates such subjects as clear air turbulence, sonic boom and aerodynamic heating. Space research efforts focus on such studies as entry heating, ablative response of the heat shield and flow fields about maneuverable bodies.

Electrophysics research is concerned with obtaining new knowledge about the electrical characteristics of matter and their interaction with acoustic, gravitational, and magnetic forces present in molecules, atoms and nuclei. New information in the electrophysics area is the source not only for advances in the technology programs of electronics, space power and space propulsion, but also for the investigation and understanding of complex space phenomena.

The objective of materials research is the understanding of the characteristics and behavior of materials when subjected to the environmental stresses and strains of advanced aircraft and more sophisticated spacecraft. Research ranges from studies into the fundamental properties of solids to investigations of how and why engineering materials fail.

The research in applied mathematics is concerned with the improvement of mathematical models and techniques needed or potentially useful for problems in aerospace science and technology. A mathematical approach is often the most feasible and economical

one for planning experiments and predicting their results. It is also a necessary basis for precise and reliable designing of the complicated and expensive pieces of hardware for the varied NASA development programs.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

SPACE VEHICLE SYSTEMS PROGRAM

The objectives of this program are to identify and solve technical problems important to the design and operation of spacecraft and launch vehicles. The program supports current missions of NASA and the military services and seeks to provide advanced technology for the conception and design of future space vehicles. The program encompasses problems of manned and unmanned flight including launch and exit through the atmosphere, flight in space, entry into the atmospheres of earth and other planets, and landing.

Research activities are conducted in a variety of ground-bases facilities in aerothermodynamics, structures, and a number of space environmental areas such as high-energy radiation, meteoroids and thermal control. Key flight experiments are also conducted in close association with the ground-based research. The program also provides a centralized function within NASA for the formulation and documentation of authoritative space vehicle design criteria based on operational experience and the latest research information.

RESOURCES REQUIRED:

	(Thousands of dollars) 1967	1968	1969
Supporting research and technology	$26,777	$30,258	$31,300
Lifting-body program	1,000	1,200	1,200
Reentry heating flight experiments.	1,800	2,206	1,500
Project Pegasus.	70	---	---
Small space vehicle flight experiments.	4,262	1,336	1,300
Total.	$33,909	$35,000	$35,300

WHY FUNDS REQUIRED:

Supporting Research and Technology ($31,300,000)

Special emphasis will continue in FY 1969 to develop the technology of gliding flexible-wing descent systems for land recovery of manned vehicles. This effort will include flight tests of large-size flexible wings to investigate deployment, air loads, flight control and structural design. Research will also continue on aerodynamic performance, flight control, heat protection and structural problems of advanced entry vehicles having substantial reentry maneuverability.

Research in space vehicle structures will be undertaken to develop advanced structural concepts, to exploit new structural materials, and to advance structures technology for improved efficiency and cost effectiveness of space vehicles. Particular attention will be given to improved techniques of analysis and better ground test simulation of high-frequency

dynamic conditions to reduce the necessity for overdesign and overtesting. Advanced structural analysis techniques are being developed for complex integrated space vehicles, including interactions on stages and subsystems. Research will continue on improved structural techniques for storing cryogenic fluids in space.

Efforts will continue on the effects of the space environment on vehicle design and operation. Research will continue on the effects of space radiation on spacecraft materials and components to advance the technology of shielding methods and design. Promising advances for simulating meteoroid impact will be pursued in FY 1969 to improve capability in the laboratory for investigating the meteoroid penetration hazard. Also, emphasis will be placed on new detection techniques for use in obtaining better flight data on the meteoroid hazard in the near-earth and asteroid regions of space. A broad attack on problems of thermal control of spacecraft will be continued in FY 1969.

In FY 1968, substantial progress was achieved in preparing authoritative space vehicle design criteria documents in areas of structures, chemical propulsion and guidance and control. Effort will be continued in these areas in FY 1969 and some initial activity will be undertaken in electromechanical mechanisms.

Lifting-Body Program ($1,200,000)

The flight program with manned research vehicles (currently two NASA types designated the M2-F2 and the HL-10) will continue to investigate the piloting and control problems of lifting-body configurations at transonic speeds and during terminal approach and landing. Flight testing was delayed in FY 1968 due to a landing accident with the M2-F2 (NASA lifting body) on

its sixteenth flight, and due to modifications found necessary for the HL-10 (NASA lifting body). The FY 1969 funds are requested to continue the HL-10 flight tests and to initiate tests of the USAF's X-24A which is a part of this cooperative program.

Reentry Heating Flight Experiments ($1,500,000)

Two reentry experiment payloads are being fabricated for launch with Scout vehicles to obtain anchor-point data on the heating rates associated with turbulent boundary layers on clean, nonablating surfaces at high Mach numbers and on the conditions related to transition from laminar to turbulent flow.

