Table 2

LAUNCH SCHEDULE FOR MAJOR PROGRAM ELEMENTS

Item	Year															
	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Earth-orbital Manned																
Living Module			1				1		2							
Working Module			1				1		3	3						
Nuclear Power Module									2							
Lunar Program																
Lunar Station Module							2									
Lunar Base									1							
STS																
Shuttle			2		1		1	1	1		1		1	1		1
Nuclear Ferry							1		1		1			1		1
Lunar Tug									1			1		1		
Saturn V							2		2	2		2		2		2
Saturn V (downrated)			1			1	3		5	1	1			1		1
Orbital Fuel Depot							2									
Shuttle Flights (includes military)			41	31	34	34	53	52	62	58	56	60	59	59	66	66

Fig. 1

BASE CASE ANNUAL SPACE PROGRAM COSTS

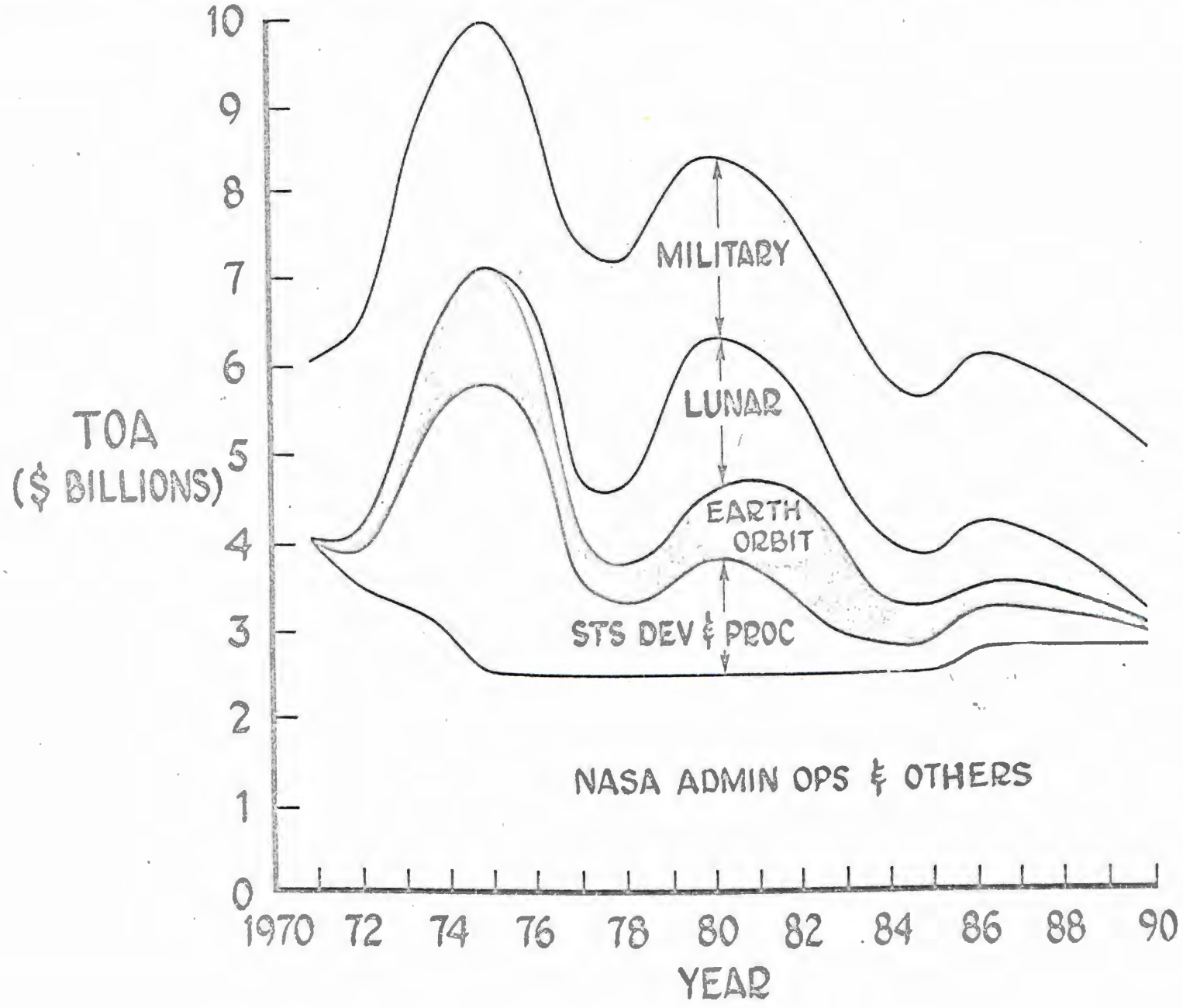
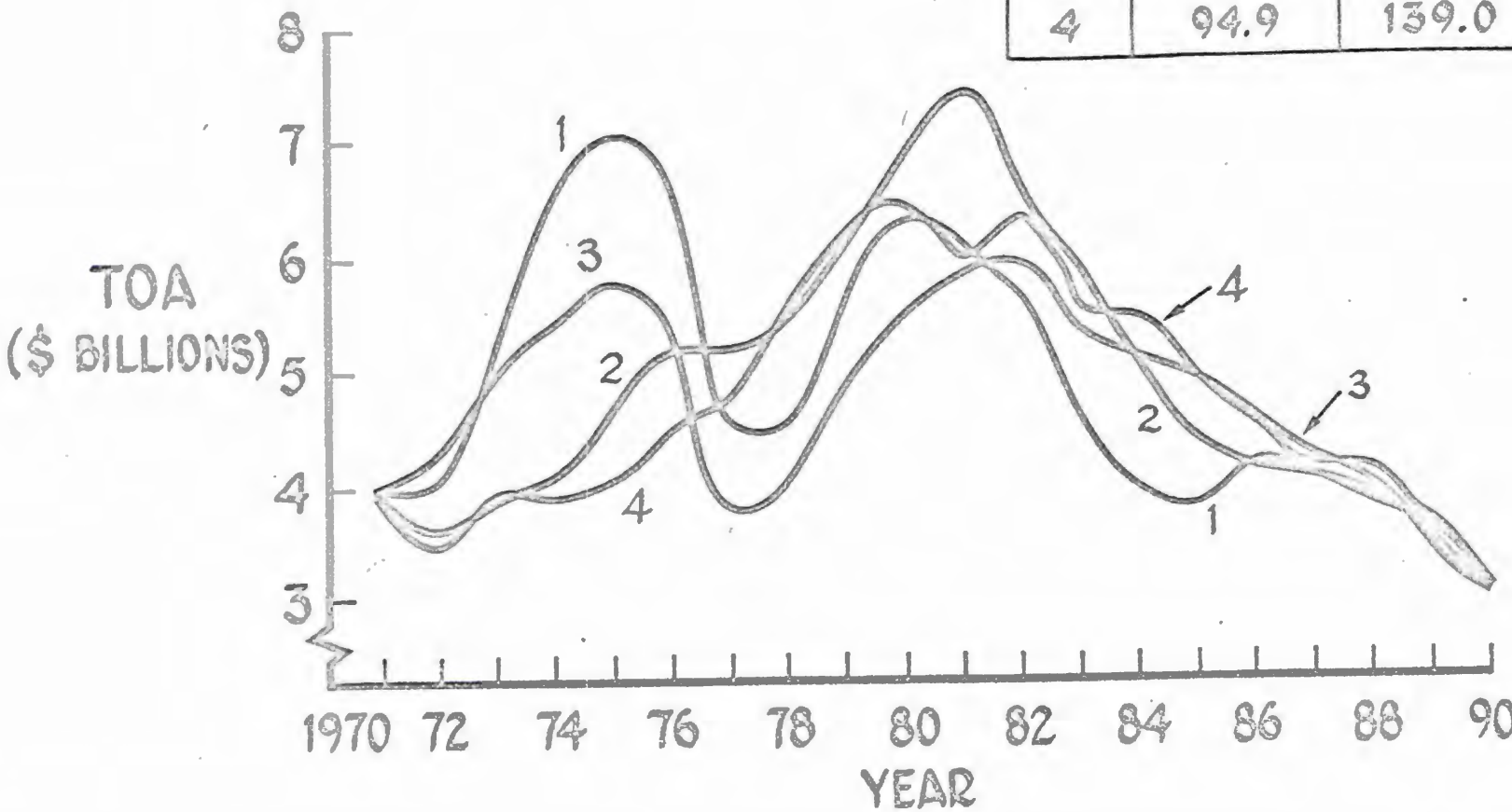


Fig. 2

NASA ANNUAL COSTS FOR ALTERNATE SPACE PLANS 1-4 (SHUTTLE)

1 BASE CASE
2 DELAY STS
3 DELAY SPACE STATION
4 DELAY STS & SPACE STATION

TOTAL COSTS-THRU 1990 (BILLIONS OF $)			
PLAN	NASA	PLUS MIL	DoD
1	97.6	141.4	43.8
2	97.4	142.7	45.3
3	94.6	138.4	43.8
4	94.9	139.0	45.1



to be effective, although in early 1980 a peak is evident for plans 2 and 4 because of concurrent shuttle and lunar program developments. Plan 3, the one that delays the space station rather than the shuttle, does not reduce the mid-'70 peak as much as 2 or 4, but it also has no sharp peak in the early '80s. Also shown in Fig. 2 are the total costs of each of the alternate space plans. There is little to choose one over another.

Plans 5-8 are in essence plans 1-4 without a lunar program component. Figure 3 shows comparative year-by-year costs for these four plans (5-8) as well as their cumulative costs through 1990. The cost trends noted for plans 1-4 also apply for these four plans, except that peaks caused by the lunar program in the early 1980s are substantially reduced. The total cumulative costs are also less than above.

Consider now implementing these plans but without a shuttle (or its development cost). Ignoring potential perturbations in space programs due to differences in peak funding levels,* we assume that each of the above plans is unaltered except for the shuttle and that modified hardware (Apollo, Titan III) will be employed to support the manned (and large unmanned) payloads. Figure 4 shows the cumulative savings (loses) for each program associated with developing the 50K shuttle. In only one case, plan 1, does the shuttle pay for itself by 1990 and in this case the savings are quite marginal. Increases in the RDT&E or operating costs would quickly deplete any savings indicated. Because of substantial uncertainties in the shuttle's RDT&E and refurbishment costs, such an increase might well be anticipated.

Consider in addition abandoning the entire STS (i.e., the shuttle, the nuclear ferry, the Lunar Tug, the orbital fuel depot, and an orbit-to-orbit chemical shuttle for synchronous orbit flights). The increase in total costs through 1990 (over the simple no shuttle case) is in excess of $3 billion for plan 1. As this cost gain is achieved in

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*It might be noted that removing the shuttle program altogether diminishes substantially most of the peak funding problems mentioned above, i.e., if no shuttle is developed, much of the pressure for delaying other programs would be relieved.

Fig. 3

NASA ANNUAL COSTS FOR PLANS 5-8 (EXCLUDING LUNAR PROGRAM)

TOTAL COSTS - THRU 1990 (BILLIONS OF $)			
PLAN	NASA	TOTAL	DoD
5	80.4	124.2	43.8
6	81.4	126.7	45.3
7	78.3	122.1	43.8
8	77.9	123.0	45.1

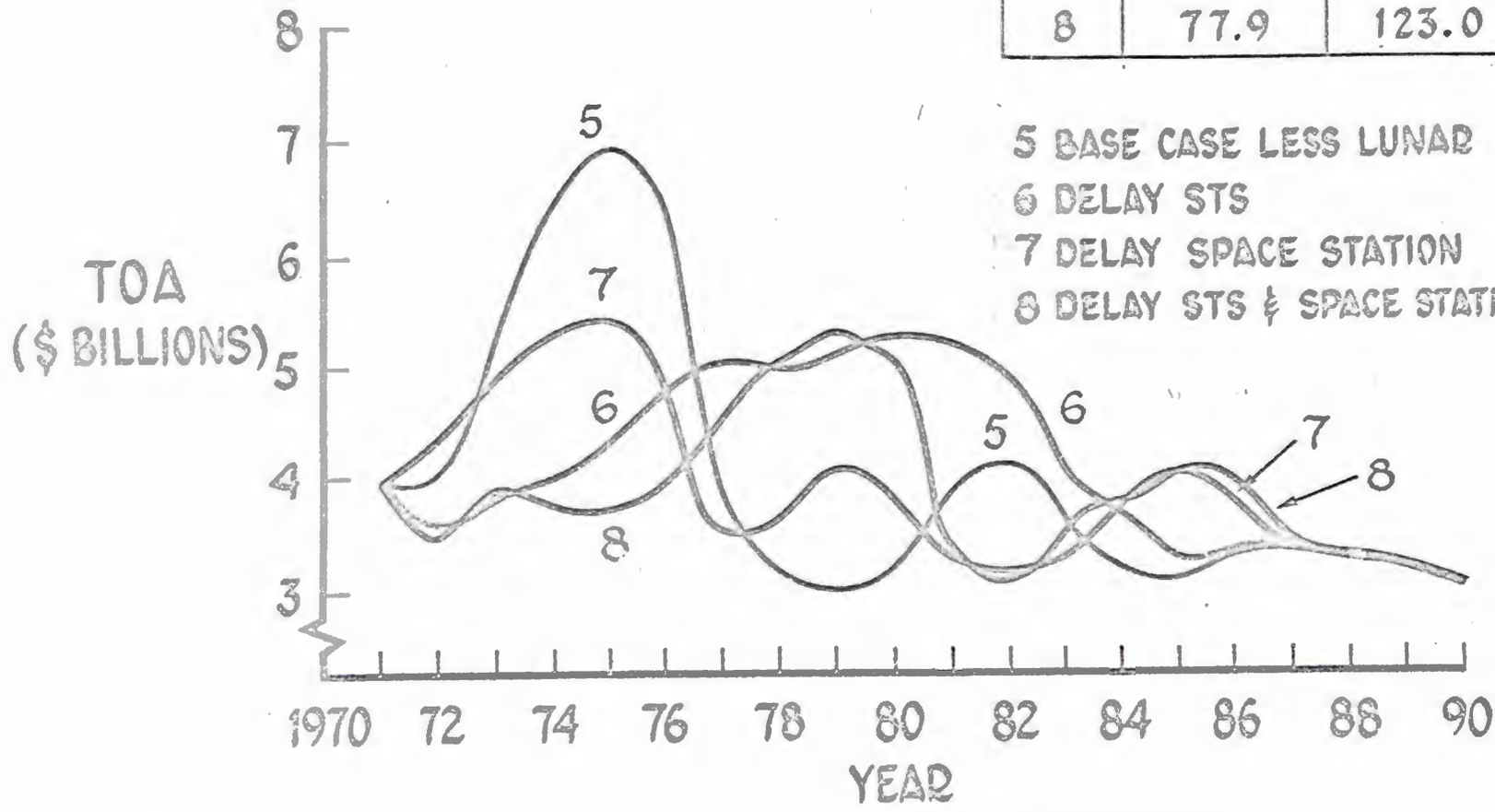
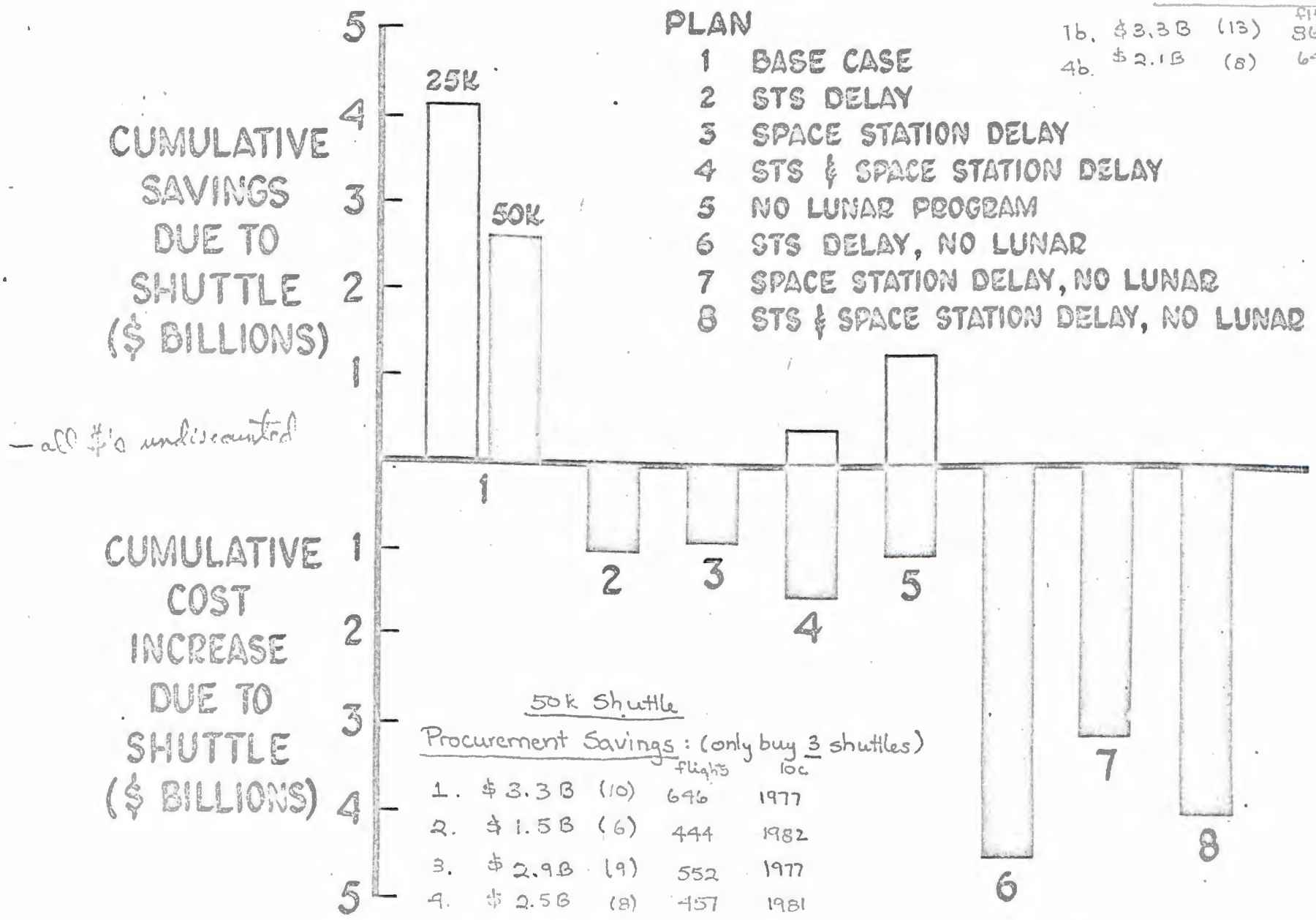


