PRELIMINARY HISTORY

OF

NASA

SUPPLEMENT

October 7, 1968 - January 20, 1969

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APPENDIX B

APPENDIX B

PUBLIC STATEMENTS OF KEY PERSONNEL

B-1 Text, White House Press Conference, James E. Webb, September 16, 1968.

B-2 Acting Administrator T. O. Paine, "The Year 2000," Address to the Young President's Association, Bermuda, October 4, 1968.

B-3 Acting Administrator T. O. Paine, Address to the Aerospace Industry Association, Phoenix, Arizona, November 20, 1968.

B-4 Associate Administrator H. E. Newell, "Science, Technology, and Society," Address to the Annual Convention, National Council for the Social Studies, Goddard Space Flight Center, November 26, 1968.

B-5 Associate Administrator for Manned Space Flight, G. E. Mueller, Address to the Ninth National Conference of United Press International Editors and Publishers, Washington, D.C., October 8, 1968.

B-6 Associate Administrator for Manned Space Flight, G. E. Mueller, Address to the National Space Club, Washington, D.C., November 26, 1968.

B-7 Associate Administrator for Advanced Research and Technology, J. M. Beggs, "Research and Technology for the Future," Address to the American Nuclear Society, Washington, D.C., November 13, 1968.

B-8 Associate Administrator for Advanced Research and Technology, J. M. Beggs, "Advanced Research and Technology," Address to the Aerospace Industries Association Fall Conference, Phoenix, Arizona, November 20, 1968.

B-9 Associate Administrator for Space Science and Applications, J. E. Naugle, "The Outlook for the Space Program," Address at the NASA Pasadena Office, Third Annual Awards Ceremony, October 4, 1968.

B-10 Associate Administrator for Space Science and Applications, J. E. Naugle, Address to the American Nuclear Society, Washington, D.C., November 13, 1968.

B-11 Deputy Associate Administrator for Space Science and Application, O. W. Nicks, "Applying Surveyor and Lunar Orbiter Techniques to Mars," Address to American Institute of Aeronautics and Astronautics, Washington, D.C., December 5, 1968.

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B-12 Assistant Administrator for DOD and Interagency Affairs, General J. E. Smart, "NASA/Interagency Coordination," Address to the Armed Forces Management Association, December 3, 1968.

B-13 Director, Marshall Space Flight Center, Wernher von Braun, interviewed by U.S. News and World Report, October 14, 1968, pages 74-76.

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This Copy For ___________

PRESS BRIEFING (ON THE RECORD)

AT THE WHITE HOUSE

WITH GEORGE CHRISTIAN AND
JAMES WEBB, DIRECTOR, NASA

12:43 P.M. EDT

SEPTEMBER 16, 1968

MONDAY

MR. CHRISTIAN: Mr. Webb has been visiting with the President this morning and has one news item to give you and possibly a brief report.

MR. WEBB: Gentlemen, the President asked me when I got back from the full week examination of our international programs in Europe and attendance at the United Nations meeting on the Peaceful Uses of Outer Space in Vienna, to give him a report and later asked me to give him a rundown on where we stood in the program.

I have done that. I reminded him that more than a year ago I had told him that I would be 62 on the seventh day of October and would have had, at that time, spent more than 25 years in the full-time service in the government out of the last 40 and that I thought we should consider stabilizing the future of the agency and prepare for my retirement.

We have done that. Dr. Thomas Paine was selected by the President six months ago to be Deputy Administrator. We have added to Dr. Paine two other executives of great capability, Mr. Whittaker, who came in to head up our industry affairs, who was former head of the Federal Systems Division of IBM; Mr. Beggs, who was formerly in charge of the service laboratory and then procurement for Westinghouse.

So we have three experienced executives in the age bracket from 40 to 47 and the President and I are highly pleased with their capability.

He has asked me to remain on as a consultant to Dr. Paine and the agency certainly until the 20th of January and I have agreed to put my time on that and any other matters that the President wishes to ask me to do.

MORE

So I think to make this very short, he has given me permission to retire on the seventh of October after more than a year of preparation for this event.

I would like to say for myself I would not retire if he felt uneasy about it, but we both feel completely confident that we have the strongest team in NASA we have ever had.

Q Mr. Webb, what will you do afterwards?

MR. WEBB: You will remember I partially retired twice before. But I certainly don't intend to take any full-time job. I have a number of quite important interests in the field of education and foreign affairs.

As you may know, I have been quite active in the Washington International Center, the Merridan House Foundation, which receives all the foreign sponsored visitors received in this country. I have done a number of things like this and will continue much of that.

You may remember that I was Chairman of the Municipal Manpower Commission at the time I took this job. I expect to examine again, after some rest, what the areas of modern technology that we have developed in the space program can do to solve some of the problems we have in the urban area.

I have a strong feeling that in the space program we have developed a combination of work that involves the economic, social and political institutions required to join together for success.. That experience can be useful in some of the problems that relate to our urban civilization.

So, I am going to put some time in. I don't expect to take any paying job.

Q How long were you in NASA?

MR. WEBB: It will be eight years on Valentine's Day, the 14th of February of next year. So it is just four months short of 8 years.

Q Mr. Webb, is Dr. Paine going to be your successor?

MR. WEBB: Yes, the President asked me to tell him and I have just telephoned him from here to tell him that the President would name him as the Acting Administrator.

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Q In terms of missions, how do you think you leave NASA?

MR. WEBB: I leave NASA well prepared and with a conservative financial structure to carry out the missions that have been approved. They will go forward. What we have not been able to do under the pressures on the budget has been to fund new missions for the 1970's. So, there is going to be a period when there will be fewer flights than would in my view have been important to do.

I could say it to you in a very simple way: We planned with the President's leadership in 1961 and his recommendations to President Kennedy to develop an ability to fly six Saturn V's per year and 6 Saturn I's per year.

As we went forward, we expected this launch rate to force the preparation of payloads that would give us a larger amount of experience and permit us then to decide what to do.

Under the reductions in the budget beginning in 1964 when the $600 million reduction was made in one year, we have reduced that anticipated flight schedule, or production schedule, to first four per year of each and then two per year of each. We have now cancelled the production lines on both of these boosters.

So, in effect, what we will have to do is develop a new base of technology for the next generation of boosters. That is number one.

The second thing we will have boosters in storage, since we are not going to fly them and we will be developing payloads for those boosters, but instead of a driving launch schedule that would launch one Saturn a month, you will have a careful examination of what you want to take a big booster out of storage for and fly it.

In other words, they will be there and can be taken out and flown, but the country will have to look with great care into what it is it wants to do with those boosters that will be in storage.

Q Are you satisfied with the program as it stands now? Do you think it is going to meet its Apollo deadline and so forth?

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MR. WEBB: I am not satisfied with the program. I am not satisfied that we as a nation have not been able to go forward to achieve a first position in space.

What this really means is we are going to be in a second position for some time to come. So, I am certainly not satisfied with that. I am satisfied with what we have developed in every field and that we have been flying three successful generations of spacecraft.

We are headed now for the fourth. On the lunar side, we have had unmanned, Ranger, Surveyor, and the Lunar Orbiter. It is a remarkable thing to go through three generations in the first ten years of a program.

In the manned program, we have gone from Mercury to Gemini to Apollo.

I think now the question is what will the fourth generation of spacecraft be. We have a vast amount of capability.

As the USSR proceeds to fly and remains in the number one position, we will have the capability to start new programs as the need is clearly indicated. So we do have the capability. We have worked up to a work force of 420,000 people. At the end of this fiscal year, we will be down to just over 200,000. So we have shown the administrative capability to build up and then to reduce without losing pace in the program.

Q What is the budget?

MR. WEBB: The expenditures will be slightly over $4 billion for this current fiscal year. The new obligational authority which starts the things for the 1970's will be about $3.85 billion. So we are spending out the money appropriated in the previous years and not replenishing the pipelines.

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Q Is Dr. Paine the Deputy now?

MR. WEBB. Yes.

Q How do you spell his name?

MR. WEBB. P a i n e just like the famous writer.

Q What about the target for the man on the Moon by 1970? Are you going to get that?

MR. WEBB. I think this will be clear in several months. We have decided to shift from the small Saturn to the big Saturn after this next flight provided the flight is successful. That flight will be in October.

We have decided to put men on the third flight of the big Saturn. That third flight will come in December.

After that, we will have one more major test which will include all the equipment including the Lunar landing module which will come in, say, late February or sometime in March.

If all of those flights go well, we will proceed to fly off rapidly four or five Saturn V flights. On any one of them, we will have the full equipment to go to the Moon, land and come back. But whether or not we will have had enough experience to feel confident in it is the question and I have a hard time answering that.

I will answer it one other way. We did calculate that we needed 15 Saturn V's in the program to make sure that we would do the Lunar landing.

We have funded eight at the moment. We expected as of last January when the President sent up his budget to fly all eight of them before 1970. Nowwe can only fly seven. So the real question is can we make the landing by number seven?

The next three or four months are going to tell how well this equipment goes. I think that will give you an indication.

Q What has taken the urgency, if I may put it that way, out of the U. S. space program? Is it the need to spend money elsewhere -- Vietnam, the ghettos?

MR. WEBB. I think this is right. I think also there have been always needs. I think a good many people have tended to use the space program as a sort of whipping boy, if you want to call it that. People in all kinds of areas of research would say, "If I just had some of that money the space program has," and this in a sense has produced a slightly different atmosphere than we had after Sputnik and Gagarin's flight. And in contrast if it were not for the strong positions taken by the President and the Director of the Budget I would believe that the program would have been supported in the Congress and in the country

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at a higher level than it has been. I don't think the base of support has been seriously eroded.

I think this is indicated by the fact that even with all the troubles that we have had on budget matters Congress still supported this expenditure of over $4 billion this year.

Q Was there any point where you thought you had reached parity with the Russians?

MR. WEBB: I thought we had reached parity with the Russians about two or two and one-half years ago in every field except the flight of the large boosters and large spacecraft. They have been ahead of us in this field all the time and I have said so in every presentation of the budget to the Congress and for the last four years I have stated that while we have developed options, each of those four budgets would not close that gap with the big spacecraft.

What I pointed out was that they had been flying 10,000 and 15,000-pound spacecraft and recovering them at will. The Gemini is only 7,000 pounds. We have had two flights with the Apollo on the Saturn V. But we were just coming into that area of matching them with these flights.

So we have not been ahead of them or equal to them in the big boosters and the big spacecraft at any time. The 12 Saturns a year would have brought us there I think without any doubt. If we could have done that in late '67 or early '68, I think we would have forged ahead. But they are still moving at the rate that they have built up to, in fact, increasing it.

So while we are reducing down to a half to two-thirds of our previous program, they are still increasing.

Q Mr. Webb, does the President naming Dr. Paine as Acting Administrator indicate that he does not intend to nominate a new Administrator?

MR. WEBB: You had better ask the President that. He has told me to tell Dr. Paine he was going to name him Acting Administrator on the 7th of October. I think I can only say that he has expressed the strongest confidence in Dr. Paine.

Dr. Paine is one of the outstanding men in this country, both in science, in technology, engineering and in management. He has had 19 years in GE before he came to us managing important activities. He was a submarine man and worked up to be executive officer of a submarine during World War II. He is qualified to run the job without a doubt.

I don't want to speak for the President.

Q What was his last position with GE?

MR. WEBB: He was the Executive Officer of an organization called TEMPO which is a technology development

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unit on the West Coast -- Santa Barbara, California. Before that he had run one of their large laboratories at Schenectady and Lynn, Massachusetts.

So he has had 19 years. They had selected him to move up in the higher echelons and be in the corporate offices that would be responsible for all the affairs of GE. He chose to come into the Government to widen out his horizons and broaden. So it was his choice. GE, I am sure, did not want him to leave.

Q You say it was about six months ago that he was made Deputy Administrator?

MR. WEBB: Yes.

Q How old is he?

MR. WEBB: He was 46 when he was appointed.

Q Mr. Webb, you say we were approaching parity about 2-1/2 years ago with the exception of the big boosters and payloads. Where do we stand now with your departure?

MR. WEBB: We are not conducting the program at a level that will bring parity.

Q Have we fallen dangerously behind their progress?

MR. WEBB: I am not going to use an adjective like that. What I said is that under the President's leadership facing all the problems we have funded the flights in a conservative way that were required to meet our commitments, the flights we have committed ourselves to, and that this will give us experience, Saturn V and Apollo experience, out to the Moon. It will give us up to 6,000 hours of flight experience.

This gives a capability to do what we have to do in the future. Any danger to the United States that would come from the Russian program would be visible in time to use this capability to start out. But they are going to have the reality and the image of being out in front for a number of years to come. How dangerous that is you will have to judge yourself.

Q You seem to be saying they have topped the Saturn V which they haven't?

MR. WEBB: I have been testifying for three years in the Congress that they were building a booster bigger than the Saturn V and they will be flying it soon.

Q I would like to clarify one point. Your decision is entirely on the grounds of length of service. It doesn't reflect any dissatisfaction with the Administration?

MR. WEBB: Nonewhatever. The President and I discussed this more than a year ago. We examined the factors of it in writing and the effort we have made is to create an agency that could operate without me.

I am very anxious that come January 20 and then July 1, 1969, which is the beginning of a fiscal year, the agency will be in the strongest possible position.

I believe and the President will have to speak for himself that to go through a period of operation with my being available for advice but not making the decisions will leave them in the strongest possible position for January 20.

Then they will have to go through what the new President does with President Johnson's budget on space and then you will enter the fiscal year.

So everything he and I have looked at has been how to leave the agency in the strongest position to do its work in a non-political way.

THE PRESS: Thank you.

END (AT 1:05 P.M. EDT)

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NOTES FOR SPEECH ON THE YEAR 2000

BY

DR. THOMAS O. PAINE

Acting Administrator

National Aeronautics and Space Administration

Summary of Talk Delivered to

<u>Young Presidents Organization</u>

Bermuda October 10, 1968

This talk is not brainwash -- not opinionated -- not prophecy -- but how you can best think about the future yourself -- broadly and free of today's inhibitions. My objective is education, not indoctrination. My thesis is that technology is engine of social change. The 32-year difference between now and the year 2000 is the same as 1936 to now, or 1904 to 1936.

Start our forward look with a brief look back 50 centuries:

Rise of cities traces to 10% population freed from farm work and residence through invention of agriculture -- nutritious and storable grains -- cities made possible, specialization, cooperation, invention, capitalization and literacy.

500 years ago European exploration of world based on sailing ship navigation revolution brought global view.

100 years ago industrial and agricultural revolutions took place; now scientific and technological revolutions in progress --

-- new scientific view. Man's mental horizon has shifted upward from tribe to city to nation, now global, becoming cosmic.

Previous Centuries, Up to 1904:

Horse and hay,

Falling water and wind energies replaced by steam engine, coal-burning steamships and locomotives.

Concrete, stone, wood, brick and cast iron materials replaced by cheap lightweight steel.

Petroleum, Internal Combustion and Electric Power revolutions just starting.

Agriculture was still human and animal muscle-powered.

Industrial mechanization in infancy.

Medicine still a black art.

First Third of the Century, 1904-1936:

Mass-produced internal combustion engines, petroleum fuel and paved roads transformed rural and suburban America.

Electric power transformed factories and cities -- commuters, elevators and skyscrapers, radio and moving pictures, mass popular art-jazz magazines -- tractor mechanized farms -- food production rising fast.

Wright Brothers to the Red Baron to the DC 3 -- propeller planes commercial, airmail, but Lindbergh flight still recent.

Factory mechanization advanced, unions and labor political power, big move into cities from farms.

Medical science, immunization, longevity and health advances, with yellow fever, smallpox and diptheria controlled.

Hybrid corn, animal breeding, fertilizer, tractors bringing sharp rise in farm productivity leading to mass exodus from rural areas to cities.