The first experiment will be flown in the first half of 1968. FY 1969 funds will provide for completion of the second payload and launching of the second experiment.

Preliminary definition of follow-on experiments with ablative heat shields to determine the effects on complex ablation processes on heat shield performance and body motions will be initiated during FY 1969.

Small Space Vehicle Flight Experiments ($1,300,000)

Selected flight experiments will be conducted using small sounding rockets and other techniques to provide critical data that cannot be acquired in ground-based facilities, as well as to provide anchor-point data in flight to verify laboratory theoretical and experimental research. The principal effort in FY 1967 and FY 1968 involved flight tests of large parachutes high in the earth's atmosphere to develop technology for deceleration of instrumented capsules in the low-density Mars atmosphere. Further tests will be conducted in FY 1969 to extend the Mach number range of investigation.

Small rocket-launched tests of advanced heat shield materials will also be continued in FY 1969 in close association with ground-based research.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

ELECTRONICS SYSTEMS PROGRAM

The Electronics Systems program supports basic and applied research and advanced technical development efforts in the allied areas of electronics and control systems. Its objective is to provide the knowledge and technology needed to satisfy the requirements of future space and aeronautical systems in the most efficient and effective manner. Research activities are performed both in-house and under contract. They range from conceptual studies through the development and evaluation of new or improved components and systems in the functional areas of guidance, control, communications and tracking, data processing, instrumentation, and electronic components. Flight experiments are performed, as necessary, to collect data needed for advanced system developments and verify experimental results.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting research and technology	$32,302	$38,700	$38,900
Flight projects.	1,295	500	500
Total.	$33,597	$39,200	$39,400

WHY FUNDS REQUIRED:

Supporting Research and Technology ($38,900,000)

Funds requested in FY 1969 will support an expanding program in aeronautical electronics and to continue the development of electronic systems for future space missions. Guidance research requires increased effort on precision inertial components and electromagnetic sensors to meet the navigation needs of supersonic aircraft and guidance requirements of future space missions. Increased emphasis on flight controls and displays is necessary to effect safe and efficient operation of V/STOL and general aviation type aircraft. Long-life control systems and precise pointing techniques will require continuing support to insure effective use of capabilities to operate in the space environment. Expanded research on optical systems for space astronomy and deep space communications, together with a continuing effort on microwave antennas and tubes, will be required to insure a maximum return of data and information from our space explorations. Advanced computer concepts and techniques for speeding the processing of data will provide efficient conversion of accumulated data into useable knowledge. Research in instrumentation technology offers potential solutions to problems of clear air turbulence and will be expanded in the coming fiscal year. Continued support of research on reliable components and advanced integrated circuit technology will make available to system designers techniques and components which satisfy the performance demands of tomorrow's systems.

Flight Projects ($500,000)

Project RAM (Radio-Attenuation-Measurements) is a research investigation concerned with overcoming the communication blackout

incurred by a spacecraft as it reenters the atmosphere. RAM C-1 was successfully flown in October 1967 and demonstrated the partial effectiveness of higher frequencies and water injection. RAM C-B will be flown in 1968 to measure plasma characteristics at higher reentry speeds. Funds requested in FY 1969 will permit flight of a back-up payload to test the use of materials other than water for plasma injection.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

HUMAN FACTOR SYSTEMS PROGRAM

The objective of this program is to provide the research and technology to qualify and support man for advanced aeronautical and space missions. It is equally important to determine optimal procedures for man's utilization in space as an observer, as a mechanic, and as a decision maker.

The technological tasks to be accomplished include assessment of the physiological and psychological effects on man, human engineering, extra-vehicular engineering, personal protection and life support. Understanding of the physiological effects on man as he responds to future aeronautical and space stresses is necessary for his effective integration with the total system. Human engineering is essential to human factors in aviation, maintainability in space, and for the appropriate design for man in the man-machine complex. Extra-vehicular engineering will provide the astronaut with work aids, translation devices, and other augmentation systems for use in free space as well as in extraterrestrial surface environments.

The Human Factor Systems Program is accomplished through a multidisciplined approach including research in medicine, biology, psychology, engineering, physics, and electronics located at NASA Centers, Department of Defense aero-space medical facilities, other government facilities, universities, and industry.