Fig. 4

SHUTTLE SAVINGS FOR ALTERNATE PLANS



— all $'s undiscounted

25 k Shuttle

Procurement Savings (buy 1)

			flts	loc
1b.	$3.3B	(13)	869	1977
4b.	$2.1B	(8)	692	1981

50k Shuttle

Procurement Savings: (only buy 3 shuttles)

			flights	loc
1.	$3.3B	(10)	646	1977
2.	$1.5B	(6)	444	1982
3.	$2.9B	(9)	552	1977
4.	$2.5B	(8)	457	1981

less than 10 years operational lifetime for the lunar specific elements, a lunar program without the nuclear ferry and the reusable lunar tug is economically unwise.

Total costs through 1990 for plans 1-4 are nearly the same despite apparent large differences in the pace of these programs. It is clear that these different plans are not entirely equivalent in their effects on U.S.-manned spaceflight activities. Delaying the space station program can only hurt these activities and delay eventual U.S. manned exploitation of space and its characteristics. It is also clear that delaying the shuttle's IOC date past that of the space station costs NASA money (about $300 million per year for a 12-man station). We urge some serious study of the tradeoffs between peak funding problems associated with concurrent shuttle/station development, the loss to U.S.-manned spaceflight associated with funding the shuttle first, and the added yearly costs (to NASA and DOD) associated with giving priority funding to the station.

THE CASE FOR A SMALLER PAYLOAD SHUTTLE

There is some doubt that 50,000 pounds is the most cost-effective size for the shuttle's payload capacity. A smaller payload shuttle, while giving up some traffic capability, would cost less than the larger shuttle to develop and purchase. Furthermore, it probably has fewer development problems and could be available sooner. The basic question to be answered is whether the loss of traffic capacity plus the additional number of flights required for some missions is compensated for by the reduced RDT&E and investment costs.

Figure 4 also shows the cost savings associated with a smaller 25,000 lb shuttle for plans 1, 4, and 5. The smaller shuttle is more cost effective than its larger brother in all cases shown. Furthermore, it becomes even more attractive than the larger shuttle when total space costs are reduced (as in case 5), showing an overall cost advantage of $2.3 billion dollars by 1990.

While the smaller shuttle reduces the total cost, it costs the military additional money to support a few, large payload launches that

cannot be accommodated in the 25K shuttle. The traffic rates for NASA increase substantially for support of the lunar program, but other program traffic requirements do not significantly change. The principal differences in the 25,000-lb payload shuttle and the 50,000-lb payload shuttle (both have 10,000 cu ft cargo bays) are:

- o significantly lower developments costs
- o slightly higher operational cost per pound of payload
- o the traffic rates are nearly the same as there are very few missions requiring payloads in excess of 25,000 pounds

It is worth noting that the reduced R&D cost for the smaller shuttle alleviates to a degree the funding peak problems.

WILL SATELLITE COST SAVINGS JUSTIFY THE SHUTTLE?

We have often seen it asserted that the availability of a low-cost Earth orbital space transportation system will inexorably lead to significant savings in total space operations costs, over and above those directly associated with launch vehicles, because of the attendant effects upon payload costs and effectiveness. One can assume that R&D and satellite hardware costs would be significantly reduced if satellites did not have to be designed to an irreducable minimum weight. While the magnitude of these additional savings is often implied to be great, or at least sufficient to erase any nagging doubts about the attractiveness of the shuttle, it remains unquantified. Quantifying these savings is admittedly a difficult if not impossible task. Nevertheless, before we can recommend their use to influence a decision on an economically questionable shuttle development program, some bound on their magnitude must be found.

The problem of finding an upper bound on these estimates divides naturally into two parts; how much money idealistically can be saved, and what fraction of this money can realistically be saved. Neither part has a ready answer. With regard to the former, only a portion

of the entire space budget (less transportation costs of course) will be influenced by lowered launch costs. Certain space programs, particularly those involving manned spaceflight, will continue to demand expenditures essentially unaltered by the existence of the shuttle. Other payloads, such as hydrogen fuel for the nuclear ferry, are simply not subject to cost-benefit tradeoffs. Still, a fairly large number of satellites, mainly military, mostly small in size and weight (less than 10,000 lbs) are theoretically subject to design savings as a result of reduced launch costs per payload weight. For the military and civilian space programs mentioned above, we have tentatively estimated the total costs of these programs as lying between $1.5 billion and $2.0 billion per year.

If most of these costs could be saved through satellite redesign, then the economic attractiveness of a shuttle could be substantial. For an appropriate set of assumptions,* it can be shown that reducing the launch costs (C_L) by a fraction f leads to a fractional decrease in total system costs equal to F, where

$$F = f^{\frac{C_L/C_p}{(C_L/C_p)+1}}$$

and where C_p is the current satellite costs.** F depends only on f and

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*We assume that total system costs are minimized for future systems for both current launch costs and for those assumed for the shuttle. Any gains shown are the differences between optimally designed systems. However, it is possible that future systems using current launch hardware would not be optimally designed, for whatever reasons present systems are not optimally designed. It is possible that the presence of a shuttle could have a catalytic effect, changing present design and management procedures to permit cost minimization to occur. In such a case, the shuttle could show larger cost savings than indicated here. However, we do not feel that such savings are properly attributed to the shuttle's reduced launch cost.

**This result is taken from work by Carl Builder, of The Rand Corporation, and will be the subject of a forthcoming Rand Research Memorandum.

the ratio of current launch to current payload costs. As F is always greater than f, the total satellite system cost savings never exceed in percent those for the transportation costs. This simply means that large system cost savings can only come about with large percentage savings in launch costs.*

In order to bound the cost savings, assume that each shuttle flight is completely filled (thus showing the lowest cost per pound into orbit). f may be estimated to be as low as 0.1.** For this estimate, total satellite cost savings between $150 and $300 million dollars per year might be anticipated. While these savings are not negligible, nor are they sufficiently large as to constitute such a bonanza that any doubts about the shuttle's economic attractiveness are dispelled.

Potential satellite cost savings do impact somewhat on which alternative space plans are preferred. Most of the satellite savings come from systems likely to be funded independent of the existence of the shuttle or the peak funding problems discussed above. These savings favor programs that call for early shuttle development. Figure 5 shows the shuttle's economic attractiveness where satellite cost savings of $200 million per year have been added.***

We have said nothing thus far about potential cost savings arising from the recovery, reuse, or in orbit maintenance of satellites. The shuttle, with its low recurring cost per launch and its return payload capability, is well suited to encouraging satellite systems designed to allow reuse and/or maintenance in orbit. Estimating potential cost

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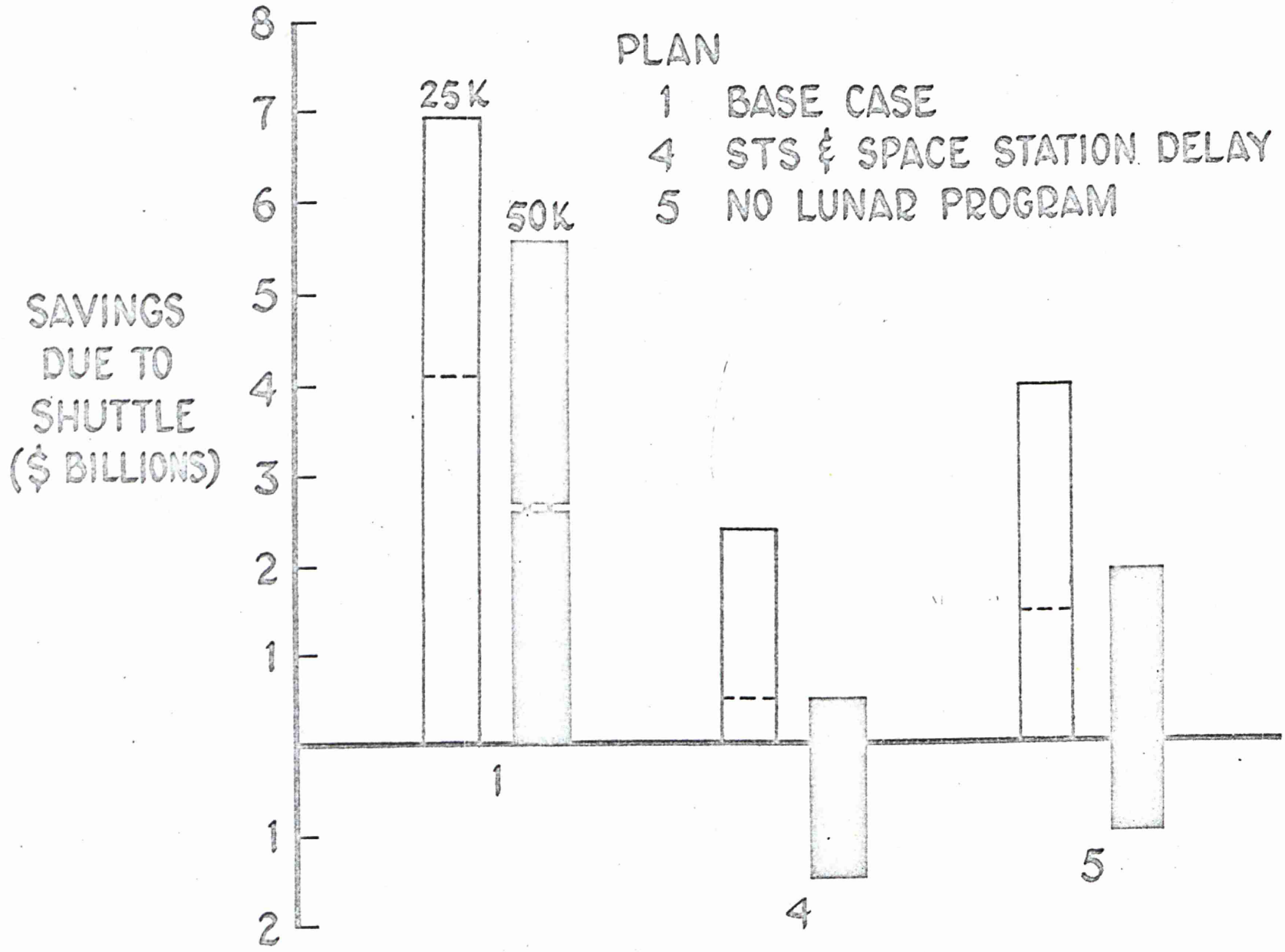
*This implies that no sudden increase in savings should be anticipated with marginal launch vehicle savings.

**When calculating a value for f, care must be taken to include in the recurring shuttle flight costs the cost of amortizing the shuttle's investment costs. Were this cost ignored, or simply added into the RDT&E costs, the minimization of the total space system costs would be incorrect.

***We might note that the 25K-lb payload shuttle does not offer as great an opportunity for satellite redesign; in fact, many military payloads, while small in size and weight, require a total shuttle payload of nearly 25 K at present designs because they require large ΔV propulsion modules to place them into synchronous orbit.

Fig. 5

SHUTTLE SAVINGS INCLUDING SATELLITE SAVINGS FOR ALTERNATE PLANS



savings requires detailed examination of individual systems. To our knowledge no one has yet carried out these studies and we can only guess at the potential space system cost savings. These satellite cost savings probably affect a smaller percentage of the space budget than that of satellite redesign, but the fraction of that theoretical cost actually saved may be considerably higher.* As an order of magnitude estimate, we place these cost savings as about equal to those for satellite redesign, i.e., neither negligible nor overwhelmingly large.

OTHER CONSIDERATIONS

If neither total transportation cost savings nor total satellite cost savings are sufficient to justify the shuttle's large RDT&E expense, then those seeking justification must look elsewhere. A number of suggestions regarding "other attributes" of the shuttle that might tip the decision in the shuttle's favor have been mentioned elsewhere. Most involve convenience of operation or an enhanced use of space. We shall not discuss the former, other than question how much this country would really be willing to pay for it. Arguments about the increased use of space, however, imply a major impact on the space program and deserve further consideration.

It is a matter of faith that low-cost transportation to Earth orbit will open up space in a manner impossible to accurately predict. If space transportation follows other transportation systems, the impact of low-cost transportation may be difficult to overestimate. But how low does this cost have to be for space to be truly exploitable. It is clear that space transportation systems have a long way yet to go before space will be available to the general public.[11] Tourism, and the like, require a reduction in recurring costs of at least an order of magnitude below those promised for the shuttle. Nor does it seem likely

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*The systems affected are probably the same as those subject to satellite redesign. However some systems located in synchronous orbit cannot cost-effectively be recovered or maintained in orbit, hence the smaller total budget affected. But satellite reuse should reduce hardware costs to an absolute minimum, as satellite refurbishment requirements should be few.

that commercial entrepreneurs will become involved in space in the next 20 years, although there is some disagreement on this point.[12] What, then, are the space activities that present shuttle designs are supposed to create?