Second Third of the Century, 1936-1968:

World War II - Cooperative thrust of U.S. industry-university-government teams; six great breakthroughs:

1. Electronic Revolution: Radar & Microwaves - now color TV - Solid State, communication satellites, micro-circuits, multibillion-dollar growth in 50's and 60's.
2. Synthetic Revolution: Butyl rubber/nylon; drugs atabrine & penicillin; polytrenes, dacrons, silicones, titanium, tranquillizers, polycarborates, vinyl, DDT, synthetic detergents, fibreglass & epoxies; elimination of TB, polio & malaria.
3. Jet propulsion Revolution: Rocket & turbojet engines - supersonic flight, 707, DC8, space flight, transformed Caribbean, trans-Atlantic and Pacific tourism, multi-billion dollar.
4. Nuclear Revolution: Atomic bomb - hydrogen bomb; now Polaris submarine, commercial nuclear power, multibillion dollar growth industry.
5. Electronic Computer Revolution: Wartime ballistic calculator; now science and business automation, ten billion dollar growth industry.

But we learned something else:

6. Far more effective management of major enterprises involving rapid scientific and technological advances on a world-wide scale; using democratic society institutions, and strengthening them in the process.

   Results of U.S. industry-university-government team most effective in history. World War II and present submarine capability example:

   3 knots underwater speed to above 30,

   100 miles underwater range to 25 thousand,

   2-mile weapon range to 2000,

   ¼-ton explosive power to 10 million tons.

   Majority of scientists who ever lived now alive, progress in science and technological advance not likely to slacken 1968-2000.

Last Third of the Century, 1968-2000:

Look ahead - rapid change in society, technology continues to be engine of social change. Don't just extrapolate past change into future, but estimate technological capabilities of future, and predict impact, resulting social change.

The Year 2000:

The Prophet Game: Only safe way is to be obscure, ambiguous, and hedge bets. But let's tackle problem honestly.

Two kinds of prophets who predict future - Science nut: optimist (Me) vs. Classics nut: pessimist (Orwell's 1984).

Those trained in classics seem to feel gloomy and overwhelmed, technical trained see challenge and believe we'll meet it.

Straight projection vs. bright prophets (Census Bureau vs. Verne and Clarke). Prophets best, usually too optimistic short range, but underestimate how far change will carry us in long range.

Delphi technique.

Iterative votes by experts, Rand Corporation - Describe.

Technological prediction -- The engine of change is technology, look at expected technical advances and predict social results. But remember we're looking at leading society, other men will remain in stone age as today.

The five World War II technical revolutions will continue:

1. Electronic Revolution:

   Lasers: Enormous communications potential, even more radical would be power transmission without wires.

   Comsats for computer networks, broadcast TV, world-wide information systems broadly accessible.

   High Fidelity TV "You are there illusion." (Home Cinerama)

All-electric city smog free, with fully automated 3D vehicles and services.

True Personal Telephone always carried with you.

Fuel Cell for portable electricity and water, freedom of home site anywhere.

2. Synthetic Materiel Revolution: Continue replace natural materials. Plastics continue inroads into metals. Two great new breakthroughs: Biological (organ transplants and artificial organs), and start of synthetic food manufacture, thus ending man's 5000-year dependence on agriculture. New drugs and therapy conquer disease, check aging, prolong vigorous life.

3. Jet Propulsion Revolution: Gas turbine brings true 3-D 1000-mile radius city. Vermont a suburb of New York City. Automatic up-down-sidewise transport in urban areas. Lunar city on moon, Mars outpost, first Deep Space voyages. Space stations continually manned in orbit.

4. Nuclear Revolution: Nuclear rockets for major space ventures. Fusion power attained. Only ten electric power stations in entire U.S. By-products from sea. Deserts blooming, automated nuclear ships and planes.

5. Electronic Computer Revolution: Soaring economic and intellectual productivity. Transformed economy -- 3 to 4-day work week standard. Age 25 before leaving college for first job, some form of marriage for students by age 18, career length 25 years, age 50 retirement. (Everybody a YPO member). Job sabbaticals for a year or two normal. Cities are recreational, educational and governing centers, factories relocated out in country. Most education by patient friendly computers that understand English, adjust to individual student interest and pace (MIT Project MAC descendants.)

EDUCATION: Making available stored information of all human experience to the individual, and helping him access and use it; the computer will completely transform this, an ideal application.

True Impact of Computer: "Papyrocentric Age" will end in favor of light pens and images. "Electrocentric" Age in 2000. Reading, writing and arithmetic -- like blacksmithing -- are doomed skills.

How about No. 6, what is NEW revolution?

Biological Time Bomb probably: Transplant and artificial organs.

Black skin kinky hair easily changed by minor adjustment to chromosome, artificial placenta, "Cyborg" artificial organ and brain, half-human, half-machine, interface between man and machine moved into human thought.

What about social changes -- How will people live?

More individualism:

Dress, careers, art, life styles, morals, pride in individual careers and accomplishments, rather than material goods accumulation. Services, government, travel, education, artistic life accomplishments in non-routine activities replace ethos that working at a routine job is "moral"; that the Lord intended everyone to labor in factories to improve and satisfy their souls. Essentially more personal freedom through wider range of choices (International choice, career choice, multiple marriage choice, information access choice, etc.)

More health, vigor and longevity:

Medical revolution continues, accelerates, broadens. Degenerative diseases conquered: cancer and heart disease; organ transplants and artificial human parts, serious moral questions now re birth control become far more complex: death and individual existence and consciousness, artificial placenta long before birth, possible artificial animal monsters and human superbeings -- multiple brains in direct thought contact -- artificial means of keeping brain alive in "Cyborgs", human-machine cross with mechanical manipulators.

Political Unifications:

Need to participate in technology will give new driving force toward multinational organizations. (Servan-Schreiber). New Bismarcks, Mohammeds, Washingtons, Garibaldis, Lenins may unite Europe, Africa, Araby and Latin America into effective modern state to close gap with U.S. and USSR. Japan may unite Asian peoples. Will 51st state be Oceana? Puerto Rico? West Indies? Israel? England, Ireland and Scotland? Plus Canada-New Zealand-Australia? Not suggesting in narrow government sense only; but 50-dollar ticket to London + world-wide passports, English TV broadcast around globe may provide strong technological impulse toward a "United English States" with free immigration, commerce, education via international computer networks, make whole of man's knowledge open to everyone in world will decrease artificial nationalistic fears, jobs as easily across oceans as across town now. But maybe not "political" unification, instead Transnational Enterprise like IBM of Thomas J. Watson, not Italy of Garibaldi. Hollywood and NBC TV culture already world-wide. Jess Bell teenage cosmetics better in touch with overseas teenagers than UN or U.S. State Dept.

That's the year 2000 through my cloudy crystal ball. You think about it in your own way. But remember -- 40 years after Lindbergh 20,000 people/day are flying the Atlantic. Our Apollo 7 astronauts aloft on October 12th--Columbus Day. The ocean voyage to the New World 476 years ago. 400 years after Columbus, 20,000/day were sailing the Atlantic. So from Columbus to Lindbergh, we can now do in a month what took a year: 400 years vs. 40 years. What do you predict will be number of men flying in space 32 years from now in 2000? Are you bold enough to say 20,000 per day? 2,000? 200? 20? What sort of society will fly in space the way we fly to Europe?

Are you worried about cost? Edison said airplane could never be cheap. First flight costs:

$50,000/seat mile Wright Brothers (1 man, $10,000-project, 1000-foot flight);

$15,000 seat mile Apollo (3 men, $25,000,000,000 project, 500,000-mile flight), but energy cost: $10.00 only to lift one man up to moon. And Apollo 7 is as economical on fuel as a Volkswagen -- about 30 miles/gallon.

But suppose by 2000 we get fusion powered rockets? Then today's estimates would be far too conservative -- like the difference between World War II and nuclear submarine capabilities.

Daniel Webster and West: Wouldn't spend a cent for worthless land, but it's made America a mighty power. Could moon, too? Same land area as North and South America.

What is NASA all about then? I believe that the five World War II breakthroughs show that a challenged democracy can transform the world, bring great national power and wealth. NASA is now showing the same thing -- but without a war. We have already duplicated World War II breakthrough feats in several areas:

- Advances in managing global (now even cosmic) systems involving complex science and technological innovation:

  90% non-gov't activity

  420,000 Americans in space program total

  20,000 contracts with Industry

  200 universities involved

  Only 33,000 NASA personnel, of which only 2,500 Washington headquarters for entire multibillion-dollar program.

- Advances in ComSats just beginning -- need larger, more powerful broadcast.

- Advances in Meteorological Satellites:

  Retrograde Polar, 24 hours/day, already 296 U.S. stations, 86 in 45 countries, great advances in atmospheric sciences and forecasting capability.

- Advances in computers and solid state -- NASA programs forcing fast pace of miniaturization, greater reliability and longer life.

- Advances in jet transport - supersonic flight, hypersonic flight, vertical and short-take-off-and-landing.

Now you hardheaded businessmen know about investment and return. I firmly believe the first decade return to the nation from ComSat, Weather, Military Defense, Navigation, Geodesy, Earth Resource and scientific satellites is already surprisingly large for only one decade. Space has challenged U.S.A. in computers, microelectronics, materials, medicine, optics, and many other fields. We have demanded and gotten a 2000 times increase in data communication capability between our 1964 and 1969 Mariner Mars expeditions. Aerospace industry in 2,000 jet transports ($8 billion backlog). Not possible without challenge of both defense and space. Furthermore, these advances are not at expense of social (e.g. economic development of our South in World War II, since then by NASA. Space created more new wealth than our welfare programs.) Future wealth and world power of U.S. depends upon a continuing leadership in science and technology. Competition between closed USSR and open free U. S. societies is intensifying in this area.

The future belongs to him who prepares for it. We must have a clear vision, set ourselves challenging goals to realize our vision, and organize the institutions of our free society to accomplish what we set out to do. That's what NASA is all about. America needs more NASA's. But beyond mere wealth and power, we need a new and clearer view of man in the universe. The view we have of our planet and of ourselves must be upgraded to cosmic view. European navigators not only explored world, Columbus transformed Europe's horizons, gave Europe a global view. So today we should look forward eagerly to a new renaissance,like that which followed Columbus and Drake seafaring, in Art, Politics, Literature, Life. No accident Drake and Shakespeare are contemporaries. Impact of Sputnik on education just starting; it will transform our culture completely in the long run. Man's view of himself in the universe, and his aspirations, will never be the same.

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SPEECH TO AEROSPACE INDUSTRIES ASSOCIATION

BY

DR. THOMAS O. PAINE
ACTING ADMINISTRATOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PHOENIX, ARIZONA

NOVEMBER 20, 1968

Gentlemen:

We are delighted to have this opportunity to meet with you today, at a critical time in the nation's space program, to share with you, the leaders of the aerospace industry, our view of the present and plans for the future.

We hope that it will be helpful to you if we use the time which you have been kind enough to allow us, to do three things - first, to provide a brief perspective of NASA's achievements during the first decade of space; second, to describe, in summary form, our present capabilities and posture; and, finally, to outline the principal options now available to the United States, with emphasis on the promising opportunities and the major problems we face in the second decade of space.

To start our discussion, I plan to take an hour this morning for a general overview from my perspective as Acting Administrator. Then, this afternoon, top management representatives from three of our four Program Offices will cover somewhat more detail to flesh out my outline - These men, known to many of you - are: Dr. John Naugle, who heads up our Office of Space Science and Applications; Jim Beggs, who heads up our Office of Advanced Research and Technology; and Chuck Mathews of our Office of Manned Space Flight. Our Assistant Administrator for the Office of Industry Affairs, Phil Whittaker, is also here to meet with representatives of your Technical Council and Procurement and Finance Committee at lunch to discuss topics of perennial mutual interest in the industry-government interface.

We realize that AIA's Annual Phoenix Meeting is ordinarily limited to industry executives, and therefore, I want to express our gratitude to Karl Harr and to your governors for this invitation. But, perhaps with some bias, I do feel that at this particular time the Space Program deserves your most thoughtful understanding and constructive support. You who lead our industries and we who run NASA are all in this thing together - as direct professional participants, as influential leaders in the forming of public opinions, and as citizens of the United States. In view of your responsibilities, I want you to have as many of the facts as we can properly make available to you so that your best thinking and, hopefully, your strongest and most effective support can be made available to NASA as our nation moves ahead in space.

Let's review, for a moment, how far we've progressed in the first decade of space. Our progress since 1958 can be simply and dramatically measured by our increasing capability to launch larger and larger payloads into space. The first successful American satellite, launched in early 1958, was the 30.8-pound Explorer I. The launch vehicle was a Jupiter C rocket with a first stage thrust of 83,000 pounds. Today, our Saturn V has a first stage thrust of 7.5 million pounds from five F-1 engines, and it can send over a quarter of a million pounds into Earth orbit, or 100,000 pounds to the moon. Thus in ten years our orbital payload capability has increased ten thousand times.

We have also progressed rapidly in overcoming the problems of manned flight. Project Mercury, which began with Alan Shepard's 15-minute suborbital flight in May 1961, was intended more to prove man's <u>durability</u> than to develop his <u>capability</u> in the then unknown environment of space. With the two-man Gemini spacecraft that followed, we began to explore and evaluate human capabilities in space thoroughly and accurately. Gemini increased our experience to approximately 2000 manhours, including one flight that lasted for 14 days. Our astronauts compiled a total of more than 12 hours of extravehicular activity, secured excellent photographs, demonstrated rendezvous and docking, carried out maneuvers while docked, and proved man's ability to work in space.

With our recently completed Apollo 7 flight, we have now demonstrated third-generation capability in the most advanced and thoroughly successful manned space mission to date.

I have here today the recently released "quick look" film of the mission, which illustrates our current status better than any words I could say. Note particularly the great ease with which the astronauts carry out IVA activities under weightless conditions within the Command Module.

*(SHOW "QUICK LOOK" FILM -- approximately 14 minutes)

As you have seen, Apollo 7's performance was almost letter perfect in every respect. We did encounter a few minor technical problems during the 10.8 day mission. There was a slight problem with overvoltage spikes from corona upon opening a motor-driven switch, the biological harnesses failed, and we had a minor temperature control problem with one of the fuel cells. These problems can be overcome quite easily in Apollo 8 without any hardware changes.

As you know, last week after a series of intensive reviews we announced the decision to fly Apollo 8 with its three astronauts headed by Frank Borman into orbit around the moon. The launch is scheduled to take place no earlier than December 21. The mission will be open-ended, with various options of increasing boldness to be selected as the flight progresses. These include a low earth-orbital flight repeating Apollo 7, a high apogee mission up to 60,000 miles from the earth, a circumlunar flight around the moon and directly back, or a lunar orbit mission. The decision to inject into a translunar trajectory with the second SIVB burn will be made after two or three orbits around the earth. At all times on the outward bound trip to the moon the spacecraft will be kept on a free-return circumlunar course. If everything goes as planned at every stage, the spacecraft will retrofire into a 60-nautical-mile-high orbit around the moon, orbiting ten times before again firing the service module SPS engine to inject into a transearth orbit from the moon. Each lunar orbit will last approximately two hours; the return flight from moon to earth occupying about 57 hours.

There was much speculation in the press after the successful Apollo 7 mission, and they decided we would go around the moon a lot more quickly and easily than we did. For those of us who were responsible for the program and who participated in the many reviews preceding the decision, the outcome was not quite so obvious. Only after an intensive and searching review of all anomalies in the Apollo 6-Saturn V flight data, post-mission analyses of the manned Apollo 7 flight, results of the Apollo 8 design certification and checkout status, and a complete examination of the risks and benefits involved in each mission alternative, did we decide to send Apollo 8 out to orbit the moon.