RESOURCES REQUIRED:

	(Thousands of dollars) 1967	1968	1969
Supporting research and technology	$14,765	$19,385	$20,200
Small biotechnology flight projects	1,500	1,600	1,500
Total.	$16,265	$20,985	$21,700

WHY FUNDS REQUIRED:

Supporting Research and Technology ($20,200,000)

This is an integrated program directed toward the accomplishment of the four major objectives of the overall Human Factor Systems Program. The program includes effort toward the definition and understanding of the effects of advanced aerospace flight on man brough about by altered and zero-gravity, spacecraft atmospheres, stress, radiation, and noise. Suitable and protective life support systems are developed and tested. The research involved covers cardiovascular stress and respiratory physiology, radiobiology, microbiology, water and waste management, oxygen regeneration, air pollution control, space suits, systems to sustain life, extra-vehicular equipment and studies of man-machine interactions. The research is directed toward defining and solving next-generation aerospace problems.

Small Biotechnology Flight Projects ($1,500,000)

These projects cover a continuing series of small flight experiments designed for the qualification of man, his support, and use in extended space flight. Work on experiments in FY

1969 will include the measurement of physiological processes in humans and animals under conditions of stress encountered in aerial and space flight and tests of life support and protective equipment designed for zero-gravity.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

SPACE POWER AND ELECTRIC PROPULSION SYSTEMS PROGRAM

The objective of this program is to determine the technologies required to adequately support potential future missions; and by application of effective research and exploratory development to improve or establish these technologies to the degree required to ensure eventual successful development and application by future mission program offices.

Current estimates of potential future mission power system requirements encompass a wide range of power, life and mission environments. The space power program is aimed at providing the research and technology necessary for the improvement and/or development of a limited number of solar, chemical and nuclear systems for anticipated auxiliary power and electric propulsion mission requirements ranging from watts to kilowatts in the 1970's to megawatts in the 1980's.

The early application of solar powered electric thrusters for spacecraft position control and for small, automated, interplanetary spacecraft continues to be a major goal of the electric propulsion program. The experience to date from the ATS (Applications Technology Satellite) flight program coupled with the design and ground evaluation of typical thruster systems confirms potential advantages of spacecraft operational flexibility and simplicity, increased payload or decreased trip time or reduced spacecraft weight. The proposed SERT (Space Electric

Rocket Test) flight, the continuing ATS program and the ground technology program are steps toward the goal of early application.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting Research and Technology	$34,940	$35,400	$35,800
Space Electric Rocket Test (SERT).	---	1,100	1,500
SNAP-8 Development	5,500	7,500	7,500
Total	$40,440	$44,000	$44,800

WHY FUNDS REQUIRED:

Supporting Research and Technology ($35,800,000)

The objective of the nuclear electric power technology program is to provide a broad option and design basis for the selection and evaluation of energy conversion equipment to be used in advanced nuclear electric power systems for future space missions. The primary program emphasis continues to be on a limited number of energy conversion concepts, e.g., the Brayton, Rankine and thermionic systems, to meet the anticipated broad range of power requirements from watts and kilowatts in the 1970's to megawatts in the 1980's. The technology underlying these systems is long range and required sustained effort to establish engineering data on new materials, working fluids and components at high temperatures never before used in power systems.

The chemical power system technology program is primarily

concerned with increasing the usefulness of fuel cells and batteries for a wide range of applications ranging from low earth orbital satellites to planetary landers. Significant improvements such as metal-gas batteries and new engineering concepts for fuel cells appear feasible based on previous years' work. During FY 1969 emphasis will be directed toward evaluating these concepts in breadboarded systems.

The solar power system technology program continues to focus on solar cell systems with special attention directed toward the requirements emphasized by consideration of high power (kilowatt) systems. Research aimed at reducing system cost, area and weight, as well as improving resistance to the space environment, will be continued in FY 1969.

Continued progress is being made in the electric thruster technology program toward the goal of early mission application. In previous years emphasis in the primary propulsion program has been on obtaining suitable thruster system performance and endurance. In FY 1969 emphasis will be directed toward evaluating and solving the problems of solar powered electric propulsion systems representative of those that could be utilized to propel small, automated, interplanetary spacecraft. Based on results obtained in FY 1966, 1967 and 1968 the operational use of resistojets (electrically heated gas thrusters) for spacecraft position control is scheduled on the ATS D&E satellites which also will carry ion engine experiments. During FY 1969 the auxiliary propulsion program emphasis will be directed toward electrostatic thruster systems to achieve the benefits of high specific impulse and electrical thrust vectoring associated with this type of thruster and toward higher temperature resistojets for large orbiting satellites.

Space Electric Rocket Test (SERT) ($1,500,000)

The overall objective of the SERT flight program is to provide information on the operations of electric thruster systems in the space environment. SERT I successfully demonstrated that an ion beam could be neutralized in space. A second flight is planned for 1969 to provide a long term evaluation (minimum of six months) of the performance and reliability of an ion thruster system and to study the effects of ion engines on other spacecraft components such as radio frequency interference. SERT II represents the next major step in the development and acceptance of electric thrusters for prime propulsion of interplanetary spacecraft. Current plans are to utilize a THORAD-Agena vehicle for launch of SERT II during Calendar Year 1969.