Probably not scientific missions. There is some chance that certain space-exploitation missions, e.g., communications or navigation, might be created, but it is in the military mission domain that the biggest impacts are likely to occur. Military space missions must be justified on a cost-effectiveness basis. Those that have unique capabilities when performed from space have already been identified and, where justified, acted upon. There are other missions, however, that have alternative ground-based competitors; these missions are likely to be sensitive to launch vehicle costs.*

Certain space systems that lack ground-based counterparts, still do not get serious consideration for funding because they are simply too expensive. Some programs (usually feasibility investigations) would clearly benefit from low-cost transportation. As has been true in many similar non-space enterprises, these programs do not have a clearcut necessity, but might be funded if they were inexpensive, with hopes that the additional expenditures will make some additional system useful. Their ultimate worth is impossible to estimate; estimates span the spectrum from worthless to invaluable. Only experience is likely to lead to a determination.

None of the above answers the question of whether new mission potentials justify a shuttle development. At this time strong assertions about the importance of these considerations cannot be justified. Some new space programs are likely to be funded once the shuttle becomes operational. No doubt some of these will turn out to be very worthwhile. But no guarantee can be given that this will be the case. To attempt to justify the shuttle on this basis would obviously be risky, a gamble on an uncertain future. We cannot recommend that course of action.

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*An enhanced use of space could increase the total costs of the space program. It is assumed in this discussion that other, non-space, costs could be reduced by an even greater margin, thus showing a net gain for the country as a whole.

DISCUSSION AND CONCLUSIONS

The space shuttle shows cost advantages if the STG schedule for the orbiting space station, space base, and lunar programs are accepted. However, this schedule causes funding problems which may force rescheduling of the STG programs, in which case the shuttle may or may not still be attractive for near-term development. In the long range, the future of the shuttle appears attractive, but its immediate economic justification depends on the pace of the national space program finally adopted.

The results of our studies to date lead us to some tentative observations:

- There are development risk (technology) and cost advantages favoring the 25,000-lb payload shuttle over the 50,000-lb version. In contrast, the larger shuttle is more flexible in meeting unanticipated launch requirements and offers a greater potential for realizing satellite cost savings.
- In the time period of almost all of the plans studied, there are quite small differences in total costs between shuttle and non-shuttle transportation systems. This may suggest that considerations other than cost be used as criteria in the evaluation of shuttle attractiveness.
- This study used the STG schedules as the basis of constructing alternate space plans. The schedule themselves might be questioned because of the 1977 IOC date for the shuttle. Two points are raised. First, what level of technology might be achieved in any five year R&D program (from 1972 to 1977). Second, can adequate funding be achieved for the shuttle within this short a time span when the program itself is still subject to question.

- The shuttle system tends to look more attractive with early IOC dates and large numbers of flights. However, the early IOC dates cause near term and large funding peaks. While funding peaks can in some measure be reduced through judicious rescheduling of launches and stretchouts in R&D programs, still the amount of early funding, and the immediacy of program start may be problems. Further, any significant delay in the operational use of the shuttle system will seriously hamper whatever economic advantage it has over competing non-reusable systems.

With the observations in mind, we recommend that:

- If early shuttle development is decided upon, serious consideration be given to a smaller than 50,000-lb shuttle, the most appropriate size still uncertain because of prevalent technology, cost, and near term space program funding problems,
- If the shuttle IOC is delayed, detailed consideration be given to the apparent conflict between the cost advantages of a smaller shuttle and the flexibility of larger shuttles. In the interim a technology program to reduce development risks and possibly a prototype shuttle program should be considered,
- Advances in expendable, reduced cost launch vehicles not be abandoned until the issue of shuttle development is resolved.

Finally, we wish to digress slightly from the problems of near-term shuttle development and take a longer view. Perhaps the proper way to view the shuttle is to consider it as the first in a long line of reusable boosters progressively lowering launch costs. In 50 years, it is conceivable (possible) that space will be open to vacationers,

tourists, and industrial manufacturing, brought about by future launch vehicles descendent from the original shuttle. Viewing space exploitation in this light, a decision to develop a shuttle is inevitable. But with $9 billion RDT&E at stake, all sides of the shuttle development problem should be examined.

Appendix A

HARDWARE DESCRIPTIONS

The budget comparisons of the proposed alternative space plans over the next 20 years required as one of the inputs the cost of the various hardware items in each plan. It should be kept clearly in mind that these elements of hardware are representative of the type required for each plan and are not necessarily definitive of what NASA is currently studying or what NASA would actually procure for any given plan. As we now understand the missions to be performed, some version of the hardware used in each program would be required. Development and production cost and a gross description of the major hardware items are given below.

SPACE SHUTTLE

	50K PL	25K PL
gross weight, lbs	3.5×10^6	1.75×10^6
development cost (billions of $)	9	7.3
first unit cost (millions of $)	750	600
launch ops cost (millions of $)	5.3	4.2

SPACE STATION AND BASE

The assumption was made that the space station and base would be built from common modules which would require the development of three unique modular forms. These we have called Module "A," Module "B" and the Nuclear Power Module. The complete 50 man base would be composed of the following modules: maneuvering, zero "G," artificial "G," nuclear power, hub, hanger, warehouse, hospital, living quarters and assorted booms and fairings.

Eight "A" modules, four "B" modules and two Nuclear Power modules would make up the complement of modules described above for a 50 man

space base. One Module A and B are required for the initial space station (12 man).

Subsystem	Module A	Module B (wt in lbs)	Nuc. Power
Structure	64,000	45,700	47,200
Adapter	2,600	2,600	--
Elec. power	6,000	2,750	4,700
ECS	9,000	3,000	--
Comm.	2,110	1,100	--
Stability & control	170	--	--
Nav & guid	1,500	--	--
Crew sys & display	8,260	2,000	--
Shielding	--	--	100,000
Elec. power nuclear	--	--	26,450
Development cost (millions of $)	2,500	1,065	250
First unit cost	190	96	70
Launch ops cost	90	53	0

EXPERIMENTAL AND SCIENTIFIC MODULES

These modules would be equipped for the experiments to be performed in earth and lunar orbit and at the lunar base.

	Experiment A	Experiment B
First unit cost (millions of $)	120	160

LUNAR MODULE

Two modules are used for the lunar station and one for the lunar base and there is some commonality to all three. A zero 'g' and living modules are used in lunar orbit to form the station which is capable of housing 12 men. One module is used for the lunar base which also houses 12 men. However, due to major differences there is an additional development cost for the lunar base over the lunar station.

Subsystem	Lunar Station Zero "g"	Lunar Station Living	Lunar Base
	(wt in lbs)		
Structure	40,000	40,000	40,000
Adapter	2,600	2,600	2,600
Electric power	14,000	14,000	16,000
ECS	5,000	5,000	7,500
Communication	650	200	650
Stability & control	200	200	0
Nav & guidance	1,000	0	0
RCS	900	900	0.
Crew system & display	3,000	5,000	3,000

	Lunar Station	Lunar Base
	($ millions)	
development	2800	1400
first unit	190	common
launch ops	90	common

LUNAR CONSTRUCTION MODULE

This module is used to build the lunar base.

weight.....10,000 lbs
development cost.....$75 million
first unit cost.....$25 million

LUNAR DESCENT STAGE

This stage is required to place payload on the moon (lunar base, construction module, etc.).

gross weight.....150,000 lbs
development cost.....$380.0 million
first unit cost.....$16.0 million

LUNAR TUG (LEM B)

This is a development of a much larger vehicle than the current LEM and is used for logistics resupply between the lunar base and lunar station. It is assumed to be reusable for 10 flights.

gross weight.....50,000 lbs
payload..... 5,000 lbs
development cost..... $1500 million
first unit cost..... $64.0 million

NUCLEAR FERRY

This vehicle is powered by a nuclear engine and is used for logistics resupply between the earth orbit space base to the lunar orbit station. It is assumed to be reusable for 10 flights.

gross weight.....350,000 lbs
payload weight..... 50,000 lbs
development cost.....$1340 million
first unit cost.....$ 88 million

ORBITAL FUEL DEPOT

The depot is used to fuel the Nuclear Ferry and Lunar Tug for their logistics mission. There is one depot in earth orbit and one in lunar orbit.

Weight in Pounds

structure 125,000
LH_2 400,000
LO_2 100,000

Cost in $ Millions

development $200
unit ..... $ 25

SPACE BOOSTERS

For those periods of time when the shuttle is not used or payloads are of such volume or weights that the shuttle cannot be used, several boosters have been employed. These include the Saturn V (SIC, SII, SIVB and IU) Saturn VD (SIC, SII and IU) Titan IIID and Titan IIIM (both are uprated versions of the Titan IIIC).

	First Unit*	Launch Ops
	(millions of $)	
Saturn V	215	$40
Saturn VD	185	$25
Titan III	31	(incl. in hardware)
Titan III	26	" " "

*These are the first units procured after development. We have accounted for prior units and the costs in the model reflect the learning curve effects of these prior units.

SIX MAN APOLLO

For those plans in which the shuttle operation is stretched or there is no program for a shuttle a six man modified Apollo spacecraft is used.

gross weight ..... 20,000 lbs
development cost ..... $1000 million
first unit cost ..... $ 300 million
launch ops cost ..... $ 73 million

Appendix B

PLANS

Various combinations of the hardware items described in Appendix A were used in the programs for the 17 alternative plans in the time period 1971 to 1990. Each of the 17 plans have six major programs of which four have been varied. These consist of the Space Transportation System (STS), Earth Orbit, Lunar and Military Transportation. The STS program consists of the Shuttle, Nuclear Ferry, Lunar Tug, and Orbital Fuel Depots. The Earth Orbit program consists of a space station which builds up to a 50 man space base. The Lunar program consists of a 12 man lunar orbit station and a 12 man lunar base. The Military Transportation Program costs have been varied with the IOC of the shuttle and shuttle development. The NASA Administrative Space and Science applications, and the Military Space (less transportation) costs are the same for all 17 plans. These two program costs were taken directly from the STG report.

Described below are the major assumptions for each plan. The hardware used and its initial operational date (IOC) is shown in Table 1 for each of the 17 plans.

PLAN 1

This is the base case. It assumes a space transportation system (STS) with a 50K payload reusable shuttle in 1977, a space station in 1977 and 50 man earth orbit space base by 1984, a 12 man lunar station in 1981 and a 12 man lunar base in 1983. The Saturn V and VD boosters are used to launch those payloads which cannot be carried by the shuttle, i.e., space base modules, lunar station modules, etc. The STS would also consist of the Nuclear Ferry and Lunar Tug.

PLAN 2

This varies from Plan 1 in that the shuttle's IOC is delayed. Due to this delay the Titan IIIM and IIID with the 6-man modified Apollo are used to support the space station until the shuttle becomes operational in 1982.

PLAN 3

This varies from Plan 1 in that the space station's IOC is delayed until 1981.

PLAN 4

This varies from Plan 1 in that both the shuttle and space station IOCs are delayed until 1981.

PLANS 5, 6, 7, and 8

In all these plans the lunar program is dropped. Their respective relationships are to Plans 1, 2, 3, and 4 (varying IOC) without the lunar station and lunar base.

PLAN 1A

This plan varies from Plan 1 in that there is no STS (shuttle, Nuclear Ferry and fuel depot). The earth orbit and lunar programs are supported by the Titan IIID, Titan IIIM, Saturn V and the 6 man Apollo. IOC for the earth orbit and lunar program is the same as Plan 1.

PLAN 1B

This plan varies from Plan 1 in that a 25K payload shuttle is used with the STS. In addition, one Titan IIID and 8 Titan IIIM flights are required for the military because of the reduced payload shuttle.

PLAN 4B

This plan varies from Plan 4 in that a 25K payload shuttle is used with the same IOC delays in the STS and space station. Again, the flights of Titan IIID and Titan IIIM are required for the military program.

PLAN 5B

This plan varies from Plan 5 in that the 25K payload shuttle is used. The lunar program is again discarded. The Titan IIID and Titan IIIM flights are required for the military program.

PLAN 1C, 2C, 3C, 5C, AND 7C

Plans 1C, 2C, 3C, 5C and 7C vary from the respective Plans 1, 2, 3, 5, and 7 in that no shuttle is used in the STS. In Plans 1C, 2C and 3C the STS retains the fuel depots and Nuclear Ferry. The Saturn V, Titan IIID, Titan IIIM and 6 man Apollo are used to support the earth orbit and lunar programs. In Plans 5C and 7C the lunar program is discarded, therefore, there is no requirement for an STS other than the 6 man Apollo.

Table 1

IOCs DATES FOR THE ALTERNATIVE SPACE PLANS
(1971 to 1990)

Item	Plan 1 Base Case	Plan 2 Delay STS	Plan 3 Delay Sp Sta	Plan 4 Delay STS & Sp Sta	Discard Lunar Program			
					Plan 5	Plan 6 Delay STS	Plan 7 Delay Sp Sta	Plan 8 Delay Sta & Sp Sta
Space Transportation System								
Shuttle, 50K payload	1977	1982	1977	1981	1977	1982	1977	1981
Shuttle, 25K payload								
Nuclear Ferry	1981	1983	1983	1983				
Lunar Tug	1983	1985	1985	1985				
Orbital Fuel Depot	1981	1983	1983	1983				
6-man Apollo		1977				1977		
Earth Orbit								
Module A	1977	1977	1981	1981	1977	1977	1981	1981
Module B	1977	1977	1981	1981	1977	1977	1981	1981
Nuclear Power Module	1983	1984	1986	1986	1983	1984	1986	1986
Experimental & Science Modules	1978	1978	1982	1982	1978	1978	1982	1982
Lunar Program								
Lunar Module	1981	1983	1983	1983				
Lunar Construction Module	1983	1985	1985	1985				
Lunar Descent Stage	1983	1985	1985	1985				
Experimental & Science Modules	1982	1984	1984	1984				

Table 1 (cont.)

IOCs DATES FOR THE ALTERNATIVE SPACE PLANS
(1971 to 1990)

Item	25K Payload				Discard Shuttle			Discard Lunar & Shuttle	
	Plan 1A No STS	Plan 1B	Plan 4B Delay STS & Sp Sta	Plan 5B Discard Lunar	Plan 1C	Plan 2C Delay STS	Plan 3C Delay STS & Sp Sta	Plan 5C	Plan 7C Delay Sp Sta
Space Transportation System									
Shuttle, 50K payload									
Shuttle, 25K payload		1977	1981	1977					
Nuclear Ferry		1981	1983		1981	1983	1983		
Lunar Tug	1983	1983	1985		1983	1985	1985		
Orbital Fuel Depot		1981	1983		1981	1983	1983		
6-man Apollo	1977				1981	1977	1981	1977	1981
Earth Orbit									
Module A	1977	1977	1981	1977	1977	1977	1981	1977	1981
Module B	1977	1977	1981	1977	1977	1977	1981	1977	1981
Nuclear Power Module	1983	1983	1986	1983	1983	1984	1986	1983	1986
Exper. & Science Modules	1978	1978	1982	1978	1978	1978	1982	1978	1982
Lunar Program									
Lunar Module	1981	1981	1983		1981	1983	1983		
Lunar Const. Module	1983	1983	1985	1983	1985	1985	1985		
Lunar Descent Stage	1981	1983	1985		1983	1985	1985		
Exper. & Science Modules	1982	1982	1984		1982	1984	1984		

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

rec'd
11/4/71

OFFICE OF THE ADMINISTRATOR

Honorable Peter M. Flanigan
Assistant to the President
The White House
Washington, D.C. 20500

Dear Peter:

I think you will be interested in the attached contractor employment estimates for the Space Shuttle Program.

The first two blocks of figures show the contractor employment projections, by region, for the MK I/II Space Shuttle approach contained in our minimum recommended budget and for the "Baseline Reusable" Shuttle configuration which we previously studied in detail.

The second part of the table shows the substantial effects of a possible acceleration of the MK I/II Shuttle program. These are the estimates we have furnished Fred Foy at his request. The total MK I/II projections including this acceleration are shown on the second page.

The two most noteworthy points are perhaps:

(1) the very sharp build-up (from 5,600 to 14,300) that would occur in the last six months of calendar year 1973, and

(2) the very substantial increases in 1972 and early 1973 that are possible with the acceleration indicated.

Please let me know if you have any questions on these projections.

