Document III-29

Document title: J.C.F., Administrator, Memorandum to Dr. Low, "Meeting with Ed David," August 24, 1971.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

This memorandum catches the character of the NASA-White House interactions during 1971 as seen from NASA's perspective. Edward David was President Nixon's Science Adviser, and Russell Drew his top staff person on space issues. The Flax Committee, named after its chairman Dr. Alexander Flax, was an *ad hoc* panel of the President's Science Advisory Committee set up to advise the White House on NASA's shuttle proposal and possible alternatives. One of the panel's members, Dr. Eugene Fubini, was particularly active in the review. Richard McCurdy was the NASA official in charge of institutional management; the Office of Management and Budget was suggesting that the post-Apollo NASA had too many facilities and too many employees for the program envisaged for the 1970s.

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[1] As we discussed, I met with Ed David, ostensibly to talk about the possibility of a $3.2 billion constant budget throughout the 70's and to get a feeling from him as to how much we can trust OMB and others with regard to holding the line at this figure if we came in with a "bare bones" budget of this magnitude, which included a minimum shuttle. Ed's feeling is that the Flax Committee (with Fubini leading the pack) is going to come in with some interesting options which I would judge to be consistent with the $3.2 billion budget and, perhaps, would include a shuttle of about $5 billion total investment running about 1 billion per year. I indicated that this might be in the same ball park, but we would have to examine any such ideas in depth before we could commit ourselves to any such programs; also, that we were thinking along similar lines but so far had not discussed them in any detail with the Flax Committee. Surprisingly enough, he felt this was the wise thing to do from our point of view and he would hope that we would continue to keep such studies confined to a small group in NASA until the time came to discuss them. I received a very definite impression that he would like to take credit for coming up with a reduced cost shuttle, and I didn't discourage him from this idea.

When it came to discussing tactics, he did agree that the two of us ought to sit down after the Flax Committee results were in and plan out a program together. However, his initial [2] thought was that he should propose the low-cost shuttle to OMB himself, but that we should try to resist in order to argue from a better bargaining position. I am not sure that this is a good way to proceed but his suggestion was based on the fact that we already recognize that OMB can't entirely be trusted to commit to any kind of program and that if we agreed too easily to the low-cost shuttle, they might try to work us down to a smaller budget yet. Basically, the strategy and tactics remain unresolved, except Ed did agree to chat further with us on the subject when the Flax Committee results were available.

I was personally a little discouraged by the conversation in the sense that he didn't feel there was anyone in OMB who could be completely trusted—not that they were dishonest, but that their sole function was to put a ratchet on the budget and couldn't make a commitment to hold the line on anything.

I tried out your ideas regarding the Space Council and, at first, he was quite defensive, indicating that OST perhaps served the function that we had in mind for the Space Council, particularly when the business of earth resources policy came up. However, after some discussion we agreed that the idea was worth considering, but he wanted to mull it over first. I think his thought was that perhaps he could chair the Space Council in the absence of the Vice President instead of "yours truly." I am afraid we are going to have some difficulty on this one, but I am willing to pursue it further if we still think it is a good idea.

Incidentally, I brought up another subject and that is his own views and those of OMB's toward our "operating base." He feels that OMB is unconvinced that there isn't considerable fat in the program because of the large operating base and although he knows Dick McCurdy's position on it, he is not himself convinced and is sure that OMB is not convinced. I indicated that we had just started our program with OMB [3] and, hopefully, Dick would be successful in a period of weeks to expose enough of OMB to the report that, at least, they would understand the problem better. Ed didn't volunteer to listen to Dick's analysis, but I think we ought to try to set up with both Ed David and Russ Drew at an appropriate time, even though they are lukewarm to the idea.

J.C.F.

Document III-30

Document title: Klaus P. Heiss and Oskar Morgenstern, Memorandum for Dr. James C. Fletcher, Administrator, NASA, "Factors for a Decision on a New Reusable Space Transportation System," October 28, 1971.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

In 1970, the Office of Management and Budget had forced NASA to hire an external contractor to analyze the economic rationale for replacing existing or new expendable launch vehicles with a reusable space transportation system. The contractor chosen was Mathematica, Inc., a Princeton, New Jersey, firm headed by the distinguished economist Oskar Morgenstern. At Mathematica, the individual with primary responsibility for the study was a brash young Austrian-born economist, Klaus Heiss.

Mathematica submitted its analysis of the economic worth of a fully reusable space transportation system in May 1971, just as NASA was deciding that budget constraints would only allow the development of a partially reusable system. NASA asked Mathematica to examine the economics of a variety of possible designs for such a system.

Working closely with several aerospace contractors, Heiss came to the conclusion that a particular design, which he called a Thrust Assisted Orbiter Shuttle (TAOS), was the preferred alternative. Recognizing that the total study would not be completed in time to influence decisions on the shuttle program (the study was submitted in May 1972), Heiss and Morgenstern prepared this memorandum and circulated it among those involved in the space shuttle decision process.

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[1]

(1) REUSABLE SPACE TRANSPORTATION SYSTEM IS ECONOMICALLY FEASIBLE, ASSUMING THAT THE LEVEL OF UNMANNED U.S. SPACE ACTIVITY WILL NOT BE LESS THAN IT HAS BEEN ON THE AVERAGE OVER THE LAST EIGHT YEARS.

(2) AMONG THE MANY SPACE SHUTTLE CONFIGURATIONS SO FAR INVESTIGATED, AND WHICH ARE DEEMED TO BE TECHNOLOGICALLY FEASIBLE, *A THRUST ASSISTED ORBITER SHUTTLE (TAOS)* WITH EXTERNAL HYDROGEN/OXYGEN TANKS EMERGES AT PRESENT AS THE *ECONOMICALLY PREFERRED* CHOICE. EXAMPLES OF SUCH CONCEPTS ARE RATO OF MCDONNELL DOUGLAS AND TAHO OF GRUMMAN-BOEING.

(3) *THE DEMAND FOR SPACE TRANSPORTATION* IN THE 1980's AND BEYOND BY THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, THE DEPARTMENT OF DEFENSE, BUT PARTICULARLY BY COMMERCIAL AND OTHER USERS IS THE BASIS FOR THE ECONOMIC JUSTIFICATION FOR THE TAOS PROGRAM. SUBSTANTIAL FURTHER EFFORT IN THIS AREA IS NEEDED TO DETERMINE THESE EXPECTED NEEDS.

The following sets forth briefly, in a summary manner, the principal considerations which lead to conclusions (1) and (2). The following arguments, which in their entirety support the recommendation (2), contribute significantly to alleviating the doubts voiced by the Congress, the public and several branches of the Executive concerning the need for a new Space Transportation System. Such doubts have been raised because of the magnitude of the investment involved and the comparative technological difficulty of the proposed undertaking. [2]

I. Major Conclusions

1. In the May 31, 1971 report by MATHEMATICA, *Economic Analysis of New Space Transportation Systems*, the overall economic worth of a reusable space transportation system was examined. The study was based on the two-stage fully reusable concept then under investigation by Phase B contractors and NASA. That report has demonstrated how an economic justification of a space shuttle system, including a space tug, with an IOC date of 1978 has to be made. The report was *not* concerned with identifying the most economic choice among alternative space shuttle configurations to be considered.

2. The Baseline, fully reusable, space transportation system had attached to it a non-recurring cost of between $10 and $14 billion when the costs of all systems were included. This large investment outlay would be largely independent of the time span within which these funds are expended. These high non-recurring costs coupled with a relatively high risk led to the study of many alternate configurations. Among the many other approaches studied by NASA and industry, our calculations show the emergence of an *economical and acceptable solution to the question of the best strategy for NASA to achieve a reusable space transportation system for the 1980's at acceptable costs.*

3. Over 200 space programs were analyzed by MATHEMATICA, comparing (a) the Baseline two-stage fully reusable system, (b) the Baseline, external hydrogen tank system, (c) the Mark I-Mark II (reusable S1C) system, (d) the RATO system of McDonnell Douglas, (e) the TAHO system of Grumman-Boeing, (f) the Stage and One-Half of Lockheed Corporation, and (g) the Identical Vehicle Concept of McDonnell Douglas. The *Thrust Assisted Orbiter Shuttle concepts (TAOS) which include concepts like* [3] *RATO and TAHO, emerge as the most preferred systems within the space programs so far analyzed,* using the economic methodology as exemplified in the May 31, 1971 report. The common feature of TAOS concepts is a single orbiter with external hydrogen/oxygen tanks and rocket assists in the form of solid rocket motors or high pressure fed unmanned boosters. This eliminates the need to develop a large manned, reusable booster.

[4] II. Objectives of a Reusable Space Transportation System

The *principal* objectives of a space shuttle system are considered to be:

1. A new capability of meeting all foreseeable space missions in NASA, DoD and elsewhere, *including* manned space flight capabilities.

2. Reduction of *space program costs* (manned, unmanned, NASA, DoD, commercial users) over the present expendable space transportation costs through reuse, refurbishment, maintenance, and updating of payloads.

3. Reduction of *space transportation costs* for all missions (low energy, high energy, manned).

4. *Option* of later transition to a fully reusable system.

Additional objectives supporting the major objectives are:

5. A low *non-recurring cost* to meet funding constraints.

6. Assurance of a *low cost per launch* of below $10 million—and if possible $5 million —justifiable when payload costs and effects are considered.

The work assigned to us and reported in the May 11 report showed clearly the *economic* justification of a fully reusable space transportation system and outlined some key

questions that remain to be answered in order to assure an overall purpose to the space shuttle decision. Not yet analyzed in that report was the question of *the most economic shuttle configuration,* to meet the major objectives of NASA. Any decision on an economic new Space Transportation System will have to reconcile major constraints with those objectives.

[5] **III. Constraints of Decision on Configuration**

The key constraints that any decision on a particular configuration is confronted with are:

1. **Technological:** The technical feasibility of the alternative configurations studied by NASA and industry is assumed. However, for each alternative configuration the time-and-cost uncertainties were analyzed as far as presently possible. This still assumes that the concepts studied are indeed technically viable.

2. **Economic:**

(a) **Total cost and components.** Different configurations have very different costs associated with them as outlined, for example, by the Baseline, Two Stage Fully Reusable system, the Baseline Two Stage External Hydrogen Tank system, the Mark I-Mark II (reusable SlC) system, the Stage and One-Half system and the various Thrust Assisted Orbiter Shuttles (TAOS). In addition to total costs in research and development, investment, and operations (including the cost per launch), elements of uncertainty of various degrees are associated with individual subsystems of these configurations. NASA, industry contractors, and others are trying to analyze in part the cost component as well as the risk component in these different configurations. All possible different configurations, but certainly TAOS, have to be analyzed as to the advantages and disadvantages in cost, risk, and uncertainty that these configurations promise when compared to the two stage fully reusable original Baseline system of NASA.

[6] (b) **Timing of the space shuttle development and its systems.** In part the choice of the current Mark I-Mark II approach was forced by a peak funding requirement for space shuttle development of, say, $1 billion per year. In this approach, however, several important parts of the system would be postponed in some configurations *while* other configurations with the same total funding requirement assure *an early IOC date not only of the space shuttle alone, but also of the space tug.* The meeting of the funding requirements, the mission capabilities of the new system and the IOC dates of interim as well as final configurations have to be further studied in detail.

(c) **Timing of the Space Tug** should be such that its IOC date comes closely after the IOC date of the Space Shuttle. If European countries undertake the tug development —after assurance that NASA will have a Space Shuttle System!—then tug funding becomes a problem outside the NASA budget and these expenditures should not affect the shuttle decision itself. They were, however, fully allowed for in our analysis.

Within the above constraints, the *trade offs* of alternative configurations have to be studied with a number of alternative mission models. In particular, very close attention has to be paid to the very different *capabilities* that are given in terms of the overall system. In connection with the TAOS concept, tank costs are yet a major uncertainty that are included in our present studies and which may come down substantially with further technical change. Such a development would further favor the TAOS concept.

The key question raised in the May 31, 1971 report is: *Does there exist a precise and detailed NASA and national space program for the 1980's?* [7] We did receive detailed *mission* models of OSSA, OMSF, the DoD, non-NASA applications and others. Yet these continue to change substantially. A space program consists of individual missions which must be specified and integrated into an overall plan of not negligible firmness, though some flexibility must also be allowed for.

To allow the space shuttle decision on the basis of the Two Stage Shuttle funding requirements, many of the important missions were postponed recently by NASA to fit the shuttle development into the expected funding limitation. A far more sophisticated analy-

sis needs to be done that allows the *scheduling* of types of payloads. The *importance* of payloads, the *interdependence* among payloads within missions and between missions, as well as an analysis of resupply, updating, maintenance, and reliability. Utilizing programming tools that are available today in operations research, substantial work can be performed, some of which is incorporated in the present ongoing work by our group.

Thus, within these constraints an acceptable Space Shuttle development program is indeed difficult: budget limitation by year, total program costs, the timing of different components of the system, the need for a Space Tug and an early full operational capability, and comprehensive and justified national space program alternatives for the 1980's.

[8]

IV. Conclusions

Among the 200 and more space programs analyzed, and comparing (a) the two stage, fully reusable system, (b) the Baseline, external hydrogen tank system, (c) the Mark I-Mark II (reusable SlC) system, (d) the RATO system of McDonnell Douglas, (e) the TAHO system of Grumman-Boeing, (f) the Stage and One-Half of Lockheed Corporation, and (g) the Identical Vehicle Concepts of McDonnell Douglas, the *Thrust Assisted Orbiter (TAOS) concepts emerge as the most economic systems within the space programs analyzed.* TAOS with external hydrogen and oxygen tanks, a 60 x 15 payload bay, and a 40,000 pound polar orbit capability, if possible by 1979, clearly dominates any other configuration.

The TAOS concept foregoes the development of a Two Stage Shuttle System. With the use of thrust assists of either solid rocket motors or high pressure fed systems—which can be made in part reusable for low staging velocities—the TAOS concepts promise a reduction of the non-recurring costs (RDT&E and initial fleet investment) from about $9 billion or more (two stage systems, including reusable SlC) to about $6 billion or less, with a minimal operating cost increase, if any, in the operating phase of the TAOS system.

The detailed economic justifications of the TAOS concept—when compared to any two stage reusable system are:

1. The non-recurring costs of TAOS are estimated by industry to be $6 billion or less over the period to 1979 or to 1984-85, depending on the objectives and choices of NASA.

2. The risks in the TAOS development are in balance lower but still substantial. Intact abort with external hydrogen and oxygen tanks is feasible; lagging performance in *the* engine area can be made up by added [9] external tank capability. A large reusable manned booster is not needed.

3. The TAOS's that were analyzed promise the *same capabilities* as the original two stage shuttle, including a 40,000 pound lift capability into polar orbit and a 60 x 15 feet payload bay.

4. The TAOS can carry the *Space Tug* and capture high energy missions from 1979 on.

5. The most economic TAOS would use the *advanced orbiter* engines immediately. Our calculations indicate that among the alternative TAOS configurations an early full operational capability (i. e., high performance engines on the orbiter) is economically most advantageous, and feasible, within budget constraints of $1 billion peak funding.

6. The TAOS *can* use J2S engines on the orbiter for an interim period.

7. The TAOS *abolishes* completely the immediate need to decide on a *reusable booster* and allows postponement of that decision without blocking later transition to that system if still desired. Thereby, TAOS eliminates or lowers the risk and potential cost overruns in booster development.

8. The TAOS can use *"parallel burn"* concepts, which, if feasible, may change the reusable booster decision.

9. Technological progress may make *tank costs,* and thrust assisted rocket costs less expensive, thus further aiding TAOS concepts when compared to two stage concepts.

10. TAOS assures NASA an *early program definition,* and a purpose to the agency. An agreement on TAOS will allow NASA Headquarters a quick and clear reorganization of major NASA centers to meet the TAOS development requirements economically.

11. The TAOS funding schedule makes an early Space Tug [10] development possible. The Space Tug is an important part of the Space Shuttle System. A 1979 Space Tug should recover its complete development costs before 1985 even with the stretched build up of Space Shuttle missions from 1979 to 1985.

12. A clear policy on TAOS development will give an incentive to European countries to undertake and fund the Space Tug development—thereby possibly even eliminating Space Tug funding from NASA budget considerations.

13. The cost per launch of TAOS can be as low as $6 million or a even less on an *incremental cost* basis, with reuse of parts of the thrust assist rockets (either SRM or pressure-fed). With Point 9 realized, the costs of TAOS would practically match the *costs per launch of two stage fully reusable systems.*

14. TAOS practically assures NASA of a reusable space transportation system with *major objectives achieved.* [11]

V. The Principal Open Problem: The Demand for Space Transportation

Within the analysis of payloads and their effects on a space shuttle system. The most important problem remains of what will *the demand for* space transportation be in the 1980's (1) *with* a space shuttle, (2) *without* a space shuttle. The demand for space transportation is an important function of the *costs* of doing space applications, the *reliability* of the space transportation system and the assured functioning of payloads as well as the *frequency* of launches over time. The present space programs analyzed by our group mainly concentrate on NASA and DoD applications. However, *it is our strong belief that the major portion of space transportation demand in the 1980's will come from economic applications of space technology to meet the growing needs of the U.S. and other developed and developing countries.*

The potential in this area is of major significance and will lead to completely new ways of looking at space and of evaluating expenditures of space programs like the space shuttle system. This needs to be further documented in detailed work. A major portion of the demand for space transportation will still come, of course, from NASA and DoD as exemplified by the mission models given to us. On commercial applications. However, an inter-agency, inter-industry, and international effort should be organized to study in detail the economic problems that can be alleviated or solved by using space technology. Communication and navigation systems are but one important component in this area. Earth resources applications, early warning systems, management information systems, television systems, along with completely new applications must he studied. The number of satellites and the different needs of many countries are likely to be of such a scale that they will contribute substantially to the demand for space shuttle flights once this system is available. The effort that should be put [12] forth in this area is such that it be best undertaken by a group like the Space Task Group effort of 1969. However it should now be oriented towards the demand for space transportation, and within this, particularly to the economic applications area of space. It is also true that with regard to space shuttle missions further work needs to be done, particularly in the area of DoD missions in support of a decision like the space shuttle. The military implications of the additional capabilities offered by the Space Shuttle System beyond those of expendable space transportation systems have to be analyzed fully. If this were done, further strong support for the space shuttle decision should become available.

The point is sometimes made by NASA that the *technological* possibility of a space shuttle program suffices by itself to justify its construction, independent of the economic analysis. The economic analysis is not a challenge against the importance of technical efforts of a program like the space shuttle, but rather assures that a decision for the space shuttle is not based solely on technology. It is difficult to see how a program like the Space Shuttle can be undertaken, without a complete economic justification.

Last but not least, it seems to us, with all the potential promised by space and space applications, that *NASA has been very limited in the past in fulfilling its potential role and in realizing finally the importance of its function within the nation.* In this NASA is severely limited

by its charter. In the present mood and the present state of the economy a program like the shuttle and its decision has to be *user* oriented, not in terms of who will build the shuttle and benefit by these expenditures, but rather in terms of who is going to use the space shuttle system and why the different agencies, corporations, and foreign countries will do so. NASA ought to adjust to such a reorientation of emphasis. [13]

Within the user area, there appear to be the following major needs:

1. **Military.** The military uses of space are in the present DoD mission model. These uses will presumably continue at this level into the 1980's. However, the missions analyzed so far in the context of the space shuttle system have to be supplemented by a comprehensive analysis of the military significance of the *added* capabilities that the Space Shuttle System offers in the 1980's. NASA will need the support of DoD and in getting this support, will have to initiate a complete re-evaluation of the additional capabilities that the space shuttle will give to DoD in addition to the "expendable mode" applications now provided for in the DoD mission model.

2. **Scientific.** The mission models of OSSA activities in the 1980's seem to cover the expected activity levels in the 1980's for scientific applications in the U.S. As scientific developments occur over the next decade, demands for new and additional missions may arise. At present NASA has fully worked out plans, schedules, and priorities. What remains is to explain further to the public and the Congress the great scientific value and ultimately practical importance of these activities. In doing so, however, this expenditure will have to be seen in the context of other national scientific and R&D efforts.

3. **Communications.** Applications are now fully developing and the encouragement of other countries becomes increasingly important. A new idea in this area would be to begin with a program by NASA to help *developing nations* in setting up communication systems within the *foreign* aid program of the U.S., through the United Nations and the International Bank for Reconstruction and Development. This could ultimately lead to a foreign aid program of *"Zero Dollar Outflow"* since the U.S. [14] contribution, as well as launch and maintenance services, of the space based systems would occur completely within the U.S.

4. **Earth Observations.** The need to assess the resources of the earth worldwide as well as for the U.S. is apparent. NASA is undertaking major demonstration programs in ERTS A and ERTS B. Yet when looking ahead to the 1980's it becomes apparent that given the many different uses of earth observation satellites, the different regions to be covered, as well as the programs of different nations, the demand for space based earth resource satellites will be much larger and specific to each field than is now contemplated. The function of a space shuttle system within such an application program would be tremendous and has not been analyzed. In this area alone one can foresee enough traffic to justify support for the development of a new space transportation system.