SNAP 8 Development ($7,500,000)

The objective of this technology project is to conduct the ground development of a 10,000 hour, 35 kilowatt nuclear electric generating system suitable for space applications in the 1970's and beyond. Principal potential applications for SNAP 8 are large earth orbiting space stations, lunar exploration, direct TV broadcast satellites and ultimately, manned interplanetary missions.

In the past year priority has been placed on developing solutions to the major life-limiting problems found in the boiler and turbine from previous development testing and on endurance testing of the other major components of the power conversion system in small component loops. During this period the first SNAP-8 component, the lube/coolant pump, passed the 10,000 hour endurance test milestone.

The budget request for FY 1969 provides primarily for the continued life development of the power conversion system com-

ponents toward the 10,000 hour mark in component loops. It is planned to complete a 2500 hour demonstration of the life capability of all major components in the bread-boarded SNAP-8 power conversion system.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

NUCLEAR ROCKETS PROGRAM

The objective of this program is to provide rocket propulsion systems for application to high-energy, high-payload missions of the future. In carrying out this objective, the AEC-NASA Space Nuclear Propulsion Office is conducting a detailed system-analysis, design, development and test program to provide an approximately 75,000 pound thrust NERVA engine of between 800-850 seconds specific impulse for flight status by approximately FY 1976. This work is proceeding on the basis of data, designs, and experience established in the technology phase of the program.

The specific NERVA activities to be conducted in FY 1969 include the completion of the technology phase of the NERVA program and continuation at an increased level of the design, development, procurement, and component testing of the approximately 75,000 pound thrust NERVA engine initiated in FY 1968. Included in FY 1969 will be the establishment of the NERVA engine detailed requirements and configuration, and facility modifications as needed.

RESOURCES REQUIRED:

	(Thousands of dollars) 1967	1968	1969
Supporting research and technology	$16,506	$15,000	$15,000
NERVA.	34,162	35,000	41,000
NRDS Operations	2,332	4,000	4,000
Total.	$53,000	$54,000	$60,000

WHY FUNDS REQUIRED:

Supporting Research and Technology ($15,000,000)

The supporting research and technology effort supplies four basic needs: (1) general SRT data for current projects; (2) advancing basic technology for nuclear rocket engines and vehicles; (3) feasibility effort on advanced nuclear propulsion concepts; and (4) studies of special flight safety considerations of nuclear rockets.

NERVA ($41,000,000)

The prime output of the Nuclear Rockets program is the NERVA nuclear rocket engine. The nuclear rocket provides a major advance in space propulsion capability. This engine in a nuclear stage could increase the payload and enhance the efficiency and operational characteristics in a variety of potential missions. The NERVA-powered stage applied as a third stage of the Saturn V launch vehicle would improve significantly its payload and mission versatility.

NRDS Operations ($4,000,000)

The mission of the Nuclear Rocket Development Station (NRDS) is to provide a site for ground static testing of the reactors, engines and eventually the propulsion modules or rocket stages

associated with nuclear rocket development. These funds will continue to provide for NASA's share of the general site operations, the major part of which is funded by the AEC.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

CHEMICAL PROPULSION PROGRAM

The purpose of this program is to provide a firm base in science and technology for the improvement and future development of propulsion equipment using combustion or chemical reaction processes. Rockets using the combustion of an oxidizer and a fuel to expel high-velocity exhaust continue to be the principle means of propulsion for space missions. Their thrust levels vary from megapounds to micropounds, and their applications include launch vehicles, earth orbit and de-orbit systems, spacecraft systems for lunar and planetary orbit and landing, trajectory correction systems, attitude control systems, rendezvous engines, propellant settling thrusters, and personnel transport devices. Work within the program encompasses scientific investigation of poorly understood phenomena relating to rocket use, obtaining an adequate base of data on engineering problems such as heat transfer, thermodynamic properties, or kinetics of reactions, design refinement of components, integration of complete propulsion systems, and demonstration testing to prove the validity of extrapolations of the basic design data to useful hardware form. The future development and production of high-reliability propulsion devices at low cost is a key objective of the work.

Research and technology programs covering both liquid propellant and solid propellant motors investigate chemical and physical properties of propellants, combustion phenomena,

ignition, non-equilibrium and classical thermodynamic processes, development and application of new materials, processes of fluid mechanics, gas dynamics, heat transfer, and solid material behavior. New propulsion concepts and design methods are assessed with a view to the functions that our future space missions must perform. Future requirements and new problem areas are identified for further work.