Sincerely,

James C. Fletcher
Administrator

Attachment

National Aeronautics and Space Administration

SPACE SHUTTLE CONTRACTOR EMPLOYMENT PROJECTIONS *

Projects	6/71	12/71	6/72	12/72	6/73	12/73
Baseline Reusable Space Shuttle	2,500	2,300	2,600	3,700	7,600	20,800
Mideast	200	200	100-200	100-400	400-1,800	1,200- 4,300
Plains	300	200	100-200	100-400	200-1,000	400- 3,300
Southern States	200	200	400-500	700-1,000	1,900-2,800	6,500-10,600
Far West	1,800	1,700	1,700-2,100	2,100-2,500	3,100-4,400	5,800-10,300
MK I/II Space Shuttle Contained Minimum Recommended Budget	2,500	2,300	2,600	3,400	5,600	14,300
Mideast	200	200	100-200	200-400	400-1,000	1,300- 3,000
Plains	300	200	100-300	100-400	100- 700	200- 2,200
Southern States	200	200	400-600	700-800	1,000-2,000	4,400- 6,300
Far West	1,800	1,700	1,700-1,800	1,600-2,100	1,900-2,900	3,200- 6,200

*Estimates include prime and major subcontract employment--they do not include secondary employment effect.

EFFECT OF POSSIBLE ACCELERATION OF MK I/II SHUTTLE

	Funding Impact (Millions of Dollars)			Employment Increases			
	FY 1972	FY 1973	FY 1974	6/72	12/72	6/73	12/73
SHUTTLE	+15	+200	+245	+1,800	+5,400	+13,600	+9,700
Engine	(+12)	(+50)	(+95)	(+1,300)	(+1,800)	(+2,700)	(+3,500)

o Initiate detailed design and development April/May 1972 rather than mid-summer 1972 as indicated in the Budget submission.

o Initiate high pressure engine development January 1971.

o More rapid buildup of effort in FY 1973 with objective of achieving earlier first manned orbital flight.

TOTAL CONTRACTOR EMPLOYMENT ON MK I/II SHUTTLE--ACCELERATED

	6/72	12/72	6/73	12/73
Space Shuttle-MK I/II	4,400	8,800	19,200	24,000
Mideast	250-350	600-1,000	2,000- 2,700	2,600- 3,800
Plains	150-200	300-600	400- 1,600	500- 2,300
Southern States	600-800	1,600-2,400	4,700- 6,400	6,200- 9,000
Far West	3,100-3,400	4,800-6,300	8,500-12,000	9,500-14,700

5-32e

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

November 3, 1971

DIRECTOR

MEMORANDUM FOR MR. FLANIGAN

I am having lunch with Jim Fletcher this Friday. I intend to convey to him our concern (i.e., yours and the Administration's) that the President deserves better planning in the space area than we have had to date. I will say that there seems to be a nonconstructive battle between NASA and OMB, and that you (PMF) want to see planning over a longer time horizon. I would like to emphasize your willingness to facilitate such an activity on the condition that Fletcher recognize the constraints and limitations under which the President must work as well as his broad objectives.

The key to all this is to get Fletcher off the battle line he seems to be drawing publicly -- that it's the Shuttle program or nothing -- and to get him to work with us toward defining a space program the President can enthusiastically endorse. The first step in this is to discuss with him the attached draft of the Administration's criteria for the future of the space program. It is consistent with, but more detailed than, the President's statement of last year. I will tell Fletcher that you have asked me to work with him to develop the outline of such planning preparatory to your meeting with him and then possibly with the President.

Clay T. Whitehead

Attachments

GENERAL CRITERIA

In summary, the U.S. should continue as a peaceful spacefaring nation and structure its programs to enhance our position and image of world leadership.

a. Conduct a balanced program of exploration, science, and application, which also contributes to the advancement of technology.

b. Conduct a visible and reasonably continuous program of manned space flight.

c. As a minimum, our program should be planned to maintain our favorable image vis-a-vis the USSR.

d. Options for innovative international cooperation should be evaluated by the Administration as the opportunities arise.

More specifically:

1. The space program should be made up of projects each of which:

   a. lends itself to evolutionary development, allowing proof of principal, reduction of technical risk and reduced cost of space operations, and demonstration of payoff along the way by producing useful results at several intervals in a multi-step development;

b. is not so large as to force future imbalance in a fixed-budget space program, nor because of its size, should it become the major driver of the space program as a whole.

2. Management factors to be considered.

a. Shape institutional base to programs, not vice versa.

b. Work towards efficient consolidation of management and base.

c. The present NASA structure was appropriate to Apollo, but could be more responsive to future directions if realigned along the lines: (1) exploration; (2) development of new, non-commercial space applications; (3) research in new space-oriented and aeronautical technology; (4) space science, and (5) launch operations and booster development, which would work toward being a self-supporting service. Manned space flight would be an integral part of the exploration, applications, and science programs.

3. The space program should stimulate and enhance the practical benefits from space operations.

a. Continue the rapid development of new uses and innovations in space.

b. Projects and technological areas should be pursued that have potential commercial or operational application, but which

are not at the stage of being cost-effective. When commercial or operational viability is demonstrated, as determined outside NASA, the program should be transferred to the user or to the commercial sector of the economy.

4. A productive exploration and science program should be continued from space for its benefit to the advancement of human knowledge and for the prestige that accrues to the U.S.

   a. Exploration missions relate to national image and should be funded by NASA.

   b. Space science should be selected and judged in relation to the U.S. science program as a whole, and the experiment and recurring costs should be funded through NSF.

   c. To reduce the cost of space science, NASA should develop an unmanned spacecraft which accommodates and supports a broad range of experiments.

5. Our efforts should keep options open for international cooperation.

   a. International cooperation projects must be individually judged on the bases of answers to the following questions: (1) is the projected benefit clearly and demonstrably worth the cost, recognizing that the value of space cooperation depends strongly on the matter of visibility; (2) are we

committing ourselves inadvertently to more than the particular project; and (3) is an appropriate balance being maintained between our national and our international space activities?

b. The concept of international cooperation should be based on the assumption that arrangements will be reciprocal and mutually beneficial, bearing in mind that world leadership will require that we compete with as well as cooperate with other nations in space.

c. Only those projects should be undertaken which are sufficiently straightforward in both a technical and management sense that we are reasonably certain they will increase rather than injure our mutual friendship. Generally speaking, visible undertakings such as joint payload or exploration missions, including manned missions, are much preferred to joint engineering projects which involve management problems and technology transfer.

d. We should put ourselves into a position that would permit the US-USSR cooperation, while recognizing the necessities of having political flexibility and reciprocity of prestige.

e. There should be sufficient mission flexibility so that important elements of our program do not become dependent on cooperative arrangements.

November 3, 1971

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CTWhitehead:lmc:11/3/71

DO Records
DO Chron
Mr. Whitehead
Dr. Mansur
Mr. Thornell

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Post Apollo

November 3, 1971

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e. There should be sufficient mission flexibility so that important elements of our program do not become dependent on cooperative arrangements.

Pertinent Facts About Nuclear Rockets

NERVA: 75 K thrust
825 Isp

1. Current status - design complete, ready to begin fabrication and test. Everything on "hold" until future settled.

2. Cost estimate: 600-700 million to complete engine development thru flight test. Additional costs for vehicle.

3. Flight readiness: 1981.

4. Large nuclear vehicle could have wide variety of uses but missions are not well defined at this time. Probably require assembly in orbit.

Alternatives:

Prototypes - small size. Technology is available for engine of about 20 K thrust. Cost would be about half (300 million) for engine. Could be ready 76-77. Would be launched on Titan 3C or Titan variation.

Comments:

The larger design (NERVA) appears more cost effective, but also has longer development schedule higher total costs and a relatively undefined need. While prototype needs more study to pin down costs it is a useful engine, and has the advantage of fitting on a launch vehicle that will be available. It is not the most cost effective development but perhaps is the

best we can do for that amount of money.

The small prototype engine appears to have a number of other advantages. It is the lowest cost way in which we can maintain capability in nuclear rocket technology, and develop something useful to take advantage of our investment to date. It will also allow us to demonstrate nuclear rocket capability, and learn a great deal about the operation of nuclear rocket engines in space and their advantages. If future needs for nuclear rockets developed more rapidly we would be in a much better position at that time to provide whatever capability is needed, if the prototype is developed now. Under the prototype development plan testing would begin early causing retention of most of the Nevada employees and requiring rehiring of a substantial number in the Sacramento area. It is possible that some employment would be lost at Los Alamos, New Mexico.

OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON

Tennie

I think TW will want to read this. Will you send it in?

Bron

Routing Slip
Office of Telecommunications Policy

Date: OCT 21 1971

From: Jeanne

To:

✓	Whitehead, C. T.	
	Mansur, G. F.	
	Babcock, C.	
	Buss, L.	
	Carruthers, B.	
	Cooke, A.	
	Culpepper, C.	
	Dean, W.	
	Doyle, S.	
	Enslow, P.	
	Goldberg, H.	
	Hailey, L.	
	Hall, D.	
	Hinchman, W.	
	Jansky, D.	
	Johnston, B.	
	Joyce, C.	
	Lamb, B.	
	Lasher, S.	
	Lyons, W.	
	McCrudden, M.	
	Nelson, R.	
	Owen, B.	
	Raish, L.	
	Robinson, K.	
	Scalia, A.	
	Smith, L.	
	Thornell, J.	
	Urbany, F.	
	Ward, D.	
	Smith, B	S

Remarks:

THE WHITE HOUSE

WASHINGTON

Date 10/20/71

TO: T. Whitehead

FROM: PETER M. FLANIGAN

✓ For your information

____ For action

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

OCT 15 1971

pc Dr. Kissinger

Honorable Peter M. Flanigan
Assistant to the President
The White House
Washington, D. C. 20500

Dear Peter:

I am forwarding for your information my letter to Dr. Kissinger concerning our common docking negotiations with the Soviet Union.

The important point to note is that we must make a preliminary decision concerning an early docking with the USSR in the context of the FY 1973 budgetary process. A negative decision will forego all opportunities to have a cooperative manned flight with the USSR until 1979, at the earliest. On the other hand, a positive decision will not commit the U.S. to carry out the docking mission -- it will merely provide the hardware for such a mission, should we make a subsequent decision to fly it.

Sincerely,

Jim F

James C. Fletcher
Administrator

Enclosure

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

OCT 15 1971

Honorable Henry A. Kissinger
Assistant to the President
for National Security Affairs
The White House
Washington, DC 20500

Dear Henry:

The purpose of this letter is to bring you up to date with regard to our negotiations with the Soviet Union on providing compatible docking mechanisms for their manned spacecraft and ours and to discuss the implications of our FY 1973 budget submission with respect to these relations.

For background, this is where we stand:

o In October 1970 we reached agreement in principle to work toward making the docking systems on future manned spacecraft compatible.

o In January 1971 we proposed to the Soviets the possibility of performing an early demonstration using existing manned spacecraft (Apollo and Soyuz).

o In June 1971 we reached agreement on many of the details for compatible docking mechanisms and also agreed to study an early experiment using an Apollo spacecraft and a Salyut space station.

o In November 1971 we are scheduled to have further talks concerning the detailed implementation of our agreements.

Throughout these discussions the Soviet side has been very forthcoming and appears to be extremely interested in bringing this cooperative effort to a positive conclusion.

Accordingly, we recommended in our FY 1973 budget submission to OMB, the inclusion of an Apollo spacecraft (plus a backup) to be capable of a joint docking flight

with a Salyut in the 1974/1975 time period. The spacecraft would also be equipped with earth resources experimental hardware so that it could fly a useful mission by itself, even if the joint docking mission does not materialize (or if there is a last-minute cancellation of that mission by either side). This budgetary recommendation involves $22 million in FY 1973, and a total cost over four years of $223 million. (Of this latter amount, $24 million is for the added earth resources experiment.)

We are, therefore, in the position of having to make a preliminary decision concerning an early docking with the USSR, as part of the FY 1973 budget process, within the next two months.

If the decision is negative, we will forego all opportunities to have a cooperative manned flight with the USSR until 1979, at the earliest.

If the decision is positive, this by itself will not commit the U.S. to carry out the docking mission -- it will merely provide the hardware for such a mission, should we make a subsequent decision to fly it.

In a related matter, we are also suggesting the inclusion of hardware for two additional U.S. manned orbital flights, using left-over Apollo hardware, in the 1975/1976 time period. This item is included at a budgetary level above our minimum recommended budget. The spacecraft could be used to:

o Provide U.S. manned flights in the gap between the last Skylab flight in 1973 and the first possible Shuttle flight in 1978 or 1979. (These "gap-filler" flights could also perform earth resources experiments.)

o Provide the possibility of flying foreign astronauts in our spacecraft.

o Provide an additional capability for joint flights with the USSR. (In our June 1971 agreement with the Soviets, we discussed a second experiment using

a Soyuz spacecraft and a Skylab space station. However, in our present plans, we will not have a Skylab available after 1973. A joint Soviet flight before that time is not possible.)

Sincerely,

James C. Fletcher
Administrator

cc:
Mr. Shultz
Mr. Rice
Mr. Flanigan
Dr. David
Under Secretary of State Johnson

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON 20502

EXECUTIVE SECRETARY

September 24, 1971

Mr. Clay T. Whitehead
Director, Office of Telecommunications Policy
Executive Office of the President
Washington, D. C. 20504

Dear Tom:

Thanks for breakfast - the next one's on me.

I'll be working up the items we discussed and will look forward to a get-together next week.

I thought you might find the attached interesting.

Sincerely,

William A. Anders

SPACE BUSINESS Daily

SPACE PUBLICATIONS, INC.
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NORMAN L. BAKER — *President & Editor-In-Chief*
KENNETH J. SILVERSTONE — *Managing Editor*

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Friday, September 24, 1971 Page 66 13th Year, Vol. 58, No. 12

NASA WILL ACCEPT LIMITED BUDGETS/BUT SHUTTLE IS IMPERATIVE

NASA's new chief executive Dr. James C. Fletcher told an industry meeting yesterday that the agency can live with limited budgets in the 1970's but that development of the Space Shuttle this decade is an imperative.

Fletcher categorized the planned U. S. "Space Program for the Seventies" as a "sensible, balanced, applications-oriented" program.

One area of balance he said is between "the urgent need to develop a program our Nation can be proud of, and the well-recognized need to be thrifty in the commitment of major government outlays." As a result of changing national priorities, he said NASA now has "a planned maximum expenditure for the immediate future more austere by a factor of almost two over the peak requirements of the sixties." Nonetheless, he called the program a sound one and expressed optimism about the future of the space (as well as aeronautics) program.

Shuttle: Price of Space Leadership. He emphasized, however, that "America's future in space in the remainder of the 20th Century depends in large measure" in proceeding with development of the Space Shuttle.

> "Development of the reusable Space Shuttle is a giant step forward into a new era of space use. The investment is for the long run: it will be substantial. It is the price of space leadership. It is the price of a brighter future for America in space, and, in turn, on Earth. The cost of turning our backs on this timely opportunity would...be much greater in the long run than the cost of proceeding with the shuttle in this decade."

Key to Space Cooperation. Development of a Space Shuttle is also the key to achieving cooperation with the Soviets in space, Fletcher said. (He cautioned anyone about underestimating the Soviet space program despite recent failures and the success of the U. S. APOLLO in contrast. He pointed out that the Soviet space effort exceeds the American program by about 60 percent, that the Soviets have a significant lead in planetary exploration and Space Station capability, and may have a significant advantage in high energy physics studies with their PROTON program.)

The NASA administrator said he is "greatly encouraged" by recent space cooperation talks with the Soviets. He noted that it would not require much additional funding to

rendezvous an APOLLO with a Soviet SALYUT station, or to orbit the backup SKYLAB to be visited by a Soviet SOYUZ.