5. **Navigation.** Different navigation satellite systems are being used at present but mainly in DoD. A demand for a *reliable* system at low cost is apparent in the aviation and shipping industries, as well as in defense. A world wide system, again covering all industrial users and different regional applications will lead to a substantial increase in the number of satellites. New demands will be made concerning reliability and maintainability of these systems.

6. **Other Applications.** Several other possible world wide applications of space can be foreseen to which the space shuttle system would contribute significantly. Among these are the use of space based *production processes* which for safety considerations, gravity, environment or other technical reasons are either too expensive or not possible when earth based. Other areas concern the generation and transmission of *energy* [15] using potentially completely new sources (for example *solar* energy, fusion energy) for either large scale space based users, or in the more distant future, for use on earth.

We conclude this memorandum with the observation—though by now trivial and obvious, but nevertheless fundamental—that any expenditure of public funds must be justified, precisely as expenditure of private and business funds, by the *aims* and *purposes* of the expenditure. Technological possibilities alone carry no conviction, though they often

bring new possible aims into sight and reach. Whatever their nature and origin, the different aims must be hierarchically ordered and must find their place in the system of national priorities.

Document III-31

Document title: James C. Fletcher, "The Space Shuttle," November 22, 1971.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, DC.

The economic benefits of the shuttle were only one, and to the NASA leadership not the most important, reason for going ahead with the program. As the NASA-White House discussions about shuttle approval reached their climax, NASA prepared a "best case" paper reflecting its arguments for approving shuttle development.

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[1]

The Space Shuttle

Summary

This paper outlines NASA's case for proceeding with the space shuttle. The principal points are as follows:

1. The U.S. cannot forego manned space flight.

2. The space shuttle is the only meaningful new manned space program that can be accomplished on a modest budget.

3. The space shuttle is a necessary next step for the practical use of space. It will help

— space science,

— civilian space applications,

— military space applications, and

— the U.S. position in international competition and cooperation in space.

4. The cost and complexity of today's shuttle is *one-half* of what it was six months ago.

5. Starting the shuttle now will have significant positive effect on aerospace employment. Not starting would be a serious blow to both the morale and health of the Aerospace Industry.

[2]

The U.S. Cannot Forego Manned Space Flight

Man has worked hard to achieve—and has indeed achieved—the freedom of mobility on land, the freedom of sailing on his oceans, and the freedom of flying in the atmosphere.

And now, within the last dozen years, man has discovered that he can also have the freedom of space. Russians and Americans, at almost the same time, first took tentative small steps beyond the earth's atmosphere, and soon learned to operate, to maneuver, and to rendezvous and dock in near-earth space. Americans went on to set foot on the moon,

while the Russians have continued to expand their capabilities in near-earth space.

Man has learned to fly in space, and man will continue to fly in space. This is fact. And, given this fact, the United States cannot forego its responsibility—to itself and to the free world—to have a part in manned space flight. Space is not all remote. Men in near-earth orbit can be less than 100 miles from any point on earth—no farther from the U.S. than Cuba. For the U.S. not to be in space, while others do have men in space, is unthinkable, and a position which America cannot accept.

[3] **Why the Space Shuttle?**

There are three reasons why the space shuttle is the right next step in manned space flight and the U.S. space program:

First, the shuttle is the only meaningful new manned space program which can be accomplished on a modest budget. Somewhat less expensive "space acrobatics" programs can be imagined but would accomplish little and be dead-ended. Additional Apollo or Skylab flights would be very costly, especially as left-over Apollo components run out, and would give diminishing returns. Meaningful alternatives, such as a space laboratory or a revisit to the moon to establish semi-permanent bases are *much* more expensive, and a visit to Mars, although exciting and interesting, is completely beyond our means at the present time.

Second, the space shuttle is needed to make space operations less complex and less costly. Today we have to mount an enormous effort every time we launch a manned vehicle, or even a large unmanned mission. The reusable space shuttle gives us a way to avoid this. This airplane-like spacecraft will make a launch into orbit an almost routine event—at a cost $^1/_{10}$th of today's cost of space operations. How is this possible? Simply by not [4] throwing everything away after we have used it just once—just as we don't throw away an airplane after its first trip from Washington to Los Angeles.

The shuttle even looks like an airplane, but it has rocket engines instead of jet engines. It is launched vertically, flies into orbit under its own power, stays there as long as it is needed, then glides back into the atmosphere and lands on a runway, ready for its next use. And it will do this so economically that, if necessary, it can provide transportation to and from space each week, at an annual operating cost that is equivalent to only 15 percent of today's total NASA budget, or about the total cost of a single Apollo flight. Space operations would indeed become *routine.*

Third, the space shuttle is needed to do useful things. The long term need is clear. In the 1980's and beyond, the low cost to orbit the shuttle gives is essential for all the dramatic and practical future programs we can conceive. One example is a space station. Such a system would allow many men to spend long periods engaged in scientific, military, or even commercial activities in a more or less permanent station which could be visited cheaply and frequently and refurbished, [5] by means of a shuttle. Another interesting example is revisits to the moon to establish bases there; the shuttle would take the systems needed to earth orbit for assembly.

But what will the shuttle do before then? Why are routine operations so important? There is no single answer to these questions as there are many areas—in science, in civilian applications, and in military applications—where we can see now that the shuttle is needed; and there will be many more by the time routine shuttle services are actually available.

Take, for example, *space science.* Today it takes two to five years to get a new experiment ready for space flight, simply because operations in space are so costly that extreme care is taken to make everything just right. And because it takes so long, many investigations that should be carried out—to get fundamental knowledge about the sun, the stars, the universe, and, therefore, about ourselves on earth—are just not undertaken. At the same time, we have already demonstrated, by taking scientists and their instruments up in a Convair 990 airplane, that space science can be done in a much more straight-forward way with a much smaller investment in time and money, and with an ability to react quickly to new discoveries, because airplane operations are *routine.* This is what the shuttle will do for space science.

[6] Or take *civilian space applications.* Today new experiments in space communications, or in earth resources, are difficult and expensive for the same reasons as discussed under science. But with routine space operations instruments could quickly be adjusted until the optimum combination is found for any given application—a process that today involves several satellites, several years of time, and great expense.

One can also imagine new applications that would only be feasible with the routine operation of the space shuttle. For example, it may prove possible (with an economical space transportation system, such as the shuttle) to place into orbit huge fields of solar batteries—and then beam the collected energy down to earth. This would be a truly pollution-free power source that does not require the earth's latent energy sources. Or perhaps one could develop a global environmental monitoring system, international in scope, that could help control the mess man has made of our environment. These are just two examples of what might be done with *routine* space shuttle operations.

What about *military space applications*? It is true that our military planning has not yet defined a specific need for man in space for military purposes. But will this always be [7] the case? Have the Russians made the same decision? If not, the shuttle will be there to provide, quickly and routinely, for military operations in space, whatever they may be. It will give us a quick reaction time and the ability to fly ad hoc military missions whenever they are necessary. In any event, even without *new* military needs, the shuttle will provide the transportation for today's rocket-launched military spacecraft at substantially reduced cost.

Finally, the shuttle helps our *international* position—both our *competitive* position with the Soviets and our prospects of *cooperation* with them and with other nations.

Without the shuttle, when our present manned space program ends in 1973 we will surrender center stage in space to the only other nation that has the determination and capability to occupy it. The United States and the whole free world would then face a decade or more in which Soviet supremacy in space would be unchallenged. With the shuttle, the United States will have a clear space superiority over the rest of the world because of the low cost to orbit and the inherent flexibility and quick reaction capability of a reusable system. The rest of the world—the free world at least—would depend on the United States for launch of most of their payloads.

[8] On the side of cooperation, the shuttle would encourage far greater international participation in space flight. Scientists—as well as astronauts—of many nations could be taken along, with their own experiments, because shuttle operations will be routine. We are already discussing compatible docking systems with the Soviets, so that their spacecraft and ours can join in space. Perhaps ultimately men of all nations will work together in space—in joint environmental monitoring, international disarmament inspections, or perhaps even in joint commercial enterprises—and through these activities help humanity work together better on its planet earth. Is there a more hopeful way?

The Cost of the Shuttle Has Been Cut in Half

Six months ago NASA's plan for the shuttle was one involving heavy investment—$10 billion before the first manned orbital flight—in order to achieve a very low subsequent cost per flight—less than $5 million. But since then the design has been refined, and a trade-off has been made between investment cost and operational cost per flight. The result: a shuttle that can be developed for an investment of $4.5-$5 billion over a period of six years that will still only cost [9] around $10 million or less per flight. (This means 30 flights per year at an annual cost for space transportation of 10 percent of today's NASA total budget, or one flight per week for 15 percent.)

This reduction in investment cost was partly the result of a trade-off just mentioned, and partly due to a series of technical changes. The orbiter has been drastically reduced in size—from a length of 206 feet down to 110 feet. But the payload carrying capability has not been reduced: it is still 40,000 lbs. in polar orbit, or 65,000 lbs. in an easterly orbit, in a payload compartment that measures 15x60 feet.

The reduction in investment cost is highly significant. It means that the peak funding requirements, in any one year, can be kept down to a level that, even in a highly constrained NASA budget, will still allow for major advances in space science and applications, as well as in aeronautics.

The Shuttle and the Aerospace Industry

The shuttle is a technological challenge requiring the kind of capability that exists today in the aerospace industry. An accelerated start on the shuttle would lead to a direct employment of 8,800 by the end of 1972, and 24,000 by the end of 1973. This cannot compensate for the 270,000 laid off by NASA cutbacks since the peak of the Apollo program but would take [10] up the slack of further layoffs from Skylab and the remainder of the Apollo programs.

Conclusions

Given the fact that manned space flight is part of our lives, and that the U.S. must take part in it, it is essential to reduce drastically the complexity and cost of manned space operations. Only the space shuttle will do this. It will provide both *routine* and *quick reaction* space operations for space science and for civilian and military applications. The shuttle will do this at an investment cost that fits well within a highly constrained NASA budget. It will have low operating costs, and allow 30 to 50 space flights per year at a transportation cost equivalent to 10-15 percent of today's total NASA budget.

Document III-32

Document title: George M. Low, Deputy Administrator, NASA, Memorandum for the Record, "Meeting with the President on January 5, 1972," January 12, 1972.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

NASA leaders James Fletcher and George Low were told in a January 3, 1972, meeting in the office of OMB Director George Shultz that the White House had made a decision to approve the development of a partially reusable shuttle with a 15-foot by 60-foot payload bay. The question of whether solid-fueled or liquid-fueled strap-on boosters would be used was left open for additional study. The next day, Low and Fletcher flew to California to meet on January 5 with President Richard Nixon, who was at the Western White House in San Clemente, for a discussion of the shuttle project. This memorandum records George Low's version of the meeting. After that meeting with the president, the White House announced approval of the shuttle to the press, and Fletcher and Low answered questions about the project.

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[1] Jim Fletcher and I met with the President and John Ehrlichman for approximately 40 minutes to discuss the space shuttle. During the course of the discussion, the President either made or agreed with the following points:

1. **The Space Shuttle.** The President stated that we should stress civilian applications but not to the exclusion of military applications. We should not hesitate to mention the military applications as well. He was interested in the possibility of routine operations and quick reaction times, particularly as these would apply to problems of natural disasters, such as earthquakes or floods. When Dr. Fletcher mentioned a future possibility of collect-

ing solar power in orbit and beaming it down to earth, the President indicated that these kinds of things tend to happen much more quickly than we now expect and that we should not hesitate to talk about them now. He was also interested in the nuclear waste disposal possibilities. The President liked the fact that ordinary people would be able to fly in the shuttle, and that the only requirement for a flight would be that there is a mission to be performed. He also reiterated his concern for preserving the skills of the people in the aerospace industry.

In summary, the President said that even though we now know of many things that the shuttle will be able to do, we should realize that it will open up entirely new fields when we actually have the capability that the shuttle will provide. The President wanted to know if we [2] thought the shuttle was a good investment and, upon receiving our affirmative reply, requested that we stress the fact that the shuttle is not a "$7 billion toy," that it is indeed useful, and that it is a good investment in that it will cut operations costs by a factor of 10. But he indicated that even if it were not a good investment, we would have to do it anyway, because space flight is here to stay. Men are flying in space now and will continue to fly in space, and we'd best be part of it.

2. **International Cooperation.** The President said that he is most interested in making the space program a truly international program and that he had previously expressed that interest. He wanted us to stress international cooperation and participation for *all* nations. He said that he was disappointed that we had been unable to fly foreign astronauts on Apollo, but understood the reasons for our inability to do so. He understood that foreign astronauts of all nations could fly in the shuttle and appeared to be particularly interested in Eastern European participation in the flight program. However, in connection with international cooperation, he is not only interested in flying foreign astronauts, but also in other types of meaningful participation, both in experiments and even in space hardware development.

3. **USSR Cooperation.** The president was interested in our joint activities with the USSR in connection with the probes now in orbit around Mars. We also described to him the real possibility of conducting a joint docking experiment in the 1975 time period. The prospect of having Americans and Russians meet in space in this time period appeared to have great appeal to the President. He indicated that this should be considered as a possible item for early policy level discussions with the USSR.

The president asked John Ehrlichman to mention both the international aspects of the shuttle and the USSR docking possibilities to Henry Kissinger.

George H. Low
cc: A/Dr. Fletcher

Document III-33

Document title: Nick MacNeil, Carter-Mondale Transition Planning Group, to Stuart Eizenstat, Al Stern, David Rubenstein, Barry Blechman, and Dick Steadman, "NASA Recommendations," January 31, 1977.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

Unlike Presidents-elect Kennedy and Nixon, Jimmy Carter did not appoint a blue ribbon group on space during his post-election transition. Instead, the NASA transition paper was prepared by one individual who took a generally skeptical view of NASA and most of its programs. Unlike earlier space transition reports, this document was completed after President Carter entered the White House.

[no pagination] **Summary**

1. NASA's priorities are on the development end of R & D, not the basic research end. NASA directs our R & D resources toward centralized big technology, maintaining the defense R & D orientation of the aerospace industry.

2. The Shuttle has become the end, rather than the means, because NASA space policy has been shaped by the Office of (Manned) Space Flight. The Offices of Space Science, Applications, and Aeronautics Technology get the funds that are left over.

3. Alternative directions for space technology may be neglected because

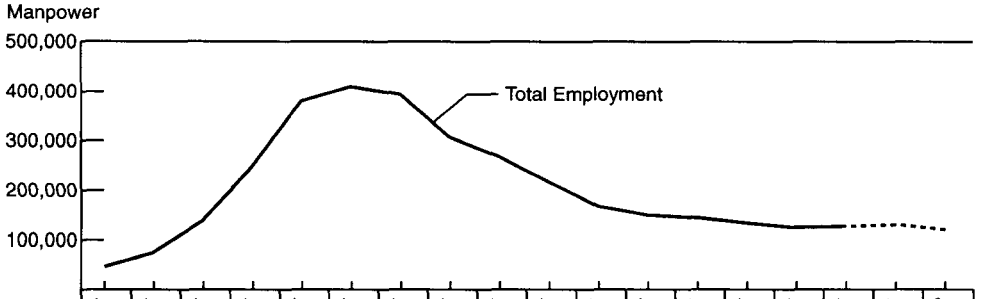
(a) the Administrator's power to hire and fire top management inhibits effective dissent

(b) important NASA managers are from Defense and the aerospace industry

(c) NASA's budget is supported and approved by a space constituency....

1. Budget History

Perhaps the agency's growth, retraction, and resiliency can best be seen in its level of employment since 1962.



	June 1960	June 1961	June 1962	June 1963	June 1964	June 1965	June 1966	June 1967	June 1968	June 1969	June 1970	June 1971	June 1972	June 1973	June 1974	June 1975	June 1976	Sept 1977
Total Employment	46,786	74,577	137,656	246,304	379,084	409,900	393,924	306,926	267,871	218,345	167,803	149,609	144,968	134,055	125,054	127,733	131,016	121,016
Contractor Employment	36,500	57,500	115,500	218,400	347,100	376,700	360,000	273,200	235,400	186,600	136,580	120,130	117,540	108,100	100,200	103,400	106,700	97,200
NASA Employees	10,286	17,077	22,156	27,904	31,984	33,200	33,924	33,726	32,471	31,745	31,223	29,479	27,428	25,955	24,854	24,333	24,316	23,816

In real year dollars NASA funding is 70% [of what] it was in its peak year, and increasing....

3. Funding Justifications Unconvincing

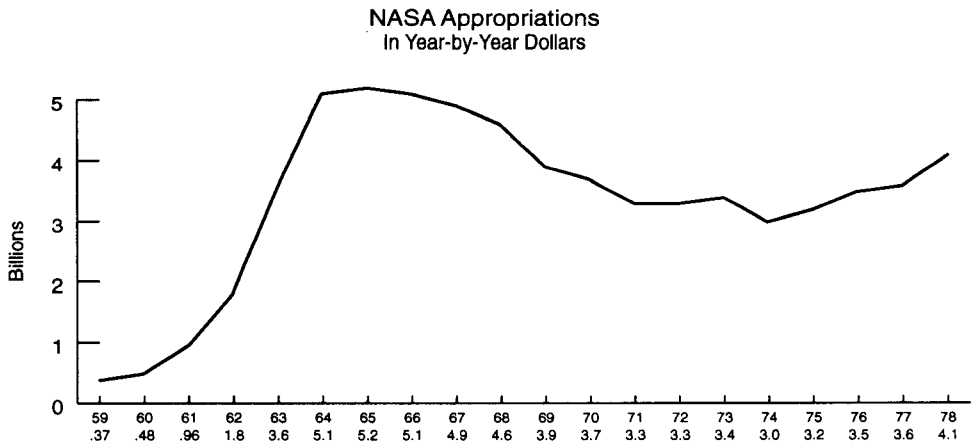
a. **NASA Mission Unclear**

Much apprehension and uneasiness about the NASA budget would disappear if the civilian apace program, like its military counterpart, had clear objectives related to national goals.

DOD, with 38% of the space budget, would deny that its space efforts constitute a program; Defense programs are not ends but rather the means of accomplishing certain military missions, the purpose of which is to defend the nation and its allies from attack. Space programs have to compete with other means of accomplishing the same mission.

The entire NASA budget, on the other hand, is considered R & D. According to the National Science Foundation, "R & D is not an end in itself but is a means whereby national goals can be achieved more effectively and efficiently...."