The experimental engineering programs in liquid and solid propellant motors verify research design and data extrapolations by demonstration tests of breadboard systems approximating anticipated mission needs. The work involves the design, fabrication and test of experimental subcomponents and systems to determine their practicality. It provides a basis for selection of advanced propulsion equipment. It furthermore provides an indication of design and test methods that will reduce the cost of development and production of these equipments. Fabrication process specifications, development procedures, costs, schedules, facility and special equipment requirements can be assessed as a result of such work.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Supporting research and technology	$30,688	$33,750	$33,600
Large solid motor project. .	2,950	3,500	3,100
Total.	$33,638	$37,250	$36,700

WHY FUNDS REQUIRED:

Supporting Research and Technology ($33,600,000)

Advanced engine design concepts and operating conditions which will launch payloads at low cost and transport payloads and maneuver in the solar space environment are being investigated. High performance liquid, solid, and hybrid propellants are being examined for use in lunar, solar, and planetary spacecraft systems. High performance propellants can be translated into greater payload capability or into carrying the necessary payload with a smaller launch and space vehicle system. The work extends the use of hydrogen fuel as a rocket propellant for space missions and is examining the use of high density mild cryogenic oxidizers and fuels for certain long-duration-in-space missions. A strong effort in simplified relatively low cost engine systems for launch vehicle systems will be continued.

Research on solid propellant motor systems includes non-destructive testing techniques for inspection and qualification of loaded motors, ignition, methods of combustion termination and restart, and improved predictability of propellant burning rate.

Large Solid Motor Project ($3,100,000)

Three test firings of the 260 inch diameter, 75 foot long large motor were successfully completed by FY 1967, with peak thrust of 5.9 million pounds produced in the last test. In FY 1968 and FY 1969, the funding indicated for this project will be used to preserve a competitive position between liquid and solid stages in the event there is established a future space launch vehicle requirement that can benefit from such a competition.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

AERONAUTICAL VEHICLES PROGRAM

The role of this program is to provide through research in the disciplinary areas of aerodynamics, loads and structures, propulsion, operating environment and flight dynamics continued improvements in the safety, efficiency and utility of all classes of military and commercial aircraft. In order to supply industry with advanced data for the design of new aircraft, to seek the technological advances needed to develop safer and superior commercial and military aircraft, the Aeronautical Vehicles program is organized with emphasis on the disciplines in the Advanced Research and Technology Category and supporting research in appropriate disciplines and proof-of-concept activities for General Aviation, V/STOL, Subsonic, Supersonic and Hypersonic aircraft. Proof of concept activity is systems integration research whereby a full scale operating system is used to extend laboratory research on system elements. The programs in all these areas encompass work in materials, noise and sonic boom, operational aspects, propulsion system and airframe integration and the relationships which exist between the pilot and the total aircraft system as appropriate.

RESOURCES REQUIRED:

	(Thousands of dollars) 1967	1968	1969
Advanced research and technology	$ 3,730	$13,440	$16,080
General aviation aircraft technology supporting research .	200	450	520
V/STOL aircraft technology supporting research.	5,550	7,417	9,600
Subsonic aircraft technology supporting research.	6,100	6,780	15,100
Supersonic aircraft technology supporting research.	14,040	24,175	24,220
Hypersonic aircraft technology supporting research.	6,280	14,538	11,380
Total.	$35,900	$66,800	$76,900

WHY FUNDS REQUIRED:

Advanced Research and Technology ($16,080,000)

Much of the research in aircraft aerodynamics is configuration - dependent and oriented toward a specific class of vehicles. It is therefore programmed under the appropriate Aircraft Technology Supporting Research area. Research of a more fundamental nature or applicable to several aircraft classes is carried out with aircraft aerodynamics funding. This research is a continuing effort on aircraft components and flow fields and associated boundary-layer phenomena throughout the aircraft and speed range. It involves the formulation and refinement of applicable theories and calculative methods, the improvement of wind-tunnel capabilities and other experimental techniques and

the application of these tools to advanced aircraft technology.

The loads and structures program area is aimed at a broad spectrum of problems common to several or all types of aircraft since there is a common design goal of lightweight efficient airframes which will withstand the operating environment and reliability and safety. Gust and maneuver loads, acoustic response, wing and tail and panel flutter, fatigue, composite materials, thermal stresses are all specific problem areas in which research will be conducted.

The primary goals of the air-breathing propulsion program area are to initiate and conduct investigations of propulsion components and system concepts, either not readily identified with a specific flight spectrum or else identified over a broad flight spectrum. Basic studies are conducted on inlets, compressors, combustors, turbines, nozzles and materials to provide higher ratios of thrust-to-engine-weight, higher ratios of thrust-to-engine volume, and lower specific fuel consumption along with minimization of air pollution due to engine operation.