However, he said cooperation with the Soviets in manned flight " is predicated on our determination to continue developing our capabilities. We should not expect to find the Soviets eager to cooperate with a second-rate space power. "

Warns Against Deeding Space Monopoly. Fletcher said, therefore, if the U. S. intends to cooperate with the Soviets in space--or to compete with them--we have to "move ahead resolutely" with development of the Space Shuttle and studies of the Space Station.

" I have no desire--and no expectation--of presiding over a bobtailed space program that would give the Soviet Union a monopoly on manned flight, " he said.

Shuttle RFP's Planned By December. The NASA administrator said the agency expects to be ready to issue RFPs for the Space Shuttle airframe by December, and to award contracts next spring, "contingent on White House approval. " Concerning design of the shuttle, he discussed the following innovations:

1)F-1 Engines For Interim /Reusable Booster. NASA has been considering for a number of months the desirability of developing an interim, expendable Booster for the shuttle to be succeeded by a fully-reusable version. The agency is now looking into the possibility of using F-1 engines from the first stage of the SATURN V for both the interim Booster and the reusable Booster. Advanced hydrogen-oxygen engines have been planned for the reusable configuration. (Meanwhile, Boeing has proposed that a winged-version of the SATURN V S-1C first stage be used as the shuttle Booster.)

2)External Tank Orbiter. The agency is favorable to the idea of equipping the shuttle Orbiter with external hydrogen and oxygen tanks, which could be discarded in orbit.

3)Phased Development of Orbiter. Consideration is also now being given to phased development of the Orbiter, with the first version of the vehicle to exclude some of the new technology that would be used in a later model, or models.

(See special report on FY '72 shuttle technology program, beginning p. 70.)

SENATE REJECTS PLAN FOR 'ALTERNATIVE' DOD BUDGET

An amendment by Sen. George McGovern that would have required the Defense Department to submit an "alternative" $60 billion FY '73 budget in addition to the actual budget deemed necessary was defeated by the Senate yesterday 58 to 26.

Previously, the Senate defeated 45 to 35 an amendment by Sen. Gaylord Nelson to bar any funds for Project SANGUINE until an environmental impact statement has been filed, and turned back by voice vote an amendment by McGovern to eliminate $339 million of the $370 million request for B-1.

The Senate is slated to vote today on an amendment by Sen. Hubert Humphrey to place all funds for deploying and testing U. S. MIRV systems in escrow until the President and Congress decide that Soviet MIRV development, or large-scale ABM deployment or other development necessitates resumption of our own program. (See SPACE Daily, July 15.)

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

DEPUTY DIRECTOR

September 1, 1971

TO: Tom

FROM: George GNN

Subject: European Cooperation and Participation in Space Programs

During the past year we have encountered difficulties in working with the Europeans in at least three space programs, i.e., INTELSAT, NATO Phase III Satellite, and Aerosat. The difficulties stem largely from a European desire to acquire space technology either through direct association with the United States or through direct or indirect subsidies obtained from their governments as a result of programs initiated by the United States.

The problems have been evidenced in several ways, but the one which most concerns us now is the question of production sharing versus international competitive bid. In NATO this is reflected in a deadlock concerning "host nation authority" and the procurement arrangements for the NATO Integrated Communications System, including NATO Phase III Satellite. Similarly, in Aerosat, the discussions with the Europeans have centered on production sharing and organizational arrangements which are favorable to European hardware interests.

France and Germany, and to a lesser extent England and Italy, are the countries most aggressive in activities to secure space technology. ESRO is the principal European spokesman and reflects the member nation views, but in addition the future of ESRO as an organization is in doubt and, therefore, ESRO is in the forefront of many of the discussions.

I am not at all certain that the problems in NATO and AEROSAT can be satisfactorily resolved in the near term until space cooperation between the United States and Europe is much more clearly defined, and in such a way as to fulfill some of the desires of ESRO and the European

space industry. I am confident that this can be done in ways which are not harmful to our operational systems, both military and commercial, if the U.S. adopts a policy of cooperation in scientific programs and by maintaining a clear distinction between scientific programs, commercial programs, and those which provide a basic capability such as space shuttle.

The problems are sufficiently urgent that the U.S. should immediately define a new initiative for presentation to the Europeans. I believe you should consider asking Ed David, Jim Fletcher, and/or Bill Anders to immediately develop a cooperative plan and subsequently, that discussions take place at the ministerial level to sell the cooperative plan, and explain its interaction with other U.S. policies in the commercial and military field.

If you wish I would be glad to talk to Anders, Low, or David concerning this approach.

Monday 8/30/71

4:40 Dr. Mansur advises that Joe Charyk also called expressing strong objections to the third launch assistance provision, i.e., the sentence on page 5 beginning "in those cases where launch assistance is requested.....basis for the lack of support within Intelsat."

Monday 8/16/71

4:00 Ambassador Washburn advises that Alex Johnson assures him that the letter to Minister Le Fevre absolutely will not go out before the signing ceremony.

Wednesday 8/11/71

5:00 Ambassador Washburn advises that he understands there is some effort going on by Mr. Pollack to get the Alex Johnson draft response to Minister Le Fevre out right away. Ambassador Washburn thinks it would really be a horrible mistake in timing to have it go before their signing ceremony. He would like to talk with you about it as soon as possible. Didn't know how involved you were in it but understood you were in a meeting with Kissinger.

This letter agreed between Washburn and Johnson - letter will not go until next week

European Cont

Monday 8/30/71

4:00 Dr. Mansur advises that you will need to call U. Alexis Johnson on Tuesday (8/31) re launch assurances and post-Apollo.

Dr. Mansur has talked with Dr. Webber and Alexis Johnson finds neither of Dr. Mansur's proposals -- A or B -- acceptable.
(see attached August 30th memo to Webber -- a and b marked in red)

9/2 all taken care of

August 30, 1971

MEMORANDUM FOR

DR. ROBERT T. WEBBER
Department of State

Reference: OTP Memo to Mr. Pollack, August 18, 1971

In accordance with your memorandum of 24 August, the following are our comments on the draft letter for LeFevre.

In our memorandum of 18 August, we expressed concern that the proposed draft substituted the unilateral views of the U. S. Government for the collective opinion of INTELSAT in the determination of which telecommunications projects would receive launch support. Specifically, the provisions of paragraph (1) (a) concerning launch assistance for projects without a favorable recommendation from INTELSAT coupled with the provisions of paragraph 3 constitute, in effect, U. S. launch assurance prior to and independent of INTELSAT discussion. Our memorandum of 18 August suggests modifications to one or both paragraphs which will avoid this difficulty.

Accordingly, we again suggest adoption of one of the following modifications:

a. Amend paragraph (1) (a), seventh line to read: "If launch assistance is requested in the absence of a favorable recommendation by INTELSAT, but with substantial favorable support, we expect that we would provide launch assistance for those systems which we had supported within INTELSAT so long as the country or international entity requesting the assistance considers that it has met in good faith its relevant obligations under Article XIV of the Definitive Arrangements."

b. If recommendation a., above is not adopted, then we recommend alteration of paragraph 3, to delete the first sentence in its entirety and the first three words (In this connection . . .) of the second sentence.

The intent of the proposed alteration of paragraph (1) (a), or paragraph 3, is to assure consistency of launch proposals with our obligations under the INTELSAT final agreements. We recognize that there have been recent discussions concerning a more open-handed launch policy, but until such time as the discussions result in clear objectives, OTP believes it is in the national interest to assure that U.S.-European launch proposals are consistent with our INTELSAT objectives.

Our concurrence with establishment of an expert group to define areas of European cooperation assumes that a comprehensive policy concerning space cooperative activities will be developed within the U.S. Government. We believe that formulation of possible new cooperative initiatives must remain free of substantive constraints at this time, particularly with respect to the Space Transportation System. Until a post-Apollo policy is adopted, the expert group should discuss a broad spectrum of cooperative activities of which the STS is only one. Accordingly, we recommend several changes to the draft text which serve to broaden the perspective of the discussions:

a. Delete paragraph 4.

b. Capitalize STS on pg. 10 and pg. 13.

c. Amend sentence beginning 7th line, pg. 10, to read:

> "While these matters are under consideration, advance studies of the Space Transportation System and other options for our post-Apollo Program are continuing."

d. Delete (or modify to deemphasize STS and management proposals) material beginning pg. 10:

> "With respect to the . . . ." and continuing through pg. 11 and pg. 12 to ". . . . would, we believe, be well served if."

Finally, we think it is advisable to refer to our launch assurance position as a proposal rather than a policy, since, as used in the letter, it is offered only to the Europeans and further their reaction to it is unknown.

George F. Mansur

George F. Mansur

GFMansur/tw/ Aug 30, 71
DD Records
DD Chron
Mr. Whitehead ✓
Mr. Thornell
Mr. Doyle
Asst. Washburn
Bob Reed

August 18, 1971

MEMORANDUM FOR

Mr. Herman Pollack
Department of State

Several views concerning the draft Le Fevre letter have been expressed by Bert Rein, Ambassador Washburn, and yourself.

Let me add the views of OTP and summarize those which affect our opinion.

1. We concur with the position in which there is a 2/3 affirmative finding.

2. The draft of 13 August, as stated, unilaterally substitutes the judgment of the USG for the collective opinion of Intelsat for projects which we support. While it is difficult to conceive of a case wherein the USG would support a project in the absence of substantial support from other member nations, nevertheless the draft may be interpreted as being contrary to the spirit of the agreement and may produce a negative reaction.

3. We believe that the alternate proposal (12 August) expressed by Bert Rein is somewhat misleading and proposes a stronger commitment than is desirable or necessary. Specifically, the sentence beginning with "Rule of thumb. . ." represents in our view a statement that may be misinterpreted when applied to specific projects.

Accordingly, we would recommend adoption of one of the following changes, selected on the basis of a judgment of being most acceptable to the Europeans.

1. Delete the sentence beginning "Rule of thumb. . . faith consultation." and adopt the remainder of Bert Rein's proposal.

2. Amend the sentence to read, "Ordinarily, those projects serving geographically contiguous areas and which command a simple majority would be launched if the request were maintained after good faith consultation."

3. Adopt the SCI draft of 13 August except amend the sentence on page 2, sixth line from bottom to read:

   "If launch assistance is requested in the absence of a 2/3 favorable recommendation by Intelsat but with substantial favorable support, we expect that we would provide launch assistance for those systems which we had supported within Intelsat so long as the country or international entity requesting the assistance considers that it has met in good faith its relevant obligations under Article XIV of the definitive arrangements."

4. Adopt the SCI draft except to delete the paragraph on page 4 which states, "In this connection . . . proposals in Intelsat."

The proposal to establish an expert group to define areas of European cooperation should prove useful. However, we think it is essential for the USG to develop a comprehensive policy concerning space cooperative activities and related matters, [e.g., export of technology]. Proposals for cooperative activities should be carefully formulated so as to achieve substantive interaction with the European space community in research and development but in a framework which is consistent with U. S. private interests and other national objectives. Our concurrence with the draft, "Statement of Views in the Post-Apollo Program," of 18 August is predicated on development of such policy.

George F. Mansur

G. F. Mansur
Deputy Director

cc: Amb. Washburn
Bert Rein
Mr. Whitehead
Dr. Mansur
Mr. Thornell – mr Doyle

GFMansur:jm 8/18/71

DRAFT
GFMansur/tw
August 26, 1971

"proposal"
European

Coordinate with Comsat

MEMORANDUM TO ROBERT WEBBER

Reference: Mansur memo to Pollack, August 18

In accordance with your memorandum of 24 August, the following ~~is~~ are our comments on the draft telegram for LeFevre.

In our letter of 18 August, we expressed concern that the proposed draft substituted the unilateral views of the US Government for the collective opinion of INTELSAT in the determination of which telecommunications projects would receive launch support. Specifically, the provisions of paragraph (1)(a) concerning launch assistance for projects without a favorable recommendation from Intelsat coupled with the provisions of paragraph 3 constitute, in effect, U.S. launch assurance prior to and independent of INTELSAT discussion. Our letter of 18 August suggests modifications to one or both paragraphs which will avoid this difficulty.

Accordingly, we again suggest adoption of one of the following modifications:

a. Amend paragraph (1)(a), seventh line to read: "If launch assistance is requested in the absence of a favorable recommendation by INTELSAT, but with substantial favorable support, we expect that we would provide launch

assistance for those systems which we had supported within INTELSAT so long as the country or international entity requesting the assistance considers that it has met in good faith its relevant obligations under Article XIV of the Definitive Arrangements."

b. If recommendation a., above is not adopted, then we recommend alteration of paragraph 3 to delete the first sentence in its entirety and the first three words (In this connection . . .) of the second sentence.

Our concurrence with establishment of an expert group to define areas of European cooperation assumes that a comprehensive policy concerning space cooperative activities will be developed within the US Government. Until ~~such time as~~ a post-Apollo policy is adopted, the expert group should discuss a broad spectrum of possible cooperative activities of which the ~~space transportation system~~ STS is only one. ~~Accordingly, we recommend that paragraph 4 be deleted so as not to focus the discussions on the space transportation system.~~

The intent of the proposed alteration to paragraph (1)(a) is to assure consistency of launch ~~policies~~ proposals with our obligations under the INTELSAT final agreements. We recognize that there have been recent discussions

concerning a more open-handed launch policy but until such time as the discussions result in a clear objective, OTP believes it is in the national interest to assure that U.S.-European launch proposals are consistent with our INTELSAT ~~launch procurement~~ objectives.

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Clay T. Whitehead Collection

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Box and Folder Information: box 12 (3); European Post-Apollo Cooperation (Le Feure visit 9/16/70)

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POST-APOLLO 6/9/70---6/7/73

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WH

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

June 7, 1973

DIRECTOR

MEMORANDUM FOR MR. FLANIGAN

Subject: Status of International Telecommunication Issues

1. Aerosat

a. Secretary Brinegar has instructed ranking Department of Transportation officials and the Administrator of FAA to initiate high level discussions with U.S. airline presidents in an effort to overcome the airlines' opposition to Aerosat--the developmental program aimed at improving oceanic air traffic control by using satellite communications. Discussions will also be held with appropriate Congressional committees whose support is necessary prior to FAA signing a memorandum covering the proposed joint program with European aeronautical authorities acting through the European Space Research Organization (ESRO). Secretary Brinegar will request White House assistance if the approaches to the airline presidents and to the Congress do not succeed in unblocking the program.

b. FAA Administrator Butterfield has told ESRO officials that the Nixon Administration strongly supports the Aerosat program as modified and is seeking to clear away domestic hurdles in order to be able to sign the FAA-ESRO Agreement spelling out the development of satellite communications in the Atlantic in anticipation of an operational aeronautical system required by the 1980's.

c. Meanwhile, ESRO is negotiating with U.S. communications companies and will shortly choose either COMSAT or RCA-Globcom as the U.S. co-owner of the satellite system which will provide the communications service required for the FAA-ESRO oceanic air traffic control program.

2. "Gapsat" - Conditions laid down by the FCC have been accepted by COMSAT which will now become part of a consortium of communication entities owning and operating a 2-ocean satellite system providing the U.S. Navy with satellite military communications for a limited period of time. Capacity of the

system not needed by the Navy will be leased to merchant ships. WUI, ITT, and RCA-Globcom are expected to join the consortium. COMSAT will have majority control (about 80%), thus ensuring that it will be the manager-operator of the system. COMSAT has contracted with Hughes to build the three satellites for the system which is scheduled to be operational within 18 months.

3. Maritime Satellite - U.S. representatives have broken the solid front of foreign representatives to the International Maritime Consultative Organization who were determined to create a new international organization which would own and operate a maritime satellite system. At the next IMCO experts meeting this fall, we plan to introduce several alternative ways for the shipowners to get the satellite communications they need without creating a new governmental organization. The opposition, led by the USSR, will continue to try to force us into an arrangement which would have the effect of taking satellite maritime communications out of the private sector.