Apollo 8 will be, of course, our first manned flight with the Saturn V booster; it is by far the most difficult and ambitious manned space mission ever attempted. Without being overconfident, we firmly believe that we'll be ready to fly this mission next month.

We expect it to teach us a great deal. Among other things, it will give us valuable experience in validating the Apollo Command and Service Module communications and navigation systems at lunar distances. It will verify ground support elements and onboard computer programs for lunar missions, and greatly increase our understanding of environmental conditions in deep space and near the surface of the moon. It will confirm the ability of the crew to see, use, and photograph lunar landmarks from a 60-mile altitude, and give us new measurements of the recently discovered variations in the moon's gravitational potential, refining the data sent back by our lunar orbiter program.

Depending on the outcome of this flight, the Apollo 9 mission that follows in March is planned as the first manned test flight of the entire Apollo spacecraft. It will test in earth orbit the lunar module and the Command and Service Modules, with the astronauts going out some 4,000 miles from earth, flying the lunar module a hundred miles away from the Command and Service Module, then rendezvous-ing and docking with it for the return to earth.

A full-dress rehearsal in lunar mission sequence should follow sometime in the second quarter of 1969, probably again in earth orbit, but with the option to perform a lunar orbital mission should circumstances then warrant it.

As you are all well aware, it is not likely that we will be able to attempt an actual lunar landing mission before next fall. We could only attempt one then if every Apollo flight now scheduled achieves 100 percent success, without any other problems developing to adversely affect a decision to "go." We'll be in a much better position to set a date for our first lunar landing when the results are in from Apollo 8 and 9.

In the meantime, we'll also be moving into our second decade of unmanned space exploration. Automated spacecraft have taken thousands of close-up photographs of the moon both from the surface and from lunar orbit. Our Mariner spacecraft have taken a few intriguing pictures of a part of the surface of Mars, and sent back valuable scientific data about our cloud-wrapped neighbor, Venus. The follow-up Mariner '69 mission to Mars is approaching its launch data.

So much progress has been made in satellite communications that the commercial ComSat Corporation is now giving us routine coverage of world events on a regular basis at a profit, and the international Intelsat organization is working reasonably smoothly.

And, incidentally, this points up one of NASA's continuing basic policies -- that of "handing off" operational responsibilities to other agencies, both public and private, when the R&D and demonstration phases are finished. Our feeling is that we can best advance the nation's space efforts if we carry our work forward to the point where operational feasibility has been established, and then transfer the operation to the appropriate institution. We should not dilute our efforts in innovating, in developing, in exploring, in testing, by saddling ourselves with operational problems. For the foreseeable future, we intend to continue this policy. We welcome your counsel and creative ideas on the major policy questions concerning the kind of public or private instrumentalities that should be <u>operationally</u> using space -- questions which industrial leaders like yourselves may well wish to ponder and discuss.

In line with this policy, we have spun off meteorological satellites to the Weather Bureau. Worldwide weather coverage from space has moved smoothly from an experimental to an operational status, with today's weather satellites routinely sending back valuable pictures of the earth's cloud cover and weather patterns -- not only to stations here in the United States, but also to over 40 other countries who have made the relatively small investment in equipment needed to interrogate our satellites as they pass overhead.

It would be easy to spend hours just giving you the details of the practical accomplishments of the first decade of the space age.

Besides weather and communication satellites, we would have to describe navigation, geodetic, nuclear test ban surveillance, and scientific probes of many kinds. Yet, even with all the progress I have described, the first decade of space exploration corresponds in a very real sense with the early years of aviation after the Wright Brothers flew at Kitty Hawk. I recently calculated the costs per seat mile of their first flight for comparison with our Apollo flight to the moon. They probably had about ten thousand dollars invested in the first Kitty Hawk flight that went one fifth of a mile, giving a cost per seat for Orville of fifty thousand dollars. We'll have twenty-five billion dollars in our first five-hundred thousand-mile trip for three astronauts to the moon, giving a cost of only seventeen thousand dollars per seat mile. We're ahead of the Wright Brothers -- but we sure have a long way to go to catch up with the 747! If return flights cost five hundred million dollars, that's only three hundred and fifty dollars a seat mile, so we're going in the right direction. But here's a real challenge for the future: What is the next generation lower-cost system going to be? Can we begin to think of low-cost logistic shuttles from earth to orbiting space stations, and reusable low-cost shuttles from earth orbit to lunar surface and return? What costs can we anticipate from the next two generations of space systems? We need your best advanced thinkers to help us lay sound long-range plans in these areas. In the next decade of space we need to further develop and strengthen the productive and cooperative working relationships between NASA and industry and university scientists that have carried us so far in the last decade.

As all of you well know, the great majority of NASA's work is done under contract to the industrial organizations that you represent, and you can be sure that we have no intention of changing this policy. More than 90 percent of all NASA dollars are so expended. At the peak of our activity in FY 1966, the space program employed a combined force of some 420,000 industry, university, and government men and women, only 35,000 of whom were NASA employees. It is interesting to note that in the first decade of space exploration, this Nation mobilized for the space program about the same number of workers as were required to build the transcontinental railroads in the 19th Century.

We have, of course, long since passed the peak. From the maximum employment level I mentioned of some 420,000 persons, which included 375,000 industrial employees, we will drop to about 235,000 by the end of this fiscal year. In contrast to this, the Soviet Union is still building its space activities, with the clearly expressed intention of attaining preeminence in space.

As I look at our greatest problem in NASA today, it is to preserve the strong scientific and technological base, and especially the management capability that we have created with you over the past ten years. The most severe loss the nation can suffer is its trained personnel organized as effective teams.

Total manpower within NASA itself, responsible for overall management and the conduct of supporting research and development work in our research centers, is now only about 32,000 employees, 40 percent of whom are scientists and engineers.

In addition to these irreplaceable human assets, our ground installations and facilities, our vital spaceyards and spaceports, represent a capital investment of $4.5 billion, which stand ready to support the nation's space program in the years to come. Another precious national asset is the close link between NASA and more than 200 universities across the country who are furnishing expert knowledge and research capabilities available from no other source. We are proud of the fact that we have not just used university capabilities, but strengthened the universities in the process by helping them build additional research facilities, and by supporting their purposes by such efforts as the NASA-sponsored pre-doctoral program which has produced 1300 Ph.D.'s in space-related disciplines.

In a very real and literal sense, these fundamental "building blocks" we have assembled for success in our aeronautics and space programs are vital national resources. We have created the facilities, the technologies, the trained manpower, the industrial know-how, and the university relationships that comprise the space power of this nation. We cannot afford to see these facilities, these men, these government-industry-university teams dispersed; once they are gone, as you know so well, it is extremely difficult and expensive to rebuild the capabilities they represent.

Today the United States stand at the crossroads. Because of the heavy demands of the Vietnam conflict and numerous other difficulties, foreign and domestic, the NASA budget has been cut back severely. From NASA's beginnings in 1958, with an expenditure of $145 million, we saw the space program grow to its maximum of $5.9 billion in FY 1966. But in FY 1969 we are operating at very close to the level that our analysts have determined to be the "breakpoint," which is approximately $4 billion. Below that level it would no longer be possible for us to continue to hold together our hard-won capabilities and utilize them effectively in critical programs; some of them would have to be dropped entirely.

On the other hand, a budget above the $4 billion level will not only allow us to utilize U. S. capabilities to carry forward major programs, but might permit us to undertake modest investments aimed at reducing costs of future space activities. We are in the position now of really needing to spend money to save money. The development and explorations of the past ten years have been carried out with success and safety as the key determinants, and cost a secondary consideration. This was proper at the time. Now we need to develop simplified, multi-purpose, perhaps reusable boosters and spacecraft, with simplified check-out and launch procedures for both greater reliability and lower cost. And as I mentioned, it is time to start planning the next NASA Center, not on earth -- but in space -- a major national orbiting platform where extremely valuable work can be performed, a permanent space station to which low-cost shuttles from earth can transport men and supplies, and from whence spacecraft can be easily launched and recovered. This can be contemplated with space budgets in the five-billion-dollar range.

Wherever we have told the NASA story, stressing the importance of preeminence in space to the nation's future, we've gotten a good reception, but we still have an awful lot of work to do before we get across to the American people the answers to such simple questions as: Why should we go to the moon? Why shouldn't we take the money we're spending on the space programs and put it into the cities or the poverty program?

Why should the United States take on the challenge of space now?

All of us in this room have a professional stake in the space program, so there's not much point in our agreeing with each other that space is of great importance to America's future. But it is of supreme importance, and I ask all of you to do everything you can to help, that the American people in the coming months understand how essential the space program is to the future of this nation. As we enter the critical period of change of Administration and a healthy reexamination of national priorities, it is particularly important that the American people and their representatives understand the long-range potential of the space program for future U.S. wealth and power. I earnestly solicit all of your assistance to this end.

What impact can a healthy space program have on our future? To help answer this, let's reexamine for a moment the long-term results of the tremendous technological effort that the United States mounted during World War II. This came about through a great national challenge following the national stagnation of a terrible depression. The technological advances of World War II are still being exploited today, and they furnish a compelling example of why America should now rise to the challenge of space. In the dark days of the 1930's the energies and capabilities of the United States lay largely idle as we struggled with the economic catastrophe of the depression. We were not vigorously opening new frontiers geographically, scientifically, or socially, although the seeds were there. We were an under-utilized nation, an under-utilized people, and that is not the character of America.

At the end of that time came the terrible challenge of World War II, which caused the United States to flex its muscles and to liberate its unique talents. Do you recall the initial disbelief when President Roosevelt set for the United States the goal of producing 50,000 aircraft a year? Yet we not only achieved that goal, but surpassed it. In the process, great social changes occurred as displaced share-cropping farmers were trained to build airplanes.

Meeting the challenge of World War II taught us more than how to produce large quantities of hardware, though, and more than how to create technological breakthroughs. More important, it taught us how to forge together our university, industrial, and government institutions into the mightiest partnership for effective action the world has ever seen. The results that this partnership of democratic institutions achieved in a very short time are still astonishing. The key to success was the ability to manage flexibly very large and complex enterprises involving advanced science and technology on a global scale. The United States concentrated this power on five major technological challenges, with spectacular breakthroughs in each. One of these was the liberation of nuclear energy which is a textbook case of national challenge met by the flexible partnership of democratic institutions that I just mentioned. There was also the great advance of microwave technology that quickly developed the powerful radars that drove the Japanese and German navies from the seas.

There was the broad field of synthetic materials development, from the new butyl rubber plants that provided a substitute for unavailable natural rubber to the synthetic drugs like Atabrine that substituted for quinine, and, of course, the antibiotic revolution that has contributed so greatly to mankind's health and longevity.

Then there were the breakthroughs in jet and rocket propulsion, which have since so radically altered military and civil aviation, and opened the space age. Finally, of course, World War II requirements led to the development and initial application of the electronic computer, one of today's most rapidly growing multibillion dollar industries.

When you consider the source of the unprecedented prosperity that America has enjoyed in the 1950's and 1960's, it is impressive how much economic progress traces back to these five basic technology breakthroughs stimulated by the national challenge of World War II.

I believe that NASA's organization to meet the challenge of space today is highly analogous to the industry-university-government teamwork that responded so effectively to the challenge of World War II. In fact, the American space program is advancing every one of these five areas today: Nuclear energy in our Nerva project, microwaves in satellite communications, synthetic materials in composite structures, rocket and jet propulsion in both aeronautics and space vehicles, and electronic computers in massive ground installations and automated lunar and planetary probes. Our future national prosperity depends upon continuing these advances in the 1970's. For example, the backlog of American aircraft builders in jet transports alone is now eight billion dollars, and the computer industry now employs 350,000 people and produces annual sales of six billion dollars. America's world-wide success in both fields is based on technological preeminence.

When people ask why we should spend money on space instead of on poverty programs, they overlook the fact that these are two different questions that need to be sorted out and addressed separately. If you want to distribute more wealth in welfare programs to alleviate poverty, one of the first things you should consider is how to create the additional wealth. And I would submit that NASA's space exploration programs that are moving science and technology ahead under the stimulating new challenge of space promise to create even more wealth than the military-oriented programs undertaken under the pressure of World War II, and in the process create new jobs and new opportunities that will not merely alleviate poverty but get at its root. We indeed have an exceptional opportunity now to invest profitably in many promising new space-oriented technologies of great future promise to the United States and to people around the world.

I have no quarrel with the need for doing a great deal more than we're doing to solve our pressing problems in the education, health, crime, and poverty areas. Conditions in many American cities are a national disgrace. But as we tackle these grave social ills, we've also got to continue to forge ahead in other areas. We must worry about how we create new wealth as much as we do about how we better distribute today's wealth. It would be an international tragedy if America were to turn back now from its forward thrust in space at the end of an astonishingly productive first decade during which the tremendous instrumentality that you saw in the Apollo 7 film was created. Rather we should be asking ourselves how we can find new ways to bring space-age management capabilities to bear on our other problems.

The World War II advance in our capability to manage on a global scale large programs involving complex science and technology by bringing together university, industry and government institutions was not a new invention in the United States. The other area where the United States leads the world today is agricultural production, where we have been able for a hundred years to maintain an effective partnership with our land-grant colleges, the Department of Agriculture, and large-scale agro-industry. These democratic institutions working together within an environment that they understand have produced the U. S. agricultural complex that is now the envy of the world. There is a general lesson here to be learned and more widely applied. We in the space program today are carrying forward this interinstitutional management pattern to explore not just our globe but the entire solar and galactic environments with which our earth interacts.

It seems to me that continuing advances in science, technology and our ability to manage large enterprises will be the cornerstone of our national power in the future. America probably derives as much of its present national power from past successful large-scale government and university research programs in support of industry and agriculture as it does from any other area of national effort, particularly when the beneficial effects of research support of university education is considered. We are the envy of the world in these areas. As you all know, this lession has certainly not been lost on the Soviet Union. The Soviets have concentrated vast energies and resources on technology since World War II, indicating that they too now appreciate the power of large-scale technical advance. Today, they are building whole new cities based on nuclear physics, whole new cities based on space. Their schools and universities are graduating large numbers of scientists, engineers, and technologists to move them forward to a position of world leadership. It's very clear to them that future world power and prestige depends upon meeting the challenge of new technological advances involving substantial investments. They are right about this, and we must see that our people and their leaders in our democratic society are equally convinced. With the press of other demands and short-range distractions, this isn't easy. Nor is it easy in a democracy to maintain the spirit of national challenge. In our pluralistic society we don't want this to come down as dogma from any small group of elite leaders trained in science and engineering with the power of those in the Kremlin. But we do have a great strength in our free democratic society to call forth new ideas from all of our people and to take on new national challenges that make sense. We can decide to go forth and excel as a spacefaring nation because it's the right thing to do, because it's an exciting thing to do, because this is a goal that we as a free people agree that we want the United States to set for itself.

Maintaining a strong U. S. effort to meet the challenge of space isn't easy, and I must say from my present position as we work to move NASA forward I am quite conscious of the difficulties involved.

But we've got a great deal of strength and a great many supporters in the public, in the Congress, and in the present and new Administrations. We've built great capability in NASA's research centers. We've organized a mighty industrial base to put together the systems that you saw today. And we've attracted an extremely brilliant group of university scientists to work with us. Working together we can certainly develop, articulate, and carry out a sound American space program.