What are these goals? NASA has more difficulty than most agencies in describing


NASA Appropriations
In Year-by-Year Dollars
Billions
0
1
2
3
4
5
59 .37
60 .48
61 .96
62 1.8
63 3.6
64 5.1
65 5.2
66 5.1
67 4.9
68 4.6
69 3.9
70 3.7
71 3.3
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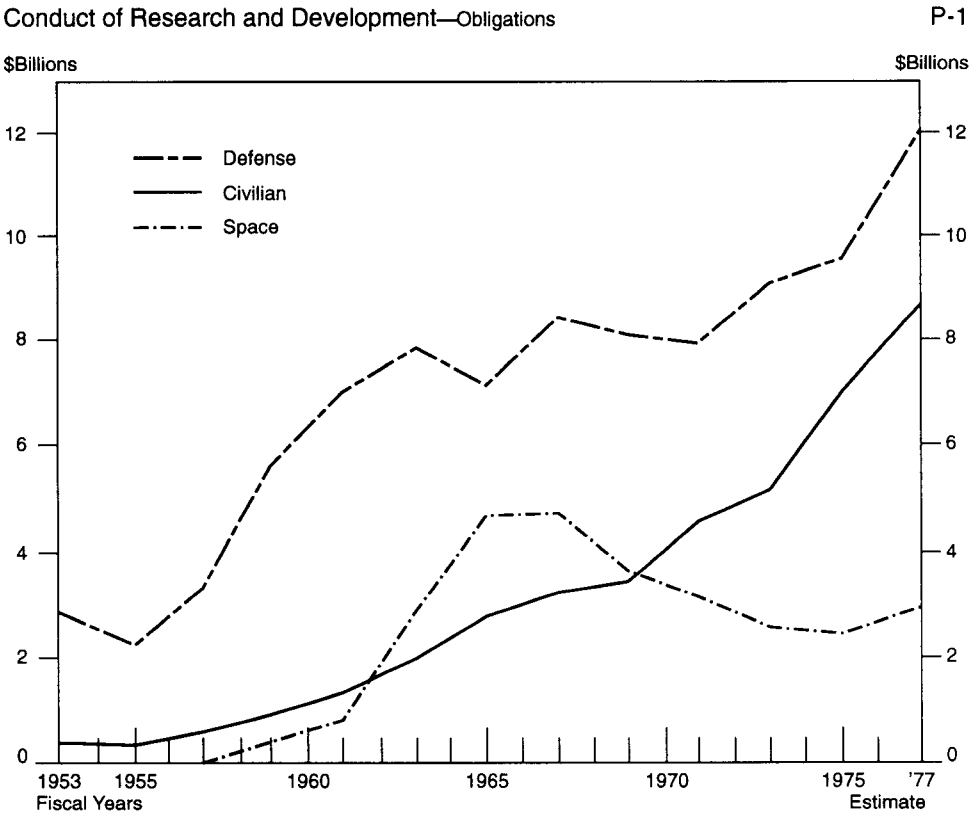
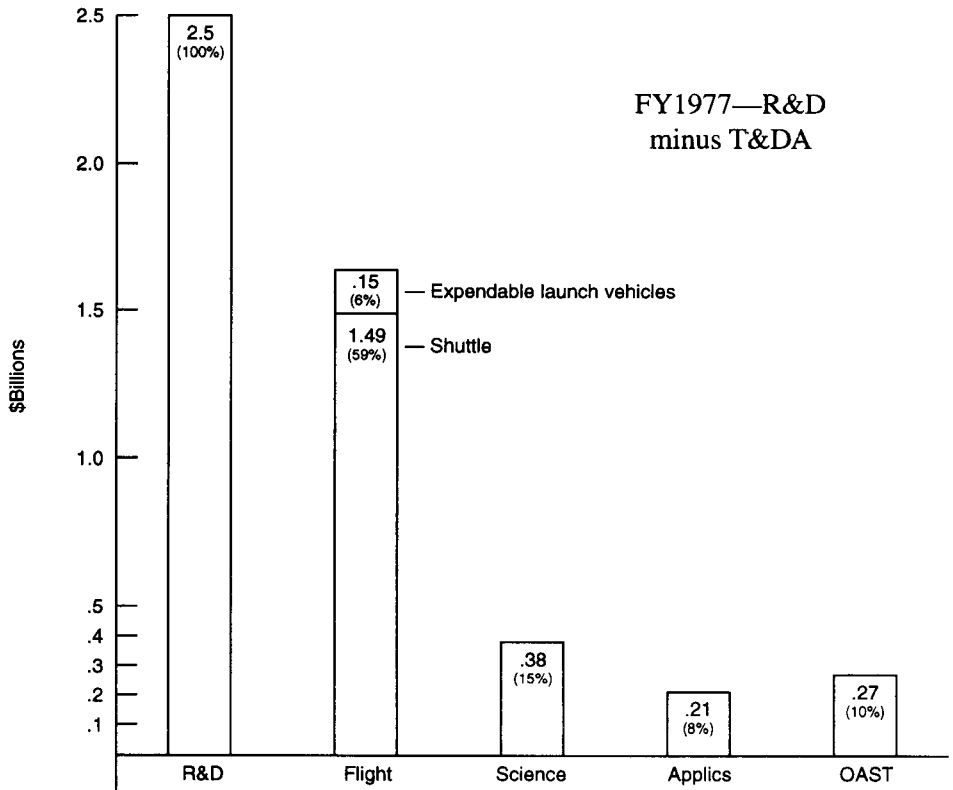
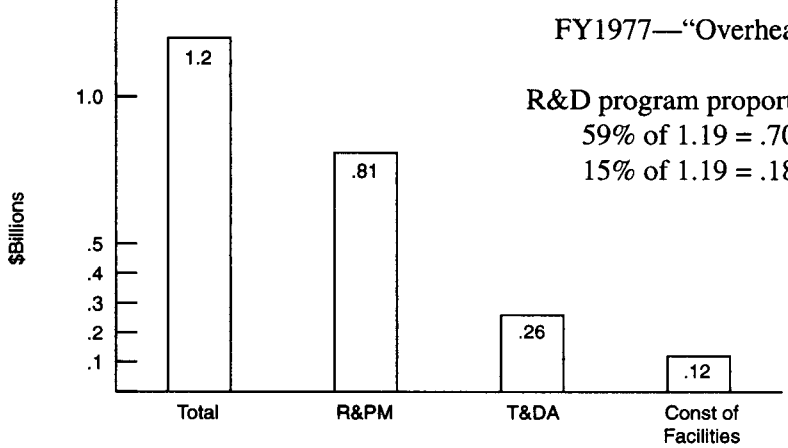
73 3.4
74 3.0
75 3.2
76 3.5
77 3.6
78 4.1


Conduct of Research and Development—Obligations
P-1
$Billions
$Billions
Defense
Civilian
Space
0
2
4
6
8
10
12
1953
1955
1960
1965
1970
1975
'77
Fiscal Years
Estimate


FY1977—R&D
minus T&DA
$Billions
2.5
2.0
1.5
1.0
.5
.4
.3
.2
.1
2.5
(100%)
.15
(6%)
— Expendable launch vehicles
1.49
(59%)
— Shuttle
.38
(15%)
.21
(8%)
.27
(10%)
R&D
Flight
Science
Applics
OAST


FY1977—"Overhead"
R&D program proportions:
59% of 1.19 = .70
15% of 1.19 = .18
$Billions
1.2
1.0
.5
.4
.3
.2
.1
.81
.26
.12
Total
R&PM
T&DA
Const of
Facilities

Construction of Facilities
and Research and Program Management

FY 77 Estimate
(Millions of Dollars)

Program Activities	C of F	R & PM	Function	R & PM
Space Flight	39.8	348.1	Personnel	612.4
Science	8.7	114.2	Travel & Transp.	19.7
Applications	—	87.1	Rent	61.7
Space Research	.7	75.3	Supplies	13.9
Aero Research	28.9	146.2	Equipment	2.5
Support 45.8	43.1		Other	103.9
	124.0	814.0		814.0

national goals in such a way that its programs relate to them. The law establishing NASA is no help in this regard. The National Aeronautics and Space Act of 1958 declares that the general welfare and security of the United States require "adequate provision" for aeronautical and space activities. But then it states that NASA must contribute to one or more of eight objectives, several of which go far beyond the usual understanding of welfare and security. Are we called as a nation to something greater than our welfare and security? There is no guide in law as to what provision is "adequate" for NASA's programs.

b. **The Budgeting Process**

Budgeting decisions are made in a framework provided by space scientists and engineers. This term is short-hand for those employed by NASA, by the aerospace industry, and by the universities. They decide what NASA's mission in space is . . . , they tell us the value of space activities, and they largely determine the share of available funds each program receives . . .

The club seems to achieve a Consensus in-house, by rallying around those programs with enough political appeal to have a spill-over or logjam-breaking effect for the most members. Thus seldom will scientists or engineers openly criticize programs that they consider ill-advised. Budget requests are made to OMB and the public with as little open dissent and as much gravity and consensus as possible. This behavior is the result of a shared outlook. It is aggravated by the ease with which most professional groups accept the "responsible" consensus.

It is true that independent budget evaluations are attempted by OMB, the Appropriations and Budget Committees, and the GAO. But as long as there is a general consensus within the club, and as long as evaluations are based on NASA-commissioned studies, these economy-oriented critiques will not be effectual. Indeed, not all these authorities are economy-oriented. As staffers become familiar with space activities they become interested in them. If pressures build to stimulate the economy, what better place than in one's favorite R & D program?

c. **Unconvincing Arguments**

Most agencies have a wide range of arguments to back up budget requests but they usually use these arguments informally. At budget hearings an agency will try to keep it simple. Informal arguments might lose some of their appeal to individual interests if they were listed together, and exposed to criticism.

Critics of a particular program would do a service if they took issue not only with the program's formal justification but with all the other claims that are made in support of it. However, the critic runs the risk of strengthening his case logically and weakening it here

National Aeronautics and Space Administration

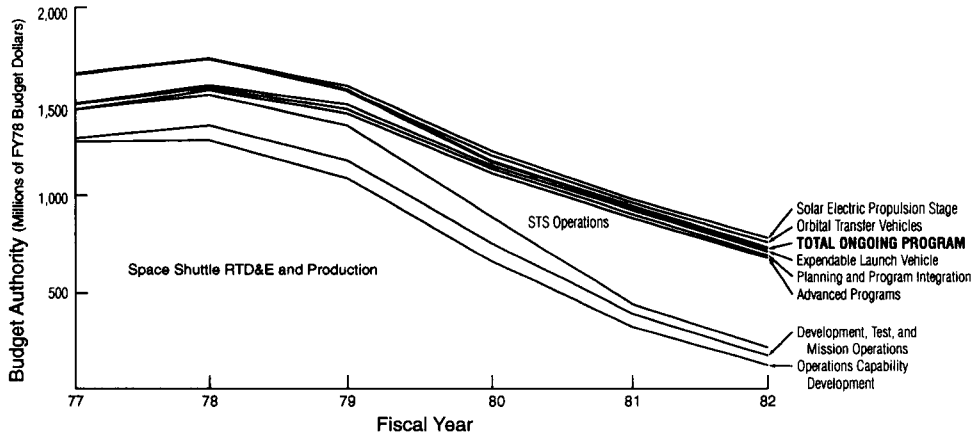
FY 1978 Budget Estimates
($Millions)

Budget Authority	FY 1976	T. P.	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
				FY 1978 Program Runout				
Research & Development								
Space Shuttle	1,206.0	321.0	1,288.1	1,302.7	1,115.4	680.8	343.9	135.9
Space Flight Operations	188.7	48.4	202.2	297.6	360.4	508.7	594.0	592.1
Expendable Launch Vehicles	165.9	37.1	151.4	138.5	95.4	45.2	25.6	20.8
Suborbital Flight	1,560.6	406.5	1,641.7	1,738.8	1,571.2	1,234.7	963.5	748.8
Physics and Astronomy	159.3	43.5	166.3	234.1	270.2	266.9	264.0	235.7
Lunar & Planetary Expl	254.2	67.5	191.9	170.3	216.2	225.9	152.1	84.4
Life Sciences	20.6	5.4	22.1	36.4	51.1	58.5	63.8	67.9
Subtotal Science	434.1	116.4	380.3	440.8	537.5	551.3	479.9	388.0
Space Applications	178.2	47.7	198.2	224.8	242.8	266.4	163.0	135.5
Multi-Mission Modular S/C	-0-	-0-	-0-	25.0	40.0	21.0	2.5	-0-
Space Research & Tech.	74.9	19.3	82.0	115.0	114.7	112.9	~110.4	110.2
Aeronautical Res. & Tech.	175.4	43.8	190.1	245.6	302.1	311.6	264.4	'198.5
Subtotal OAST	250.3	63.1	272.1	360.6	416.8	424.5	374.8	308.7
Tracking & Data Acquisition	240.8	63.4	255.0	284.3	312.8	384.7	376.0	374.8
Technology Utilization	7.5	2.0	8.1	10.0	10.0	10.0	10.0	10.0
Energy Technology Applic.	5.9	1.5	6.0	8.5	10.5	5.O	5.0	5.0
Subtotal R&D	2,677.4	700.6	2,761.4	3,092.8	3,141.6	2,857.6	2,374.7	1,970.8
Construction of Facilities	82.1	10.7	118.1	19 5.6	200.O	161.0	125.O	110.0
Research & Program Management	792.3	220.8	813.0	818.5	818.5	818.5	818.5	818.5
Total NASA	3551.8	932.1	3,692.5	4,106.9	4,160.1	3,837.1	3,318.2	2,899.3
Additional Requirement								
Procurement of Fourth and Fifth Shuttle Orbiter				46.5	141.4	213.3	278.4	291.2
Grand Total	3,551.8	932.1	3,692.5	4,153.4	4301.5	4,050.4	3,596.6	3,190.5

National Aeronautics and Space Administration
New Starts in FY 1978 Budget
($Millions)

Research and Development	FY 1978	FY 1979	FY 1980	FY 1981	FY1982	Balance	Total
Space Flight Operations	15.0						15.0
Space Industrialization	15.0						15.0
Physics and Astronomy	36.0	79.4	92.0	95.7	66.8		435.0
Space Telescope	36.0	79.4	92.0	95.7	66.8	65.1	435.0
Lunar and Planetary Exp.	47.8	122.6	139.4	75.3	21.6		406.7
Jupiter Orbiter Probe	20.7	78.7	102.0	61.4	18.9		281.7
Lunar Polar Orbiter	7.1	43.9	37.4	13.9	2.7		105.0
Mars Follow-on	20.0						20.0
Applications	14.0	60.0	72.0	34.0	15.0	18.0	213.0
Landsat D	14.0	60.0	72.0	34.0	15.0	18.0	213.0
Multi-Mission Modular Spacecraft	25.0	40.0	21.0	2.5			88.5
Aeronautics	4.2	10.5	19.6	17.2	5.5		57.0
Lift Cruise Fan Research Aircraft	4.2	10.5	19.6	17.2	5.5		57.0
Expendable Launch Vehicles	.4	17.3	6.5				
Landsat D		11.0	4.9				
Lunar Polar Orbiter	.4	6.3	1.6				
Tracking & Data AcquisitionSupport	2.6	4.9	9.9	7.1	10.2		
Total New Starts	145.0	334.7	360.4	231.8	119.1		

	1975 Actual ($Thousands)	1977 Budget Estimate ($Thousands)
Space Shuttle	797,500	1,288,100
Space Flight Operations	298,800	205,200
Expendable Launch Vehicles	139,500	151,400
Total	1,235,800	1,644,700



and there politically. Inaccurate claims can usually be asserted more quickly than they can be refuted.

Unconvincing arguments tend to weaken the aura of scientific invincibility and suggest a bureaucratic tendency to keep trying a multitude of arguments to weaken people's resistance, or to provide that particular argument which one group can accept. This list is by no means complete.

(1) The "Critical Threshold" Argument

NASA will maintain that funding must be kept at a certain level to preserve the necessary scientific and engineering base in people and facilities.

There is no one threshold, but a series of thresholds depending on the level and the purpose of R & D. The concept itself is suspect: if a base could be created when needed, it can be recreated. The costs of starting it up must be balanced against the costs of an entrenchment process that diverts the government's attention and funds from new problems, or new approaches to old problems.

(2) NASA's Stimulative Effect on the Economy

It is claimed that NASA expenditures are highly labor intensive, have a high multiplier effect, are not inflationary, and return the investment many times over due to the advanced technology involved.

Aside from the fact that these are the findings of studies commissioned by NASA (see following section on vested experts), the point is not how stimulative NASA spending is in absolute terms, but how stimulative it is compared to equivalent spending by some other agency in some other sector, or by different fiscal and monetary policies.

(3) The Level Budget "Commitment" of January 1972

NASA often refers to OMB assurances that it would have a funding floor in constant dollars to build the shuttle. Actually the "commitment" was made by NASA, not by OMB. The political process does not permit long-term commitments to controversial programs, yet claims of a "commitment" are still heard.

(4) The "Cutting Edge" of Technology

In simplest form this argument holds that what makes America preeminent is advanced technology, and that we depend on it for our defense and foreign exchange earnings. The "cutting edge" is never far from nuclear energy and the aerospace industry, and in these areas the high quality of research brings the highest return on our R & D dollars.

This argument confuses the value of R & D with subjective judgments on the value of different types of R & D. The issue should not be whether aircraft sales are a major earner of foreign exchange, but whether some other industry would have produced greater social and economic benefits if an equivalent amount had been invested in it. As to quality of

research, talent follows money.

Our military and space efforts might well benefit from cheaper, more numerous and more expendable units. See Annex D,

(5) Individual Science Programs Vital

This tactic is to evaluate individual science programs in isolation from basic research policy. The stress is on the worthy objective and not on whether the program is cost effective, or whether data are related to results from recent or concurrent programs, or whether technology offers the possibility of leap-frogging to a more advanced stage.

The Space Telescope is a case in point. If observations are vastly improved outside the earth's atmosphere, why have observatories been built or upgraded recently in Chile, Mexico, Hawaii, Puerto Rico, and Arizona? Is there duplication from military space programs?

(6) National Security, or A Race with the Russians

The space club is not averse to taking a page out of DOD's book. When pressed, NASA will disclaim competition, but say the Russians are ahead.

DR. FLETCHER. We don't regard ourselves as being in a race with the Soviet Union. We do feel that we cannot fall too far behind in technology.

Some proponents will say that NASA programs have profound security implications. These claims suggest that DOD does not recognize certain defense needs, or that NASA should pay for a certain part of national defense.

(7) International Prestige

Akin to national defense is the notion that to keep our political and cultural values in high esteem, here and abroad, we must periodically give a display of technological virtuosity. Perhaps a winning team in sports or technology helps Americans feel less threatened by foreign developments beyond our control. We transfer vigor and Number 1 status in a particular field, to the nation as a whole. Selling international prestige on this basis panders to people's insecurities.

(8) The Call of Adventure

Adventure covers a variety of appeals to our emotions and imaginations.

– Vicarious space travel: e.g. the Shuttle will have hygienic facilities for both men and women and that "average" people—non-astronauts—will be placed in orbit, to obtain the "liberating perspectives" of space

– Creativity: e.g. the space program fills the same human need as cathedral-building in the Middle Ages.

– An Alternative to War: e.g. World War I might have been avoided if European nations could have vented their aggressiveness on space operations rather than armaments.

– A New Start for Mankind: e.g. artists' conceptions of space colonies, space factories.

– America's Destiny: e.g. the United States is the only country on this planet that can answer the riddle of man.

– Spectator Sport: e.g. Astronauts—technological sports figures—may do more to heighten this sense of adventure than to justify the added expense of manned over un-manned space missions. Perhaps they can be likened to a strong football team, that provides the gate receipts to support other athletic programs.

As with the international prestige appeal, there is a touch of "Madison Avenue" to this—space is more than R & D—it is patriotism, "gee-whiz" technology, entertainment, creativity, our national destiny. But the very success of these appeals to our emotions and imaginations shows that welfare and security are not the total of human aspiration. We enter a decision-making area full of risk for public policy which imposes certain responsibilities on government officials. Programs funded emotionally often lead to waste, empty psychological gratifications, and inflation. Ancient and recent history offer examples of peoples who have asserted their values and spirit in unprecedented, uneconomic programs that drained them, sometimes fatally, of their vitality and resources. The display of power was as important as the end it was put to. See Annex, Shuttle Justifications, 2g.

But non-economic or "irrational" motivations do exist, and they carry the potential for great creativity as well as great waste. Adventurous social programs and R & D programs

have given us new knowledge, new powers and perhaps a new identity. Thus it is essential to argue over what kind of adventure we are getting into, and the costs. This is almost impossible when budget requests are made entirely on economic grounds, and the appeal to non-economic motivations is under the table. (See Recommendations.)

(9) Fait Accompli Statement

"The debate over manned vs. unmanned space flight was settled by the decision to build the Shuttle." This ploy can be used for most programs. It was a favorite for continuing the Vietnam war.

d. **Expert vs. Popular Opinion**

Related to the consensus of scientists and engineers with regard to budget requests is the absence of an outside vantage point that the layman could turn to for a professional but fresh perspective. The problem goes beyond the natural similarity of viewpoint of persons in the same field. As then Senator Mondale asked on May 9, 1972:

How can Congress and the public approve massive spending on new technology programs without the benefit of independent evaluations of such programs?

NASA's contractors are not likely to offer opinions which have not been checked with NASA. At times estimates suggest a form of blackmail:

NASA said that if the expendable alternate were selected, a further analysis might increase the development cost of the new expendable (launch vehicles) by about 1 billion dollars.[1]

On the one hand there must be a taxpayer counterweight to vested expert opinion. On the other hand there must be disinterested expert opinion to dampen public enthusiasm for space programs based on psychic gratifications rather than economic or scientific returns. Those who find entertainment or the solution to war in space may ultimately push space expenditures higher than space scientists and engineers. The object of both counterweights is to use national resources wisely.

4. Recommendations

a. **Outline National Goals—for example—**

(1) The President's Economic Goals:
- 4 1/2% unemployment by 1981
- inflation under x%
- a balanced budget, amounting to 21% of GNP
- a relatively favorable balance of trade

(2) Defense Against Military Threat
(3) Pollution at Acceptable Levels
(4) International Collaboration, Project Humanitarian Values
(5) Scientific Discovery
(6) A program to Express National Values and Energy (?)

b. **Outline Corresponding Space Programs—for example—**

(1) Defense Satellites
(2) Scientific Probes, Experiments
(3) Economic Application Satellites (crop and weather forecasting, resource management)
(4) Pollution Detection Devices
(5) Public Service Satellites (education, search and rescue)
(6) Solar Energy Platform
(7) Reimbursable Projects (communications satellites, space manufacturing)
(8) International Cooperative Ventures (To train foreign scientists, share information, share the expense, use and seek superior talent.) To make these ventures effective the U.S. should avoid paternalism, or the notion that our resources give us a Manifest Destiny in space.

[1] Note that there is no comparison of *total* development costs of expendable and reusable launch systems.

(9) Experimental Civilian R & D Develop technology that applies to the way people live now, in this country and abroad.
See Annex D, NASA's R & D Direction.

c. **Accurate Labelling**

Avoid the scientific mystique. Justify programs in terms of all other activity being carried out to achieve the same broad objective. Set forth all the arguments used to support the program, strong or weak, point by point, if the program is based partly on non-economic considerations, such as curiosity or adventure, make that part of the appeal explicit, so that the rest of us can recognize the trade-offs and judge for ourselves whether the adventure will strengthen or weaken us in the long run.

d. **Downgrade Economic Objectives**

Economic stimulation should take a back seat when R & D programs are funded, because these programs invest in personnel and facilities that are far more specialized and influential, and multiply more rapidly, than the constituencies of non-R & D programs. Multiplying the supply of program administrators multiplies the demand for more of the same. This skews the economy more than it stimulates it. See Annex D, NASA's R & D Direction, Constituencies.

e. **Curb Budget Expansion**

Through Executive Order establish an obstacle course of hearings, studies and consultations for budget increases over, say, 5%. Once a benchmark budget has been set, vary the size of the slices, not the pie.... When priorities change, resources must be shifted, not added on. Scientists and engineers should be encouraged to blunt their spears on each other rather than the Administration.

f. **Use a Science/R&D Jury to Recommend R & D Priorities to the President**

Appoint a Science/R&D Council, headed by the Vice President, made up of distinguished laymen, to recommend allocation of R & D funding as to function and agency....