The research in the aircraft operating environment program area is aimed at solving general problems associated with flight environment, flight safety, noise, flight instrumentation and sonic boom. It involves theoretical analyses and laboratory and flight test experiments to validate current engineering procedures and to explore solutions to aircraft operational problems. The results provide the technological know how for safer and quieter aircraft operations and the basic environmental data for application to specific classes of aircraft (for example, V/STOL, Subsonic, etc.).

Research in the flight dynamics area is directed toward obtaining a better understanding of the interrelationship between

the pilot and the vehicle he controls. This includes improving methods for aircraft control, handling characteristics and the improvement in the capability of ground and flight piloted simulators for handling qualities investigations of all classes of aircraft.

The Research Centers use various aircraft in direct support of advanced research and technology programs. The maintenance, spare parts and ground support equipment for these R&D support aircraft and chase and proficiency aircraft which are used for various missions are included in this funding category.

General Aviation Aircraft Technology Supporting Research ($520,000)

General aviation aircraft are rapidly assuming a position of increasing importance to the economy and are not restricted to the hobby type of flying but are a principal mode of transportation for individuals such as businessmen, doctors, etc., and also include expanding air taxi and charter services which even fly U.S. Mail. The principal factors of concern in general aviation are first safety and second utility. NASA has examined these problems with industry and with the FAA and agreement has been reached that most of the R&D effort should be directed at examining the flight dynamic characteristics best suited to the class of pilots who are becoming increasingly involved in this type of flying.

V/STOL Aircraft Technology Supporting Research ($9,600,000)

V/STOL aircraft have a great potential in an increasingly crowded and transportation dependent society. The problem is one of flight dynamics of the aircraft, of matching the machine and the pilot and in providing proper integration of propulsion systems which are for this class of vehicle also a primary means of control. To be successful a V/STOL machine must convert its

thrust-producing power into lift-producing power very efficiently; propulsion and aerodynamics must interact strongly and properly to achieve this. The NASA V/STOL supporting research program is therefore defined with these problems as a primary focus. Full-scale wind tunnel tests have been completed of a model aircraft using a full span rotating cylinder flap as an efficient means of providing the powered lift required for improving propeller driven STOL aircraft. The rotating cylinder flap concept will be tested by modification of an OV-10A aircraft being provided by the Navy.

Subsonic Aircraft Technology Supporting Research ($15,100,000)

Research on subsonic aircraft is oriented toward safety of flight, improvement of flight efficiency and the reduction of noise. In the disciplinary areas aerodynamics research required funding for new models, model changes, instrumentation for wind tunnel tests and the uprating of wind tunnel hardware. The research to be carried out will be aimed at studying the lift, drag and stability characteristics of aircraft configurations most suitable for improved subsonic/transonic operation. Loads and structures research will examine the specific application of fatigue, buffeting and aeroelastic studies to advanced commercial aircraft and the funding will cover the costs of models, instrumentation and structural/fatigue specimens. Propulsion research will include an increase in support of long neglected areas for fuel, combustor and engine component efficiency studies to suppress the tendency of jet engines to smoke and requires the procurement of the necessary components and materials to support the in-house effort. The safe climbout and landing techniques for noise minimization, the refinement of flight instrumentation for more accurate measurement of airspeed at transonic speeds

and the meteorological environment of particular concern to operations at high transonic speeds will be studied. Flight dynamics research will be concentrated on continuing studies of aircraft control for flight through turbulence and will include both simulator and flight tests.

As its part of the Inter-Agency Aircraft Noise Abatement Program, NASA has the primary responsibility for the research and development leading to the reduction of aircraft noise at its source. This has involved NASA in proof-of-concept activities in aircraft noise and the quiet research engine. A fan-compressor noise minimization program was initiated in FY 1967, and in FY 1968 has involved wind tunnel testing and design and testing of boilerplate nacelle modifications. In FY 1969 the final nacelle configurations will be constructed for flight proof tests on a 707 type aircraft and on a DC-8 type aircraft.

In FY 1968 preliminary work will be conducted to define the scope and some of the hardware components of a quiet research engine. The second phase of this proof-of-concept, to be implemented in FY 1969, will include large scale engine component fabrication and full-scale tests of compressors and fans designed for minimum noise.

Supersonic Aircraft Technology Supporting Research ($24,220,000)

NASA's Aeronautical Vehicles program in supersonic aircraft technology supporting research is conditioned largely to meet the needs of two national activities associated with supersonic aircraft; the supersonic transport and the military supersonic aircraft such as the F-111, FX, VFAX, and AMSA. In general, the NASA program is designed either to study potential improvements not incorporated in original designs because of high technical risks, to study problem areas which might be expected to

become critical in later stages of vehicle development or operation or to lay the groundwork well in advance for new state-of-the-art advances such as the SST or the F-111 have turned out to be. The program to support the supersonic transport contains three major elements; direct support of the FAA and its contractor, anticipation of future problem areas and the research directed at a "second generation" supersonic transport. The NASA program is designed to explore the areas of technology which carry the potential of significant performance but with advances involving technical uncertainties. The principal area of research is therefore propulsion. The supersonic aircraft supporting research program also contributes much to research in support of the military aircraft listed previously.