Let me say another word about why I feel it's important that we develop strong support for the space program now. The United States has experienced in the last few years, and particularly in this last catastrophic year, an inordinate national questioning of the values of our society, and of the direction that young people should take. In this uneasy discussion, it's becoming fashionable to question whether an industrial-university-government institutional partnership is indeed healthy. Is it proper for independent universities in our society to work so closely with industry and government? Should not this effective partnership now be dissolved in the interest of freedom of discussion and criticism? In my view, this would be a national disaster. The suggestion arises from an inward-looking uncertainty, a self-doubting "National hypochondria" we're now experiencing. Instead of looking outward at the real world, we're directing our national attention inward, reexamining our goals and institutions, questioning programs and expenditures. A little of this is healthy; too much is morbid and crippling. But I don't think this will long be the mood of this country. There will certainly be further unrest, but the answers must come from constructive new programs. In the long run the United States will move forward to take on greater challenges, and the space program has a major role to play in redirecting our energies and attentions outward.

In conclusion, let me outline for you several additional areas for future work where we'll need your support. We've got to do a great deal more to integrate our scientific unmanned and manned satellite programs to utilize more effectively the growing capabilities for men to operate in orbit that you saw in the film. This will require a great deal of energy and thought; we're going to have to be even more inventive in the second decade of space than we've been in the first. But we now have built the instrumentalities for this.

Another area that we must pay increasing attention to is the initial exploratory probe of the outer planets beyond Mars, and of Mercury. You are already aware of our plans for upcoming unmanned spacecraft missions to our nearby planets, Mars and Venus, but we are also studying the problem of extended missions to the outer planets of our solar system--Jupiter, Saturn, Uranus, and Neptune. In 1977 the gravitational fields of these planets can be employed to help kick the spacecraft ever farther away from the Sun. This opportunity for a "grand tour" presents itself only once every 179 years.

Wernher von Braun has pointed out that, although this mission can be accomplished with an all-chemical rocket, this might be an excellent opportunity for nuclear propulsion. For example, a Saturn V with a nuclear upper stage could offer a "grand tour" scientific payload of about 40,000 pounds, which would permit individual probes or orbiters to the various planets as our spacecraft flies by. This does not appear possible with chemical rocket propulsion only. How can we best use nuclear energy for long-term power in orbiting space stations, on the surface of the moon, and in unmanned probes to the planets beyond the range where solar power is effective?

Another area demanding increasing attention is the complex of activities known as "Earth Resources Satellites", and the way in which these blend in with meteorology, geodesy, navigation, and other satellite programs. It's very clear that just as we've had substantial payoffs from communications, navigation, geodetic, and weather satellites in the first decade of the space age, earth resources satellites will represent extremely promising investment opportunities in the second decade. Earth resources satellites will require close cooperation among many agencies in Washington, and in the long run with new commercial and international institutions that can bring the benefits of the space age to many people around the world.

Jim Beggs has prepared an interesting presentation for you this afternoon on the aircraft and space technology program, so I will not presume on his talk other than to emphasize the fact that in addition to more exotic space activities, there remains a continuing need for expanded R&D support for general aviation. Air traffic control research, more intensified efforts to understand the fundamentals of aircraft noise and sonic booms, and research directed toward improved safety related to small aircraft operation and avoidance of mid-air collisions, are the kinds of activities I'm talking about. The resolution of these problems are important because of the continued increase in the importance of air transportation to our national economy.

I have great confidence in our ability to do all of these things, and to do them well, returning to the American people the substantial rewards that long-range investments ought to return. The successes of the first decade of space augur well for this. The nation can be proud of the way in which it set bold objectives in space exploration and went on to meet its commitments. This ability to set and achieve challenging goals is a prerequisite for the public confidence that must be the cornerstone of our future space program. We're extremely conscious of this in NASA. For this reason, we are now devoting the utmost energy and attention to make certain that our bold Apollo program is concluded in the finest possible fashion, so that we will indeed merit further public support based on successful performance.

Well, these are some of the thoughts that I wanted to share with you on this November day in 1968 as we look at the status of America's space odyssey. We've concluded the first decade of the space age and are entering the second. We've reached the end of our Apollo preliminaries, and are now engaged in the real test of whether we've skillfully spent twenty-five billion dollars to take us to the moon. I'm certain that this will indeed prove to have been a wise investment for America. We really have no choice. There are probably very few people in this room who would argue with this. So I ask again of you that you pitch in to help those of us who are directly within NASA to get this important message across to the American people now. Our citizens must understand and strongly support the supreme importance of the United States being Number One in science and technology, and preeminent as a spacefaring nation.

In 1969 we should have many fine opportunities to develop a better public understanding and support for the promise of space as the nation watches our Apollo program reach its dramatic conclusion. So now is the time for us to work together to hold the United States on a trajectory toward preeminence in space. We must forge an even more effective partnership among our university, industry, and government institutions. Clearly we must accept the challenge of world leadership in space, not just for the United States, but for the future of the free world.

Thank you very much.

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SCIENCE, TECHNOLOGY, AND SOCIETY

by

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INTRODUCTION

Our modern society, resting as it does upon an involved and complex past, seems to grow ever more complicated with the passage of time. And while there seems to be an increased awareness of what is going on -- brought about by rapid and widespread means of communication -- our citizens find it increasingly difficult to comprehend the full import of the issues and problems besetting us. The one thing that does seem clear is that the world's activities and thought interact in many ways. The interweavings of science and technology, of industry and commerce and the humanities are complex and varied.

The interactions of science and the humanities are both obvious and subtle. Science and technology are not separate and distinct from the humanities as some have suggested, but

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are integral parts of our modern culture, contributing to the arts and furnishing new media for human expression. They provide better and new musical instruments and improved acoustics for enriched enjoyment. They give the artist new materials and techniques for his work. They enrich the humanities in furnishing man with a broader basis for understanding himself, his potentialities, and his place in nature.

Scientific methodology provides the historian with a better approach to his subject. Physics and chemistry give the archeologist a surer grasp of temporal relationships by offering improved tools for dating materials and identifying their sources. Science generates an increased understanding of man and nature and this understanding is reflected in the world's literature, in its social, political, and economic institutions, and in its application to human daily living.

Much of the world's population today is aware of the earth as a body in a solar system which is part of a galaxy among millions of other galaxies. These people can conceive of man in a historical and cosmological perspective that did not exist in centuries past. As this understanding and these concepts spread to more and more of the world's people, it may be hoped that this common bond of understanding will increasingly motivate the search for the peaceful solutions of the problems that beset the world and provide the means for doing so as well.

The two cultures of C. P. Snow do not live in isolation from each other. The forces generated by living together, writing together, working together, debating political and social issues together, struggling for survival together, battling human problems, playing together, traveling together, viewing television together, and reading newspapers together irresistably impel an interaction between the two cultures that reveal them as not really separate cultures, but rather as two aspects of one culture. By spreading this sort of interaction to more and more of the world's people, science and technology can be used to strengthen the common bond of humanity. To understand and to use properly and effectively these powerful tools of our time is an inescapable challenge to men the world over.

I should like today to discuss briefly some of the ways in which science and technology do have an impact on human activities in your field of social studies. Although I will use the field of aeronautics and space to focus the discussion, many of the points to be made apply quite broadly to the general fields of science and technology.

PROGRESS IN AERONAUTICS AND SPACE

During the first decade of what has come to be called the Space Age, the United States has developed a far-ranging ability to operate either manned or automated devices in the earth's atmosphere and space. Visible proof of this is to be found in accomplishments such as Mercury, Gemini, and Apollo, Surveyor and Lunar Orbiter, Mariner, Explorers, our weather and communications satellites, and in the expanding accomplishments of the aeronautics industry.

A national team of highly trained and experienced people in industry, government, and the universities undergird this capability. They have the knowledge and the skills to build aircraft, rockets, and spacecraft, to launch and operate them, and to use them in achieving commercial, scientific, technological, and other national objectives. This national team now has available to it the industrial complexes required for manufacture, assembly, test, and check out of components, subsystems, and the aerospace vehicles that they operate.

The nation has brought into being facilities for preparation in launching, and networks of ground stations for tracking vehicles and spacecraft and for acquiring data and information from them.

Our capability in space gives the nation the ability to do the following:

-- To make extensive applications of aeronautics and space research to benefit mankind.

-- To conduct manned exploration of the solar system, starting with the moon.

-- To create and use space stations in earth orbit.

-- To explore and investigate the planets and the stars with automated spacecraft.

-- To force the advancement of aerospace technology through the accomplishment,of specific missions.

-- To advance the life sciences through the study, in space, of zero gravity and radiation.

-- To contribute to the strengthening of our military posture.

-- To strengthen the development of civil aeronautics.

These benefits are not just future possibilities. The first decade of the Space Age has chalked up a remarkable list of accomplishments.

We have learned how to explore the physics of our universe in a manner that no earth-bound instruments can provide. The United States achieved early eminence in space physics with the discovery of the Van Allen Belt, the study of the geomagnetic tail, the extensive research on cosmic rays, the solar wind, and earth's upper atmosphere.

Closer relations between the earth's populations have been made possible by our communications satellites, and the world-wide weather satellites, both of which were pioneered by NASA. Using operational TIROS weather satellites, the Commerce Department's Environmental Science Services Administration is providing the first operational weather satellite service for our Weather Bureau stations throughout the country, and satellite results are transmitted through usual global weather service networks to other countries. More than 40 other nations around the world also receive the ESSA service through the Automatic Picture Transmission reception equipment which they have set up for the purpose. Transatlantic aircraft use ESSA satellite cloud cover photographs for the most up-to-date information available on weather conditions en route.

Similarly, the Communications Satellite Corporation, created as a semi-private firm, operates communications satellites based on technology developed in NASA's communications research and development programs, particularly in the synchronous orbit satellite Syncom.

Further advances are being sought by NASA in its Applications Technology Satellite series, and in studies which offer the possibility at some time in the future of bringing radio and TV programs directly into the home and classrooms, or to groups desiring special educational programs.

Project Ranger made possible the greatest single advance in lunar observing since the time of Galileo. Camera-equipped Ranger rockets crash-landed on the moon, taking pictures up to the moment of impact. Telecast back to earth, these photographs revealed lunar features as small as 10 inches across.

Surveyor landed gently on the moon and gave us further high resolution pictures, information on the bearing strength of the lunar surface, and data on lunar temperatures.

Lunar Orbiter, circling the moon, provided a massive amount of data. Essentially, the entire lunar surface was mapped, including the heretofore unseen far side of the moon.

Mariner spacecraft have explored Venus and Mars. The surface of the Red Planet is also pocked with craters, much like those seen on the moon.

The secrets of the mysterious cloud-wrapped planet Venus, have been probed by sensors of two Mariners, and the Soviet spacecraft Venera IV.

The study of the moon and planets is particularly important in seeking for evidence as to the origin of the solar system, including the earth. In this respect the solar system may be viewed as the environment of the earth in an enlarged sense, in which investigation of the other planets will serve to illuminate our study of the earth itself. We need especially to understand better our atmosphere and what we are doing to it to know better how to handle problems of pollution, water reserves, and weather. The search for such understanding gives a special importance to the investigation of planetary atmospheres, which is now made possible by probes like the Mariner and Pioneer spacecraft.

The sun's energy literally controls the behavior of the earth's atmosphere. Hence the sun has a double interest for us -- as our nearest star and because of its continuous profound influence on our lives. Radiation from the sun, together with the earth's rotation, drives the general circulation of the air in the familiar weather patterns. Indeed, the earth's atmosphere has often been referred to as a gigantic heat engine driven by the sun. Its meteorology is one of the most complex problems ever tackled by scientists.

Manned space flight contains its own drama. We have logged nearly 2,800 hours of flight time for men in space throughout our Mercury, Gemini, and Apollo programs. With the scheduled flight around the moon, December 21, we move closer to landing men on the moon and returning them safely to earth. In the process we will gather knowledge about space, the moon, and our own planet through the unique sensory and judgment abilities of living men.

NASA continues to make contributions to progress in aeronautics, from hypersonic flight concepts at one end of the spectrum to helicopters and short takeoff and landing craft at the other. Problems of aircraft noise arising from jet engines and sonic boom, and flight safety are current subjects of intensive study and tests.

One of the most interesting and important of our research aircraft has been the X-15, a cooperative venture of NASA and the armed forces. For the better part of a decade, the X-15 has been setting record after record for speed and altitude. It has gone as fast as 4,534 miles per hour, and reached an altitude of 67 miles. But these records only symbolize the more important large volume of data on a multitude of engineering subjects such as the characteristics of high speed flight, aircraft propulsion, control, structural behavior, and human factors.

Bv much more in the way of returns can be anticipated in the future. We can look forward to long-range weather forecasting, very high capacity communications systems, manned cities in the sky, a growing familiarity with our solar system, and man ranging out to other planets. Within our atmosphere a whole new dimension in air transportation will develop, ranging from quick and ready short hops to super-speed trans- and inter-continental flights.

INTERNATIONAL ASPECTS

Space science and technology affect our relative position in the world in fundamental ways. Carried out before the eyes and ears of all of the world, our space program has provided a graphic contrast between open and closed societies. But more than this, the visible strength and capability represented by space technology exerts profound influence at the negotiating tables of nations. The early and continuing Soviet successes in space and the appearance of power and strength that those successes give the USSR, have undoubtedly affected the thinking and actions of nations and increased Soviet willingness to take risks of a political and military nature. Our own later but growing success in space -- maintaining our freedom of action in this new dimension -- has undoubtedly helped to stabilize and in some measure improve the situation. It has also contributed to such advanced international developments as the space treaty which applied and even extended the freedom of the high seas to a new dimension of man's activity, preempting it for peaceful purposes.

Satellites have made possible an international system of communications which already includes over 60 nations in a new global consortium, Intelsat, and opens up whole new continents to the early potential of educational TV, which under older systems would be generations off.

Weather satellites, along with the unique APT or Automatic Picture Transmission system, encourage international cooperation and benefit, providing early warnings of typhoons and hurricanes for Japan, Australia, Madagascar, and other countries. Thrilling and heartwarming is the story of Mexico's use of the APT receiving station which we loaned them, and which makes it possible to receive from ESSA satellites photos of surrounding cloud cover. With such pictures and <u>only</u> with these pictures, Mexican observers were able to follow the course of Hurricane Naomi, to issue evacuation warnings along the coast, and to meet the onslaught of the storm with no loss of life, and greatly reduced property damage. Knowing again from APT pictures when the rain would cease, made it possible to ride through the storm with the knowledge that the torrential rains would stop before it would be necessary to open the floodgates of a dam under construction to relieve the buildup of pressure on the structure. Opening the gates would have entailed flooding an entire village in the valley below. So impressed was the Mexican Government with the success of this operation, that a Presidential Citation was issued to the Mexican Space Commission.

In all, some 45 countries have already installed these APT sets which enormously improve their weather forecasting capabilities, especially in the vast areas where monitoring stations such as we have in the North Atlantic are beyond their means.

Perhaps the greatest potential benefit opened to us by space technology lies in the future survey of earth resources by satellite. Already, relatively simple hand-held camera work from Mercury, Gemini, and Apollo has shown us that such photographs can tell us much about fresh water resources and water management, help us to monitor sea ice for navigation purposes, and discover previously undetected geologic features which may have practical value as prospecting aids. More sophisticated satellites in the future should help us to evaluate the health and progress of food crops, grass cover, and forest stands, to locate fishing grounds, and so forth. Hydrology, glaciology, geology, oceanography, cartography, agriculture, civil engineering are all being advanced by the new tools of the Space Age. But the global impact of space is not just a matter of future promise. Examples like that of the Mexican experience recur again and again, in meteorology, communications, navigation, earth observations, and space science. At the August 1968 meeting on space applications, in Vienna, sponsored by the United Nations Committee on the Peaceful Uses of Outer Space, and attended by 78 nations, worldwide interest in the value of space research and application was evident. Both achievement and potential were discussed in a two-week review of the world's stake in space.

Because of these values, the U. S. has given special attention to international cooperation in space. Some of the statistics may be of interest here.