4. Pacific Basin Submarine Cable - FCC is poised to authorize construction of a new Pacific Basin submarine cable (California-Hawaii-Guam-Okinawa). Our effort to get a U.S. Government decision on long-term communications facility planning in the Pacific Basin has encountered FCC's desire to clear the docket by deciding now on a specific cable which the carriers want, especially AT&T. The case illustrates how ad hoc decisions, pushed by domestic and foreign communications entities, get in the way of long range planning efforts aimed at benefiting the rate payer.

5. International Communications Industry Structure - We are studying the reactions of Executive Branch departments to the draft legislative proposals covering the structure of the international communications industry which we put forward recently. Upon completion of our study, we will consult with the FCC. We are several months away from a decision on what, if any, legislative proposals we would recommend be sent to the Congress. Senator Pastore has not been pushing us since we gave him our international communications policy statement early this year.

6. Direct Broadcast Satellites - The Soviet draft convention to control direct satellite broadcasting will be debated next week in New York when the UN Working Group reconvenes. Canada and Sweden have submitted a watered down draft which is still unacceptable to the U.S. An up-hill battle is being fought by the U.S. in an attempt to prevent a UN imposed regime of world-wide TV censorship. The State Department reports that

Secretary Brezhnev is expected to raise the subject with the President later this month.

7. International Telecommunication Union - U.S. policy positions to be taken during the ITU Plenipotentiary Conference this September are nearing completion. The U.S. Delegation comprising representatives from State, OTP, FCC, and U.S. industry will be in place by August to complete policy preparations. The Conference is not expected to make major changes in the structure or functions of the Union. However, numerous political issues will be raised, thus complicating the telecommunications work of the Conference.

Clay T. Whitehead

Attempts have been made to persuade the Europeans that Aerosat and post-Apollo are separate issues (one potentially commercial and the other not), but we have had virtually no success in making this separation, owing, at least in part, to the fact that telecommunications in Europe are not in the private sector, and the distinction between Aerosat and post-Apollo is therefore more evident to us than them.

Concerning the matter of climate: the U. S. government has made no secret of the fact that it is searching for a new relationship with our competitors (nee allies) in the area of the transfer of commercially exploitable technology. In this transitional period there is a tendency for Europeans to generalize from specific cases in an attempt to forecast our new policy and attitude. Again because of its size and timing, and because of the internal indecision implicit in our withdrawal from the earlier ad referendum memorandum of understanding, Aerosat is being accepted as a credible indicator of broader U. S. intentions with respect to all technology. The lack of a U. S. position on Aerosat and European comprehension of our internal dissention are interpreted as indicating an emerging hard line, which chills European interest in post-Apollo. If, in fact, Aerosat is not a bellwether for our new technology policy, then we are paying the penalty of European disaffection and disinclination to join us in post-Apollo without gaining the advantage of having a new, recognized policy. Moving forward with an Aerosat proposal, which we feel has a good chance of being acceptable to Europe, can be expected to defuse an issue that has taken on much more importance in European thinking than either we intended or is valid.

William A. Anders

Europ. Cooperation

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON 20502

EXECUTIVE SECRETARY

SEP 21 1972

MEMORANDUM FOR

THE HONORABLE CLAY T. WHITEHEAD

Subject: The Influence of Aerosat on European Participation in Post-Apollo

The ability of the U.S. to engage the Western European nations in a program of substantial cooperation in space, as desired by the President (reference, e.g., his statement of March 7, 1970) and as transmitted with specific directions by Dr. Kissinger (memorandum to the Secretary of State, June 1, 1972), devolves on several concrete issues and also on a question of technological climate. The fate of Aerosat is one of the concrete issues and also one of the major contributors to this matter of climate. If an Aerosat program, acceptable to the Europeans, can be proffered by the U.S., it will significantly improve the likelihood of a favorable post-Apollo decision within Europe. This viewpoint has been expressed by many Europeans, the most recent being Minister von Dohnanyi (FRG) during his visit to Washington on September 12-13.

Aerosat would be the largest joint program to date ($100-150 million) in the space arena. (The experiment is actually devoted to advancing air traffic control, and only makes use of space technology for this purpose. The European space community, however, views the space technology aspects as the important focus of the program for the next few years, and this attitude seems to predominate within the governments.) Because of the coincidence of its timing with relation to the post-Apollo decisions, Aerosat is a test case in European eyes. Our putative abrogation of an earlier agreement is taken by some influential Europeans as an indicator of how the U.S. will behave in future joint space projects. Thus, the longer we delay the definition of a new U.S. position on Aerosat, the greater credence is given to the views (French mainly) that the U.S. is an unreliable space partner and post-Apollo cooperation would be disadvantageous. It must be recognized, however, that if a new U.S. position on Aerosat was found unacceptable by Europe, or if the program foundered in its infancy over fundamental issues, we may harm rather than improve the prospects for successful post-Apollo cooperation.

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

August 18, 1972

DIRECTOR

Honorable Samuel DePalma
Assistant Secretary
Bureau of International Organization Affairs
Department of State
Washington, D. C. 20520

Dear Mr. DePalma:

It is my understanding that the United States will be required this Fall to state a position on the international aspects of direct television broadcasting from space. Despite the unlikelihood of such broadcasting being technically or economically feasible in the near future, the upcoming consideration of the UNESCO Draft Declaration of Guiding Principles for Space Broadcasting set for this October and the recent request of the Soviet Union to add a proposed convention on direct space broadcasting to the U.N. General Assembly's agenda will require us to move expeditiously and forcefully to reaffirm both our domestic Constitutional principles of free expression and our long-held goals of fostering the free flow of information in the international sphere.

I am most familar with the background of the UNESCO Draft Declaration which resulted from the May 1972 meeting of experts, and which was forwarded to our Office on July 13. It is here that I am afraid we have lost the most ground. In several respects we believe this document to be opposed to our national interests. We deeply regret that it was adopted unanimously, without any reservations on the part of the United States participant.

The most disturbing aspects of both the Draft Declaration and the U.S.S.R. proposed convention are the controls they would have the United States impose on satellite broadcasts originating on our soil - a kind of preemptive jamming - and the leeway they would give the United States and any country receiving direct broadcasts from foreign countries to jam and otherwise preclude reception. There is, in my view, no doubt that such provisions in both proposed documents are in direct contravention of the principles of free expression embodied in

our Constitution and of any goal of "facilitating" the international free flow of information. We have previously expressed these views with respect to the Draft Declaration (Memorandum from Bromley Smith, Assistant Director, OTP, to Mr. Landfield, January 31, 1972). They are also briefly summarized in the attached memorandum prepared by OTP's General Counsel, which discusses the legal effect of the proposed provisions on space broadcasting.

We realize that the United States has had relatively little support for its position on the free flow of information, both in UNESCO and the General Assembly. We also appreciate that the language of the Draft Declaration may be the most favorable that was possible to achieve. We do not believe, however, that the United States can remain on record in support of provisions such as those discussed above. Formal action should be taken as soon as possible to disassociate our Government from the unanimous endorsement of these provisions of the Draft Declaration, and to make it clear in the international community in general that we cannot support such provisions even if adopted by UNESCO or considered by the General Assembly.

Since both the General Assembly and the General Conference of UNESCO will be convening within several weeks, we think the U. S. Government must take immediate action to develop a firm position on direct television broadcasting from space that is fully consistent with our national principles and international goals regarding the unrestricted flow of information. In this connection, I offer OTP's assistance in formulating such a position, given our responsibilities and experience in the communications area. We would be pleased to continue participating in discussions with the State Department and with other agencies, and with the various governmental and non-governmental groups and committees that have been considering the problem.

In closing, I must emphasize that, if we do not formulate the kind of policy position I have referred to, we will be abandoning nothing less than the principle of freedom of information which we have defended at great diplomatic cost in prior international negotiations. I consider it, therefore, most important to take action on this matter as soon as possible, and I look forward to receive your comments or suggestions at your earliest convenience.

Sincerely,

Clay T. Whitehead

Enclosure

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

GENERAL COUNSEL

MEMORANDUM

Re: UNESCO Draft Declaration of Guiding Principles for Space Broadcasting and USSR Request for a Convention on Direct Television Broadcasting

The most offensive provision of the Draft Declaration is the second paragraph of Article VI, which asserts that "[e]ach country has the right to decide on the content of the educational programmes broadcast by satellite to its people...." This provision is so fundamentally contrary to the principles of our democracy, and breathes a spirit of governmental paternalism so incompatible with our institutions, that it is unthinkable that we should support it. There is in my view no question that, if our Government attempted to enforce this asserted Guiding Principle, it would directly contravene the First Amendment of our Constitution.

While the state has the right to prescribe the acquisition of a minimal education by its citizens, that is a far cry from the power to forbid or prevent education which goes beyond -- or even contradicts -- these minimal requirements. Such a power is clearly not permissible under our system of government, whether exercised with regard to information obtained domestically, or information obtained from

abroad. "[T]he State may not, consistently with the spirit of the First Amendment, contract the spectrum of available knowledge." Griswold v. Connecticut, 381 U.S. 479, 483 (1964). See also Farrington v. Tokuskige, 273 U.S. 284 (1927); Pierce v. Society of Sisters, 268 U.S. 510 (1925); Meyer v. Nebraska, 262 U.S. 390 (1923); Lamont v. Postmaster General, 381 U.S. 301 (1964).

Of course, once we have acknowledged an international principle permitting each country to "decide on the content" of satellite-broadcast programs, we will be hard put to refrain from preventing our nationals from violating that principle from United States soil. Thus, even if we do not apply the principle ourselves by unconstitutionally controlling the programs to be received by our citizens, we will be pressed to assist other nations by policing the broadcasts originating on our soil. The first indication of this unavoidable development is contained within the Draft Declaration itself, in the provision of the first paragraph of Article IX, asserting that "it is necessary that States . . . reach or promote prior agreements concerning direct satellite broadcasting to the population of countries other than the country of origin of the transmission." It is true that we may avoid the rigorous application of this provision by relying upon the phrase "or promote", but it is indicative of the kind of

pressure to which we are exposing ourselves by acknowledgement of a political principle with which we do not agree. My understanding is that while United States Government control of information transmission by its citizens has not been as fully explored as that of information reception -- which has obtained judicial disapproval -- it is at least highly questionable that fundamental constitutional rights may be suppressed merely to facilitate the conduct of foreign affairs. A number of cases have considered the question in contexts other than international broadcasting and have ruled in the negative. See e.g., Afroyim v. Rusk, 387 U.S. 253 (1966); Reid v. Covert, 354 U.S. 1 (1956); Powell v. Zuckert, 366 F.2d 634 (D.C. Cir. 1966).

Finally, we are seriously concerned with the second paragraph of Article IX of the Draft Declaration, which appears to impose an outright prohibition upon commercial advertising in satellite broadcasts unless the agreement of the receiving country is obtained. This is an unnecessary compromise of our commercial interests, and an implicit denigration of a free market practice that we should not hasten to censure. Moreover, while our Government's power to restrict purely commercial advertising is doubtless broader than its power over other forms of free speech, (see e.g., Valentine v. Chrestensen, 316 U.S. 52 (1942)), that power is nevertheless not unlimited. It is not clear that we can prohibit our citizens from

broadcasting commercial messages abroad simply because foreign governments do not wish their citizens to receive them.

Essentially, similar objections must be raised with regard to the recent Russian proposal for a convention on direct broadcasting. Unlike the UNESCO Draft, the convention would have the binding force of a treaty, and would compel our Government to do that which the Draft only exhorts; thereby clearly running afoul of the First Amendment's proscriptions. Moreover, the proposed convention would enlarge the class of forbidden programs, permit jamming, and enable nations to take measures against activities considered detrimental even if undertaken outside their jurisdictions.

Antonin Scalia
General Counsel

August 18, 1972

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

ASSISTANT DIRECTOR

HOLD FOR MR. WHITEHEAD'S RETURN

July 12, 1972

INFORMATION MEMORANDUM

Subject: US Position on Post Apollo Program

Because of your interest in the Post Apollo program, you should read in their entirety the attached opening and closing statements of Herman Pollack to the European Space Conference Delegation which met in Washington on June 14-16. Upon their return to Europe, the ESC Delegation's report prompted the conference members to adjourn their scheduled July session until September.

The key sentences in the Pollack presentation help in understanding some of our difficulties with the State Department on aerosat. It reads:

> "I want to assure you that European cooperation in this program, while evolving in form with passing time and changing circumstances, continues to be an objective of the United States. Let me say, however, that this is not essentially a commercial or a technical transaction we are discussing. Above all, it is a political act."

Bromley Smith

Attachment

He's only not a "yes-man"!

Opening Remarks by Mr. Herman Pollack
Meeting with ESC Delegation on
Post-Apollo Cooperation
June 14, 1972

Welcome.-

Many of us sat in this room for the second of the two meetings between Minister Lefevre and Under Secretary Johnson and their delegations 16 months ago in early 1971.

A good deal has occurred during those 16 months to enable us all to have a clearer definition of the post-Apollo program and a somewhat better understanding of each others' readiness and interest in cooperating in that program. In retrospect perhaps the most significant of these developments have been:

1. The development by the U.S. of a launch assurance policy, which stands independent of European participation in the development of the reusable Space Transportation System or its use. I refer to the launch assurances conveyed in Under Secretary Johnson's letter to Minister Lefevre of September 1, 1971.
2. The discussions held between NASA and technical representatives of the European Space Conference.

3. The decision of our President to proceed with the development of the Space Shuttle System, and the development timetable which follows from that decision.

4. The preparations under way in Europe for Ministerial decisions, prospectively this summer, on a broad range of matters affecting European space activities.

5. Considerable changes in the economic perceptions and budgetary circumstances in the U.S. I imagine the same is true in Europe.

We meet now, at your request, specifically to discuss the questions which you have raised in the agenda before us.

It is our understanding that these discussions are not negotiations. Obviously we will not reach decisions here. Rather, we anticipate informal and frank exchange of views in which we seek to understand more precisely each others' preferences and interests on the matters which you have raised.

In the absence of a clear indication of the measure of European interest in possible participation, we shall do our best to make the U.S. views regarding the questions you have raised as helpful as we can. Were it possible during

the early part of our discussions to obtain a clearer understanding of the measure of European interest and possible participation, our views could possibly be more responsive and useful to you. In the interest of constructive use of our time I shall, later in my opening remarks, provide a brief overview of the U.S. approach to post-Apollo cooperation with Europe.

We propose the following schedule for our discussions:

1. That we meet here at the State Department morning and afternoon today for an initial discussion of items 1 through 5, 7 and 8, 11 and 12 on our agenda. We will break for lunch in the Executive Dining Room of this building at 1:00 p.m.
2. That you meet with NASA at NASA Headquarters tomorrow morning and afternoon for discussion of management arrangements (item 6 on the agenda), and for technical and program presentations on Research Applications Modules and the mission model foreseen for use of the Space Shuttle System (items 9 and 10 on the agenda).
3. We have reserved this room here at the State Department for Friday morning in the event a

third and concluding meeting should be found desirable.

During the meetings here in the State Department interpreters are available so that you may speak in French if you wish.

May I now introduce the members of the U.S. delegation:

Dr. James C. Fletcher, Administrator, National Aeronautics and Space Administration

Mr. Arnold W. Frutkin, Assistant Administrator for International Affairs, National Aeronautics and Space Administration

Mr. Dale D. Myers, Associate Administrator for Manned Space Flight, National Aeronautics and Space Administration

Mr. Philip E. Culbertson, Director for Advanced Missions, National Aeronautics and Space Administration

Mr. Robert F. Packard, Director, Office of Space and Atmospheric Science Affairs, Department of State

Mr. William A. Anders, Executive Secretary, National Aeronautics and Space Council

Dr. Russell C. Drew, Technical Assistant, Office of Science and Technology

Dr. Maurice J. Mountain, Office of the Assistant Secretary of Defense for International Security Affairs, Department of Defense

I would like also to introduce Mr. George Springsteen, Acting Assistant Secretary for European Affairs in the Department of State who has joined us for the opening of our discussions.

Now, if I may, I should like to present a brief overview, which I referred to earlier, of U.S. attitudes toward cooperation with Europe in the post-Apollo program.