In FY 1969 measurements of the stability and control characteristics of the XB-70A and the evaluation of its handling qualities throughout the complete flight test envelope will be completed. Special tests will be performed to obtain additional information leading to an explanation of the major differences found between flight measured characteristics and those obtained by theoretical prediction and wind-tunnel techniques in FY 1968. Another area to be explored in FY 1969 is the ground effect on the aerodynamic forces and moments in the landing configuration when close to the ground. This has not been accomplished on an aircraft of this size before. An important structural problem which has been noted during the flight tests of the XB-70 is the relatively large response to turbulence. During FY 1969 a modal suppression system will be installed and flight tested to determine possible means of gust alleviation at supersonic speeds. As planned the flight tests of the modal suppression system will be completed by mid-Fiscal Year 1969.

With the completion of the handling qualities program and the gust alleviation research program the XB-70 flight research program will be completed. The funding requirement for the XB-70, which is the responsibility of the NASA in FY 1968 and in FY 1969 since the transfer of the aircraft to the NASA in March 1967 will be for one-half year. The program is expected to be completed by January 1969.

Hypersonic Aircraft Technology Supporting Research ($11,380,000)

The possibility of achieving sustained, efficient hypersonic flight has not been proven, yet systems analyses of such vehicles based upon best available theory shows it to be a potentially economically sound transport mode. Verification of the theories is required and the NASA research program is designed to provide information against which the adequacy of the theories can be judged. The program is directed first at examining the most fundamental first order assumptions in aerodynamics, propulsion and structures. Questions regarding the soundness of analyses in other disciplines are deferred until these primary answers have been obtained.

The various experiments currently being carried on the X-15 research aircraft will be completed by the end of FY 1968 or early in FY 1969 and it is not planned to operate the aircraft following the completion of these tests. Therefore no funding is required for the X-15 program in FY 1969.

The Hypersonic Research Engine proof-of-concept program was initiated in FY 1965 as the result of an obvious need for information relating to propulsion systems operating at hypersonic speed in a real environment. The Garrett Corporation is proceeding with the design and development and construction of

one flight weight regeneratively cooled research engine. A boilerplate engine will be under test in FY 1969 at the Ordnance Aerophysics Laboratory in clean air up to Mach 5. The regeneratively cooled engine will be delivered to the Lewis Plum Brook Research Facility for research testing in FY 1970.

RESEARCH AND DEVELOPMENT
FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF TRACKING AND DATA ACQUISITION
TRACKING AND DATA ACQUISITION PROGRAM

The purpose of this program is to provide responsive and efficient tracking and data acquisition support to meet the requirements of all NASA flight projects. In addition, support is provided, as mutually agreed, for projects of the Department of Defense, other Government agencies, and other countries and international organizations engaged in space research endeavors.

Support is provided for manned and unmanned flights; for spacecraft, sounding rockets, and research aircraft; and for earth orbital and suborbital missions; lunar and planetary missions and space probes.

Types of support provided include: (a) tracking to determine the position and trajectory of vehicles in space, (b) acquisition of data from scientific experiments and on the engineering performance of spacecraft and launch vehicle systems, (c) transmission of commands from ground stations to spacecraft, (d) communication with astronauts and acquisition of medical data on their physical condition, (e) communication of information between various ground facilities and mission control centers, (f) processing of data acquired from the space vehicles. Such support is essential for the critical decisions which must be made to assure the success of all flight missions, and, in the case of manned missions, to insure the safety of the astronauts.

Tracking and data acquisition support is provided by a

worldwide network of NASA ground stations supplemented by instrumentation ships, aircraft, and selected ground stations of the Department of Defense. These facilities are interconnected by a network of ground communications lines, undersea cables, high frequency radio links, and communication satellite circuits, which provide the capability for instantaneous transmission of data and critical commands between spacecraft and the control centers in the United States from which the flights are directed. Facilities also are provided to process into meaningful form the large amounts of data which are collected from flight projects. In addition, instrumentation facilities are provided for support of sounding rocket launchings and flight testing of research aircraft.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Operations	$195,050	$213,600	$239,800
Equipment.	62,000	49,450	52,200
Supporting research and technology	13,800	12,800	12,800
Total.	$270,850	$275,850	$304,800

WHY FUNDS REQUIRED:

Operations ($239,800,000)

Funds are requested for the operation and maintenance of the worldwide tracking and data acquisition facilities. Most of the increase in the FY 1969 operations program is related to the support requirements for the Apollo manned lunar landing

program. All Manned Space Flight Network stations which were augmented for the Apollo Program, the Apollo instrumentation ships, and the Apollo/Range Instrumentation Aircraft will be fully operational during FY 1969. The currently planned mission workload will require a limited second shift of personnel at network stations in FY 1969. Communications services will increase to provide the required capacity for the heavier Apollo flight program.