As we achieve and extend these international benefits, we are cooperating with scientists of over 70 nations in flight and ground-based space projects. Already we have carried out joint projects in which we have used our boosters to orbit 10 satellites contributed by other nations. We are accommodating nearly two dozen foreign experiments, selected on their merits, on <u>our</u> satellites. Over half of our sounding rocket experimentation is done in partnership with other nations, often using <u>their</u> launch sites for special investigations in the auroral and equatorial zones or other locations of scientific import. Our tracking stations abroad give foreign nationals a vantage place for training in and assimilating the new technology. The first lunar surface samples we retrieve will be shared with over two dozen foreign experimenters whose proposals for analysis were meritorious.

This is only a glimpse of the political, practical and research value of our space efforts in the international sphere.

CONTRIBUTIONS TO EDUCATION

The space program is also important to the educational system upon which it must draw. Our prime point of contact with that system has been the university. We have set up a complex of advisory committees and boards staffed by university people to help us define and chart our programs of space investigation. We have provided direct grants in support of specific space experiments, and we have established a Sustaining University Program providing broader grants to finance facilities for multidisciplinary research, to fund graduate fellowships, and to support long-range special studies in both the physical and social sciences.

The university contains within its walls the broadest range of expertise in the world today. Many of the most serious problems of our times are going to require the application of a broad range of expertise in the social, political, and physical sciences, engineering, and mathematics, to achieve acceptable solutions. It is our expectation that the university will have to play a fundamental role in solving these problems, providing not only the education of new talent, but the application of its own multidisciplinary talent to the effort. NASA has, therefore, worked with the universities in such a way as to encourage the development of multidisciplinary thinking about regional and national problems while at the same time accomplishing the specific research of the space program.

NASA is informing the secondary school teacher, attempting to place him in a position to exploit the interest and enthusiasm which the space program typically excites in the student. We are producing curriculum resource packages for the teacher and textbook author which relate space science and technology developments to regular curriculum topics.

But the challenge which confronts our educational institutions goes beyond curriculum enrichment and information services. More than ever before, this nation needs men and women whose minds and imaginations can combine the solving of technological problems with the solving of sociological problems. This need has the most profound implications for the educative process, for the way in which we train future scientists, engineers, businessmen, and social scientists, and for the way in which we will put them to work.

We must reduce the overlong period which is now required for new knowledge to be applied over a wide area of civic, industrial, and school life. We must make the application of new knowledge an instinctive element in the point of view of scientists, engineers, risk takers, and public servants. The early and competent exploitation of technology is a critical factor to progress. Dynamic concepts are essential in evaluating our nation's position today. And this means students must be educated for the future as well as the present. They must be prepared for their world, not ours or that of our fathers.

IMPORTANCE OF BASIC RESEARCH

In these difficult times, with the expense of the Viet Nam war, science in general and space in particular are finding it difficult to receive the strong support they need if they are to move forward at a pace commensurate with our ability to progress. In addition, such problems as air and water pollution, urban congestion, food supplies and over-population, and transportation demand the country's attention.

Actually, the needs represented by the list of problems I have mentioned should not detract from the support of science and technology, but should rather enhance its support, since the results of science and technology, combined with the best social, political, and economic skills we can muster, will be required to solve many of these problems.

Because of the importance of understanding the way in which science needs nourishment and fostering for a long period of time before it can play its role in this important partnership, I should like to conclude with a few remarks about the nature and needs of basic research, and the responsibility we all bear as citizens of the world to understand and meet those needs.

Values ultimately rest upon human needs. Such needs are manifold. There are the basic needs of food and shelter. When the means for meeting these needs are severely limited, these needs become urgent and overriding. When the means are ample, there is a natural tendency to expand the concept of needs to include comforts, pleasures, and the pursuit of individual interests.

In discussing what is often referred to as the full development of human capacities, of the human individual, of a society, we find there are additional needs. When the basic needs for survival are amply met, these additional needs come to rank high in importance. They include the arts, sports, the development of the individual physically, mentally, and spiritually, the search for knowledge in both the humanities and the sciences.

Science, technology, and the development of practical applications all contribute to the meeting of human needs. They aid in the task of meeting the basic requirements for survival. In times of large and growing populations, and tremendous demands for food, clothing, and shelter, the skills and knowledge afforded by science and technology are likely to be essential to achieving an acceptable solution.

The importance of technology and the development of practical applications of technical knowledge are usually clear and understood. The relationship between a felt need and technology and its application can generally be made clear in concept and acceptably close in time. Under such conditions there is strong motivation to support the development and application of technology.

The role of science in satisfying human needs is not so clear or so easily conveyed to the general understanding. History has shown that the results of basic scientific research usually precede by a considerable time interval the development of useful applications resting ultimately upon the new knowledge. In the nineteenth century this time interval was typically half a century. From the discovery of the laws of thermodynamics to their substantial application in heat engines was about fifty years. From the enunciation of Dalton's laws of combining weights to the development of the organic chemistry and dye industries was again fifty years. From the discovery of the principles of optics in the first half of the nineteenth century to the development of the sizable and important optics industry in the last half of the nineteenth century was again half a century. Similar intervals intervened between the work of Faraday and the widespread practical use of electricity, and between the work of J. C. (Clerk) Maxwell and the development of radio and electronics.

In the twentieth century the period seems to have shortened, to between twenty and thirty years. There are, of course, notable exceptions. X-rays were used for medical photography within a year after their discovery. On the other hand, it was many decades before the full development of the use of X-rays in medicine and in industrial technology was accomplished. Similarly, the transistor was quickly put to use in electronics applications. Nevertheless, it is taking decades again to develop fully the application of solid state techniques to micro-miniaturized electronics and integrated circuitry.

It appears that a significant time period is an essential characteristic of the process of moving from the raw results of basic scientific research to its substantial application to practical human problems. It may be that this period of time is that required for large numbers of technical people to make the new knowledge and principles an integral and second-nature part of their thinking and perception. Perhaps the requirement is for the new knowledge to find its way into the textbooks, to be communicated to a new generation of students, who in growing up with this new information find it a ready and natural part of their conceptual thinking.

A new ingredient of science and technology, characteristic of our times, is the conscious attention, to the problem of how useful applications eventually accrue from basic scientific research. Since the process seems to involve a substantial natural time constant, it may prove to be a very worthwhile subject of research to explore what are the ingredients of that time constant. It may be possible from a knowledge of the nature of the time constant to develop methods for shortening the time between basic research and ultimate application.

In the meantime, because of the length of time between investment in basic scientific research and important use of the results thereof, support by Congress and the public of basic research is hesitating and often outright skeptical. The development and application of technology to the quick solution of current problems is better understood and more readily supported. Yet the fact is that the technology to be used in the solution of a practical problem rests ultimately upon the results of basic research performed years, and often many years, ago.

Because of the long time constant involved, there is a great hazard in attempting to try to sell basic scientific research in terms of immediate practical returns. Moreover, history shows that the ways in which the results of a given basic research effort will become useful are often utterly unpredictable. It is demonstrable from actual experience that the effort to select the basic research to support in terms of predicted usefulness would over and over again preclude support of the research that in time would prove to be the most valuable.

So it seems clear, at least to me, that science and technology are inextricably interwoven into the fabric of human life today. Their enrichment of our lives goes beyond the material benefits that they help to provide. They contribute to the spiritual life of understanding better the universe in which we live and of our place in it. Out of this understanding there comes a greater appreciation of the beauty and grandeur of our world and universe, and the opportunity to improve the common lot to the point where everyone may share in that enjoyment.

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Address by

Dr. George E. Mueller
Associate Administrator for Manned Space Flight
National Aeronautics and Space Administration

before the

Ninth National Conference of
United Press International
Editors and Publishers

October 8, 1968

This is a significant week in the history of the National Aeronautics and Space Administration for many reasons and a most appropriate one for my discussion with you.

It is a very special pleasure to be with you a few hours before I leave for Cape Kennedy where in three days the United States will fly the Apollo 7 on its first manned mission since Gemini 12 returned to earth on November 15, 1966.

Only a few days ago we passed the tenth anniversary of the National Aeronautics and Space Administration, and only yesterday our long-time Administrator, Jim Webb, retired after eight years of finely focused drive and energy. All of you know with what dedication he applied his many talents to the creation of the great capability which we have today. I would like to stress the importance of the base which he has built as the foundation of our future in space.

Tomorrow at 1 o'clock at Cape Kennedy, Apollo 8, scheduled for launch in December, rolls out to Launch Pad A, having been assembled and fully tested in the Vehicle Assembly Building.

On Friday, October 11, Apollo 9, scheduled for launch early in 1969, will be fully stacked in the Vertical Assembly Building and ready for testing.

At this moment many representatives of your newspapers and the United Press International are covering prelaunch activities at Cape Kennedy and the Manned Spacecraft Center in Houston. A sizeable news pool is on the Carrier Essex, the prime recovery vessel in the Atlantic.

What I hope to do today is recall our accomplishments to date and sketch for you the Apollo Flight activity which will lead to a manned landing on the moon and return to earth before the end of next year.

I think you will agree that we have indeed made great progress in the seven years since man first ventured into space and in the 10 years since the establishment of the National Aeronautics and Space Administration.

In a short span of time, minute in terms of history, man's ability to live and work in space has been proven and the technology created to support his meaningful presence in space. Apollo and the earlier Mercury and Gemini programs represent great strides toward mastery of this new environment. Mercury and Gemini produced accomplishments which had been in the realm of science-fiction only a few years ago. Among these achievements are the longest manned flight, 330 hours; the highest altitude ever attained by man, 850 miles; the accumulation of 2000 hours of manned space flight by 18 astronauts,

INCLUDING 12 HOURS OF EXTRAVEHICULAR ACTIVITY; THE GREATEST NUMBER OF MILES TRAVELED ON ONE MISSION, 5,129,400 AND THE GREATEST NUMBER OF REVOLUTIONS ABOUT THE EARTH ON ONE FLIGHT, 206. FINALLY, RENDEZVOUS AND DOCKING AND INSPECTION WERE ACCOMPLISHED NINE TIMES, USING SEVEN DIFFERENT METHODS.

IN ADDITION, WE HAVE BEEN SUCCESSFUL IN 14 CONSECUTIVE UNMANNED MISSIONS WITH THE SATURN I AND SATURN IB LAUNCH VEHICLES AND OUR FIRST TWO SATURN V FLIGHTS HAVE BROUGHT US TO THE POINT WHERE WE WILL MAN THE THIRD FLIGHT LATE THIS YEAR.

WITH THESE ACHIEVEMENTS BEHIND US, WE ARE MOVING INTO THE MANNED PHASE OF THE APOLLO PROGRAM WITH CONFIDENCE THAT THE HARD WORK BY THOUSANDS OF PEOPLE IN GOVERNMENT AND CONTRACTOR ORGANIZATIONS HAS MADE THE APOLLO/SATURN SYSTEM AS RELIABLE AS HUMANLY POSSIBLE.

NOW, I'D LIKE TO TELL YOU ABOUT THE APOLLO FLIGHT SYSTEM.

TWO LAUNCH VEHICLES, THE SATURN I AND THE SATURN V, PROVIDE THE PROPULSION OR POWER TO PUT THE APOLLO SPACE-CRAFT IN SPACE. THE SATURN I ROCKET IS USED FOR EARTH ORBITAL FLIGHTS SUCH AS THE APOLLO 7 MISSION. IT HAS A LIFTOFF THRUST OF 1.6 MILLION POUNDS, OR ABOUT FOUR TIMES AS MUCH POWER AS THE TITAN II WHICH LAUNCHED GEMINI SPACE-CRAFT.

THE SATURN V HAS 7.5 MILLION POUNDS OF THRUST AT LIFTOFF. WITH THE APOLLO SPACECRAFT, IT STANDS 363 FEET

TALL, TWO-THIRDS AS TALL AS THE WASHINGTON MONUMENT. IT WEIGHS MORE THAN SIX MILLION POUNDS, AS MUCH AS EIGHT C-5 AIRCRAFT AND CAN PUT 285,000 POUNDS IN EARTH ORBIT OR SEND 100,000 POUNDS TO THE MOON.

THE SATURN V HAS 5,600,000 PARTS. IF WE HAD A 99.9 PERCENT RELIABILITY FOR THE FLIGHT THERE WOULD STILL BE 5,600 DEFECTIVE PARTS. YET, THE APOLLO 4 MISSION FLEW A "TEXTBOOK" FLIGHT WITH ONLY TWO ANOMALIES OCCURRING, DEMONSTRATING A RELIABILITY OF 99.9999+ PERCENT. IF AN AVERAGE AUTOMOBILE WITH 13,000 PARTS WERE TO HAVE THIS SAME RELIABILITY, IT WOULD HAVE ITS FIRST DEFECTIVE PART IN ABOUT 100 YEARS. IN FACT, ITS LIFE WOULD BE DETERMINED BY RUST OR WEAR AND NOT BY MECHANICAL FAILURE.

THE APOLLO SPACECRAFT IS MADE UP OF THREE ELEMENTS -- THE COMMAND, SERVICE, AND LUNAR MODULES. THE COMMAND MODULE IS A CONE ABOUT 12 FEET HIGH AND 13 FEET WIDE AT THE BASE. IT HAS ROUGHLY TWICE THE VOLUME OF THE GEMINI SPACECRAFT AND IS THE COMMAND POST OF THE THREE-MAN APOLLO SPACECRAFT SYSTEM.

THE SERVICE MODULE, ATTACHED TO THE BASE OF THE COMMAND MODULE, CONTAINS THE FUEL CELL ELECTRICAL POWER SYSTEM AND ROCKET ENGINES FOR MANEUVERING THE APOLLO SPACECRAFT AFTER IT IS DETACHED FROM THE SATURN LAUNCH VEHICLE. IT ALSO CONTAINS THE OXYGEN SUPPLY FOR THE CREW.

THE LUNAR MODULE IS DESIGNED TO CARRY THE ASTRONAUTS FROM ORBIT AROUND THE MOON TO THE LUNAR SURFACE, PROVIDE A BASE FROM WHICH TO WORK WHILE ON THE MOON AND THEN CARRY THEM BACK TO THE COMMAND MODULE FOR THE RIDE HOME.

ON OCTOBER 11, WALTER SCHIRRA, WALTER CUNNINGHAM AND DONN EISELE WILL FLY THE SATURN IB ON A MISSION PRIMARILY AIMED AT PROVING THE COMMAND AND SERVICE MODULES. THE PRIMARY OBJECTIVES OF THE FLIGHT ARE TO "WRING-OUT" THIS NEW GENERATION OF SPACECRAFT. THE SPACECRAFT SYSTEMS PERFORMANCE WILL BE MONITORED BY ONBOARD AND TELEMETERED DATA. THE PERFORMANCE OF THE CREW, PRIME AND BACKUP SPACE-CRAFT SYSTEMS AND MISSION SUPPORT FACILITIES IN EARTH ORBIT WILL BE CHECKED OUT. A TRANSPOSITION AND SIMULATED DOCKING MANEUVER WITH THE SATURN IVB STAGE WILL BE PER-FORMED AS WELL AS MANY OTHER CHECKS OF EQUIPMENT AND PROCESSES.

APOLLO 7 IS THE FIRST FULL USE IN THE MANNED PROGRAM OF THE "OPEN END" MISSION CONCEPT. AS YOU RECALL IN THE GEMINI PROGRAM WE BUILT UP OUR FLIGHT EXPERIENCE AND VERIFIED THE DESIGN OF THE SPACECRAFT IN A SERIES OF STEPS, BEGINNING WITH A THREE-ORBIT FLIGHT, THEN FLIGHTS OF FOUR, EIGHT AND FINALLY 14 DAYS.