This Council would not resemble the President's new Committee on Science and Technology. It would present the president with a proposed R & D budget. Its members would represent labor, business, education, consumers, the press and other sectors without being weighted 2 to 1 in favor of engineers, scientists and bureaucrats. The members would serve full-time, for a year, without staff.

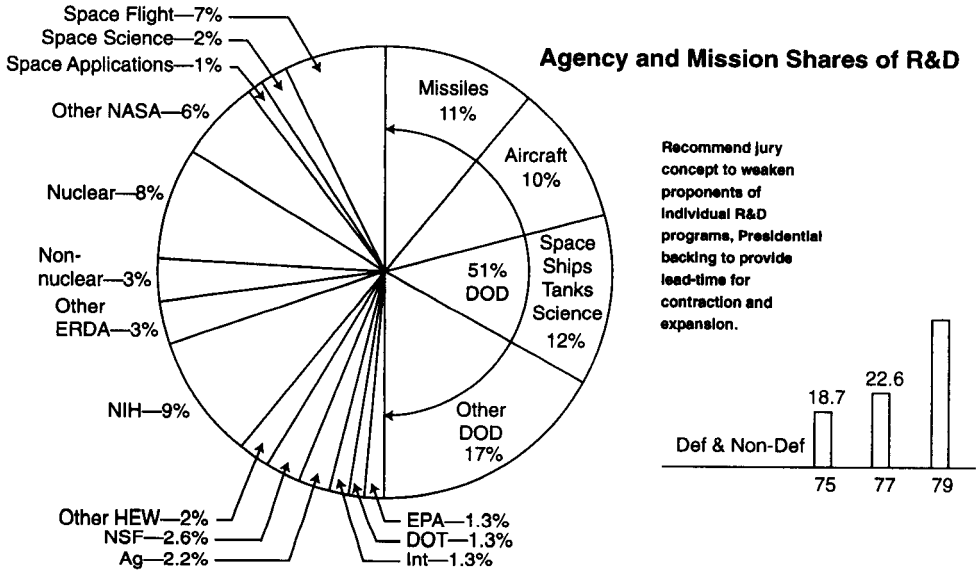
The Council would hear expert testimony from scientists, engineers, and those most knowledgeable about R & D. Its recommended budget would include military as well as civilian R & D in the space field, for example, the members would have security clearances adequate to allow them to try to fund military and space programs from the same "pie," minimizing duplication and maximizing multiple missions.

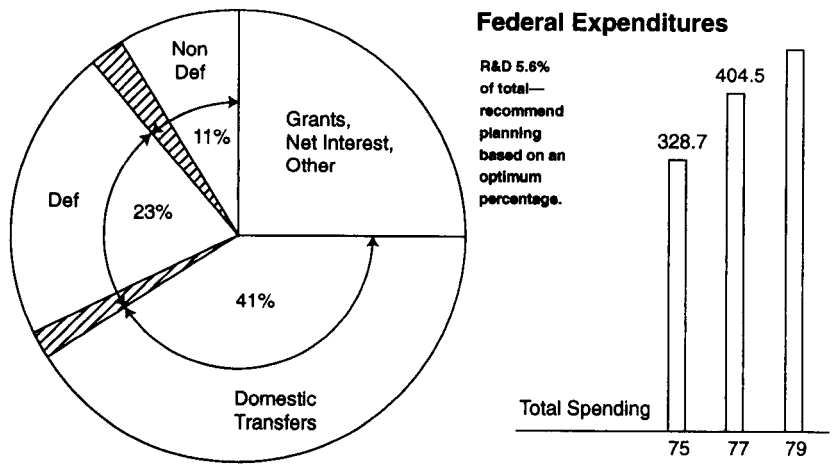
Discussion:

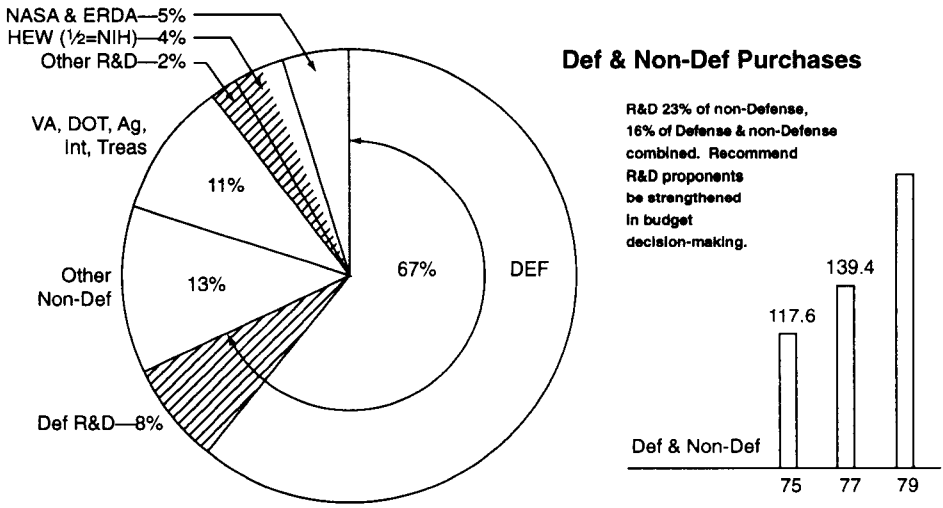
In seeking impartiality for decision-makers it would seem logical to assign laymen to determine *the over-all size* of the Science/R&D budget, and scientists and engineers to decide *how the R & D pie will be divided.* But more impartiality can be achieved by reversing the roles.

At the level of deciding between the nation's R & D and other non-defense goods and services (assuming this model is accepted, laymen are not disinterested, and may be too shortsighted to see the value of R & D, whereas the parochialism of scientific and engineering opinion would be less at the overall R & D level than at the level of funding individual R & D programs. At the program level, experts seek national commitments to their own programs, thus tending to jack up overall R & D on political considerations. Expert opinion at the *overall* R & D level, however, might dampen this effect. A compromise would be to set R & D within a narrow percentage range of general spending (not GNP).

R & D priorities are as political as they are scientific. A full debate is necessary. Without it we will be less likely to achieve mid-range budgetary stability and more importantly the lead-time necessary for contractors and scientists to prepare themselves for new problems and priorities.


Agency and Mission Shares of R&D
Space Flight—7%
Space Science—2%
Space Applications—1%
Other NASA—6%
Nuclear—8%
Non-nuclear—3%
Other ERDA—3%
NIH—9%
Other HEW—2%
NSF—2.6%
Ag—2.2%
EPA—1.3%
DOT—1.3%
Int—1.3%
Missiles 11%
Aircraft 10%
Space Ships Tanks Science 12%
51% DOD
Other DOD 17%
Recommend jury concept to weaken proponents of individual R&D programs, Presidential backing to provide lead-time for contraction and expansion.
18.7
22.6
Def & Non-Def
75
77
79


Federal Expenditures
Non Def
11%
Grants, Net Interest, Other
Def
23%
41%
Domestic Transfers
R&D 5.6% of total—recommend planning based on an optimum percentage.
328.7
404.5
Total Spending
75
77
79



g. **Enforce ONE Circular A-109; Decentralize**

Depending on how one defines a need, circular A-109 could have prevented the Shuttle controversy. The circular states:

"When analysis of an agency's mission shows that a need for a new major system exists, such a need should not be defined in equipment terms, but should be defined in terms of the mission, purpose, capability, agency components involved, schedule and cost objectives, and operating constraints."

The present arrangement allows Space Flight to turn to Space Science and Space Applications and say "Here is your equipment, the Shuttle. Make use of it." Manned Space Flight will then find a new project. When it can no longer carry the expense of the Spacelab, or Space Industrialization, it will turn these half-started programs over to Science or Applications, the offices which should have controlled R & D from the beginning.

To take mission-orientation further, overhead could be funded out of the end-result offices (Science, Applications, and OAST). The NASA Comptroller would be split in three, and those three offices would draw up budget requests for C of F and R & PM. Facilities would bill those 3 offices for services rendered. (OMB and the GAO would have to ensure that billings represent the full cost of government facilities and personnel.) In effect all work would be contracted out, to either private or government contractors, whichever program management preferred.

Some of the advantages of decentralized budgeting are the following:

– it would weaken the agency's hierarchy, its institutional values, its growth as a bureaucracy.

– it would force economies on laboratories and facilities of marginal usefulness.

– it would increase the practical applications of independent (unstructured) R & D.

– it would make programs available to facilities, and facilities available to programs, across the board. Facilities and laboratories affected would be subject to a wider range of ideas and work opportunities.

– it would require ways of making the Civil Service more responsive to public needs.

h. **Reorient NASA Leadership**

Section 203 (b) (2) of the 1958 Aeronautics and Space Act allows the ASH Administrator to hire up to 425 executives, and set their salaries to the top Civil Service grades. This high number of excepted positions tends to unify top management. Unity is more beneficial to the implementation of policy than to the formation of it.

This system naturally lends itself to the notion of a network, and a perception that when RIFs come the Civil Service takes a disproportionate share. The system may also be related to NASA's poor Equal Employment Opportunity (EEO) record, discussed in Annex E.

Disturbing also is the number of former military personnel and former NASA contractors within the excepted positions. They cannot help but affect relations between NASA, Defense, and industry, and the kinds of work that NASA undertakes. Likewise a survey should be made of where NASA scientists have done their work. There may be a certain parochialism among the prestige institutions. This too may affect the kinds of work NASA does, who does it, and where.

If the thrust of this memorandum is followed, a new Administrator will have to come from outside the space club. He or she will have to be willing and able to use his authority to remove NASA veterans from excepted positions, and replace them with younger professionals. The purpose of these changes would be:

- to make NASA's personnel system more responsive to need, not less.
- implement the spirit of EEO.
- offset the steady increase in the average age of NASA employees.
- encourage disciplined dissent.

i. Postpone the Appointment of a Science Adviser (OSTP) and a NASA Administrator Until These Issues Nave Been Discussed

Do not approve new starts at NASA until the budget decision-making has been studied. Do not be rushed. If an attempt is made to challenge the experts who choose our options, appoint science and R & D officials who will support the new approach and make it work.

5. Options

The three options listed probably bear little relation to OMB options, which reflect expert opinion. My options suggest that we explore new directions for R & D, that we not commit ourselves to Shuttle operations, regardless of "cost-effectiveness," and that we give laymen a share in setting R & D priorities. To sum up, the options are based on keeping control of the agency.[2]

The options also reflect a bias toward Space Applications. Admittedly there are no options as to how Applications could use additional resources, but current NASA emphasis suggests that money (and talent) thrown at this area could bring significant results.

Option 1 - Appoint "jury" to recommend all R & D program priorities.

Budget effect - Unlikely to change level of space funding, but might favor Applications over Flight and Science.

Discussion

OMB states that R & D funding "is not a separately program[m]ed or budgeted activity of the Federal Government. Its funding must therefore be considered primarily in light of the potential contributions of science and technology to meeting agency or national goals and not as an end in itself."

Realizing that "therefore" belongs to the first sentence, not the second, the crucial point is that agency or national goals are slurred together. There is often a time-lag between *agency goals* and new perceptions of how *national goals* can be achieved. Since R & D needs more lead-time it is important that agency R & D decisions be subject to modification by a group with a totally national perspective.

[2] OMB may not see this as a problem. In discussing NASA's FY 1979 budget request, an OMB report states: "Substantial flexibility exists for reducing future year funding based on long-range policy and budget decisions in future budgets"—as if a program's constituency did not grow and gain a wider hearing, as if our investment does not bind us tighter to a program, with each passing year.

Advantages	Disadvantages
1. Less overlap between military and civilian space programs.	1. "Jury" unqualified to grasp issues involved.
2. Build broader consensus for longer-range planning, more lead-time for contractors.	2. "Jury" will become the captive of a particular R & D faction.
3. A form of Executive oversight over Defense R & D.	
4. More attention to national goals than agency goals.	

Option 2 - Build only three Shuttles. Use Shuttle for R & D and as required by individual missions.

Budget effect - Gradual reduction instead of sharp increase in Shuttle expenditure. FY 1978 is build-up year.

Discussion

Using the Shuttle as an R & D program for launch and payload reusability, while improving expendable systems, will provide greater flexibility. Some resources can be shifted to Space Applications. Publicize DOD distrust, and Mondale, Proxmire and GAO objections. OMB notes "widely divergent views."

Advantages	Disadvantages
1. Change the big-program legacy of NASA; re-direct R & D from "producers" to "consumers."	1. Political repercussions from areas surrounding affected facilities.
2. Take advantage of new broom; use press and public concern over inflation and bureaucracy.	2. Wide currency of "cost-effectiveness" argument.
3. Decision to put "Carter imprint" on Applications, give shuttle contractors an advantage in seeking Applications contracts.	
4. Catch up in expendable vehicle technology, building Fords instead of Cadillacs.	
5. More Science and Applications value per dollar spent, less drama.	

Option 3 - Expand the NASA charter to provide limited funding for specified technological breakthroughs.

Budget Effect - None.

Discussion

NASA coordinates with other agencies, industry and academia. It has capabilities in energy research, materials development, and across the spectrum of advanced technology. It put a man on the moon. It thinks more about the future than other agencies.

Why not challenge NASA to find technological breakthroughs to problems here on earth? NASA would serve as a gadfly, to weaken monopolization of R & D fields by other

agencies. Congress and NASA would draw up a list of problems most susceptible to new technology, and NASA would in effect bid for a contract. New automobiles, insulation, and housing modules come to mind. See Annex U, NASA's R & D Direction, section 3.

Advantages	Disadvantages
1. Encourage new interdisciplinary approaches to old problems....	1. Maintain unneeded personnel and facilities on harebrained schemes.

Document III-34

Document title: Presidential Directive/NSC-37, "National Space Policy," May 11, 1978.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

This directive resulted from a comprehensive review of U.S. space policy and programs undertaken during the early months of the Carter administration. It dealt primarily with the relationships among the civilian and national security portions of the national space program; its policy guidance with respect to the national security aspects of the effort was highly classified. The review was carried out under the auspices of the National Security Council, and it established a National Security Council Policy Review Committee chaired by the Director of the White House Office of Science and Technology Policy, Frank Press, as the mechanism for space policy formulation.

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[1]

Presidential Directive/NSC-37

May 11, 1978

This directive establishes national policies which shall guide the conduct of United States activities in and related to the space programs and activities discussed below. The objectives of these policies are (1) to advance the interests of the United States through the exploration and use of space and (2) to cooperate with other nations in maintaining the freedom of space for all activities which enhance the security and welfare of mankind.

1. The United States space program shall be conducted in accordance with the following basic principles.

[2] a. [paragraph deleted during declassification review]

b. The exploration and use of outer space in support of the national well-being and policies of the United States.

c. Rejection of any claims to sovereignty over outer space or over celestial bodies, or any portion thereof, and rejection of any limitations on the fundamental right to acquire data from space.

d. The space systems of any nation are national property and have the right of passage through and operations in space without interference. Purposeful interference with operational space systems shall be viewed as an infringement upon sovereign rights.

e. The United States will pursue Activities in space in support of its right of self-defense.

f. [paragraph deleted during declassification review]

g. The United States will pursue space activities to increase scientific knowledge, develop useful civil applications of space technology, and maintain United States leadership in space.

h. The United States will conduct international cooperative space-related activities that are beneficial to the United States scientifically, politically, economically, and/or militarily.

i. [paragraph deleted during declassification review]

j. [paragraph deleted during declassification review]

[3] k. Close coordination, cooperation, and information exchange will be maintained among the space sectors to avoid unnecessary duplication and to allow maximum cross-utilization, in compliance with security and policy guidance, of all capabilities.

2. [remainder of page deleted during declassification review]

[4] 3. [paragraph deleted during declassification review]

4. The United States shall conduct civil space programs to increase the body of scientific knowledge about the earth and the universe; to develop and operate civil applications of space technology; to maintain United States leadership in space science, applications, and technology; and to further United States domestic and foreign policy objectives. The following policies shall govern the conduct of the civil space program.

a. The United States shall encourage domestic commercial exploitation of space capabilities and systems for economic benefit and to promote the technological position of the United States, except that all United States earth-oriented remote sensing satellites will require United States Government authorization and supervision of regulation.

b. [paragraph deleted during declassification review]

c. Data and results from the civil space programs will be provided the widest practical dissemination, except where specific exceptions defined by legislation, Executive Order, or directive apply.

d. [paragraph deleted during declassification review]

[5] e. [paragraph deleted during declassification review]

f. [paragraph deleted during declassification review]

5. The NSC Policy Review Committee shall meet when appropriate to provide a forum to all federal agencies for their policy views; to review and advise on proposed changes to national space policy; to resolve issues referred to the Committee; and to provide for orderly and rapid referral of open issues to the President for decision as necessary. The PRC will meet at the call of the Chairman for these purposes, and when so convened, will be chaired by the Director, Office of Science and Technology Policy.

Jimmy Carter

Document III-35

Document title: Zbigniew Brzezinski, Presidential Directive/NSC-42, "Civil and Further National Space Policy," October 10, 1978.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

An initial assignment of the Policy Review Committee (Space) established by Presidential Directive/NSC-37 was to carry out a detailed review of civilian space policy and several other outstanding issues. NASA and its allies, recognizing that shuttle development was only a few years from completion, were beginning to lobby the White House for a new large-scale space initiative, and the president in this directive took a position on such a possibility. Other portions of the directive dealt with shuttle utilization for both civilian and national security missions.

[1]

Presidential Directive/NSC-42

October 10, 1978

This directive establishes national policies based on Presidential review of space policy issues submitted by the Policy Review Committee (Space). The President has approved civil and further national space policies which shall guide the conduct of United States space programs and activities discussed below. These policies are consistent with and; augment decisions reached in PD/NSC-37–National Space Policy.

ADMINISTRATION CIVIL SPACE POLICY. The United States' overarching civil space policy will be composed of three basic components.

First: Space activities will be pursued because they can be uniquely or more efficiently accomplished in space. Our space policy will become more evolutionary rather than centering around a single, massive engineering feat. Pluralistic objectives and needs of our society will set the course for future space efforts.

[2] Second: Our space policy will reflect a balanced strategy of applications, science, and technology development containing essential key elements that will:

– Emphasize applications that will bring important benefits to our understanding of earth resources, climate, weather, pollution, and agriculture.

– Emphasize space science and exploration in a manner that permits the nation to retain the vitality of its space technology base, yet provides short-term flexibility to impose fiscal constraints when conditions warrant.

– Take advantage of the flexibility of the Space Shuttle to reduce operating costs over the next two decades.

– Increase benefits by increasing efficiency through better integration and technology transfer among the national programs and through more joint projects.

– Assure US scientific and technological leadership for the security and welfare of the nation and to continue R&D necessary to provide the basis for later programmatic decisions.

– Provide for the private sector to take an increasing responsibility in remote sensing and other applications.

– Demonstrate advanced technological capabilities in open and imaginative ways having benefit for developing as well as developed countries.

– Foster space cooperation with nations by conducting joint programs.

– Confirm our support for the continued development of a legal regime for space that will assure its safe and peaceful use for the benefit of all mankind.

Third: It is neither feasible nor necessary at this time to commit the US to a high-challenge, highly-visible space engineering initiative comparable to Apollo. As the resources and manpower requirements for Shuttle development phase down, we will have the flexibility to give greater attention to new space applications and exploration, continue programs at present levels, or contract them. An adequate Federal budget commitment will be made to meet the objectives outlined above.

[3] **SPACE APPLICATIONS.** The President has approved the following:

Government Role in Remote Sensing

1. **Land Programs.** Experimentation and demonstrations will continue with LANDSAT as a developmental program. Operational uses of data from the experimental system will continue to be made by public and private users prepared to do so. Strategies for the future of our civil remote sensing efforts are to be addressed in the FY 1980 budget-review. This review should examine approaches to permit flexibility to best meet the appropriate technology mix, organizational arrangements, and potential to involve the private sector.

2. **Integrated Remote Sensing System.** NASA will chair an interagency task force to examine options for integrating current and future potential systems into an integrated

national system. This review will cover technical, programmatic, private sector, and institutional arrangements. Emphasis will be placed on user requirements; as such, agency participation will include Commerce, Agriculture, Interior, Energy, State, appropriate Executive Office participation, as well as Defense, the DCI, and others as appropriate. This task force will submit recommendations to the Policy Review Committee (Space) by August 1, 1979, for forwarding to the President prior to the FY 1981 budget review.