Operations in support of the unmanned space flight programs will remain at approximately the same level as in the current year. A small increase in funding for Satellite Network operations is requested in FY 1969 to provide for the operation of special Orbiting Astronomical Observatory ground equipment at selected stations and for additional personnel to operate the control center complex at the Goddard Space Flight Center. Completion of Lunar Orbiter and Surveyor program support will permit some reductions in funding for Deep Space Network operations in FY 1969.

The FY 1969 operations budget also includes an increase for funds required to reimburse the Air Force Eastern Test Range for downrange instrumentation services heretofore provided to NASA without charge. This charge is one part of the results of a study which was made by the Bureau of the Budget of the entire Air Force Eastern Test Range operation to determine an appropriate basis for NASA reimbursement to ETR for costs attributable to support of NASA's requirements.

Equipment ($52,200,000)

The tracking and data acquisition support requirements placed on the networks establish needs for equipments which

provide the continual ongoing support to approved and planned programs. Funds for equipment are requested to replace obsolete and wornout items, to modify existing systems to maintain compatibility with changes in spacecraft instrumentation, to increase the support utilization and efficiency of existing systems, and to complete or provide new systems required to support specific flight missions of approved and planned programs. In FY 1969, effort will be directed primarily toward sustaining the existing capability of the networks with only minor augmentations of equipment to meet the requirements of new programs.

Supporting Research and Technology ($12,800,000)

Here, concepts, techniques, and hardware are developed, tested, and evaluated for use in the networks to meet support requirements of new flight projects. In FY 1969, emphasis will be placed on network performance and operating techniques aimed at improved network effectiveness and lower operating costs.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1969 BUDGET REQUEST

OFFICE OF TECHNOLOGY UTILIZATION

TECHNOLOGY UTILIZATION PROGRAM

This program provides for NASA a follow-on to all government supported programs in line with the principle that techniques and methods discovered and/or developed with public support should be made available to the public expeditiously for their benefit. Those techniques and methods which are of direct benefit to the aeronautical and space communities almost automatically are put to use throughout that community. However, NASA feels there are inevitable discoveries and developments in any line of research which are of potential benefit to users outside of the developing community. It is the purpose of the program to uncover such useful discoveries and provide a mechanism for making them known and available to the general public. In addition, this program provides a similar service in connection with management techniques for large, complex research and development activities by giving wide dissemination to new systems and concepts in this area.

The objectives of the NASA Technology Utilization Program are: (1) to increase the return on the national investment in aerospace research and development by encouraging additional uses of the knowledge gained in those programs; (2) to shorten the time gap between the discovery of new knowledge and its effective use in the marketplace; (3) to aid the movement of new knowledge across industry, disciplinary, and regional boun-

daries; (4) to contribute to the knowledge of better means of transferring technology from its points or origin to its points of potential use.

RESOURCES REQUIRED:

	(Thousands of dollars)		
	1967	1968	1969
Identification and publication .	$1,265	$1,500	$1,600
Evaluation	650	700	800
Dissemination.	2,085	1,600	1,400
Analysis	1,000	200	200
Total.	$5,000	$4,000	$4,000

WHY FUNDS REQUIRED:

Identification and Publication ($1,600,000)

Technology Utilization Officers at NASA field installations and specialists from universities, research institutes and private industry search through selected areas of scientific and technical endeavor, and identify and document those inventions, innovations, improvements, and discoveries that have potential utility to the nonaerospace sector of the economy. Continued increased emphasis is placed on the identification and reporting of new technology by NASA contractors.

Evaluation ($800,000)

Personnel at NASA installations and research institutes evaluate the new technology so identified, determine its potential industrial utility and prepare reports which are published and made available to the scientific, industrial and academic communities.

Dissemination ($1,400,000)

This program element is accomplished by the employment of regional dissemination centers that store, retrieve and interpret the new technology developed by NASA for local industry. Biomedical application teams are also employed to assist researchers in defining and solving medical problems by adaptation of NASA technology. Cooperative programs are underway with several other agencies such as the Bureau of Reclamation, Office of Law Enforcement Assistance, Social Rehabilitation Service of HEW, Small Business Administration, Atomic Energy Commission and others to disseminate applicable new technology developed by NASA.

Analysis ($200,000)

This program element is concerned with the goal of understanding new and improved techniques for managing complex research and development activities. Methods used in achieving this goal include support of research covering the organization and management of large research and development projects, and defining the various roles of the research director in both government and industry.

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