IN APOLLO 7 WE ARE CARRYING OUT THE SAME SET OF STEPS BUT INSTEAD OF STOPPING AFTER EACH ONE AND RETURNING TO EARTH, WE ARE USING THE CAPABILITY OF OUR TELEMETRY NETWORK TO EVALUATE IN REAL TIME THE READINESS OF THE

SPACECRAFT TO TAKE THE NEXT STEP. IF ALL GOES WELL, WE WILL BE ABLE TO ACCOMPLISH AS MUCH IN TERMS OF DESIGN VERIFICATION IN THE FIRST MANNED FLIGHT OF THE APOLLO SPACECRAFT AS WE DID IN THE FIRST FIVE MANNED GEMINI FLIGHTS.

IN ORDER TO MAXIMIZE THE RETURNS FROM THE FLIGHT, WE HAVE ALSO ARRANGED THE FLIGHT PLAN SO THAT THE PRIMARY AND SECONDARY OBJECTIVES OF THE APOLLO 7 MISSION ARE COMPLETED AS EARLY IN THE MISSION AS POSSIBLE. THUS WE WILL ACCOMPLISH ALL THE PRIMARY OBJECTIVES IN THE FIRST THREE DAYS AND IN TERMS OF THE PARTIAL ACCOMPLISHMENT OF THE PRIMARY OBJECTIVES WE WILL HAVE COMPLETED ABOUT 1/3 IN THE FIRST SIX ORBITS, 2/3 IN THE FIRST DAY AND OVER 90 PERCENT BY THE END OF THE 32ND ORBIT, THE END OF THE SECOND DAY.

APOLLO 7 IS SCHEDULED FOR LAUNCH AT 11:00AM FRIDAY INTO AN ORBIT RANGING FROM 142 TO 176 MILES. SPACECRAFT SYSTEMS CHECKOUT WILL BE THE PRINCIPAL ACTIVITY DURING THE FIRST TWO REVOLUTIONS.

NEAR THE END OF THE SECOND REVOLUTION, THE CREW WILL SEPARATE THE SPACECRAFT FROM THE SECOND STAGE AND PERFORM A SIMULATED DOCKING MANEUVER, USING THE SPACECRAFT LUNAR MODULE ADAPTER ATTACHED TO THE SECOND STAGE AS A TARGET.

EXTENSIVE OPERATIONAL CHECKOUTS OF THE SPACECRAFT'S ENVIRONMENTAL CONTROL, GUIDANCE AND NAVIGATION, AND SERVICE PROPULSION SYSTEMS, WILL OCCUPY THE CREW FOR

THE NEXT SEVERAL REVOLUTIONS. INCLUDED WILL BE A RENDEZVOUS WITH THE SECOND STAGE OF THE LAUNCH VEHICLE APPROXIMATELY 30 HOURS AFTER LIFTOFF. THE MAJOR MANEUVERS BY THE COMBINED COMMAND AND SERVICE MODULES WILL BE MADE BY USING THE SERVICE PROPULSION SYSTEM, A 20,500-POUND-THRUST ROCKET ON THE SERVICE MODULE.

CREW ACTIVITIES, SYSTEMS PERFORMANCE, AND GROUND SUPPORT FACILITIES WILL BE EVALUATED DURING THE REMAINDER OF THE MISSION. ADDITIONAL OPERATIONS OF THE SERVICE PROPULSION SYSTEM ARE SCHEDULED DURING THIS PHASE.

IF ALL GOES WELL, TEN DAYS, 21 HOURS AFTER LIFTOFF, THE CREW WILL FIRE THE SERVICE PROPULSION SYSTEM TO DECREASE THE SPEED OF THE SPACECRAFT AND BEGIN ITS RETURN FROM ORBIT.

APOLLO 7 LANDING IS PLANNED IN THE ATLANTIC OCEAN ABOUT 230 MILES SOUTH-SOUTHWEST OF BERMUDA.

WE PLAN TO LAUNCH APOLLO 8 IN DECEMBER. THIS WILL BE THE FIRST MANNED OPERATION OF THE SATURN V, THE ROCKET DESIGNED TO LAUNCH MANNED MISSIONS TO THE MOON. ASTRONAUTS FRANK BORMAN, JAMES LOVELL AND WILLIAM ANDERS WILL FLY THE COMMAND AND SERVICE MODULES FOR ANOTHER TEST OF ITS SYSTEMS AND REHEARSAL OF SOME OF THE SPACE MANEUVERS REQUIRED FOR LUNAR LANDING MISSIONS. AS IN APOLLO 7, A LUNAR MODULE WILL NOT BE CARRIED ON THIS MISSION.

THE FLIGHT PLAN FOR APOLLO 8 WILL NOT BE DETERMINED UNTIL WE EVALUATE THE APOLLO 7 MISSION. HOWEVER, THERE

ARE SEVERAL ALTERNATIVES AVAILABLE, ALL OF WHICH WOULD ADVANCE THE OPERATIONAL STATUS OF THE APOLLO PROGRAM.

FIRST, IF APOLLO 7 DOES NOT ACHIEVE ITS PRINCIPAL OBJECTIVES, FLIGHT QUALIFICATION OF THE SPACECRAFT COULD BE ACCOMPLISHED WITH APOLLO 8 REPEATING ESSENTIALS OF THE APOLLO 7 MISSION. THIS IS THE MOST LIKELY MISSION ASSIGNMENT OF APOLLO 8. SHOULD THE APOLLO 7 MISSION INDICATE THAT A SYSTEM OR SOME EQUIPMENT REQUIRES MODIFICATIONS, CHANGES COULD BE FLIGHT TESTED DURING APOLLO 8.

THE MAN-RATING OF THE SATURN V IS A PRIMARY OBJECTIVE OF APOLLO 8. THE POSSIBILITY DOES EXIST FOR APOLLO 8 TO BE A MANNED FLIGHT ORBITING THE MOON.

I WISH TO STRESS THAT, EVEN IF NEXT WEEK'S FLIGHT SHOULD APPEAR TO BE AN UNQUALIFIED SUCCESS, APOLLO 8 WILL NOT BE COMMITTED TO ANYTHING MORE THAN AN EARTH ORBITAL MISSION UNTIL AFTER THE MOST CAREFUL EVALUATION OF THE RESULTS OF APOLLO 7 AND STATUS OF THE APOLLO 8 HARDWARE, A PROCESS WHICH WILL TAKE UNTIL LATE NOVEMBER.

AN APOLLO 8 LUNAR ORBITAL MISSION WOULD PROVIDE PHOTOGRAPHS IN COLOR OF APOLLO LUNAR LANDMARKS AND LANDING SITES AND OTHER AREAS OF THE MOON.

TECHNOLOGICALLY, A LUNAR ORBIT MISSION WOULD VERIFY THE SATURN V AND APOLLO SPACECRAFT SYSTEMS FOR DEEP SPACE OPERATIONS, WITH THE EXCEPTION OF THE ACTUAL LUNAR LANDING AND LAUNCHING SEQUENCES.

Five Apollo missions are planned in 1969 and I believe it is reasonable to expect that we will be able to carry out a lunar landing mission by the fourth or fifth of these.

The first of the 1969 flights is scheduled for February or March, when Astronauts Jim McDivitt, David Scott, and Russell Schweickart fly the complete three-module Apollo spacecraft. It will be the first manned operation of the lunar module in space.

This open-ended mission of up to 10 days duration is planned to perform various rendezvous and dockings of the command module and lunar module. McDivitt, the mission commander, and Schweickart, the lunar module pilot, will enter the lunar module through a tunnel which connects with the command module. The two lunar module engines will be fired in a manned operation for the first time while McDivitt and Schweickart are at their posts in that vehicle. While the two modules are docked, Schweickart will transfer from the lunar module to the command module in a procedure to be used in the event the usual through-the-tunnel method is impossible. Outside lighting and hand rails have been installed on both modules so that the crews will be able to make such a transfer, if necessary, during dark periods of flight. This will be the first space walk in the Apollo program and the only one planned before the moon-landing mission.

IF THE FIRST MANNED LUNAR MODULE OPERATIONS ARE SUCCESSFUL, THE FOLLOWING MISSION COULD SIMULATE A LUNAR LANDING MISSION OPERATION IN A 4,000-MILE-HIGH EARTH ORBIT. IT WOULD BE A "DRESS REHEARSAL" OF A LUNAR LANDING. IT IS EXPECTED TO FULFILL OPERATIONAL REQUIREMENTS NEEDED BEFORE A LUNAR MISSION IS UNDERTAKEN.

EACH APOLLO/SATURN V FLIGHT REPRESENTS A MAJOR STEP IN DEMONSTRATING OUR CAPABILITY - BUT OF COURSE, THE CONSEQUENCE OF THESE GIANT STEPS IS THAT THE PLANS FOR EACH FLIGHT DEPEND ON RESULTS OF PREVIOUS MISSIONS, AS WELL AS STATUS OF SUPPORTING PROGRAMS.

THE MANNED LUNAR LANDING FLIGHT -- FROM LIFTOFF TO RECOVERY AND RETURN OF THE LUNAR SAMPLES AND ASTRONAUTS TO THE LUNAR RECEIVING LABORATORY AT HOUSTON -- WILL BE AN OPEN OPERATION IN KEEPING WITH THE POLICIES ESTABLISHED WHEN NASA WAS CREATED 10 YEARS AGO.

WHENEVER POSSIBLE, COVERAGE WILL BE OPEN TO ALL. WHERE SPACE IS RESTRICTIVE, SUCH AS ON RECOVERY SHIPS AND THE LUNAR RECEIVING LABORATORY, NEWS POOL TEAMS REPRESENTING ALL MEDIA WILL BE ESTABLISHED.

I MENTION NASA'S MANNED FLIGHT PUBLIC INFORMATION ACTIVITIES NOT SO MUCH BECAUSE I AM SPEAKING TO A GROUP OF EDITORS, BUT BECAUSE THE OPENNESS OF OUR PROGRAM HAS ACCELERATED THE IMPACT OF THE SPACE AGE ON ALL ASPECTS OF OUR NATIONAL LIFE.

THE MANNED LUNAR LANDING IS NOT AN END IN ITSELF, BUT WHEN TWO AMERICAN ASTRONAUTS RETURN FROM THE SURFACE OF THE MOON, WE WILL MARK THE ACCOMPLISHMENT OF OUR GREATEST NATIONAL PEACETIME GOAL. WE WILL HAVE FIRMLY ESTABLISHED AND DRAMATICALLY DEMONSTRATED TO ALL THE WORLD THE UNITED STATES' CAPABILITY TO OPERATE IN THIS NEW OCEAN -- A QUARTER OF MILLION MILES FROM EARTH!

THIS NATION HAS DEVELOPED AND BUILT THE FACILITIES AND THE CAPABILITY FOR THE INVESTIGATION AND UTILIZATION O OF A NEW ENVIRONMENT. OVER $4 BILLION HAS BEEN INVESTED IN FACILITIES INCLUDING AMONG OTHERS, THE MISSISSIPPI TEST FACILITY AT BAY ST. LOUIS, THE MANNED SPACECRAFT CENTER AT HOUSTON AND THE KENNEDY SPACE CENTER AT CAPE KENNEDY IN FLORIDA.

WITH NASA AS THE CATALYST, WITH THE NEEDS OF THE SPACE PROGRAM AS THE SPUR, AMERICAN INDUSTRY HAS AGAIN DEMONSTRATED ITS RESOURCEFULNESS AND CAPABILITY.

A MEASURE OF THIS CAPABILITY TO CARRY OUT FORWARD-LOOKING NEW PROGRAMS, IS OUR RECORD OF ACHIEVEMENT. SINCE OCTOBER 1, 1958, NASA HAS COMPLETED 234 UNITED STATES AND INTERNATIONAL LAUNCHES, NOT INCLUDING THOUSANDS OF SOUNDING ROCKETS OR FLIGHTS OF THE THREE X-15 ROCKET-PROPELLED AIRCRAFT.

THROUGH THESE SPACE FLIGHT ACTIVITIES AND SUPPORTING RESEARCH AND DEVELOPMENT ACTIVITY IN ITS OWN LABORATORIES

AND IN INDUSTRY FACILITIES, NASA HAS PROVIDED THE NATION WITH:

1. AN OPERATIONAL COMMUNICATIONS SATELLITE CAPABILITY THAT CREATED AN ENTIRELY NEW INDUSTRY.

2. OPERATIONAL WEATHER SATELLITE SYSTEMS THAT PROVIDE GLOBAL WEATHER INFORMATION 24 HOURS A DAY.

3. DETAILED MAPPING OF THE MOON, INCLUDING CLOSEUP PICTURES AND EXAMINATION OF THE LUNAR SURFACE.

4. PICTURES OF THE SURFACE OF MARS AND NEW MEASUREMENTS OF GREAT SCIENTIFIC VALUE FROM SPACE PROBES OF THE CHARACTERISTICS OF MARS, VENUS, AND THE SUN.

5. A GREAT VOLUME OF NEW INFORMATION ON THE NEAR SPACE ENVIRONMENT OF THE EARTH, INCLUDING THE INTERACTION OF THE MAGNETIC FIELD AND ENERGETIC PARTICLES FROM THE SUN.

6. A CONTINUING CONTRIBUTION THROUGH AERONAUTICAL RESEARCH TO BOTH MILITARY AND CIVILIAN AVIATION INCLUDING DIRECT SUPPORT IN THE DEVELOPMENT OF THE SUPERSONIC TRANSPORT.

7. DEVELOPMENT OF MANNED SPACE FLIGHT SYSTEMS IN MERCURY, GEMINI AND APOLLO THAT MAKE IT POSSIBLE FOR TRAINED SCIENTIFIC OBSERVERS TO INSPECT OTHER OBJECTS IN SPACE; MAKE SCIENTIFIC MEASUREMENTS; PHOTOGRAPH IN DETAIL THE SURFACE OF THE EARTH; OBSERVE AND REPORT ON THE WEATHER, AND MOST IMPORTANTLY, APPLY CRITICAL HUMAN JUDGMENT TO WHATEVER MISSION MUST BE PERFORMED.

For the conception and construction of the equipment necessary to the safe transport of men into space and for their accomplishment of productive tasks in that new atmosphere, a new mix of professional and scientific disciplines has been created which has forced cooperation between engineers and medical doctors, chemists and astronomers, oceanographers and geologists.

Many of the technologies which are essential to our sending three men to the moon and back, did not exist a few years ago. They had to be invented, adapted or developed. We did just that -- we invented, adapted and developed.

We now have the giant boosters which have released man from his atmosphere, and we have invented the life-support systems that can maintain him in space.

As a result of the cleanliness requirements of the space program we have the largest "clean rooms" in the world--rooms which hospitals are now emulating.

The requirements of the space program for a worldwide communications network demanded major

IMPROVEMENTS IN THE STATE OF THE ART OF COMPUTER TECHNOLOGY. OVER 600 COMPUTERS NOW COMPRISE THE LARGEST AND MOST ADVANCED COMMUNICATIONS SYSTEM IN THE WORLD.

THE FUEL CELL, WHICH HAD LAIN DORMANT FOR MANY YEARS, WAS ACTIVATED TO POWER SPACECRAFT IN ORBIT. THIRTY PUBLIC UTILITY COMPANIES NOW HAVE A $27,000,000 PROGRAM FOR THE ADAPTATION OF THE FUEL CELL FOR HOME POWER UNITS.

WE HAD TO KNOW ON A REAL-TIME BASIS, HOW FAST THE HEARTS OF THE ASTRONAUTS WERE BEATING WHILE THEY WERE IN SPACE. WE HAD TO KNOW HOW MUCH OXYGEN THEY WERE USING, AND HOW THEIR MUSCLES WERE RESPONDING TO THEIR STRANGE ENVIRONMENT. SO WE INVENTED ANOTHER NEW SYSTEM, BIOSENSOR TO COMPUTER TO DATA GATHERING EQUIPMENT, AND THROUGH THE COMMUNICATIONS NETWORK TO THE MANNED SPACECRAFT CENTER AT HOUSTON -- FROM 100 MILES -- OR 800 MILES, OR FROM A 1/4 OF A MILLION MILES OUT IN SPACE. AND A HALF A DOZEN NEWLY FORMED COMPANIES ARE NOW MANUFACTURING THESE ADAPTED SPACE-CREATED INSTRUMENTS FOR THE USE OF DOCTORS AND HOSPITALS HERE ON EARTH.