3. **Weather Programs**. In the FY 1980 budget review, OMB–in cooperation with Defense, the DCI, NASA, and NOAA–will conduct a cross-cut review of meteorological satellite programs to determine the potential for future budgetary savings and program efficiency. Based on this cross-cut, the Policy Review Committee (Space) will assess the feasibility and policy implications of program consolidation by April 1, 1979.

4. **Ocean Programs**. Any proposed FY 1980 new start for initial development of a National Oceanic Satellite System (NOSS) will be reviewed based on a ZBB priority ranking. The Policy Review Committee (Space) will assess the policy implications of combining civil and military programs as part of this process.

[4] 5. **Private Sector Involvement.** Under the joint chairmanship of Commerce and NASA, along with other appropriate agencies, a plan of action will be prepared by February 1, 1979, on how to encourage private investment and direct participation in the establishment and operations of civil remote sensing systems. NASA and Commerce jointly will be the contacts for the private sector on this matter and will analyze proposals received before submitting to the Policy Review Committee (Space) for consideration and action.

Communications Satellite R&D. NASA will undertake carefully selected communications technology R&D. The emphasis will be to provide better frequency and orbit utilization approaches. Specific projects selected will compete with other activities in the budget process.

Communications Satellite Services. Commerce's National Telecommunications and Information Administration (NTIA) will formulate policy to assist in market aggregation, technology transfer, and possible development of domestic and international public satellite services. This policy direction is intended to stimulate the aggregation of the public service market and for advanced research and development of technology for low-cost services. Under NTIA this effort will include: (a) an identified 4-year core budget for Commerce to establish a management structure–competitive against other budgetary priorities in Commerce–to purchase bulk services for domestic and international use; (b) support for advanced R&D on technologies to serve users with low-volume traffic requirements subject to its competitiveness against other applications expenditures; and (c) AID and Interior coordination with NTIA in translating domestic experience in emerging public service programs into potential programs for lesser-developed countries and remote territories. (U)

Long-term Economic Activity. It is too early to make a commitment to the development of a satellite solar power station or space manufacturing facility. There are very useful intermediate steps that would allow the development and testing of [5] key technologies and experience in space industrial operations without committing to full-scale projects. We will pursue an evolutionary program to stress science and basic technology-integrated with a complementary ground program–and will continue to evaluate the relative costs and benefits of proposed space activities compared to earth-based activities.

SPACE SCIENCE AND EXPLORATION GOALS

Priorities at any given time will depend upon the promise of the science, the availability of particular technology, and the budget situation in support of the following Presidentially approved goals:

– We will maintain US leadership in space science and planetary exploration and progress.

– The US will continue a vigorous program of planetary exploration to understand the origin and evolution of the solar system. Our goal is to continue the reconnaissance of the outer planets and to conduct more detailed exploration of Saturn, its moons, and its rings; to continue comparative studies of the neighboring planets, Venus and Mars; and to conduct reconnaissance of comets and asteroids.

– To utilize the space-telescope and free-flying satellites to usher in a new era of astronomy, as we explore interstellar molecules, quasars, pulsars, and black holes to expand our understanding of the universe and to complete the first all sky survey across the electromagnetic spectrum.

– To develop a better understanding of the sun and its interaction with the terrestrial environment. Space probes will journey towards the sun. Earth orbiting satellites will measure the variation in solar output and determine the resultant response of the earth's atmosphere.

– To use the Space Shuttle and Spacelab, in cooperation with the Western Europeans, to conduct basic research that complements earth-based life science investigations and human physiology research.

– Our policy in international space cooperation should include three primary elements: (1) support the best science available regardless of national origin, but expand our international planning and coordinating effort; (2) seek [6] supplemental foreign support only for selected experiments on spacecraft which have been chosen on the basis of sound scientific criteria; and (3) avoid lowering cooperative activities below the threshold where our science and international cooperative efforts would suffer.

STEPS TO INCREASE BENEFITS FOR RESOURCES EXPENDED. The President has approved the following:

Strategy to Utilize the Shuttle

1. [Paragraph deleted during declassification review]

2. [Paragraph deleted during declassification review]

3. Incremental improvements in the Shuttle transportation system will be made as they become necessary and will be examined in the context of emerging space policy goals. An interagency task force will make recommendations on what future capabilities are needed. Representation will include NASA, Defense, the DCI, Commerce, Interior, Agriculture, OMB, NSC, OSTP, State, and others as appropriate. This task force will submit the findings to the Policy Review Committee (Space) for transmittal to the President by August 1, 1979.

4. [Paragraph deleted during declassification review]

[7] **Technology Sharing.** The existing Program Review Board (PBS) will take steps to enhance technology transfer between the sectors. The objective will be, as directed in PD/NSC-37, to maximize efficient utilization of the sectors while maintaining necessary security and current management relationships among the sectors. The PBS will submit an implementation plan to the Policy Review Committee (Space) by May 15, 1979. In addition, the PBS will submit subsequent annual progress reports.

Zbigniew Brzezinski

Document III-36

Document title: George M. Low, Team Leader, NASA Transition Team, to Mr. Richard Fairbanks, Director, Transition Resources and Development Group, December 19, 1980, with attached: "Report of the Transition Team, National Aeronautics and Space Administration."

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

The transition team assembled to advise President-elect Ronald Reagan on space issues consisted of individuals with long experience in the field, both within and outside of NASA. It was chaired by George Low, who had left NASA in 1976 after a long career to become president of the Rensselaer Polytechnic Institute. The team's report provided a detailed set of recommendations and actions for the incoming administration.

December 19, 1980

Mr. Richard Fairbanks, Director
Transition Resources and Development Group
1726 M Street, NW
Washington, DC 20270

Dear Mr. Fairbanks:

I am pleased to submit the report of the transition team for the National Aeronautics and Space Administration (NASA). We hope you will find that it presents a balanced view of the status of the agency, its problems, strengths, and potentials. Team members received full cooperation from NASA officials. Our group worked together well, with frequent unanimity on identification and resolution of issues.

Recognizing that many members have been involved in the past with space programs, the team was particularly sensitive to its appearance of a pro-space bias. Members worked hard to prepare an objective report, with minimal personal advocacy. Team members have asked, however, that in this letter I emphasize our view that NASA and its civil space program represent an opportunity for positive accomplishment by the Reagan administration. In contrast with many government agencies that are mired in seemingly insoluble controversy, NASA can be many things in the future—the best in American accomplishment and inspiration for citizens.

We are pleased to have had the opportunity to aid the new administration and trust that our report will serve you and the next NASA Administrator well. The members of the team and I will be happy to provide additional consultation should it be needed.

Sincerely,
George M. Low
Team Leader
NASA Transition Team...

[1]

I. INTRODUCTION

A. Overview

In 1958 the people of the United States set out to lead the world in space. By 1970 they had achieved their goal. Men walked on the moon, scientific satellites opened new windows to the universe, and communications satellites and new technologies brought economic return. With these came new knowledge and ideas, a sense of pride, and national prestige.

In 1980, by contrast, United States leadership and preeminence are seriously threatened and measurably eroded. The Soviet Union has established an essentially permanent manned presence in space, and is using this presence to meet economic, military, and foreign policy goals. Japan is broadcasting directly from space to individual homes and business, and France is moving ahead of the United States in preparing to reap the economic benefits of satellite resource observation. Ironically, U.S. commercial enterprises are turning to France to launch their satellites. In space science, the United States has decided to forego the rare opportunity to visit Halley's comet in 1986, yet the Soviet Union, the European Space Agency, and Japan are all planning such a venture.

Technically, it is within our means to reestablish U.S. preeminence in space. The civil space program and the National Aeronautics and Space Administration offer a number of options to carry out the purpose and direction of U.S. aeronautics and space activities. These options are examined in this report in full recognition of the need for fiscal restraint in the immediate future.

B. The U.S. Aeronautics and Space Program in 1980

The National Aeronautics and Space Administration (NASA) was created in 1958 by the National Aeronautics and Space Act (PL 85-568), largely as a response to the launch of Sputnik by the Soviet Union.

The Act declared that it is the policy of the United States that activities in space be developed to peaceful purposes for the benefit of all mankind, and that these activities (except those primarily associated with the defense of the United States) should be the responsibility of a civilian agency. [2] This agency—NASA—was chartered to carry out significant programs in aeronautics, space science, space technology and applications, and manned space flight.

In 1961, the President challenged the nation to land men on the Moon by the end of that decade. The Apollo project not only made the United States preeminent in space technology, but also instilled a sense of pride in the American people. Apollo's success was due to a long term commitment; adequate and stable financial support; a technological partnership among government, industry and universities; and disciplined managers drawn from within and outside the government.

Also in the past two decades, automated spacecraft explored Mercury, Venus, Mars, Jupiter and Saturn, while telescopes above the earth's atmosphere gave us new eyes to learn about our universe—the strange world of pulsars, quasars and black holes. The result was a new understanding of the past, present, and future of our total environment.

In the meantime, communications satellites have spawned an entire new industry, weather satellites can warn us of storms, and remote sensing satellites offer tremendous economic potential from assessing and managing the earth's resources.

At the end of 1980 we are on the eve of the launch of *Columbia*, the first Space Shuttle, and its promise to provide a multiplicity of benefits—in science, in exploration, in terrestrial applications, and in the security of our nation—from easy access to this new ocean of space.

C. Aeronautics

Since 1915 NASA (and its predecessor, the National Advisory Committee for Aeronautics) has been the world leader in aeronautical research. At NASA's laboratories are many of the national facilities and technical experts necessary to continue progress in the rapidly advancing field of aviation. NASA is also at the focal point of a unique partnership among industry, universities, the Department of Defense, and NASA itself that has been

responsible for U.S. preeminence in aeronautics.

Built on the foundation of this research and technology base, the U.S. aviation industry employs about 1,000,000 Americans, ranks second largest among U.S. manufacturing employers, contributes more than any other manufacturing industry to the U.S. balance of trade, and has replaced agriculture as first in net trade contribution.

Continued advancements in research and technology are essential if the U.S. aviation industry is to remain a viable competitor in the world market.

D. **The Space Program and U.S. Policy**

In recent years the United States has lost its competitive edge in the world, militarily, commercially, and economically, [3] and our competition with the Soviet Union has taken on a new dimension.

The Soviet Union recognizes that science and technology are major factors in that competition. The nation that is strong in science and technology has the foundation to be strong in all other areas and will be perceived as a world leader.

Aeronautics and space can be major factors in our technological strength. They demand the very best in engineering, because the consequences of mistakes are great: the crash of an aircraft, or the complete failure of a spaceship.

A viable aviation industry and a strong space program are important visible elements in our international competition. Beyond these fundamental points, the United States civil space program, unlike many other government programs and agencies, has significant actual and potential impact on U.S. policy. Although some elements of the program have been so utilized, their potential in U.S. policy remains largely unrecognized and unrealized. The major factors are as follows:

1. **National Pride and Prestige**

National pride is how we view ourselves. Without a national sense of purpose and identity, national pride ebbs and flows in accordance with short-term events. The Iranian hostage situation and the abortive rescue mission have done harm to our national pride quite out of proportion to our true abilities as a nation. On the other hand, the recent Voyager visit to Saturn, reported by an enthusiastic press, made a significant contribution to our sense of self-worth. The space program has characteristics of American historic self-image: a sense of purpose; a pioneering spirit of exploration, discovery, and adventure; a challenge of frontiers and goals; a recognition of individual contributions and team efforts; and a firm sense of innovation and leadership.

National prestige is how others view us, the global perception of this country's intellectual, scientific, technological, and organizational capabilities. In recent history, the space program has been the unique positive factor in this regard. The Apollo exploration of the Moon restored our image in the post-Sputnik years, and the Voyager exploration of Saturn was a bright spot in an otherwise gloomy period of dwindling world recognition. With space programs we are a nation of the present and the future, while in the eyes of the world we become outward and forward looking.

2. **Economics and Space Technology**

A vigorous space program has provided many technological challenges to our nation. Efforts such as Apollo, Voyager, and the Space Shuttle have involved challenges and risks far more significant than those of short-term technological needs.

Meeting these challenges has resulted in a "technological push" to American industry, fostering significant innovation in [4] a wide range of high technology fields such as electronics, computers, science, aviation, communications and biomedicine. The return on the space investment is higher productivity, and greater competitiveness in the world market.

The space program also returns direct dividends, as in the field of satellite communications. The potential economic returns from satellite exploration for earth's resources are great.

3. **Scientific Knowledge and Inspiration for the Nation's Youth**

U.S. leadership in the scientific exploration of space has provided new knowledge about the earth and the universe, thus forming the basis for applied research and

development–a significant factor in our society and economy.

The exploration of space has provided an inspirational focus for large numbers of young people who have become students of engineering and science. At a time when there is a shortage of technically trained people, when the U.S. productive vitality depends on the application of science, the space program could help attract young people into these fields.

4. **Relation to U.S. Foreign Policy**

Aspects of the civil space program can serve as instruments to develop and further U.S. foreign policy objectives. Not only can the space program contribute to how this country is viewed in the eyes of the world, but cooperative space activities, such as the U.S.-U.S.S.R. Apollo-Soyuz mission and European Space Agency payloads on the Space Shuttle, are important to other countries. Technology associated with the space program has resulted in strong economic and technological interaction with developed countries, as well as in important aid to underdeveloped countries, particularly in the areas of communications and resource exploration.

E. **Observations**

At the end of 1980 the U.S. civil space program stands at a crossroads. The United States has invested in a great capability for space exploration and applications, a capability that provides benefits in national pride and prestige, in science and technology, in the inspiration of young people, in foreign policy, and in economic gain.

Now this capability is waning. NASA and the space program are without clear purpose or direction....

[39] **VI. SUMMARY OF RECOMMENDATIOMS**

NASA represents an important investment by the United States in aeronautics and space. The agency's programs have provided, and continue to offer, benefits in science and technology, in national pride and prestige, in foreign policy, and in economic gain. However, in recent years the agency has been underfunded, without purpose or direction. The new administration finds NASA at a crossroads, with possible moves toward either retrenchment or growth. The transition team has examined ten major areas and various options for dealing with them. For each issue, the team has made recommendations as follows:

A. **Presidential statement of purpose of the U.S. civil space program** (pages 5-7)

It is recommended:

1. That the President recognize the importance of the U.S. space program at an early date (e.g., the inaugural address) without yet making a commitment.

2. That the purpose and direction of the U.S. space effort be defined, and that a commitment to a viable space program be articulated by the President at a timely opportunity, such as the first flight of the Shuttle in the spring of 1981.

(N.B. A viable space program could be smaller than, equal to, or larger than the present one, but it must have purpose and direction.)

B. **NASA as an organization** (pages 8-11)

1. The NASA Administrator

It is recommended that the President select a politically experienced and strong manager as NASA Administrator, that he reestablish the Administrator's role as that of principal advisor on civil space matters, and that he be accessible to the Administrator as necessary.

2. Management capability

It is recommended that the Administrator, working either within the agency or with an outside group, assess NASA's vitality and discipline in management of complex projects, and make changes necessary to effect improvements.

3. Staffing

It is recommended that the dual problem of bringing experienced people from in-

dustry into governnent, and of [40] attracting bright young engineers and scientists into government service be addressed immediately, for the government as a whole and for NASA in particular.

4. The size of NASA

It is recommended that the question of whether or not NASA needs all its field centers be addressed as soon as the purpose of the aeronautics and space program is defined.

C. **Space policy and conflict resolution** (pages 12-16)

It is recommended that space policy development and conflict resolution be assigned to the NASA Administrator or special ad hoc groups as the need arises; and that consideration be given to a permanent space policy board for this purpose.

D. **The civil space program and national policy** (pages 14-15)

It is recommended that the administration develop an unequivocal statement of national space policy and an organizational framework that promotes economic exploitation of our capabilities and uses space to further our international goals.

In the area of remote sensing, the administration should undertake the development of an integrated civil program.

In foreign policy, the administration should develop procedures for the Department of State and other government agencies, together with industry, to employ space technology to further foreign policy objectives.

E. **Space Shuttle flight readiness** (pages 16-17)

It is recommended that

1. The NASA Administrator schedule immediate briefings and reviews, with NASA and contractor personnel, to become familiar with the Shuttle and its problems.

2. The Administrator obtain a formal assessment of Shuttle readiness from the Aerospace Safety Advisory Panel.

3. The Administrator seek the advice (outside the regular review process), of the knowledgeable outside experts.

4. The Administrator and/or Deputy participate in scheduled reviews and make specified Flight Readiness Firing and Launch decisions.

[41] F. **U.S. space launch capability** (pages 18-19)

It is recommended:

1. That existing plans for initial Shuttle operations, retention of expendable launch vehicles for the time being, and transfer of payloads to the Shuttle, be allowed to stand.

2. That at an appropriate time after the first flight (or flights) of the Shuttle, the President direct the Administrator of NASA to address the issues of Shuttle enhancement, continued Shuttle production, and expendable launch vehicle production; and to resolve them in the best interest of the United States, taking into account all users–commercial, civilian, government, DOD, and foreign.

G. **The transfer from research and development to operations** (pages 20-22)

It is recommended:

1. That the question of operational management of remote sensing satellite systems be addressed on an urgent basis (see section on "The Civil Space Program and National Policy").

2. That consideration be given to turning the operation of expendable launch vehicles over to a government agency other than NASA or to a private commercial organization in the next year.

3. That long term Space Shuttle operations be addressed only after some flight experience with the Shuttle is in hand.

H. **Aeronautics** (pages 23-24)

It is recommended that NASA's traditional role of research and technology support to civil and military aviation be reaffirmed, and perhaps even strengthened, to help stem the loss of U.S. leadership in aviation.

I. **NASA's role in areas other than aeronautics and space** (pages 25-26)

It is recommended that NASA's future role in non-aeronautics and non-space activities be confined to assistance to other agencies as requested for limited periods of time

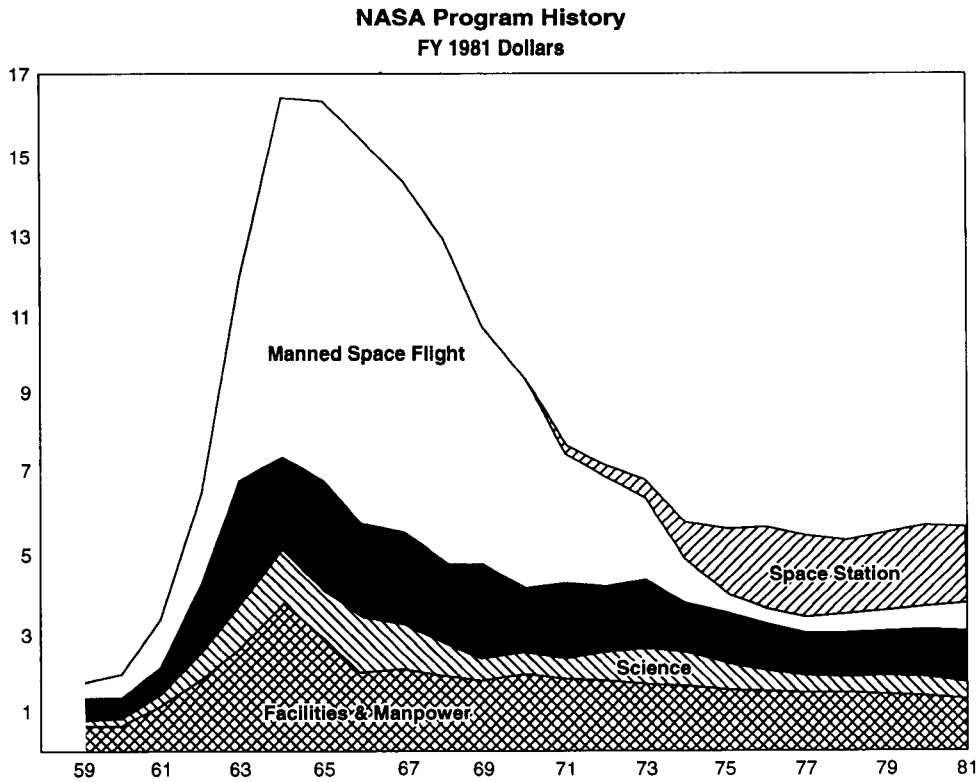
only, using cost reimbursements as possible, and that current long term commitments in other areas be eventually moved from NASA.