1. We urge Europe to anticipate and make extensive use of the Space Shuttle System when it becomes operational, and to participate in payload development, both manned and unmanned.
2. We have concluded that from our point of view, as well as yours as we understand it, that the development by Europe of one or more of the Research Applications Modules would constitute a desirable form of cooperation, and we encourage you to undertake such a task.
3. With the passage of time the concept of European participation in the development of the Shuttle itself has changed considerably. We are now strongly impressed by the potential difficulties that might ensue from an inter-governmental effort to produce a relatively small number of components of a massive piece of highly complex hardware, whose timetable is pressing and in whose success the political and economic stakes are so high. Cooperation in some of the Shuttle

items is not precluded. However, it will be necessary for Europe to undertake to meet rather stringent conditions designed to satisfy fully U.S. concerns. In candor I must report that the conditions the United States finds necessary may diminish the attractiveness to Europe of participating in the Shuttle items.

4. Since the definition of the Tug is still uncertain and the decision by the United States to proceed with its development has not yet been made, and there are no hard predictions as to when it will be made, the United States has concluded that it is not prudent to continue discussions of the possibility of cooperation on this task.

As I indicated earlier I have presented this overview in the interests of making our discussion here today more constructive and to help illuminate the responses we shall make to the questions you have raised.

I have, as you know, participated in these discussions from their outset. If words alone were all that were required to get cooperation under way we would be in full orbit by now. I want to assure you that European cooperation

in this program, while evolving in form with passing time and changing circumstances, continues to be an objective of the United States. Let me say, however, that this is not essentially a commercial or a technical transaction we are discussing. Above all, it is a political act. In the absence of mutual political will to achieve a state of cooperation the real and apparent hazards and pitfalls will assume inordinate proportions and I fear that this venture will founder. It is my hope that our discussion today, and any that may subsequently follow, will be strongly motivated by a mutual desire to find a basis for agreement.

That concludes my opening remarks.

Concluding Remarks by Mr. Herman Pollack
Meeting with ESC Delegation on
Post-Apollo Cooperation
June 16, 1972

In this meeting we have tried to be entirely forthcoming, realizing fully the difficulty and the importance of the decisions that are to be made in Europe and the value to you of the clearest possible understanding of what the United States has in mind. It is our hope that we have provided the facts you are seeking and that they will enable your Governments to arrive at affirmative decisions when your Ministers meet in July. Some of the facts, however, which I think are relevant to the decisions of your Governments cannot be expressed with mathematical precision but are nevertheless important, and perhaps fundamentally of greater importance than some of the hard information we have provided you with during this meeting.

For example, it is important that both sides keep in mind the basic, enduring nature of the ties that bind the United States and Europe. These are well understood on both sides of the Atlantic and need not be elaborated here. But, it is this compelling and fundamental fact of life that above all else has motivated the United States in its search for European participation in the post-Apollo program.

Another major but somewhat ineffable motivation arises out of the awe which United States leaders viewed the potential of outer space which would become possible once

capability such as that contemplated in the post-Apollo program became a part of mankind's competence. We felt then and continue to feel now that this potential is too great, its implications to mankind too far-reaching to be properly the subject solely of national decision. We therefore began to seek ways to make it possible for other qualified and interested nations to participate with us in the development and utilization of this new capability.

I repeat my statement made on the first day that commercial or technical factors have practically no influence in motivating our desire for European participation in the post-Apollo program. Rather, the considerations I mentioned above have generated this objective and keep it alive and strong today.

When we began our discussions with Europe we ourselves did not fully understand the nature of the system whose construction we shall embark on this summer.

Furthermore, it is clear in retrospect, that we approached these opportunities in prospect of a considerable interest abroad in participating in the development and use of a new Space Transportation System.

You have participated with us in the preliminary definition of that System and, indeed, have made significant contributions to our changing perspectives and deepening

understanding of it. Positions which originated several years ago relied heavily on predictions -- indeed speculation -- both as to the System itself and your interest in it. These positions have been altered and modified as our mutual comprehension grew.

Thus we have arrived at a point in time at which your participation in the development of the Shuttle on a significant scale, as originally conceived, has been overtaken by time and, for the reasons we have enumerated during our discussions, can no longer be encouraged by us even on the limited scale we are still discussing. Consideration of mutual development of the Tug has of necessity been set aside. The opportunity to develop Sortie modules and to plan together for the use of the over-all Space Shuttle System and actually to make use of it, nonetheless constitute a major challenge and would be a significant response to our earlier expectations. We hope we have made it clear that we would warmly welcome your participation in these two areas.

Finally, let me repeat that for over two years we have sought European participation in this program and let me emphasize that we continue to do so. It is my hope that for your own reasons as well as for those which move us, we shall be able to come this summer to an agreement to move forward together on this historic project.

5-620

OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON

June 20, 1972

To: The Director

From: Bromley Smith BKS

Here is the Lefevre letter as it was finally signed by Alex.

Note that Alex backed off a bit on a U.S. commitment by including the phrase "taking into account those developments which we can now foresee."

European comp.

Taken from State Message 108877 (17 Jun 72)

Dear Minister Lefevre:

In my letter to you of January 11, 1972, I advised that the United States would examine your outline of the proposed European communication satellite system and would inform you whether the United States would support that program within INTELSAT. We have now completed our review of the proposed program which you provided as an enclosure to your letter to me on December 23, 1971.

It is our conclusion that the proposed communications satellite system could have an economic impact on INTELSAT in the form of higher charges to the users than otherwise would be the case. This penalty would, of course, be borne by all users of INTELSAT facilities. We also believe that the orbital location selected could give rise to technical incompatibility with INTELSAT's future requirements for Atlantic Basin satellite positions. We believe that the communications mission of the European communications satellite system could be met by positioning the satellite between 10 degrees and 20 degrees east.

However, taking into account those developments which we can now foresee, the United States representative in the Assembly of Parties would vote for the proposed system provided that the proposal submitted to INTELSAT would call for the satellite orbital position to be located between 10 degrees and 20 degrees east and that the proposal is limited, particularly with reference to countries not now members of CEPT, to the services and coverage described by reference to figures 2.3 and 3.1 of the ESRO document which you provided in your letter of December 23, 1971. We could not support the program if expanded geographic coverage or services were planned, either (a) as implied in the statement in paragraph 2.3(B) of the aforementioned ESRO document that the system must be capable of providing television relay service to the "European broadcasting area as defined by the ITU where one authority at least is a member of the EBU"; or (b) as would appear possible from the fact that the capability and capacity of the proposed system appears to exceed that needed to satisfy its stated communications mission.

I trust, Mr. Minister, that this response will be useful to you in the deliberations of the European Space Conference over the next few months. We are, of course, ready to discuss this matter with your representatives in any further detail which you may wish.

Sincerely,

U. Alexis Johnson

European Cost

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
WASHINGTON, D. C.

REFERRED TO

Mr. Whitehead --

For your information there is attached a copy of OMB's response to us regarding the change we have recommended in our policy respecting reimbursement for satellite launch services.

for Bernard Moritz
June 2, 1972

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

Action Copy to D
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S
Rec'd in NASA 5-31-72
Suspense Date 6-13-72
Prepare Reply for
Signature of A

Honorable James C. Fletcher
Administrator
National Aeronautics and
Space Administration
Washington, D. C. 20546

Dear Jim:

I write in response to your letter of May 10, 1972, to George Shultz which outlined your recommended change in the current policy regarding reimbursement to NASA for satellite launch services performed for others. We would be pleased to review your proposed new policy and to cooperate with you in developing appropriate methods of implementation should the policy be approved. I have designated Mr. Daniel H. Taft to work with your staff on this matter.

We will, of course, need to understand your recommended policy in more detail than is contained in your letter of May 10. We therefore request that NASA prepare a staff paper by June 15 on the recommended policy and other alternatives. Ideally, the staff paper would cover such subjects as the prospects for the private sector providing guaranteed launch services, the amount of potential liability to the United States Government, the possible availability of private insurance to cover all or part of the potential liability, a description of alternative cost recovery plans, an evaluation of the extent to which the present policy is inhibiting commercial exploitation of space, and a determination of whether legislation is required.

In the meantime, in order to expedite the review of your recommended policy, my staff has arranged to meet with your staff on this subject in the near future.

Sincerely,

Caspar W. Weinberger
Deputy Director

MEMORANDUM

THE WHITE HOUSE

WASHINGTON

May 26, 1972

MEMORANDUM FOR

Clay T. Whitehead, OTP
Jonathan Rose, WH

Attached is an OST staff paper on post-Apollo. It indicates that the Europeans are probably ready to accept our RAM proposal and abandon, at least for the time being, the tug and shuttle participation. However, we haven't yet heard the result of their May 19 meeting.

Nevertheless, I believe the time is ripe to "come clean" with them. Not to do so will cause more harm in the long run, and it appears we now have the opportunity of arriving at a mutually satisfactory agreement with them, based on RAM alone. Let's strike while the iron's hot.

Ed

Edward E. David, Jr.
Science Adviser

encl.

Dr. Edward E. David, Jr. May 16, 1972

Dr. Russell C. Drew

Post-Apollo Space Cooperation

The attached memorandum to the President is now being staffed with NSC and Peter Flanigan. There is, as yet, no clear indication which way this matter may be resolved. OST has not been formally approached for views on this subject, but I suggest that you discuss it either by memo (draft attached) or informally with Peter Flanigan. I have taken an approach to this issue that is intended to reflect our earlier discussions.

My personal sympathies lie with the State Department in their desire to arrive at a non-zero level of participation by the Europeans in the post-Apollo (shuttle) program, but I suggest consideration of several important modifications in the areas for cooperation. For example, in Secretary Rogers' Point 2 about tug development, I believe the U. S. policy should be more definitive, i. e. we inform the Europeans now that tug development would not be a suitable candidate for cooperative activity.

Similarly, in Point 3, I would suggest that U. S. negotiations be conducted in a way that demonstrates a distinct change in the U. S. position. I believe the change can be portrayed not as a change in policy toward the Europeans but rather as a change in our definition of tasks that would be suitable for European participation. (The State Department memo implies that we would somehow conceal this major change in U. S. attitude from the Europeans.) Such attempts at subterfuge, I believe, are likely to backfire. We would be better off to face up to any changes and portray them honestly to our potential partners.

For your information, last night I discussed this issue with Arnold Frutkin at NASA. He informed me that in very recent discussions with the French, they have indicated privately that they will be proposing at the forthcoming European Space Conference meeting (May 19) that the Europeans adopt development of Sortie or RAM modules as the principal candidate for post-Apollo cooperation, and abandon both the tug and substantial participation in the shuttle vehicle. (Presumably, on a conntry by country basis, European contractors could negotiate with the U. S. privately for specific pieces of this development in a normal commercial negotiation.) Frutkin

believes that the general flavor of the U. S. internal discussions of this issue have reached the Europeans and have caused this change in their approach. Thus, European actions may pre-empt somewhat a decision on the attached memo from Secretary Rogers.

The Europeans have also indicated that they will probably wish to send a subministerial level delegation to the U. S. (without Minister Lefevre) to discuss the results of the European Space Conference meeting. We should, therefore, as a minimum be prepared to accept or reject their contribution to the shuttle program through construction of RAM or Sortie modules, if they are able to agree on the French proposal. This lends a sense of urgency to resolution of this issue that the attached draft is intended to communicate to Peter Flanigan.

Russell C. Drew
Technical Assistant

Enclosures

May 18, 1972

MEMORANDUM FOR
Henry Kissinger
Peter Flanigan

SUBJECT: Post-Apollo Relationships with the Europeans

I have reviewed the memorandum from Secretary Rogers to the President on this subject, dated April 29th, (copy attached) and have several comments to offer.

The cumulative effect of several U.S. actions in the past year in the field of space cooperation has been to cause considerable cooling in U.S.-European relationships in this area. European leaders, however, appear to understand the background for the changing attitude of the U. S. toward the flow of technology and management difficulties and they are pragmatic enough to seek acceptable solutions to this problem without abandoning cooperation. I have recent information that the French are going to propose that their European partners give priority to development of Sortie or RAM modules that would eventually be carried as a payload in the shuttle and that they abandon plans for a potential role as developer of the tug and contributor of subsystems to the shuttle vehicle itself. If this proposal is accepted by the European Space Conference, it will pre-empt somewhat action on the memo to the President from Secretary Rogers.

It is anticipated that a delegation from the European Space Conference will request a meeting with the U. S. following their meeting later this week. We should be prepared to respond to the Europeans at that time with a clearly defined U. S. position. I believe the proposal outlined below will provide a basis for that position.

In my view, the U. S. can accept European participation in the shuttle program, if limited to RAM and Sortie payload modules. The State Department proposal (point 2 of the attached) that the U.S. leave open the question of European development of the tug would only raise false hopes that the U. S. might agree to such development. I am opposed to European development of the tug

and I believe this view is shared by most of the interested agencies. The State Department has also proposed that we continue to negotiate with the Europeans on specific shuttle vehicle tasks that had been identified by NASA as appropriate to European participation. I believe we can terminate such negotiations and discussion of the tug and should point out in so doing that our further review of these tasks reveals that they would lead to excessive additional costs and management complications that the U. S. is unwilling to accept.

I will be pleased to discuss this in further detail with you, if you wish.

Edward E. David, Jr.

Enclosure

EED:RCD:of:18 May 72
OST file, chron
EED File, chron
RCD file, chron

OFFICE OF TELECOMMUNICATIONS POLICY

Europ. Coop.

Log In No. _____

INFORMATION MEMORANDUM

May 1, 72

To: Tom Whitehead

From: Jack Thornell

Brief Summary of the Material:

Why it is worthwhile to read:

Info re your meeting with Fletcher & Anderson on launch risk

Jack T

Form OTP 11
January 1972

OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON

May 1, 1972

Tom,

Dave Miller, Bill Ander's Deputy, called Friday and relayed the following information relative to activities on reducing launch risk:

1. The issues are now being considered by Fletcher of NASA.

2. NASA has prepared, or is preparing, two papers focusing on (a) the role of NASA in "demonstration" programs to prove commercial feasibility, and (b) a paper concerning the position of NASA on how to effect a program to reduce launch risk to the private sector.

Neither of the papers has as yet been disclosed and will probably be a subject of discussion at your Wednesday meeting with Anders and Fletcher.

Jack Thornell

cc: B. Smith

SEC. CL.	ORIGIN	CONTROL NO.

DATE OF DOC	DATE REC'D	DATE OUT	SUSPENSE DATE
4/11	4/11	4/11	-

CROSS REFERENCE OR POINT OF FILING: Europ. Coop.

TO Director
FROM William A. Anders - NASA
SUBJ. International Cooperation re Post Apollo

ROUTING	DATE SENT
BKS	4/11
CTW	4/12

COURIER NO.	ANSWERED	NO REPLY
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EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON 20502

EXECUTIVE SECRETARY

April 11, 1972

MEMORANDUM FOR

THE HONORABLE TOM WHITEHEAD
Director, Office of Telecommunications Policy

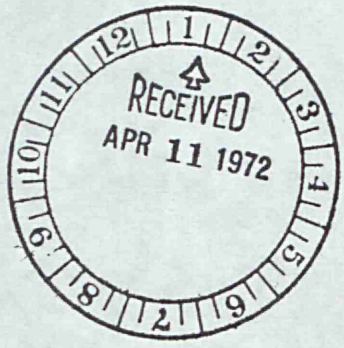
Subject: International Cooperation re Post Apollo

The attached draft attempts to incorporate your views as expressed last week. Since I was unable to precipitate a three way discussion between you, me and John today, I hope we will be able to do so prior to the meeting with Flanigan et al.

I would also like to discuss the DOS/DOT letter to you on Aerosat, along with the European "program plan" Rind picked up over lunch.