The need for fireproof materials for Apollo spacecraft has demanded a complete testing and documentation of the flamability characteristics of hundreds of materials. These results have been computerized and are available for the asking. Within a short time there will be no excuse for a large percentage of disastrous fires -- from mattresses burning to childrens' sweaters catching fire to aircraft curtains igniting. Fireproof Beta cloth has been developed which is already being used for firefighter suits in municipal departments as well as on board our aircraft carriers at sea.

Now, where do we go from here?

The hardware, facilities, and team developed to carry out the Apollo program represent a major national investment. A relatively small additional investment will be required to adapt these to future programs which promise substantial practical benefits to man.

The Orbital Workshop, now under development in the Apollo Applications Program, is a space station utilizing for its components and its logistics support, stages, modules, and spacecraft which were developed in the Apollo Program. It will provide accommodations for three people and their equipment for several months in orbit.

THE ORBITAL WORKSHOP IS THE PROGENITOR OF SPACE STATIONS THAT SHOULD BE USED FOR THE CONDUCT OF THE MANY SCIENTIFIC, TECHNOLOGICAL, AND COMMERCIAL EXPERIMENTS AND PROCESSES WHICH PLANNERS ARE NOW DESCRIBING.

THESE SPACE STATIONS WILL BE USED AS LABORATORIES IN ORBIT AND WILL PROVIDE THE FACILITIES TO STUDY AND UNDERSTAND THE NATURE OF SPACE. THEY WILL PROVIDE OBSERVATORIES TO VIEW THE SUN, THE PLANETS AND THE STARS BEYOND THE ATMOSPHERIC VEIL OF EARTH. STATIONS IN ORBIT WILL PROVIDE BASES FOR CONTINUOUS OBSERVATION OF THE EARTH AND ITS ATMOSPHERE ON AN OPERATIONAL BASIS -- FOR METEOROLOGICAL AND OCEANOGRAPHIC USES, FOR EARTH RESOURCE DATA GATHERING AND EVALUATION, FOR COMMUNICATIONS AND BROADCASTING, SPACE AND AIR TRAFFIC CONTROL AND CATASTROPHY ALERTS.

WEIGHTLESSNESS IN ORBITAL SPACE FLIGHT, A PHENOMENON REGARDED WITH APPREHENSION BEFORE MAN VENTURED INTO SPACE, OFFERS INTRIGUING POSSIBILITIES FOR MANUFACTURING IN SPACE. FOR INSTANCE, MATERIAL IN THE LIQUID STATE FLOATING IN A WEIGHTLESS ENVIRONMENT, TAKES THE SHAPE OF A PERFECT SPHERE. THUS, IT IS CONCEIVABLE THAT METAL BALL BEARINGS COULD BE MANUFACTURED IN SPACE TO TOLERANCES IMPOSSIBLE IN OUR PRESENT TECHNOLOGY YET AT A COST, INCLUDING TRANSPORTATION, LESS THAN WE CAN NOW ACHIEVE. SUCH BEARINGS WOULD REDUCE FRICTION AND NOISE LEVELS TO THE VANISHING POINT.

FURTHER, BY BLOWING GAS INTO MOLTEN METAL, PRECISION HOLLOW SPHERES CAN BE FORMED. THESE PRECISION HOLLOW SPHERES ARE BADLY NEEDED TO MOVE LARGE RADAR ANTENNAS, ROTATE LARGE AIRCRAFT WINGS AND TO SUPPORT LOADS IN LARGE JET ENGINES.

IF WE SPIN THE FREE FLOATING SPHERES DURING THE CHILLING PHASE WE CAN PRODUCE ACCURATE ELLIPSOID SHAPES TO TOLERANCES ABSOLUTELY IMPOSSIBLE TO PRODUCE ON EARTH. THE APPLICATION OF ELECTROSTATIC FIELDS COULD FORM THE MOLTEN METAL INTO MANY DIFFERENT SHAPES TO PRECISION TOLERANCES.

FREE-FALL CASTING TECHNIQUES COULD BE UTILIZED TO CAST LARGE FLAWLESS OPTICAL BLANKS FOR TELESCOPES AND BY PROPER COMBINATIONS OF SPINNING AND ELECTROMATIC FORCE WE SHOULD BE ABLE TO SHAPE THE SURFACE AS WELL.

STABLE FOAMS FROM A WIDE VARIETY OF LIQUIFIED MATERIALS AND GASES OFFER EXCITING POSSIBILITIES. SUCH FOAMS CANNOT BE SATISFACTORILY PRODUCED ON EARTH BECAUSE OF THE EFFECTS OF GRAVITY. IN WEIGHTLESSNESS, THE MIXING AND EQUAL DISTRIBUTION OF GAS BUBBLES IN ANY LIQUID CAN BE STABILIZED AND MOVED INTO A DESIRED PATTERN. USING THIS TECHNIQUE, WE CAN PRODUCE A STEEL FOAM HAVING THE WEIGHT OF BALSA WOOD BUT MANY OF THE PROPERTIES OF SOLID STEEL. OF MUCH MORE IMPORTANCE, COMBINED MATERIALS LIKE STEEL AND GLASS OF DRASTICALLY DIFFERENT DENSITIES AND PROPERTIES CAN ALSO BE PRODUCED.

Some potential applications of these foam materials are extremely lightweight armor plates, vests and helmets, variable density turbine blades and insulation materials to compensate for very high temperature gradients.

Many products could undoubtedly be better and more economically manufactured in the clean vacuum of space in the weightless state. Much that has been considered impossible will move to the possible category following research. Technology and engineering experiments, such as electron beam welding, thermal control coating evaluation, tube joining, heat exchanger service and extravehicular activity hardware evaluation will be conducted in the Apollo Applications Program, follow-on to the Apollo Program.

The exploration of space has been limited in concept and extent by the high cost of putting a payload into orbit, and the inaccessibility of objects after they have been launched. Today we have in sight the technology necessary for reusable space vehicles. This knowledge together with the need of the upcoming space stations lead me to forecast that the next major thrust in space will be the development of an economical space vehicle for shuttling between earth and the installations, such as orbiting space stations which will be operating in space.

Until now it has been essential to optimize space transportation systems on the basis of performance. Only

A DECADE AGO, TECHNOLOGY WAS PUSHED TO ITS LIMITS IN ORDER TO BARELY ACHIEVE ORBITAL FLIGHT. OUR FIRST VANGUARDS AND EXPLORERS COST IN THE ORDER OF A THIRD OF A MILLION DOLLARS PER POUND OF PAYLOAD TO FLY INTO SPACE. A SPACE SHUTTLE SHOULD EVOLVE INTO A SYSTEM WHICH CAN DELIVER USABLE PAYLOAD AT A COST APPROACHING $5 PER POUND.

IDEALLY, THE 'SPACE SHUTTLE' WOULD BE ABLE TO OPERATE IN A MODE SIMILAR TO THAT OF LARGE COMMERCIAL AIR TRANSPORTS AND BE COMPATIBLE WITH THE ENVIRONMENT OF MAJOR AIRPORTS.

IT WOULD TAKE OFF VERTICALLY FROM A SMALL PAD AT AN AIRBASE OR MAJOR AIRPORT, DISPATCHED BY CREWS SIMILAR IN SIZE TO THOSE REQUIRED FOR INTERCONTINENTAL JETS. UPON ITS RETURN FROM ORBIT, THE "SPACE SHUTTLE" WOULD REENTER THE ATMOSPHERE AND GLIDE TO A HORIZONTAL RUNWAY LANDING, WITH PRACTICALLY NO NOISE.

INTERESTINGLY ENOUGH, THE BASIC DESIGN FOR AN ECONOMICAL SPACE TRANSPORT COULD ALSO BE THE IMMEDIATE ANCESTOR OF AN AIRCRAFT FOR TERRESTRIAL POINT-TO-POINT TRANSPORT.

THE USE OF THE "SPACE SHUTTLE" AS A GLOBAL TRANSPORT WOULD REQUIRE THAT IT BE AS SAFE, FLEXIBLE AND ECONOMICAL AS THE THEN OPERATIONAL SYSTEMS. ESTIMATES WHICH ALREADY EXIST ANTICIPATE THAT THE TOTAL OPERATING COST OF A SPACE SHUTTLE, FLYING A NOMINAL ROUTE, (NEW YORK TO TOKYO) WOULD BE A LITTLE ABOVE TEN CENTS PER PASSENGER NAUTICAL MILE. ALTHOUGH MORE THAN SUPERSONIC COST ESTIMATES, THAT COST IS LESS THAN THE HYPERSONIC ESTIMATE EVEN NOW. THE TRIP WOULD TAKE 46 MINUTES.

Over the past several years studies have progressed to the point where several promising designs for an economical, reusable space vehicle already exist.

No really meaningful estimate of the number of "space shuttle" vehicles which will be required can be given at this time, for that number is a function, not only of the various missions which it will be called upon to perform, but it is also a function of the existence of the machine itself. After all, no one needed an airplane, a computer or a telephone before they existed.

The "space shuttle" is another step toward our destiny in space and on the earth. In my opinion, it is the key to our efficient utilization of the capability we now have and to the application of the knowledge we have already gained.

I have tried to summarize in a few minutes what is immediately ahead in manned space flight activities and to indicate what I believe are some of the vast opportunities open to us as a spacefaring nation. Perhaps the simplest, most eloquent reason for exploring space was expressed by the late Dr. Hugh L. Dryden, distinguished first Deputy Administrator of NASA, and Home Secretary of the National Academy of Sciences, when he said:

"None of us knows what the final destiny of man may be -- or if there is any end to his capacity for growth and adaption. Wherever this venture leads us, we in the

United States are convinced that the power to leave the Earth -- to travel where we will in space -- and to return at will -- marks the opening of a brilliant new stage in man's evolution."

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Address by

Dr. George E. Mueller
Associate Administrator for Manned Space Flight
National Aeronautics and Space Administration

The National Space Club
Washington, D. C.

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TODAY, WE MEET AT A SIGNIFICANT TIME IN THE HISTORY OF THE U. S. SPACE PROGRAM. ONLY LAST MONTH THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OBSERVED ITS FIRST DECADE OF SERVICE, A DECADE MARKED BY THE BIPARTISAN SUPPORT OF SIX CONGRESSES AND THREE PRESIDENTS.

THE 91ST CONGRESS WILL CONVENE ON JANUARY 3; EVERY CANDIDATE EXCEPT ONE AMONG DEMOCRATIC AND REPUBLICAN REPRESENTATIVES SERVING ON THE HOUSE COMMITTEE ON SCIENCE AND ASTRONAUTICS WAS REELECTED ON NOVEMBER 5, INCLUDING ITS MOST ABLE CHAIRMAN, THE HONORABLE GEORGE P. MILLER.

THE COMPOSITION OF THE HOUSE SPACE COMMITTEE AND SENATOR ANDERSON'S SENATE COMMITTEE MAKES ME OPTIMISTIC ABOUT HAVING AN ORDERLY PROGRAM FOR CONTINUED ADVANCEMENT IN EXPLORING AND EXPLOITING THE SPACE ENVIRONMENT. BOTH OF THESE COMMITTEES HAVE DEDICATED THEIR EFFORTS TO THE BUILDING OF A STRONG FOUNDATION FOR THE U. S. SPACE PROGRAM.

WE CAN EXPECT A CONTINUATION OF SUPPORT FROM THE EXECUTIVE BRANCH AS WELL. PRESIDENT-ELECT NIXON EXPRESSED HIS VIEWS DURING THE CAMPAIGN IN THESE WORDS, "I WISH IT CLEARLY UNDERSTOOD THAT I CONSIDER THIS PROGRAM AS ONE OF OUR NATIONAL IMPERATIVES, THAT IT MUST BE SUPPORTED AT A LEVEL ASSURING EFFICIENT AND STEADY PROGRESS..."

THIS IS A SIGNIFICANT TIME IN OUR APOLLO FLIGHT SCHEDULE AS WELL. WE AT NASA WERE VERY PLEASED WITH THE 11-DAY APOLLO 7 MISSION FLOWN LAST MONTH. THIS FIRST APOLLO MANNED FLIGHT WAS ONE OF THE MOST SUCCESSFUL IN THE HISTORY OF THE SPACE

PROGRAM. ALL PRIMARY MISSION OBJECTIVES WERE COMPLETELY ACCOMPLISHED. EVERY DETAILED TEST OBJECTIVE WAS ATTAINED. APOLLO 7 PROVED THE CAPABILITIES OF THE CREW, THEIR SPACE VEHICLE, AND THE MANNED SPACE FLIGHT SUPPORT CREWS AND FACILITIES.

WE WERE ABLE TO ACCOMPLISH AS MUCH IN TERMS OF DESIGN VERIFICATION IN THE FIRST MANNED FLIGHT OF THE APOLLO SPACECRAFT AS WE DID IN THE FIRST FIVE MANNED GEMINI FLIGHTS WHICH PROGRESSED FROM THREE ORBITS TO FOUR DAYS, THEN EIGHT, AND FINALLY 14 DAYS. IN APOLLO 7 WE CARRIED OUT THE SAME SET OF STEPS BUT INSTEAD OF STOPPING AFTER EACH ONE AND RETURNING TO EARTH, WE USED THE CAPABILITY OF OUR TELEMETRY NETWORK TO EVALUATE THE READINESS OF THE SPACECRAFT TO TAKE THE NEXT STEP. THE APOLLO SPACECRAFT WAS READY EVERY STEP OF THE WAY.

THE SATURN LAUNCH VEHICLE PROVED ITSELF FOR THE 17TH TIME IN THIS MISSION. IT WAS THE 15TH SUCCESS OF THE SATURN I. TWO SATURN V'S ALSO HAVE BEEN FLOWN IN TESTS OF THIS LARGER SATURN ROCKET DESIGNED TO LAUNCH MANNED MISSIONS TO THE MOON. WITH APOLLO 8 NEXT MONTH, THE THIRD FLIGHT AND FIRST MANNED LAUNCH OF THE SATURN V WILL TAKE PLACE.

YOU ARE AWARE OF THE FLIGHT OBJECTIVES OF THE APOLLO 8 MISSION. A LAUNCH IS NOW SCHEDULED FOR DECEMBER 21ST THAT WILL TAKE THREE APOLLO ASTRONAUTS ON A 63 HOUR FLIGHT TO THE VICINITY OF THE MOON, AND POSSIBLY INTO LUNAR ORBIT FOR 20 HOURS. AFTER A 57 HOUR RETURN FLIGHT THE APOLLO 8 SPACECRAFT AND CREW WILL SPLASH DOWN IN THE PACIFIC OCEAN.

The Apollo 8 flight will be an "open-ended" flight conducted in steps referred to as "plateaus" followed by "decision points." Conducting the flight in this manner provides for maximum crew safety together with maximum forward progress. We provide alternate flight profiles which can be selected while the flight is in progress.

Each plateau provides for a thorough check of crew, systems and equipment operations. Only when all conditions are satisfactory will the decision be made to proceed to the next plateau.

Our final decision on Apollo 8 was made only after a thorough assessment of the total risks involved and the total gains to be realized in this next step toward a manned lunar landing. Satisfactory results in all of our tests on the ground of the Apollo 8 spacecraft, and review of the previous Apollo flights, led us to the determination that the Saturn V launch vehicle and the Command and Service Module are ready.