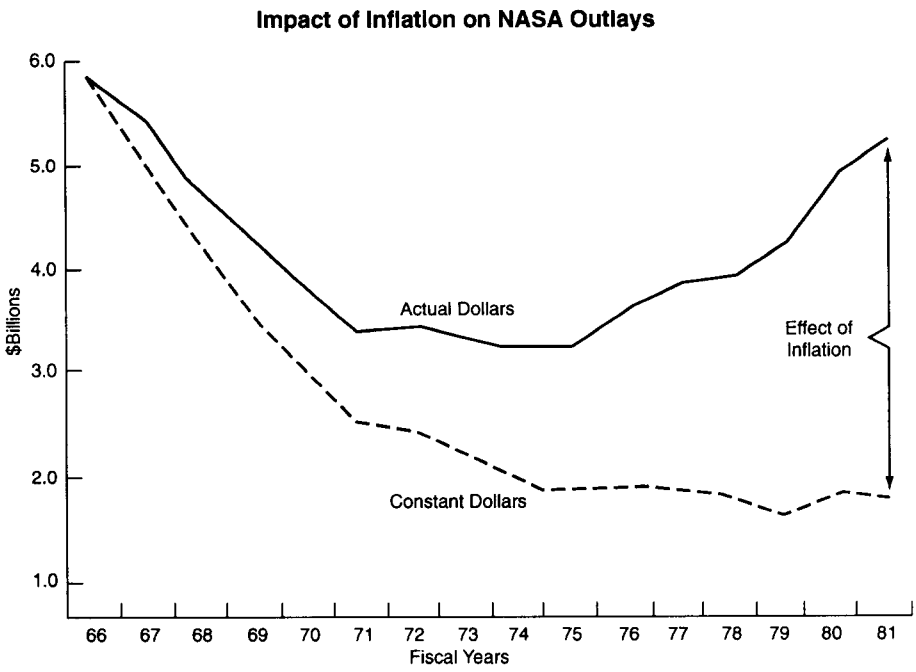
[42] J. **Personnel** (pages 27-30)

It is recommended that the new NASA Administrator review the situation of reemployed annuitants at an early date with the view of terminating the employment of many of them....

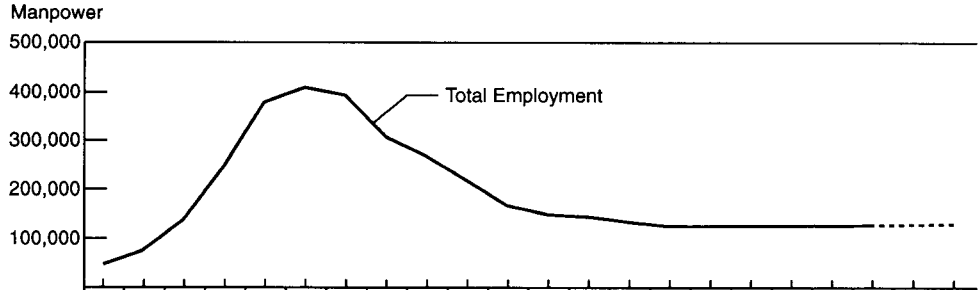
Requested New Starts
($Millions)

	Funding Requested	*Funding Obtained*
FY 1981		
Solar Electric Propulsion	20	7.5
Power Extension Package	17	—
Gamma Ray Observatory	19.1	19.1
Venus Orbiting Imaging Radar	30	—
National Oceanic Satellite System	15	5.8
Upper Atmospheric Research Satellite	10	—
Numerical Aerospace Simulator	3	—
FY 81 Total	114.1	32.4
FY 1982		
Venus Orbiting Imaging Radar	40	40
Halley Flyby	4	—
Halley Watch	1	1
Upper Atmospheric Research Sat. (Instrument only)	20	20
Geological Application	21.3	—
Numerical Aerodynamic Simulator	16	16
Large Composite Primary Structures	8	4
Energy Efficient Transport Technology Development	7	—
General Aviation Propulsion Technology	5.5	—
High Temperature Engine Core	6	—
Advanced Rotorcraft Technology	5	—
Cooperative Auto Research Program	6.5	—
Solar Power Systems	5	—
Research & Technology Base Augmentation	25	9
Solar Electric Propulsion	28	18
Shuttle Performance Augmentation	28	—
Shuttle Performance Augmentation (Study)	5	5
Power Extension Package	27	—
Advanced Space Transportation System Capability	4.5	—
FY 82 Total	262.8	113
Grand Total	376.9	137.9


NASA Program History
FY 1981 Dollars
17
15
13
11
9
7
5
3
1
Manned Space Flight
Space Station
Science
Facilities & Manpower
59
61
63
65
67
69
71
73
75
77
79
81


Impact of Inflation on NASA Outlays
$Billions
6.0
5.0
4.0
3.0
2.0
1.0
Actual Dollars
Constant Dollars
Effect of Inflation
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
Fiscal Years

Total Employment on NASA Programs



	June 1960	June 1961	June 1962	June 1963	June 1964	June 1965	June 1966	June 1967	June 1968	June 1969	June 1970	June 1971	June 1972	June 1973	June 1974	June 1975	June 1976	June 1977	June 1978	June 1979	June 1980	Sept 1981
Total Employment	46,786	74,577	137,656	246,304	379,084	409,900	393,924	306,926	267,871	218,345	167,803	149,609	144,968	134,055	125,054	127,733	132,839	124,989	124,589	131,831	142,313	138,813
Contractor Employment	36,500	57,500	115,500	218,400	347,100	376,700	360,000	273,200	235,400	186,600	136,580	120,130	117,540	108,100	100,200	103,400	108,000	101,500	101,400	109,298	119,700	116,100
NASA Employees	10,286	17,077	22,156	27,904	31,984	33,200	33,924	33,726	32,471	31,745	31,223	29,479	27,428	25,955	24,854	24,333	24,839	23,489	23,189	22,533	22,613	22,713

12/11/80

Budget History
(Millions of Dollars)

Subfunction Code		Annual Authorization FY '77	FY '78	FY '79	FY '80	FY '81	Appropriation FY '81**
	Research and Development	2856.4	3041.5	3522.6	4123.5	4436.8	4396.2
253	Space Shuttle	1383.1	1354.2	1628.3	1871.0	1873.0	1873.0
253	Space Flight Operations	202.7	267.8	315.9	463.3	779.5	769.5
253	Expendable Launch Vehicles	151.4	134.5	74.0	70.7	55.7	55.7
254	Physics & Astronomy	166.3	228.2	285.5	337.5	352.7	352.7
254	Planetary Exploration	192.1	153.2	187.1	220.2	179.6	179.6
254	Life Sciences	22.1	33.3	42.6	43.9	45.2	43.2
254	Space Applications	198.2	239.8	280.3	338.3	378.7	361.5
254	Technology Utilization	8.1	9.1	12.1	12.1	12.6	12.1
402	Aeronautical Research & Technology	191.1	234.0	275.1	309.3	289.8	282.55
254	Space Research & Technology	82.8	99.7	111.3	119.4	115.2	113.2
254	Energy Technology	3.5	7.5	5.0	5.0	4.0	4.0
255	Tracking & Data Acquisition	255.0	280.0	305.4	332.8	349.7	349.0
	Construction of Facilities	120.3	160.9	150.0	157.6	118.0	115.0
	Research & Program Management	845.1	892.8	940.4	1001.2	1033.2	1030.0
	Total	3821.8	4095.2	4612.6	5282.3	5587.9	5541.2
	Appropriation	3819.1	4063.7	4558.8	5243.4	5541.2	

**Does not include proposed 2% cut

Document III-37

Document title: Hans Mark and Milton Silveira, "Notes on Long Range Planning," August 1981.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

Soon after taking office as NASA's Deputy Administrator in July 1981, Hans Mark and his assistant Milton Silveira prepared this document in response to a call from new Administrator James Beggs for ideas on the future of the space agency. The document was widely circulated within NASA, and soon adopted by Beggs and Mark as the basis for their initial actions as they assumed control.

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[1]

Notes on Long Range Planning

The development of long range planning for NASA should be based on Section 5 in the 1958 Space Act requiring "the preservation of the role of the United States as a leader in aeronautical and space science and technology. . . ." This may be a difficult thing to do in view of limited funds that will be available to NASA in the coming years but the intent of the statement in the law is crystal clear and NASA must act accordingly.

1) FACILITIES

Fundamental to all that NASA does are the facilities that exist at NASA's research and development centers. It is not always recognized but the NASA aeronautical facilities are vital, not only to aircraft design, but also to the development of our space technology. For example, the 40' x 80' wind tunnel at the Ames Research Center which is justified solely as an aeronautical facility was used for testing the flying qualities of the Space Shuttle during the critical approach and landing phase. A one-third scale model was tested many hundreds of hours in the wind tunnel to insure performance, stability, and control characteristics. There are many other examples where wind tunnel and high temperature facilities are used to insure safe flight of a spacecraft as it passes through the atmospheric portion of its flight.

Broadly speaking, NASA's facilities fall into five separate categories:

1. Wind Tunnels
2. Flight and Operations Simulators
3. Propulsion Test Facilities
4. Experimental Airplanes
5. Computational Facilities

[2] Recently, heavy investments have been made in required wind tunnel facilities. Approximately $250M have been spent, improving the Ames 40' x 80' wind tunnel and building at Langley the High Reynolds Number Cryogenic Tunnel. Large investments have also been made in flight simulators, although more needs to be done in developing and building simulators to overcome current deficiencies. There is a need to develop more facilities for the simulation of operations and construction in space with a zero "g" environment and under demanding thermal conditions. The major aeronautical propulsion facility in the country is being developed by the United States Air Force at the Arnold Engineering Development Center. NASA must take advantage of this facility as best it can. NASA must also develop a policy toward the development of propulsion facilities at the Lewis Research Center. Particularly, NASA must also see to it that the rocket propulsion

test stands are adequate for programs in launch vehicles that may be initiated following the completion of the Space Shuttle program. Experimental aircraft tend to be more specialized toward specific flight configurations. However, there are some programs such as the F-8 fly-by-wire aircraft and the Boeing 737 control configured vehicle in which the aircraft are used more-or-less as general purpose simulation facilities. Computers are not usually regarded as facilities but they should be viewed as such. The Numerical Aerodynamic Simulator now being proposed is particularly important in this regard since it may overcome certain limitations in the simulations of the other facilities now operated by NASA (wind tunnels, propulsion facilities and flight simulators) if the promise of computational methods in aerodynamics, chemically reacting flows, and dynamic structures can be realized. The maintenance and development of the necessary facilities to accomplish the mission stated in the law must, therefore, have the highest institutional priority in NASA.

[3]

2) AERONAUTICS

Work in aeronautics by NASA, and the NACA prior to 1958, has traditionally been oriented toward the support of military and civil aviation. Future interest in the military is likely to be centered on the development of a new long range combat aircraft (LRCA) by the United States Air Force having low radar, infrared, and visible observables (i.e., stealth technology), the creation of a new family of V/STOL aircraft for the Navy, and the continuing enhancement of the performance of rotor craft for the Army. To maintain a lead in civil aircraft sales, continual improvements must be made for greater economy. The technology suitable for third level carriers (i.e. commuter airlines) is likely to be the major civil requirement. The latter is especially important in view of the inroads being made by foreign competition in that field. Right now the Dehavilland Twin Otter, the DHC-7, and the Shorts Skyvan dominate that field in the United States. In addition to all of these things, a strong basic research program in fluid mechanics, materials and other topics related to aeronautics and space vehicles must be maintained.

3) THE SPACE SHUTTLE

The major technological development carried out by NASA in the last decade is the Space Shuttle vehicle. That basic development is now nearly complete and the next step is to turn it into an operational system. This effort must have the highest programmatic priority in NASA for the coming years to realize a return for this large investment. It should take about three years to make the space Shuttle an operational transportation system. It is necessary to arrive at an agreed-upon definition of what is meant by "operational" and to determine whether NASA should be the agency that operates the Shuttle or whether some other institutional mechanism needs to be provided for that purpose. The organizational structure needs to be developed for [4] Shuttle Operations. No matter how the matter of Shuttle Operations is finally decided, the Johnson Space Center should phase out of the operational mission during the next three years. It is very unlikely that it will be possible to control costs of operation if the developmental attitudes that prevail at the Johnson Space Center dominate after the Space Shuttle becomes operational. The operations of the Space Shuttle, both launch as well as mission control, should be handled by the Kennedy Space Center and by Vandenberg Air Force Base once the West Coast launch facility is complete.

4) THE SPACE STATION

While the Space Shuttle becomes operational, a project to establish a permanent presence in space (i.e., a Space Station) should be initiated. This should become the major new goal of NASA and, some time during the next two years, the President should be persuaded to issue a statement proclaiming a national commitment to that effect. The

necessary arguments that justify this step must be carefully developed now, and these arguments range from national security (i.e., arms control verification, military surveillance) to the improvement of space operations (i.e., satellite maintenance on orbit and other things of this kind). The necessary committees of the National Academy of Engineering, the National Academy of Sciences, and other bodies of this kind should be established to set up now the technical baselines for this new enterprise.

5) UNMANNED LAUNCH VEHICLES

The Shuttle program has led to the creation of a new propulsion technology which should be further exploited. It is now generally agreed that unmanned launch vehicles will not be phased out completely once the Shuttle is operational. They will always be necessary to supplement the Shuttle launch capability. The current launch vehicles, (Atlas, Titan, Delta) are based on technology that is now thirty [5] years old and should be replaced by more efficient and economical vehicles. New unmanned launch vehicles based on the Shuttle technology using solid rocket boosters and the Shuttle's main engine system should be developed. The solid rocket booster itself is an excellent rocket with a sea level thrust of the order of 2.5M lbs. Several solid rocket boosters strapped together could provide a formidable launch vehicle in terms of payload capacities. Such a vehicle with three solid rocket boosters could put into low earth orbit a payload weighing something like 100,000 lbs. and perhaps up to 20,000 lbs. into geosynchronous orbit with an appropriate upper stage. An important feature of the solid rocket booster is that they are recoverable which means that the cost advantages inherent in that property could be important. This new generation of launch vehicles would not be "expendable" although it would be unmanned.

6) SCIENTIFIC EXPLORATION

NASA has a fundamental responsibility to continue with the scientific exploration of objects in space and conditions in space. In the coming decade, scientific investigations conducted in earth orbit will be the most important because these take the best advantage of the unique properties of the Shuttle. Specifically, this means that astronomy, experiments involving certain cosmological things such as general relativity and experiments in zero gravity using Spacelab will be the dominant trend in scientific space research. An extremely important aspect of this are the medical and biological experiments to be done using the Shuttle to establish what must be done to permit people, animals, and plants to live in zero gravity conditions for lengthy periods. It is probable that exploration will be deemphasized somewhat until we have a Space Station that can serve as a base for the launching of a new generation of planetary exploration spacecraft. It is apparent that the return of samples from various bodies in the solar system will be given highest priority once that time arrives.

[6]

7) SPACE APPLICATIONS

The applications program should emphasize the scientific part of earth observations, specifically oceanography, geodesy, and things of this kind. In view of the Administration's policies with respect to technical demonstration programs, NASA should de-emphasize efforts to commercialize various applications projects. The applications program should also emphasize technology development and should cooperate closely with the national security community in these efforts. It is likely that the nation's surveillance satellites will move to geosynchronous orbit in the next two decades. This means that large space structures will be required, mirrors, antennas, and other systems of this type. NASA should be extremely active in the development of this technology and should establish the closest possible support of the national security community in achieving these objectives.

A few thoughts regarding future directions for NASA have been outlined in this paper. Obviously, much more detail needs to be done to develop some of these ideas. It is very important to begin now by setting up the proper procedural methods within NASA as well as the NASA advisory structure to make certain that these ideas are properly considered and developed into a coherent long range plan for the nation's aeronautical and space programs.

Hans Mark
Milton Silveira
August 1981

Document III-38

Document title: National Security Decision Directive Number 42, "National Space Policy," July 4, 1982.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

In 1981, its first year in office, the Reagan administration issued a National Security Decision Directive (NSDD-8, November 13, 1981) that reiterated the central role of the Space Transportation System in U.S. space activities. The White House then initiated a comprehensive space policy review under the direction of new Science Adviser George Keyworth II. The results of that review were contained in NSDD-42, issued on July 4, 1982. This directive replaced NSDD-8 and the three Carter administration space policy statements, NSDD-37, 42, and 54. It also established as the primary forum for space policy formulation the National Security Council Senior Interagency Group (Space)—SIG (Space)—chaired by the assistant to the president for national security affairs. SIG (Space) was the locus of policymaking throughout the two terms that Ronald Reagan was president.

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[1] July 4, 1982

National Security Decision Directive Number 42

National Space Policy

I. INTRODUCTION AND PRINCIPLES

This directive establishes national policy to guide the conduct of United States space program and related activities; it supersedes Presidential Directives 37, 42, and 54, as well as National Security Decision Directive 8. This directive is consistent with and augments the guidance contained in existing directives, executive orders, and law. The decisions outlined in this directive provide the broad framework and the basis for the commitments necessary for the conduct of United States space programs.

The Space Shuttle is to be a major factor in the future evolution of United States space programs. It will continue to foster cooperation between the national security and civil efforts to ensure efficient and effective use of national resources. Specifically, routine use of the manned Space Shuttle will provide the opportunity to understand better and evaluate the role of man in space, to increase the utility of space programs, and to expand knowledge of the space environment.

The basic goals of United States space policy are to: (a) strengthen the security of the United States; (b) maintain United States space leadership; (c) obtain economic and scientific benefits through the exploitation of space; (d) expand United States private-sector

investment and involvement in civil space and space-related activities; (e) promote international cooperative activities that are in the national interest; and (f) cooperate with other nations in maintaining the freedom of space for all activities that enhance the security and welfare of mankind.

[2] The United States space program shall be conducted in accordance with the following basic principles:

A. The United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all mankind. [sentence deleted during declassification review]

B. The United States rejects any claims to sovereignty by any nation over outer space or celestial bodies, or any portion thereof, and rejects any limitations on the fundamental right to acquire data from space.

C. The United States considers the space systems of any nation to be national property with the right of passage through and operations in space without interference. Purposeful interference with space systems shall be viewed as infringement upon sovereign rights.

D. The United States encourages domestic commercial exploration of space capabilities, technology, and systems for national economic benefit. These activities must be consistent with national security concerns, treaties, and international agreements.

E. The United States will conduct international cooperative space-related activities that achieve sufficient scientific, political, economic, or national security benefits for the nation.

F. [paragraph deleted during declassification review]

G. The United States Space Transportation System (STS) is the primary space launch system for both national security and civil government missions. STS capabilities and capacities shall be developed to meet appropriate national needs and shall be available to authorized users—domestic and foreign, commercial, and governmental.

[3] H. The United States will pursue activities in space in support of its right of self-defense.

I. The United States will continue to study space arms control options. The United States will consider verifiable and equitable arms control measures that would ban or otherwise limit testing and deployment of specific weapons systems should those measures be compatible with United States national security. The United States will oppose arms control concepts or legal regimes that seek general prohibitions on the military or intelligence use of space. [declassified]

II. SPACE TRANSPORTATION SYSTEM

The Space Transportation System (STS) is composed of the Space Shuttle, associated upper stages, and related facilities. The following policies shall govern the development and operation of the STS:

A. The STS is a vital element of the United States space program and is the primary space launch system for both United States national security and civil government missions. The STS will be afforded the degree of survivability and security protection required for a critical national space resource.

B. The first priority of the STS program is to make the system fully operational and cost-effective in providing routine access to space.

C. The United States is fully committed to maintaining world leadership in space transportation with an STS capacity sufficient to meet appropriate national needs. The STS program requires sustained commitments by all affected departments and agencies. The United States will continue to develop the STS through the National Aeronautics and Space Administration (NASA) in cooperation with the Department of Defense (DoD). Enhancements of STS operational capability, upper stages, and efficient methods of deploying and retrieving payloads should be pursued as national requirements are defined.

D. United States Government spacecraft should be designed to take advantage of the unique capabilities of the STS. The completion of transition to the Shuttle should occur as

expeditiously as practical.

[4] E. [paragraph deleted during declassification review]

F. Expandable launch vehicle operations shall be continued by the United States Government until the capabilities of the STS are sufficient to meet its needs and obligations. Unique national security considerations may dictate developing special-purpose launch capabilities.

G. For the near-term, the STS will continue to be managed and operated in an institutional arrangement consistent with the current NASA/DoD Memoranda of Understanding. Responsibility will remain in NASA for operational control of the STS for civil missions and in the DoD for operational control of the STS for national security missions. Mission management is the responsibility of the mission agency. As the STS operations mature, options will be considered for possible transition to a different institutional structure.

H. Major changes to STS program capabilities will require Presidential approval.

III. CIVIL SPACE PROGRAM (U)

The United States shall conduct civil space programs to expand knowledge of the Earth, its environment, the solar system, and the universe; to develop and promote selected civil applications of space technology; to preserve the United States leadership in critical aspects of space science, applications, and technology; and to further United States domestic and foreign policy objectives. Consistent with the National Aeronautics and Space Act, the following policies shall govern the conduct of the civil space program.

A. **Science, Applications, and Technology:** United States Government civil programs shall continue a balanced strategy of research, development, operations, and exploration for science, applications, and technology. The key objectives of these programs are to:

(1) Preserve the United States preeminence in critical major space activities to enable continued exploitation and exploration of space.

[5] (2) Conduct research and experimentation to expand understanding of: (a) astrophysical phenomena and the origin and evolution of the universe, through long-term astrophysical observation; (b) the Earth, its environment, and its dynamic relation with the Sun; (c) the origin and evolution of the solar system, through solar, planetary, and lunar sciences and exploration; and (d) the space environment and technology required to advance knowledge in the biological sciences.

(3) Continue to explore the requirements, operational concepts, and technology associated with permanent space facilities.

(4) Conduct appropriate research and experimentation in advanced technology and systems to provide a basis for future civil space applications.

B. **Private Sector Participation:** The United States Government will provide a climate conducive to expanded private sector investment and involvement in civil space activities, with due regard to public safety and national security. Private sector space activities will be authorized and supervised or regulated by the government to the extent required by treaty and national security.

C. **International Cooperation:** United States cooperation in international civil activities will:

(1) Support the public, nondiscriminatory direct readout of data from Federal civil systems to foreign ground stations and provision of data to foreign users under specified conditions.

(2) Continue cooperation with other nations by conducting joint scientific and research programs that yield sufficient benefits to the United States in areas such as access to foreign scientific and technological expertise, and access to foreign research and development facilities, and that serve other national goals. All international space ventures must be consistent with United States technology-transfer policy. [declassified]

D. **Civil Operational Remote Sensing:** Management of Federal civil operational remote sensing is the responsibility of the Department of Commerce. The Department of

Commerce will: (a) aggregate Federal needs for civil operational remote sensing to be met by either the private sector or the Federal government; (b) identify needed civil operational system research and development objectives; and (c) in coordination with other departments or agencies, provide for regulation of private-sector operational remote sensing systems.

[6] [page deleted during declassification review]

[7] [page deleted during declassification review]

[8] [paragraph deleted during declassification review]

(1) The fact that the United States conducts satellite photo-reconnaissance for peaceful purposes, including intelligence collection and the monitoring of arms control agreements, is unclassified. The fact that such photo-reconnaissance includes a near-real-time capability and is used to provide defense related information for indications and warning is also unclassified. All other details, facts and products concerning the national foreign intelligence space program are subject to appropriate classification and security controls.

(2) [paragraph deleted in declassification review]

VI. INTER-SECTOR RESPONSIBILITIES

[paragraphs A-F deleted during declassification review]

[9] G. The United States Government will maintain and coordinate separate national security and civil operational space systems when differing needs of the sectors dictate.

VII. IMPLEMENTATION

Normal interagency coordinating mechanisms will be employed to the maximum extent possible to implement the policies enunciated in this directive. To provide a forum to all Federal agencies for their policy views, to review and advise on proposed changes to national space policy, and to provide for orderly and rapid referral of space policy issues to the President for decisions as necessary, a Senior Interagency Group (SIG) on Space shall be established. The SIG (Space) will be chaired by the Assistant to the President for National Security Affairs and will include the Deputy or Under Secretary of State, Deputy or Under Secretary of Defense, Deputy or Under Secretary of Commerce, Director of Central Intelligence, Chairman of the Joint Chiefs of Staff, Director of the Arms Control and Disarmament Agency, and the [10] Administrator of the National Aeronautics and Space Administration. Representatives of the Office of Management and Budget and the Office of Science and Technology Policy will be include as observers. Other agencies or departments will participate based on the subjects to be addressed.

Document III-39

Document Title: National Security Decision Directive 5-83, "Space Station," April 11, 1983.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

During 1982, NASA decided to push for presidential approval of a space station during 1983. To establish the basis for such a decision, SIG (Space) requested a study of NASA's station proposal and alternatives to it. President Reagan was briefed on the concept of a space station on April 7, 1983, and a few days later signed this directive establish-

ing the terms of reference for the needed study. Ordinarily, Assistant to the President for National Security Affairs William Clark would have signed the directive as chairman of SIG (Space); the White House decided to have the president himself sign the document as an indication of the study's significance. Because the various agencies participating in the study mandated by the directive could not reach a consensus on a recommendation to the president, that study was never completed, and other paths were followed as the basis for President Reagan's decision to approve the station program.

Space Station

[1] April 11, 1983

OBJECTIVE

A study will be conducted to establish the basis for an Administration decision on whether or not to proceed with the NASA development of a permanently based, manned Space Station. This NSSD establishes the Terms of Reference for this study.

GUIDELINES

The specific policy issues to be addressed are the following (responsible agencies are indicated in parenthesis):

- How will a manned Space Station contribute to the maintenance of U.S. space leadership and to the other goals contained in our National Space Policy? (NASA)
- How will a manned Space Station best fulfill national and international requirements versus other means of satisfying them? (NASA/State for national and international civil space requirements; DOD/DCI for national security needs.)
- What are the national security implications of a manned Space Station? (DOD/DCI)
- What are the foreign policy implications, including arms control implications, of a manned Space Station? (State/NASA/ACDA)
- What is the overall economic and social impact of a manned Space Station? (NASA/Commerce/State)

These five policy issues will be addressed for each of the four scenarios outlined below.

In order to assess the policy issues in a balanced fashion, NASA will provide a background paper outlining four example scenarios that represent possible approaches for the continuation of this nation's manned space program. These example scenarios are:

[2] – Space Shuttle and Unmanned Satellites
- Space Shuttle and Unmanned Platforms
- Space Shuttle and an Evolutionary/Incrementally Developed Space Station
- Space Shuttle and a Fully Functional Space Station

A separate, unrelated, generic space requirements paper will be produced for use in addressing the national policy issues. The representative set of requirements for each space sector will be provided by DOD/DCI for national security and NASA/DOC for civil programs. A drafting group consisting of representatives of the DCI, DOD, DOC and NASA will coalesce the requirements into a single document. It will represent currently identifiable official agency statements of requirements for a Space Station. Long-term agency requirements and objectives should also be included.

IMPLEMENTATION

A Working Group under the Senior Interagency Group for Space has been established to conduct this study. The Working Group is chaired by NASA and includes representatives from DOD, DOC, DCI, DOS, and ACDA. The Working Group will produce a summary paper that assesses the issues and identifies policy options. Results of the study will be presented to the SIG (Space) not later than September 1983 prior to presentation to the President. Papers produced by the Working Group will not be distributed outside the Executive Branch without the approval of the SIG (Space). The SIG (Space) may issue more detailed Terms of Reference to implement this study.

Document III-40

Document title: "Revised Talking Points for the Space Station Presentation to the President and the Cabinet Council," November 30, 1983, with attached: "Presentation on Space Station," December 1, 1983, no pagination.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

After having failed to get the support of a majority of the members of SIG (Space) for a recommendation to the president that he approve a space station program, NASA and its allies in the White House sought another path to get the issue before the president. NASA Administrator James Beggs was confident that the president would approve the program if only it was presented to him for decision. Cabinet Secretary Craig Fuller arranged for the station to be discussed at a meeting of the Cabinet Council for Commerce and Trade, a group not dominated by those opposed to the station. NASA Administrator Beggs made his presentation to the council, speaking from a set of staff-prepared "talking points" reproduced here.

FIRST VIEWGRAPH (IKE'S QUOTE ETC.)

- President Kennedy's decision to go to the moon chartered a course that resulted in leadership in space for the United States
- Incidentally, the Kennedy quotation is from a press conference in which the President is asked why he doesn't stop the Apollo program in light of budget concerns and other pressing needs
- President Nixon, against the wishes of many, continued America's commitment to leadership in space by approving the Space Shuttle

Link to next viewgraph

- This focus on leadership in space was reaffirmed in your Space Policy announced a year ago last July

NATIONAL SPACE POLICY VIEWGRAPH

- This policy sets forth goals and objectives that will keep America preeminent in space

Link to next viewgraph

• Today, the Space Shuttle makes us the leading Nation in space
• Tomorrow, America's preeminence in space can be achieved through a space station, manned and in permanent orbit around the earth

SHUTTLE VIEWGRAPH

• The Space Shuttle flies beautifully, and is something every American can see and be proud of
• Shuttle is operational, a ten year development program is over. By 1991, the earliest a space station could be in orbit, Shuttle will have been flying a full decade
• We brought the Shuttle in within 30% of the original budget projection:
- declining NASA budget (24% in constant $, 1972-1981)
- difficult technical hurdles
- declining civil service work force
- 20% between 1972 and 1981
- 28,382 to 22,736

• Might be appropriate to mention here that a space station would cost $8 billion
- describe what the $20 billion station is
- launch by 1991

• The Shuttle has captured worldwide attention:
- reassures our Allies of America's technological strength
- concerns our enemies
- impresses the fencesitters

• At a time when many in Europe and elsewhere focus on what divides us, the Shuttle has focused attention on what unites us (refer to Spacelab flight)
• Shuttle's impact is extraordinary. It exerts an influence over ordinary people and heads of government:
- millions of Europeans turned out to see Enterprise
- West German leadership
- Mitterand

Link to next viewgraph

• Shuttle is routine transportation to Earth orbit. What's needed now, what was originally envisioned, is a place to Shuttle to...

THE WHAT IS A SPACE STATION VIEWGRAPH

• It's the logical extension of our past activities in space
• A United States Space Station would:
- dominate the space environment for twenty years
- stimulate commercial endeavors in space (recall the President's meeting with aerospace executives who emphasized commercial potential of space)
- place in orbit an American outpost in space. With a space station, there would always be Americans working in space
- be a national technology laboratory in space
- check out and launch rockets to higher orbit
- open up, for the first time, the possibility of assembling large satellites in space
- stake out some options for the future, enabling a President in the years to come, to embark the United States upon missions that transcend the boundaries of earth:
- back to a moon

- to an asteroid
- to the surface of Mars
- implement the overriding theme of your space policy: United States leadership in space

Link to next viewgraph

• In the 1990's, leadership in space will have a new dimension, something perhaps that Presidents Nixon and Kennedy could not foresee when they committed America to leadership in space...

A SPACE STATION WOULD STIMULATE VIEWGRAPH

• The new dimension will be the presence of the private sector in space
• The space program is going to change over the next 20 years
- no longer the monopoly of government
- no longer driven solely by motives of exploration and prestige

• Space is going to become a place of business:
- new products
- new services
- new benefits
- let me give you just one concrete example:
- McDonnell Douglas electrophoresis

• The government has a role to play in the commercialization of space
- sponsor K & D
- encourage entrepreneurs
- provide some essential support services

• This is where space station comes in:
- the station is a laboratory where pre-production research will need to be carried out
- the station is a servicing base where repairs to commercial equipment can be carried out. Modifications to equipment can be made, and spares can be stored for timely deployment

• In the future, there will be commercial enterprises making products in space, and a space station is going to make that possible
• Note importance of space program to scientific and technical education in the U.S, and to development of new technologies, both strong thrusts of this Administration

Link to next viewgraph

• These new commercial enterprises will involve the presence of man. Just as factories on the ground that have robots require men and women working in the plant to fix the robots and do things that machines can't, so will the space-based factories

MAN IN SPACE VIEWGRAPH

• Some people say you can do it all in space with robots. In fact, you must have man. He–and she–are the essential ingredient
• The presence of man is the key to leadership in space. And there are technical reasons for having man as well

• A principal reason for the excitement and attention the current Shuttle mission is having in Europe is the simple fact that there is a European scientist onboard the Columbia

• Compare Apollo 16 and Luna 16:
- both were missions to the moon
- both took place early in the 1970s
- both brought lunar samples back to the Earth
- but one, Apollo, was manned and captured the world's attention
- while the other, an unmanned Russian rover, made no impression other than on the surface of the moon

• Man can repair and maintain spacecraft, and there are a number of satellites that have broken down where the capability to repair and maintain would be enormously beneficial:
- Seasat
- Solar Max
- Landsat 4
- IRAS

Link to next viewgraph

• The Soviets understand the importance of man in space

THE SOVIET VIEWGRAPHS

• The Soviets have an active, expanding space program in which cosmonauts play a central role

• The Soviet program:
- is technically proficient: at present, two sophisticated Soviet scientific spacecraft are orbiting Venus. The Soviets were the first to take pictures from the surface of the moon and the first to transmit data from the surface of Venus
- is an instrument of Soviet propaganda, particularly the cosmonauts (10 foreigners have flown with the Soviets)

• The centerpiece of the Soviet program is the Salyut Space Station:
- about 49 feet long, and 42,000 lbs
- usually a crew of two, sometimes four (five with Chratien)
- automatic refueling capability
- civil and military missions
- overflies the U.S. 5-6 times a day

• What worries me is what the Soviets are up to. What are they planning to fly in the late 1980s and the 1990s? Will they be successful in their plans to dominate space?
- CIA says they are expanding their level of activity and the CIA analysts expect qualitative improvements
- the National Intelligence estimate indicates they are building:
- heavy lift launch vehicle
- a reusable Space Shuttle to Sly in '86 or '87
- and they repeatedly have said and we have some evidence to support it that they intend to fly a large and permanent space station with up to 20 cosmonauts on board. I have no doubt that they can and will

• The Soviets are clearly taking their space program very seriously; they appear committed to a large space station–and I'm very concerned about it

Link to next viewgraph

• What are our alternatives?

SIG OPTIONS VIEWGRAPH

• The SIG study group outlined several options:
- commit to a space station
- build an Extended Duration Orbiter and unmanned space platforms, or
- simply defer a decision on space station

• An Extended Duration Orbiter is an upgraded Shuttle that could stay up beyond the current limit of about nine days
• An unmanned platform is a satellite that would provide basic services such as power and data management to a bunch of scientific instruments on board the platform
• We have studied both of these for some time and have a good understanding of their capabilities

• The platform would let you do some good science, but:
- it's not a staging base for transportation to higher orbit
- it's not going to lead to the commercialization of space
- it's not going to let you assembly large space systems
- it's not going to impress many people, except for some scientists

• The Extended Duration Orbiter is something we have been looking at:
- it would be nice to extend the orbiter's stay time
- and we could devise some useful things to do
- but the cost would be high for marginal improvements
- $1.5 billion for orbiter mods
- $1.6 billion for dedicated orbiter
- plus $1.5 for a platform
- and you still would not have continuous operations
- just 40 days

• These may indeed be worthwhile projects, but they are hardly America's next step in space, and no one seems to be pushing them very hard

SIG OPTIONS VIEWGRAPH (CONTINUED)

• A decision to defer
- details new commercial endeavors in space
- simply means developing a station later, for a station is crucial to future operations in space
- sends a signal to the American people that their space program is going to rest on its laurels, for the Shuttle will have flown for 10 years by the earliest time we could have a station ready to go
- sends a signal to the Soviets that we are going to stand still in space

Link to next viewgraph

• A decision to defer or to build an extended duration orbiter in lieu of a space station really means that, in the years ahead, that we are going to forfeit our hard won leadership in space

LAST VIEWGRAPH

• First 25 years in space have been years of accomplishment for the United States. We have shown the world–and ourselves–what a Free People can do

• In 1958 the United States accepted the challenge of Sputnik and chartered a course from which I believe we can not now retreat
- President Kennedy sent men to the moon, and in doing so sent a message to the world about America
- we landed a scientific laboratory on the surface of Mars, in one of the most impressive scientific expeditions of all time
- we began the exploration of the solar system and got a close-up look at the outer planets including Saturn with her intriguing rings
- and we developed the most sophisticated flying machine the world has ever seen, one that routinely takes us into orbit around the Earth

• In doing all this, we developed new technologies and expanded the world of knowledge. And life here in the United States is better because of it. Our leadership in space these past 25 years told the world that America was strong and that America accepted the challenge of space, and that she was equal to the responsibilities of leadership.
• Now, today, here in this room, we must look forward to the next twenty-five years. The time to start a space station is now:
- Shuttle development is over
- technology is at hand
- requirements have been analyzed
- industry is ready
- lead times are long
- the stakes are enormous: leadership in space for the next 25 years

Document III-41

Document title: Caspar Weinberger, Secretary of Defense, to James M. Beggs, Administrator, NASA, January 16, 1984.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

Throughout 1982 and much of 1983, NASA attempted to gain Department of Defense support for the space station program. That attempt was not successful, and in the fall of 1983, NASA decided to seek approval of the station program as solely a civilian program. In this letter, written after the decision to proceed with the station was made, Secretary of Defense Caspar "Cap" Weinberger spells out for the record his reservations about going ahead with the station.

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[1] Dear Jim:

In your discussions and your correspondence after the 10 August Senior Interagency Group (Space) meeting and before the 1 December Cabinet Council for Commerce and Trade meeting you solicited my support for a space station commitment. Since this Department has been unable to identify any national security requirements that can be uniquely satisfied or capabilities that could be significantly enhanced by a manned space station, you have proposed that it proceed as a civil program.

My reservations about your proposal relate to cost and impact on the Space Transportation System.

The $8 billion estimate represents only a fraction of the actual costs required to achieve the initial capabilities you desire from a space station. Modules to make it operationally useful, and an extensive complement of instruments to support scientific

missions, would inevitably multiply the total cost several times. In today's constrained fiscal environment, unprogrammed cost growths can only be funded at the expense of other programs. I have continuing concerns about the ability of the nation to support and sustain major commitments to defense programs, as well as new proposals like the President's Strategic Defense. You would not wish to cancel any of your approved civil programs to meet increased funding requirements for space station any more than we in Defense would like to see our national security budget jeopardized.

We remain firmly committed to the Space Transportation System. We have reconfigured all our payloads to be Shuttle compatible and have invested a considerable portion of our space related funding in Shuttle related projects. Our development of the west coast Shuttle launch facilities is a prime example of our commitment to the Space Transportation System. I believe that a major new start of this magnitude would inevitably divert NASA managerial talent and resources from the priority task of making the Space Transportation System fully operational and cost effective. With all our national security space programs committed to the Shuttle and dependent on it for their sole access to space, I am sure that you can appreciate my concern in this area.

[2] I regret not being able to endorse the modified thrust of the proposed space station, but the national security implications are too extensive and are not mitigated by calling it a civil program.

I will be pleased to discuss these issues with you further at your convenience.

Sincerely,
Cap

Document III-42

Document title: Office of the Press Secretary, "Fact Sheet: Presidential Directive on National Space Policy," February 11, 1988.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

Between the issuance of the first Reagan administration space policy statement in July 1982 and 1987, there were a number of significant changes, including the *Challenger* accident, increased emphasis on the commercial uses of space, and the report of the blue ribbon National Commission on Space. A five-month SIG (Space) review during the second half of 1987 resulted in a new statement of national space policy reflecting these and other changes. President Reagan approved the new policy statement on January 5, but he withheld its release until a parallel review of commercial space policy initiatives being conducted by the Economic Policy Council was completed. The policy statement itself was classified; this unclassified summary was all that was publicly released.

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[1]

Fact Sheet
Presidential Directive on National Space Policy

The President approved on January 5, 1988, a revised national space policy that will set the direction of U.S. efforts in space for the future. The policy is the result of a five-month interagency review which included a thorough analysis of previous Presidential decisions, the National Commission on Space report, and the implications of the Space Shuttle and

expendable launch vehicle accidents. The primary objective of this review was to consolidate and update Presidential guidance on U.S. space activities well into the future.

The resulting Presidential Directive reaffirms the national commitment to the exploration and use of space in support of our national well being. It acknowledges that United States space activities are conducted by three separate and distinct sectors: two strongly interacting governmental sectors (Civil, and National Security) and a separate, non-governmental Commercial Sector. Close coordination, cooperation, and technology and information exchange will be maintained among sectors to avoid unnecessary duplication and promote attainment of United States space goals.

GOALS AND PRINCIPLES

The directive states that a fundamental objective guiding United States space activities has been, and continues to be, space leadership. Leadership in an increasingly competitive international environment does not require United States preeminence in all areas and disciplines of space enterprise. It does require United States preeminence in key areas of space activity critical to achieving our national security, scientific, technical, economic, and foreign policy goals.

- The overall goals of United States space activities are: (1) to strengthen the security of the United States; (2) to obtain scientific, technological, and economic benefits for the general population and to improve the quality of life on Earth through space-related activities; (3) to encourage continuing United States private-sector investment in space and related activities; (4) to promote international cooperative activities taking into account United States national security, foreign policy, scientific, and economic interests; (5) to cooperate with other nations in maintaining the freedom of space for all activities that enhance the security and welfare of mankind; and, as a long-range goal, (6) to expand human presence and activity beyond Earth orbit into the solar system.
- The directive states that United States space activities shall be conducted in accordance with the following principles:

– The United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all mankind. "Peaceful purposes" allow for activities in pursuit of national security goals.

[2] – The United States will pursue activities in space in support of its inherent right of self-defense and its defense commitments to its allies.

– The Unites States rejects any claims to sovereignty by any nation over outer space or celestial bodies, or any portion thereof, and rejects any limitations on the fundamental right of sovereign nations to acquire data from space.

– The United States considers the space systems of any nation to be national property with the right of passage through and operations in space without interference. Purposeful interference with space systems shall be viewed as an infringement on sovereign rights.

– The United States shall encourage and not preclude the commercial use and exploitation of space technologies and systems for national economic benefit without direct Federal subsidy. These commercial activities must be consistent with national security interests, and international and domestic legal obligations.

– The United States shall encourage other countries to engage in free and fair trade in commercial space goods and services.

– The United States will conduct international cooperative space-related activities that are expected to achieve sufficient scientific, political, economic, or national security benefits for the nation. The United States will seek mutually beneficial international participation in its space and space-related programs.