The Apollo spacecraft is designed for operations out to and including the moon. The design includes ample margins for variation of performance and many redundancies in systems and subsystems. In any space flight there is risk; however, we feel that by taking this deep space flight now we will gain engineering and operational information that will ultimately reduce the total risk of a manned lunar landing during the next year.

Our conclusion, therefore, was that the greatest benefit to the nation's space program could be achieved by sending the manned Apollo 8 spacecraft on an orbital flight of the moon. The trajectory of the flight will be such that a circumlunar flight -- a swing around the moon and return to earth -- can be accomplished automatically. If all systems are "go" when Apollo 8 reaches the moon's vicinity, a decision will then be made to perform up to 10 lunar orbits.

The circumlunar flight will significantly advance the progress of the Apollo program -- lunar orbit will be even more valuable. It will prove the Command and Service Module at lunar distance. It will demonstrate the deep space capability of the Manned Space Flight Network. It will provide needed data on the anomalies of the Moon's gravitational field, it will allow us to check out our navigation systems for getting into the lunar landing sites, and will establish our ability to use lunar landmarks. It will also give us additional photography of the proposed landing sites. It will, in short, produce much information which will help our later flights. While there are these practical engineering reasons for undertaking this mission, we should not forget -- for history will not -- that this may be the first time that man will fly truly free of the gravity of his mother planet.

During the coming weeks the orderly process of testing every component, and rehearsing every procedure, will continue until we determine that the millions of parts and thousands of people involved in the lunar expedition are ready. Then and not until then, Apollo 8 will be launched to the moon.

Turning now to the future: Our long-time administrator, Jim Webb, has been a good architect. Now retired, he has handed over to the nation an efficient organization including the men, the facilities and the expertise which are necessary to the exploration and the exploitation of the unknown.

Jim Webb saw the realization of our earth as "one world" with the accomplishment of instant global communications. And he has built the foundation for our becoming a "world and a quarter" as we close the loop with the moon -- a quarter the size of the earth -- a quarter of a million miles away.

The manned lunar landing is not an end in itself, but when two American astronauts return from the surface of the moon, we will mark the accomplishment of our greatest national peacetime goal. We will have firmly established and conclusively demonstrated to all the world, the United States' capability to design and develop and operate complex space systems.

But if we are to maintain our status as a first class nation we must be able to operate in all parts of our environment -- on land, on and under the sea, in the air and in space. Space

WILL BE THE GREATEST TEST OF OUR ABILITY TO SUSTAIN THE EFFORT REQUIRED TO REACH AN OPERATING STATUS. I BELIEVE WE ARE GOING TO PASS THAT TEST.

WHEN WE HAVE ACCOMPLISHED OUR FIRST MAJOR MANNED SPACE GOAL, WHERE DO WE GO?

SPACE ACTIVITY HAS PRODUCED THE MOST SOPHISTICATED TECHNOLOGY WHICH THIS COUNTRY HAS EVER DEVELOPED. MAN-RATING OF THOUSANDS OF SYSTEMS AND MILLIONS OF PARTS HAS FORCED A NEW ELEMENT INTO THE AMERICAN MANUFACTURING SYSTEM -- PERFECTION. U.S. MANUFACTURING HAS BEEN EFFICIENT, COST EFFECTIVE AND HIGHLY SENSITIVE TO THE NEEDS OF THE MARKET. NOW IT HAS SHOWN THAT IT IS ALSO CAPABLE OF PRECISION AND PERFECTION. EVERY TIME A SATURN V IS SUCCESSFULLY LAUNCHED WE KNOW THAT MORE THAN THREE HUNDRED THOUSAND PEOPLE IN MORE THAN 20,000 DIFFERENT ORGANIZATIONS DID THE ESSENTIAL THINGS RIGHT. WE HAVE A NEW RESPECT FOR OUR CAPACITY, AND FOR OURSELVES.

IF THE REQUIREMENT FOR PRECISION EQUIPMENT FOR MAN IN SPACE DID NOTHING ELSE EXCEPT UPGRADE OUR NATIONAL PRODUCTION, IT MIGHT BE WORTH WHATEVER IT COSTS TO TAKE HIM INTO SPACE. BUT HIS FUNCTION THERE IS A VITAL ONE, AND I BELIEVE THAT HE WILL PROVE TO BE ESSENTIAL TO THE EXPLORATION AND EXPLOITATION OF THE SPACE ENVIRONMENT.

A COMPUTER EXPERT ESTIMATED NOT LONG AGO THAT A CALCULATOR WHICH WOULD SIMULATE THE HUMAN BRAIN WOULD COVER

TWENTY ACRES -- AND BE THIRTY STORIES HIGH. WE'RE NOT LIKELY TO BE ABLE TO ORBIT THAT MUCH HARDWARE ANYTIME IN THE NEAR FUTURE.

BUT WITH THE POWER NOW AVAILABLE IN THE SATURN LAUNCH VEHICLE, IT BEGINS TO BECOME COST EFFECTIVE TO TAKE MEN ALONG -- CERTAINLY FOR WHAT THEY WILL DISCOVER, BUT ALSO TO ASSURE THE EFFICIENCY OF OUR FLIGHTS. EVERY ONE OF THE GEMINI FLIGHTS' SUCCESS WAS INCREASED BY INTELLIGENT AND TIMELY PILOT ACTION.

IN ORDER TO MORE CLEARLY DEFINE THE ROLE OF MAN IN SPACE WE HAVE ASKED THE SCIENCE AND TECHNOLOGY ADVISORY COMMITTEE TO STUDY AND APPRAISE THE USES OF MAN IN SPACE, IN NEAR TERM AND LONG TERM APPLICATIONS. WE EXPECT THAT THEIR STUDY WILL BE AVAILABLE EARLY NEXT YEAR.

WHATEVER THE IMMEDIATE USES OF MANNED SPACE MAY BE, NASA, SINCE IT IS A CIVILIAN ACTIVITY AT THE FOREFRONT OF RESEARCH, DOES DELIBERATELY PROVIDE FOR THE MOST RAPID TRANSFER OF TECHNOLOGICAL DEVELOPMENT AND INNOVATION TO THE DAILY LIFE OF THE COUNTRY. SPACE IS, SO FAR, A BENIGN TECHNOLOGY. TODAY, SPACE ACTIVITY IS ENHANCING OUR INSIGHT INTO THE BASIC SCIENCES, ASTRONOMY, PHYSICS, MEDICINE, BIOLOGY, METEOROLOGY, MATHEMATICS, CHEMISTRY, HYDROLOGY AND MINERALOGY -- ALL OF THESE AND MORE. IF WE PERSIST IN THE INVESTIGATION AND APPLICATION OF SPACE-GENERATED KNOWLEDGE, WE MAY REASONABLY EXPECT THAT THE CONDITION OF EVERYONE IN THE WORLD WILL EVENTUALLY BE IMPROVED.

I SAID AT THE OUTSET THAT THIS IS A SIGNIFICANT TIME TO TALK WITH YOU, FOR YOU ARE AN INVOLVED GROUP AND THE TIME

FOR DECISIONS IS UPON US. WE MUST NOW DECIDE, BEFORE OUR FIRST MAJOR GOAL HAS BEEN COMPLETED, HOW BEST TO APPLY OUR CAPABILITY AND KNOWLEDGE FOR THE FUTURE OF OUR NATION.

NEW GOALS MUST NOW BE SET, OR WE WILL LOSE THE IMPETUS WE HAVE THUS FAR DEVELOPED. MUCH HAS ALREADY BEEN LOST FOR LACK OF A FIRM AND FORWARD THRUSTING POLICY FOR OUR MANNED SPACE PROGRAM BEYOND APOLLO. THE APOLLO APPLICATIONS PROGRAM, USING THE EQUIPMENT AND THE FACILITIES AND INTEGRATED TEAM OF EXPERTS WHICH WERE DEVELOPED FOR THE APOLLO PROGRAM, SHOULD NOW BE ACCELERATED IN ORDER THAT WE MAY BEGIN TO REALIZE A RETURN ON OUR APOLLO INVESTMENT.

CERTAINLY, AFTER OUR INITIAL LANDING ON THE MOON, WE WILL WANT TO RETURN TO FULLY EXPLORE THE LUNAR SURFACE. USING EQUIPMENT ALREADY DEVELOPED, WE CAN ESTABLISH PERMANENT AUTOMATED OBSERVATION STATIONS FOR CONTINUING SCIENTIFIC DATA ACQUISITION.

OF COURSE, UNTIL WE HAVE EXAMINED THE SAMPLES WHICH APOLLO ASTRONAUTS WILL BRING BACK, WE DO NOT KNOW WHAT THIS OTHER WORLD WILL YIELD.

THE EARTH AND THE MOON, BY ASTRONOMICAL STANDARDS, ARE A DOUBLE PLANET, LIKELY TO HAVE BEEN FORMED OF THE SAME MATERIALS, BY THE SAME PROCESSES, AND DURING THE SAME TIME PERIOD. A NEARBY PLANET WITH A DIAMETER ONE-FOURTH THAT OF EARTH CAN HARDLY BE DISCOUNTED AS REAL ESTATE HAVING NO VALUE TO OUR FUTURE DEVELOPMENT.

The three man Workshop which will orbit the earth, now under development in the Apollo Applications Program, will be a space station utilizing equipment developed in the Apollo Program. It will provide accommodations for three people and their equipment for several months in orbit. We will be asking the 91st Congress to continue this development program for the early accomplishment of this forward step in space exploration.

The Orbital Workshop is the forerunner of space stations that will be used as laboratories in orbit for the conduct of the many scientific, technological, and commercial experiments and processes which planners are now describing. They will be observatories to view the sun, the planets and the stars, beyond the atmospheric veil of earth. Stations in orbit will be bases for continuous observations of the earth for meteorological and oceanographic uses, for earth resource data gathering and evaluation, for communications and broadcasting, for space and air traffic control and for national security..

Farther down the time line are some provocative possibilities. For instance, the unique conditions of space suggest that certain kinds of manufacturing should be carried out in space stations.

Weightlessness in orbital flight, a phenomenon regarded with apprehension before man ventured into space, offers intriguing possibilities: new materials could be produced,

PRODUCTS MADE MORE PRECISELY AND MATERIALS OF ALL KINDS PROCESSED IN DIFFERENT WAYS. FOR INSTANCE, LIQUID FLOATING IN A WEIGHTLESS ENVIRONMENT, TAKES THE SHAPE OF A PERFECT SPHERE. THUS, IT IS CONCEIVABLE THAT METAL BALL BEARINGS COULD BE MANUFACTURED IN SPACE TO TOLERANCES IMPOSSIBLE ON EARTH, YET AT A COST, INCLUDING TRANSPORTATION, LESS THEN WE CAN NOW ACHIEVE. PERFECT BEARINGS WOULD REDUCE FRICTION AND NOISE LEVELS TO THE VANISHING POINT.

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SOME POTENTIAL APPLICATIONS OF THESE FOAM MATERIALS ARE EXTREMELY LIGHTWEIGHT CONSTRUCTION COMPONENTS, VARIABLE DENSITY TURBINE BLADES AND VERSATILE INSULATING COMPOSITES TO WITHSTAND EXTREME TEMPERATURES.

But the realization of these exciting possibilities must await new developments.

The uses of space have been limited in concept and extent by the high cost of putting a payload into orbit, and the inaccessibility of objects after they have been launched. Today we have in sight the technology necessary for reusable space vehicles. This knowledge, together with awareness of the logistics requirements of continuing space activity, leads me to conclude that the next major thrust in space should be the development of an economical space vehicle for shuttling between earth and the installations, such as orbiting stations, which will be operating in space.

Only a decade ago, technology was pushed to its very limits in order to barely achieve orbital flight. Our first Vanguards and Explorers cost in the order of a million dollars per pound of payload to fly into space. A "space shuttle" which we can now foresee, should evolve into a system which can deliver usable payload at a cost that might approach $5 per pound.

Ideally, the "space shuttle" would be able to operate in a mode similar to that of large commercial air transports and be compatible with the environment of major airports, taking off vertically from a small pad, dispatched by crews similar in size to those required for intercontinental jets, and upon its return from orbit, reentering the atmosphere and gliding to a horizontal runway landing.

INTERESTINGLY ENOUGH, THE BASIC DESIGN FOR AN ECONOMICAL "SPACE SHUTTLE" COULD ALSO BE THE PROGENITOR OF AN AIRCRAFT FOR TERRESTRIAL POINT-TO-POINT TRANSPORT. NO PLACE ON EARTH WOULD BE MORE THAN ONE HOUR FROM ANY OTHER.

OVER THE PAST SEVERAL YEARS STUDIES HAVE PROGRESSED TO THE POINT WHERE SEVERAL PROMISING CONCEPTS FOR AN ECONOMICAL, REUSABLE SPACE VEHICLE ALREADY EXIST.

HOWEVER, THE GERMINATION PERIOD OF NEW DESIGNS IS FROM 7 TO 15 YEARS. JET POWER, AVAILABLE IN 1946, CAME INTO COMMERCIAL USE ON THE BOEING 707 IN 1958. DRIVING AGAINST TRADITIONAL TIME LAGS, THE SATURN V SYSTEM HAS BEEN DEVELOPED AND USED WITHIN 7 YEARS OF ITS CONCEPTION.

IT IS REASONABLE TO CONCLUDE THEN, THAT A "SPACE SHUTTLE" DEVELOPMENT PROGRAM, INITIATED NOW, COULD BE BROUGHT TO FRUITION BEFORE THE END OF THE 1970'S.

UNFORTUNATELY, A CRITICAL NEED FOR SUCH A TRANSPORTATION SYSTEM WILL EXIST BEFORE THEN. WE ALREADY KNOW THAT CREWS AND MATERIALS WILL NEED TO BE SHUTTLED BETWEEN EARTH AND LABORATORIES IN SPACE. MEN AND MATERIALS WILL BE FLOWN BACK AND FORTH TO THE SPACE STATIONS WHICH ARE SCHEDULED TO BEGIN SOLAR INVESTIGATIONS IN 1971. COMMUNICATIONS, NAVIGATION, AND EARTH-SENSING SATELLITES WILL PROBABLY REQUIRE MAINTENANCE OR REFIT. IN ITS ROLE AS A GLOBAL TRANSPORT, THE "SPACE SHUTTLE" COULD GO TO WORK TOMORROW.

No really meaningful estimate of the number of "space shuttle" vehicles which will be required can be given at this time, for that number is a function, not only of the various missions which it will be called upon to perform, but also a function of the existence of the machine itself. After all, no one needed an airplane, a computer or a telephone before they existed.

The "space shuttle" is in my opinion, the key to our efficient utilization of the capability we now have and to the application of the knowledge we have already gained. I believe it will be the bridge which will carry space-gained knowledge across the gap between the public and private sectors for profitable earth applications.

Turning now from possibilities to reality; today is a critical time for our nation. We must recognize the realities of Viet Nam and of our cities. We must make those decisions today which will maintain our nation's leadership in science and technology. Aggressive creation and utilization of new technology have been vital forces in making this land, in less than two hundred years, the greatest in the world. These talents have patterned our space program and at the same time are one of the chief benefits coming from our space program. We must recognize tomorrow's need for new technology which can only be developed from today's research.

WE STAND TODAY WITH A TESTED AND EFFICIENT SYSTEM FOR THE ORDERLY EXPLORATION OF THE UNKNOWN, WITH THE PEOPLE, THE MOTIVATION, THE KNOWLEDGE, THE FACILITIES, AND THE EQUIPMENT TO ATTAIN FOR THIS COUNTRY THE FIRST PLACE IN SPACE AND IN ALL RELATED ASPECTS OF TECHNOLOGY. ONLY SUFFICIENT FUNDING IS NECESSARY TO OUR MAINTENANCE OF A FORWARD THRUSTING NATIONAL SPACE PROGRAM.