CIVIL SPACE POLICY

The directive states that:

- The United States civil space sector activities shall contribute significantly to enhancing the Nation's science, technology, economy, pride, sense of well-being and direction, as well as United States world prestige and leadership. Civil sector activities shall comprise a balanced strategy of research, development, operations, and technology for science, exploration, and appropriate applications.
- The objectives of the United States civil space activities shall be (1) to expand knowledge of the Earth, its environment, the solar system, and the universe; (2) to create new opportunities for use of the space environment through the conduct of appropriate research and experimentation in advanced technology and systems (3) to develop space technology for civil applications and, wherever appropriate, make such technology available to the commercial sector; (4) to preserve the United States preeminence in critical aspects of space science, applications, technology, and manned space flight; (5) to establish a permanently manned presence in space; and (6) to engage in international cooperative efforts that further United States space goals.

COMMERCIAL SPACE POLICY

The directive states that the United States government shall not preclude or deter the continuing development of a separate, non-governmental Commercial Space Sector. Expanding private sector investment in space by the market-driven Commercial Sector generates economic benefits for the Nation and supports governmental Space Sectors with an increasing range of space goods and services. Governmental Space Sectors shall purchase commercially available space goods and services to the fullest extent feasible and shall not conduct [3] activities with potential commercial applications that preclude or deter Commercial Sector space activities except for national security or public safety reasons. Commercial Sector space activities shall be supervised or regulated only to the extent required by law, national security, international obligations, and public safety.

NATIONAL SECURITY SPACE POLICY

The directive further states that the United States will conduct those activities in space that are necessary to national defense. Space activities will contribute to national security objectives by 1) deterring, or if necessary defending against enemy attack; 2) assuring that forces of hostile nations cannot prevent our own use of space; 3) negating, if necessary, hostile space systems; and 4) enhancing operations of United States and Allied forces. Consistent with treaty obligations, the national security space program shall support such functions as command and control, communications, navigation, environmental monitoring, warning, and surveillance (including research and development programs which support these functions).

INTER-SECTOR POLICIES

This section contains policies applicable to, and binding on, the national security and civil space sectors:

- The United States Government will maintain and coordinate separate national security and civil operational space systems where differing needs of the sectors dictate.
- Survivability and endurance of national security space systems, including all necessary system elements, will be pursued commensurate with their planned use in crisis and conflict, with the threat, and with the availability of other assets to perform the mission.
- Government sectors shall encourage, to the maximum extent feasible, the

development and use of United States private sector space capabilities without direct Federal subsidy.

- The directive states that the United States Government will: (1) encourage the development of commercial systems which image the Earth from space competitive with or superior to foreign-operated civil or commercial systems; (2) discuss remote sensing issues and activities with foreign governments operating or regulating the private operation of remote sensing systems; and (3) continue a research and development effort for future advanced, remote sensing technologies. Commercial applications of such technologies will not involve direct Federal subsidy.

- The directive further states that assured access to space, sufficient to achieve all United States space goals, is a key element of national space policy. United States space transportations systems, must provide a balanced, robust, and flexible capability with sufficient resiliency to allow continued operations despite failures in any single system. The goals of United States space transportation policy are: (1) to achieve and maintain safe and reliable access to transportation in, and return from, space; (2) to exploit the unique attributes of manned and unmanned launch and recovery systems; (3) to encourage to the maximum extent feasible, the development and use of United States private sector space transportation capabilities without direct Federal subsidy; and (4) to reduce the costs of space transportation and related services.

- The directive also states that communications advancements are critical to all United States space sectors. To ensure necessary capabilities exist, the directive states [4] that the United States Government will continue research and development efforts for future advanced space communications technologies. These technologies, when utilized for commercial purposes, will be without direct Federal subsidy.

- The directive states that it is the policy of the United States to control or prohibit, as appropriate, exports of equipment and/or technology that would make an significant contribution to a foreign country's strategic military missile programs. Certain United States friends and allies will be exempted from this policy, subject to appropriate non-transfer and end-use assurances.

- The directive also states that the United States will consider and, as appropriate, formulate policy positions on arms control measures governing activities in space, and will conduct negotiations on such measures only if they are equitable, effectively verifiable, and enhance the security of the United States and its allies.

- The directive further states that all space sectors will seek to minimize the creation of space debris. Design and operations of space tests, experiments and systems will strive to minimize or reduce accumulation of space debris consistent with mission requirements and cost effectiveness.

IMPLEMENTING PROCEDURES

The directive states that normal interagency procedures will be employed wherever possible to coordinate the policies enunciated in this directive. To provide a forum to all Federal agencies for their policy views, to review and advise on proposed changes to national space policy issues to the President for decisions as necessary, a Senior Interagency Group (SIG) on Space shall continue to meet. The SIG (Space) will be chaired by a member of the National Security Council staff and will include appropriate representatives of the Department of State, Department of Defense (DOD), Department of Commerce (DOC), Department of Transportations (DOT), Director of Central Intelligence (DCI), Organization of the Joint Chiefs of Staff, United States Arms Control and Disarmament Agency, the National Aeronautics and Space Administration (NASA), Office of Management and Budget, and the Office of Science and Technology Policy. Other Executive agencies or departments will participate as the agenda of meeting shall dictate.

* *

POLICY GUIDELINES AND IMPLEMENTING ACTIONS

The directive also enumerates Policy Guidelines and Implementing Actions to provide a framework through which the policies in the directive shall be carried out. Agencies are directed to use this section as guidance on priorities, including preparation, review, and execution of budgets for space activities, within the overall resource and policy guidance provided by the President. Within 120 days of the date of this directive, affected Government agencies are directed to review their current policies for consistency with the directive and, where necessary, establish policies to implement the practices contained therein.

CIVIL SPACE SECTOR GUIDELINES

- The directive specifies that in conjunction with other agencies: NASA will continue the lead role within the Federal Government for advancing space science, exploration, and appropriate applications through the conduct of activities for research, technology, development and related operations; the National Oceanic and Atmospheric Administration will gather data, conduct research, and make predictions about the [5] Earth's environment; DOT will license and promote commercial launch operations which support civil sector operations.
- Space Science. NASA, with the collaboration of other appropriate agencies, will conduct a balanced program to support scientific research, exploration, and experimentation to expand understanding of: (1) astrophysical phenomena and the origin and evolution of the universe; (2) the Earth, its environment and its dynamic relationship with the Sun; (3) the origin and evolution of the solar system; (4) fundamental physical, chemical, and biological processes; (5) the effects of the space environment on human beings; and (6) the factors governing the origin and spread of life in the universe.
- Space Exploration. In order to investigate phenomena and objects both within and beyond the solar system, the directive states that NASA will conduct a balanced program of manned and unmanned exploration.
- Human Exploration. To implement the long-range goal of expanding human presence and activity beyond Earth orbit into the solar system the policy directs NASA to begin the systematic development of technologies necessary to enable and support a range of future manned missions. This technology program (Pathfinder) will be oriented toward a Presidential decision on a focused program of manned exploration of the solar system.
- Unmanned Exploration. The policy further directs NASA to continue to pursue a program of unmanned exploration where such exploration can most efficiently and effectively satisfy national space objectives by among other things: achieving scientific objectives where human presence is undesirable or unnecessary; exploring realms where the risk or costs of life support are unacceptable; and providing data vital to support future manned missions.
- Permanent Manned Presence. The directive states that NASA will develop the Space Station to achieve permanently manned operational capability by the mid-1990s. The directive further states that the Space Station will: (1) Contribute to United States preeminence in critical aspects of manned spaceflight; (2) provide support and stability to scientific and technological investigations; (3) provide early benefits, particularly in the materials of life sciences; (4) promote private sector experimentation preparatory to independent commercial activity; (5) allow evolution in keeping with the needs of Station users and the long-term goals of the United States; (6) provide opportunities for commercial sector participation; and (7) contribute to the longer term goal of expanding human presence and activity beyond Earth orbit into the solar system.
- Manned Spaceflight Preeminence. The directive specifies that approved programs such as efforts to improve the Space Transportation System (STS) and return it to safe flight and to develop, deploy and use the Space Station, are intended to ensure United

States preeminence in critical aspects of manned spaceflight.

- Space Applications. The policy directs NASA and other agencies to pursue the identification and development of appropriate applications flowing from their activities. Agencies will seek to promote private sector development and implementation of applications. The policy also states that:

– Such applications will create new capabilities, or improve the quality or efficiency of continuing activities, including long-term scientific observations.

– NASA will seek to ensure its capability to conduct selected critical missions through an appropriate mix of assured access to space, on-orbit sparing, advanced [6] automation techniques, redundancy, and other suitable measures.

– Agencies may enter cooperative research and development agreements on space applications with firms seeking to advance the relevant state-of-the-art consistent with United States Government space objectives.

– Management of Federal civil operational remote sensing is the responsibility of the Department of Commerce. The Department of Commerce will: (1) consolidate Federal needs for civil operational remote sensing products to be met either by the private sector or the Federal government; (2) identify needed civil operational system research and development objectives; and (3) in coordination with other departments or agencies, provide for the regulation of private sector operational remote sensing systems.

- Civil Government Space Transportation. The policy states the unique Space Transportation System (STS) capability to provide manned access to space will be exploited in those areas that offer the greatest national return, including contributing to United States preeminence in critical aspects of manned spaceflight. The STS fleet will maintain the Nation's capability and will be used to support critical programs requiring manned presence and other unique STS capabilities. In support of national space transportation goals, NASA will establish sustainable STS flight rates to provide for planning and budgeting of Government space programs. NASA will pursue appropriate enhancements to STS operational capabilities, upper stages, and systems for deploying, servicing, and retrieving spacecraft as national and user requirements are defined.

- International Cooperation. The policy guidelines state that the United States will foster increased international cooperation in civil space activities by seeking mutually beneficial international participation in its civil space and space-related programs. The SIG (Space) Working Group on Space Science Cooperation with the U.S.S.R. shall be responsible for oversight of civil space cooperation with the Soviet Union. No such cooperative activity shall be initiated until an interagency review has been completed. The directive provides that United States cooperation in international civil space activities will:

– Be consistent with United States technology transfer laws, regulations, Executive Orders and presidential directives.

– Support the public, nondiscriminatory direct readout of data from Federal civil systems to foreign ground stations and the provision of data to foreign users under specified conditions.

– Be conducted in such a way as to protect the commercial value of intellectual property developed with Federal support. Such cooperation will not preclude or deter commercial space activities by the United States private sector, except as required by national security or public safety.

COMMERCIAL SPACE SECTOR GUIDELINES

- The directive states that NASA, and the Departments of Commerce, Defense, and Transportation will work cooperatively to develop and implement specific measures to foster the growth of private sector commercial use of space. A high-level focus for commercial space issues has been created through establishment of a Commercial Space Working Group of the Economic Policy Council. SIG (Space) will continue to coordinate the development and implementation of national space policy.

[7] - To stimulate private sector investment, ownership, and operation of space assets, the directive provides that the United States Government will facilitate private sector access to appropriate U.S. space-related hardware and facilities, and encourage the private sector to undertake commercial space ventures. The directive states that Governmental Space Sectors shall, without providing direct Federal subsidies:

– Utilize commercially available goods and services to the fullest extent feasible, and avoid actions that may preclude or deter commercial space sector activities except as required by national security or public safety. A space good or service is "commercially available" if it is currently offered commercially, or if it could be supplied commercially in response to a government service procurement request. "Feasible" means that such goods or services meet mission requirements in a cost-effective manner.

– Enter into appropriate cooperative agreements to encourage and advance private sector basic research, development, and operations while protecting the commercial value of the intellectual property developed;

– Provide for the use of appropriate Government facilities on a reimbursable basis;

– Identify, and eliminate or propose for elimination, applicable portions of United States laws and regulations that unnecessarily impede commercial space sector activities;

– Encourage free trade in commercial space activities. The United States Trade Representative will consult, or, as appropriate, negotiate with other countries to encourage free trade in commercial space activities. In entering into space-related technology development and transfer agreements with other countries, Executive Departments and agencies will take into consideration whether such countries practice and encourage free and fair trade in commercial space activities.

- Provide for the timely transfer of Government-developed space technology to the private sector in such a manner as to protect its commercial value, consistent with national security.

– Price Government-provided goods and services consistent with OMB Circular A-25.

– The directive also states that the Department of Commerce (DOC) will commission a study to provide information for future policy and program decisions on options for a commercial advanced earth remote sensing system. This study, to be conducted in the private sector under DOC direction with input from Federal Agencies, will consist of assessments of the following elements: (1) domestic and international markets for remote sensing data; (2) financing options, such as cooperative opportunities between government and industry in which the private sector contributes substantial financing to the venture, participation by other government agencies, and international cooperative partnerships; (3) sensor and data processing technology and; (4) spacecraft technology and launch options. The results of this study will include an action plan on the best alternatives identified during the study.

NATIONAL SECURITY SPACE SECTOR GUIDELINES

- General. The directive states that:

– The Department of Defense (DOD) will develop, operate, and maintain an assured mission capability through an appropriate mix of robust satellite control, assured access to [8] space, on-orbit sparing, proliferation, reconstitution or other means.

– The national security space program, including dissemination of data, shall be conducted in accordance with Executive Orders and applicable directives for the protection of national security information and commensurate with both the missions performed and the security measures necessary to protect related space activities.

– DOD will ensure that the military space program incorporates the support requirements of the Strategic Defense Initiative.

- Space Support. The directive states that:

– The national security space sector may use both manned and unmanned launch systems as determined by specific mission requirements. Payloads will be distributed among launch systems and launch sites to minimize the impact of loss of any single launch system

or launch site on mission performance. The DOD will procure unmanned launch vehicles or services and maintain launch capability on both the East and West coasts. DOD will also continue to enhance the robustness of its satellite control capability through an appropriate mix of satellite autonomy and survivable command and control, processing, and data dissemination systems.

– DOD will study concepts and technologies which would support future contingency launch capabilities.

- Force Enhancement. The directive states that the national security space sector will develop, operate, and maintain space systems and develop plans and architectures to meet the requirements of operational land, sea, and air forces through all levels of conflict commensurate with their intended use.

- Space Control. The directive also states that:

– The DOD will develop, operate, and maintain enduring space systems to ensure its freedom of action in space. This requires an integrated combination of antisatellite, survivability, and surveillance capabilities.

– Antisatellite (ASAT) Capability. DOD will develop and deploy a robust and comprehensive ASAT capability with programs as required and with initial operational capability at the earliest possible date.

– DOD space programs will pursue a survivability enhancement program with long-term planning for future requirements. The DOD must provide for the survivability of selected, critical national security space assets (including associated terrestrial components) to a degree commensurate with the value and utility of the support they provide to national-level decision functions, and military operational forces across the spectrum of conflict.

– The United States will develop and maintain an integrated attack warning, notification, verification, and contingency reaction capability which can effectively detect and react to threats to United States space systems.

- Force Application. The directive states that the DOD will, consistent with treaty obligations, conduct research, development, and planning to be prepared to acquire and deploy space weapons systems for strategic defense should national security conditions dictate.

INTER-SECTOR GUIDELINES

The directive states that the following paragraphs identify selected, high priority cross-sector efforts and [9] responsibilities to implement plans supporting major United States space policy objectives:

- Space Transportation Guidelines.

– The United States national space transportation capability will be based on a mix of vehicles, consisting of the Space Transportation System (STS), unmanned launch vehicles (ULVs), and in-space transportation systems. The elements of this mix will be defined to support the mission needs of national security and civil government sectors of United States space activities in the most cost effective manner.

– As determined by specific mission requirements, the national security space sector will use the STS and ULVs. In coordination with NASA, the DOD will assure the Shuttle's utility to national defense and will integrate missions into the Shuttle system. Launch priority will be provided for national security missions as implemented by NASA-DOD agreements. Launches necessary to preserve and protect human life in space shall have the highest priority except in times of national security emergency.

– The STS will continue to be managed and operated in an institutional arrangement consistent with the current NASA/DOD Memorandum of Understanding. Responsibility will remain in NASA for operational control of the STS for civil missions, and in the DOD for operational control of the STS for national security missions. Mission management is the responsibility of the mission agency.

– United States commercial launch operations are an integral element of a robust national space launch capability. NASA will not maintain an expendable launch vehicle (ELV) adjunct to the STS. NASA will provide launch services for commercial and foreign payloads only where those payloads must be man-tended, require the unique capabilities of the STS, or it is determined that launching the payloads on the STS is important for national security or foreign policy purposes. Commercial and foreign payloads will not be launched on government owned or operated ELV systems except for national security or foreign policy reasons.

– Civil Government agencies will encourage, to the maximum extent feasible, a domestic commercial launch industry by contracting for necessary ELV launch services directly from the private sector or with DOD.

– NASA and the DOD will continue to cooperate in the development and use of military and civil space transportation systems and avoid unnecessary duplication of activities. They will pursue new launch and launch support concepts aimed at improving cost-effectiveness, responsiveness, capability, reliability, avaliability, maintainability and flexibility. Such cooperation between the national security and civil sectors will ensure efficient and effective use of national resources.

- The directive lists guidelines for the federal encouragement of commercial unmanned launch vehicles (ULVs):

– The United States Government fully endorses and will facilitate the commercialization of United States unmanned launch vehicles (ULVs).

– The Department of Transportation (DOT) is the lead agency within the Federal Government for developing, coordinating, and articulating Federal policy and regulatory guidance pertaining to United States commercial launch activities in consultation with DOD, State, NASA, and other concerned agencies. All Executive departments and agencies shall assist the DOT in carrying out its responsibilities as [10] set forth in the Commercial Space Launch Act and Executive Order 12465.

– The United States Government encourages the use of its launch and launch-related facilities for United States commercial launch operations.

– The United States Government will have priority use of Government facilities and support services to meet national security and critical mission requirements. The United States Government will make all reasonable efforts to minimize impacts on commercial operations.

– The United States Government will not subsidize the commercialization of ULVs, but will price the use of its facilities, equipment, and services with the goal of encouraging viable commercial ULV activities in accordance with the Commercial Space Launch Act.

– The United States Government will encourage free market competition within the United States private sector. The United States Government will provide equitable treatment for all commercial launch operators for the sale or lease of Government equipment and facilities consistent with its economic, foreign policy, and national security interests.

– NASA and DOD, for those unclassified and releasable capabilities for which they have responsibility shall, to the maximum extent feasible:

— Use best efforts to provide commercial launch firms with access, on a reimbursable basis, to national launch and launch-related facilities, equipment, tooling, and services to support commercial launch operations;

— Develop, in consultation with the DOT, contractual arrangements covering access by commercial launch firms to national launch and launch-related property and services they request in support of their operations;

— Provide technical advice and assistance to commercial launch firms on a reimbursable basis, consistent with the pricing guidelines herein; and

— Conduct, in coordination with DOT appropriate environmental analyses necessary to ensure that commercial launch operations conducted at Federal launch facilities are in compliance with the National Environmental Policy Act.

- The directive lists government ULV Pricing Guidelines. The price charged for the use of United States Government facilities, equipment, and service, will be based on the following principles:

– Price all services (including those associated with production and launch of commercial ULVs) based on the direct costs incurred by the United States Government. Reimbursement shall be credited to the appropriation from which the cost of providing such property or service was paid.

– The United States Government will not seek to recover ULV design and development costs or investments associated with any existing facilities or new facilities required to meet United States Government needs to which the U.S. Government retains title;

– Tooling, equipment, and residual ULV hardware on hand at the completion of the United States Government's program will be priced on a basis that is in the best overall interest of the United States Government, taking into consideration that these sales will not constitute a subsidy to the private sector operator.

[11] - The directive also states that commercial launch firms shall:

– Maintain all facilities and equipment leased from the United States Government to a level of readiness and repair specified by the United States Government;

– Comply with all requirements of the Commercial Space Launch Act, all regulations issued under the Act, and all terms, conditions or restrictions of any license issued or transferred by the Secretary of Transportation under the Act.

- The directive establishes the following technology transfer guidelines:

– The United States will work to stem the flow of advanced western space technology to unauthorized destinations. Executive departments and agencies will be fully responsible for protecting against adverse technology transfer in the conduct of their programs.

– Sales of United States space hardware, software, and related technologies for use in foreign space projects will be consistent with relevant international and bilateral agreements and arrangements.

- The directive states that all Sectors shall recognize the importance of appropriate investments in the facilities and human resources necessary to support United States space objectives and maintain investments that are consistent with such objectives. A task force of the Commercial Space Working Group, in cooperation with OSTP, will conduct a feasibility study of alternate methods for encouraging, without direct Federal subsidy, private sector capital funding of United States space infrastructure such as ground facilities, launcher developments, and orbital assembly and test facilities. Coordinated terms of reference for this study shall be presented to the EPC and SIG (Space).

- The directive notes that the primary forum for negotiations on nuclear and space arms is the Nuclear and Space Talks (NST) with the Soviet Union in Geneva. The instructions to the United States Delegation will be consistent with this National Space Policy directive, established legal obligations, and additional guidance by the President. The United States will continue to consult with its Allies on these negotiations and ensure that any resulting agreements enhance the security of the United States and its Allies. Any discussions on arms control relating to activities in space in fora other than NST must be consistent with, and subordinate to, the foregoing activities and objectives.

- Finally the directive states that using NSC staff approved terms of reference, an IG (Space) working group will provide recommendations on the implementation of the Space Debris Policy contained in the Policy section of this directive.