William A. Anders

Attachment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DRAFT

A PRESIDENTIAL ACTION MEMORANDUM

A Need for a Decision Regarding Foreign Participation in the Hardware Development Aspect of Our Space Program

Synopsis

Tom Paine, interpreting a sanction from you at the time of Apollo 11, set NASA's course to seek some European financial and technical participation in the hardware development phase of the post-Apollo program, with the major emphasis now being on the space shuttle transportation system. This course was a departure from NASA's earlier successful space cooperation which focused almost entirely on the use of space through joint payloads, primarily of a scientific nature. Based on our evolving understanding and experience, it now appears that this new direction is likely to produce an effect opposite to the one you were seeking of engendering goodwill abroad without domestic penalty. It is therefore advisable to redirect NASA toward seeking international cooperation only through the use of space. With regard to post-Apollo this redirection is in line with the NASA Administrator's preference; however, it should be expected that the action will create some short-term ill will in Europe.

A Newer Appreciation of Risks

A developing understanding of the various factors involved in European participation has led the new NASA Administrator and others in the Executive Office to conclude that there are substantial risks involved in post-Apollo hardware cooperation. Specifically:

a. European participation in the shuttle offers great potential for management problems, both in the domestic and international aspects of the program. Some very contrived formulas have been suggested to obviate these problems, but even so the likelihood is that the management and cost of the program, as well as our international relations, will ultimately suffer as a result of European involvement in shuttle development.

b. One task that had been urged by NASA (a reusable upper rocket stage for the shuttle, called a tug), is now thought to be outside European development capability. This task could necessitate a substantial technology flow from the U.S. or our later rejection of the European product, due to poor performance, after they had expended as much as several hundred millions of dollars. This project also would create the greatest stimulation and focus of Europe's competitive high technology and would have a substantial potential for dollar outflow, owing to the possibility of an appreciable production run for U.S. purchase.

Redirecting U.S. Policy to Avoid Major Risks

It is probable that any sizable joint engineering development project, which intermixes our non-commercial space effort with the desire of other nations to improve their technology position vis-a-vis the U.S., will suffer risks similar to those associated with post-Apollo. It is therefore proposed to redirect U.S. policy re our non-commercial space program toward international cooperation in the use of space -- through beneficial payloads and international crews -- and foreclose joint hardware developments. This does not mean closing the door altogether on European involvement in post-Apollo during the development stage, but it does preclude their working on such launcher systems as the shuttle and tug. We would encourage their undertaking the development of one of the research modules which would be carried as payload in the shuttle since this is a logical extension of our past policy to encourage foreign development of payloads in our joint programs. A research module can be pursued independently without U.S. government or industry involvement, and is not so exacting as to overstress European technical and management capabilities, so the prospect of later intergovernmental recriminations is minimal. In order to orient our relations with Europe toward suitable non-commercial space activities, we should expand our efforts to draw the Europeans into joint payload projects, and increase our efforts to attract their astronauts and technicians to join us in the use of the shuttle.

Foreign Reaction

A modification of the U.S. policy, specifically with regard to post-Apollo, will undoubtedly cause some adverse foreign reaction, at least in European science and technology circles. European criticism will be justified to the extent that the U.S. might have studied the details of its proposition more carefully before seeking their participation. The Europeans have spent up to $5 million studying their possible involvement in post-Apollo, and although this expenditure is not very significant in relation to the R&D sums under consideration, it presumably will be an irritant. The State Department is concerned that the adverse reaction may, in this instance, be broader than otherwise since our action would follow closely upon what the Europeans see as bad deals dealt them by the U.S. in two other space-related projects, Intelsat and Aerosat. European reaction to all of these matters is not fully justified in our view but is indicative of their aggressive commercial interest and desire to obtain high technology work to better their competitive posture. This has made agreement difficult between us on all space matters but the purely scientific ones, and in the case of Aerosat it seems that Europe is asking us to sacrifice our principles to accommodate its intransigence.

Two concessions may mitigate the effect on Europe of a modification of U.S. policy. One has already been given as part of our continuing post-Apollo

negotiations: viz, the U.S. has guaranteed to launch, on a reimbursable basis, almost all of Europe's future satellites. This guarantee should save Europe the cost of going ahead with the development of its own launcher which would be expensive, duplicative, and obsolescent. The second is our offer for joint or unilateral use of the completed shuttle, which will be the most advanced launcher system in the world and should, much as it will for us, open new space capabilities and reduce the cost of access to and use of space.

Tactical Considerations re Post-Apollo

The post-Apollo problem raised in this memorandum deals with an international issue, but the fact must not be overlooked that the issue is a small appendage to the larger domestic matter of successfully and promptly setting the space program on course and keeping it there. Actions that minimize the technical, management, and political problems are most desirable. In the international arena, your basic choice is probably between some negative reaction now and a messier problem later if the Europeans choose a disadvantageous task. U.S. action to remove the shuttle and tug developments as candidates for international participation would not necessarily have to be overt or abrupt since we may have an opportunity informally to guide the European decision over the next three months. Also, of course, the Europeans may well decide the cost of their participation is too high and withdraw, obviating the need for any U.S. action. In any event, no open U.S. action should be taken before June in order not to risk disruption of the appropriation process for the FY 1973 shuttle budget. To soften any impact of closing some options and to put prospective space cooperation more into line with past policies and our understanding of your interests, we should increase our efforts to obtain greater European involvement in joint projects to use the shuttle for beneficial payloads and participation of international crews.

Your Options

Although there are various gradations, in our judgment there are two reasonable options open to you. (1) To redirect NASA away from international hardware development projects and toward international cooperation through payload development and use, and specifically re post-Apollo, to channel European participation to projects involving joint usage of the shuttle including international crews, while accepting the likelihood of some short-term adverse European reaction. Or (2), to leave de facto U.S. policy unchanged and to allow the tentative post-Apollo offer to stand, i.e., accepting European participation in the hardware phase of post-Apollo as well as eventual joint usage of the shuttle.

Options

1. Redirect U.S. policy with respect to international space cooperation to joint projects for the use of space. _____

2. Leave U.S. policy unchanged and allow international participation in the development of our advanced space transportation systems. _____

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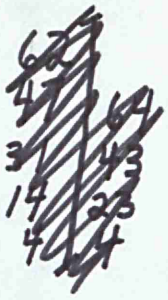

NATIONAL AERONAUTICS AND SPACE COUNCIL
EXECUTIVE OFFICE OF THE PRESIDENT, WASHINGTON 20502

Sat AM

Tom —

Welcome home!

Pete Flanigan & Jon would like to be able to discuss the with you & Ed David Monday AM.

Please give me a call at home Sun pm or in the office mon. AM if you have any questions.

Bill

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON 20502

March 17, 1972

EXECUTIVE SECRETARY

MEMORANDUM FOR

THE HONORABLE PETER M. FLANIGAN

Pursuant to our conversation at lunch on March 3, I have summarized what I believe are the issues, objectives, and options for international participation in the post-Apollo space program. The outstanding problem is that in the past, NASA, interpreting a Presidential sanction, emphasized joint shuttle development with the Europeans, whereas our involvement would appear to have been greatly more in tune with the President's desire if it had been focused on joint manned operations and mutual utilization of space.

Joint European participation in our hardware programs has always seemed to me to have little national advantage and several drawbacks. However, as a country we have gone some distance down the pike with the Europeans, and an abrupt, visible change in policy will probably create a foreign relations problem of measurable but uncertain magnitude. Possibly the problem can be reduced by a careful selection of options and tactics. Taking the factors I see bearing on the problem into account and weighing them as best I can, I have proposed a "strawman" cooperative program in this paper which, <u>if</u> it could be accepted by the Europeans, would be to the net advantage to the U.S. This program, consisting of payload cooperation and joint manned flight, plus European development of the Sortie can, is acceptable to NASA from their viewpoint as program managers. State will likely view this course of action as not responsive to Europe's expectations and as representing a significant change in previous policy. They can be expected to resist such a change or urge some intermediate concession by the U.S. A possible concession is discussed in the attached paper, whereby the U.S. prime contractor for the shuttle does a nominal amount of subcontracting in Europe; however, NASA would agree to this arrangement only if directed to as a concession to our foreign relations.

Please excuse the length of the paper, but there is a several year history of the development of this issue and a significant difference in motivations that are relevant to an understanding of our commitment and posture. Your

reaction to this paper and the strawman proposal, which has been coordinated with Jim Fletcher and John Walsh, of Kissinger's staff, and discussed with others, would be most timely if available by Tuesday a.m. The State Department has opened the post-Apollo policy for reexamination and will be meeting that afternoon. Since I will be attending, I could see that your views and whatever guidance you may have are put forward. Attention to and resolution of this messy issue should be soon since decision dates (e.g., NASA selection of prime contractors) are approaching inexorably and NASA needs a clear directive on how to proceed.

William A. Anders

Enclosure

Tom – the intent is to get Pete to react to this so that I'll know how to cope with State as the "U.S. Position" is developed.

Bill

POSITION PAPER ON EUROPEAN PARTICIPATION IN OUR POST APOLLO SPACE PROGRAM

This paper examines our current position re European participation in our post-Apollo space program, how we got to this position, what are our commitments, and the options for decisions. A pragmatic program is proposed, and tactics for its implementation are discussed. Because of the technical content of the post-Apollo program and some semantical confusion, a definition of terms is desirable.

Definition of Terms

Post-Apollo literally encompasses all of the U.S. space program that comes after Apollo, starting in 1973. In the context of European cooperation, however, it has meant, at various times, the partnership development and utilization of the space station or space shuttle, then the shuttle alone, and now the shuttle, tug, or RAM. These elements of the post-Apollo system have the following characteristics:

The Space Station was a multi-manned, permanent orbital laboratory, which was dropped from NASA's plans on cost grounds, at least until the shuttle is completed and operational.

The Shuttle is a partially reusable launcher used to put a payload plus upper stage ("tug") into a 100 to 200 mile orbit, and to return them to earth. The shuttle can also be used to carry, support, and return a small manned space laboratory. The shuttle and later the tug will be used both in DOD and the civil space program. Development cost of the shuttle is projected to be $5.5B, unit cost will be $250M with an anticipated production of 5 units, and the operating cost is estimated between $10 to $12M per flight.

The Tug is a reusable upper stage, carried and returned in the shuttle payload bay, which moves payloads from the altitude of the shuttle orbit to higher altitudes, and returns payloads in the same fashion. Virtually all payloads above 200 n.m. will use the tug (or an expendable transfer stage), but owing to reuse, the production run for the tug will not be great - perhaps 25 altogether. Costs are estimated to be $1B for development, $20M per production unit, and $0.5M per flight for operations.

RAM (Research and Applications Module) refers to a family of small manned (or unmanned) laboratories to be carried to orbit and supported there, internally or externally, by the shuttle, and then returned in the shuttle bay. (The first version has been referred to as a sortie module or sortie can.) In later versions, the laboratories may be left in orbit independently and recovered on a later shuttle flight. Because of distinctly different uses of the system, there will be several different versions of RAM, and each version can be developed and equipped independently. For each version the production run might be 10 units, development cost of $150 to $200M, and unit cost $15 to $20M, though a basic "stripped" version might be less.

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Normal Commercial Subcontracts. Subcontracts of this nature are undertaken between industries with no unusual government involvement. The prime contractor chooses certain parts of a system for outside development and production, selects the winner among bidders for the work (with NASA's concurrence in the case of the shuttle contract), and then has sole control of managing and paying the subcontractor. In this context, European industry would not be precluded from bidding on the shuttle subcontracts, and under normal economic pressures to use low bid from a qualified supplier, they could conceivably win $10 to $100M of the subcontracts. However, because of the nature of

R&D contracts, such as for the shuttle, there is little inherent pressure on our industry to choose low bid subcontractors; rather the most important considerations are minimizing programmatic, schedule, and management risks, and thereby maximizing the possibility of receiving their incentive. Historically, Europe has won no subcontracts of significance on space systems. Relaxation of implied restrictions and guidance to our industry to be more receptive to qualified bidders in Europe could be employed by us as a bargaining tool in the post-Apollo negotiation; and if the dollar flow is considered a problem, it might be balanced through some reciprocal arrangements. These alternatives are discussed later under "Options".

U.S. Motivations and Objectives in Post-Apollo Cooperation

It has been U.S. policy and President Nixon's desire to promote international cooperation in space and to share the benefits (and burdens) of space with all mankind. It has also been U.S. policy to strengthen our allies and alliances, and to foster a sense of community among the Europeans and to encourage their joint undertakings. The desire to implement these policies and also to make a new program more attractive to Congress (and also less cancelable), led NASA to seek European partnership in the post-Apollo space program over two years ago. The prospect of a European financial contribution to our program was thought to be a further plus. There was, however, ambivalence in our understanding of how much of the Administration's desire for international participation in space focused on joint usage and how much on joint development of space hardware. In recent weeks there has been some clarification of Presidential preference; his interest is primarily in European involvement in the use of space, coming from the development of payloads and operations rather than from big joint engineering projects, and specifically to share in the use of our post-Apollo space systems for international manned operations.

Whatever cooperative program is devised, we seek maximum benefit for ourselves in terms of (1) creating togetherness and good will, or at least minimizing any ill will, (2) drawing their interest away from undertaking separate space systems (e.g., the Europa III booster, aerosat, or those competitive with Intelsat), and (3) gaining some technology from areas of European special qualification, and possibly obtaining some minor components at a lower cost. At the same time, we want to minimize (1) increased risk and management complexity of our development program, (2) technology/dollar/job outflow, and (3) foreign relations impairment resulting from disputes as the program progresses.

European Motivations and Objectives in Post-Apollo Cooperation

A major European objective is to gain large systems management capability and some technology. Their government/industry technocrats were very impressed by our success with Apollo, and they belive that by participating with us in a major systems development, such as the shuttle, they can learn how to better manage and build their own big technical projects (Europa III being a possible example). Their willingness to pay for the development of part of our shuttle is, in their view, a ticket to participate in or at least get a front row seat to our management process. A second European objective is to have the use of the world's most advanced space system, the shuttle, to carry out more complex science and applications programs in space, and, in spite of no explicit European plans at this time, there may be awakening interest in sharing in the prestige and greater capabilities of manned flight. Finally, the science-technology ministers and the international space organizations are looking for big projects that their respective governments will support (bureaucratic empire building). Also, of course, the European aerospace industry, which is in a decline analogous to ours, wants to get some business, particularly if that business might have fallout that would improve their competitive posture in other high technology areas. The direct business prospect appears to them as twofold: the R&D money from European governments and then the sale of production items to both European and U.S. users.

The History of the U.S. Commitment to Post-Apollo Cooperation

It has been a U.S. attitude that space like Antarctica is inherently international, only to be explored for humanitarian reasons. Whatever benefits that derive from being in space can be benefits to all mankind, except, of course, where military utility is involved. The one challenge, thus far, to this viewpoint has been in the use of satellites for communications, where commercial exploitation exists for point-to-point communications and is in dispute for mobile usage (aerosat). Such challenges will become more common as the shuttle opens up the commercial utilization of space. All Presidents since the inception of the space program have called for international cooperation in space, many in Congress favor it, and the Space Act, which formed NASA, urges it. President Nixon publicly promoted it in his statement of March 7, 1970.

NASA has had an international outlook and has engaged other nations in many useful joint science projects. Partially because of this international orientation and partially because of the desire to make the program more attractive (and less cancelable), Tom Paine in private discussions with President Nixon at the time of Apollo 11 raised the issue of seeking greater international participation in our space program after Apollo. Paine reported that the President concurred in the desirability of this course of action, though it was not made clear as to the relative preference between participation in hardware development or participation in manned flight and science payloads. Paine then went to Europe to test and stimulate the Europeans' interest, and at the same time he narrowed the candidates for cooperation to the joint development and use of the space station or shuttle, and then only to the latter when the space station was dropped from our plans due to funding reductions. NASA did report to the White House on its progress in obtaining European involvement, and these reports elicited acknowledgments which were possibly of a somewhat perfunctory nature. NASA, however, accepted these acknowledgments as direction to continue. Operating from the same background and with stimulation from NASA and in response to European overtures, the State Department conducted two minister-level exploratory talks with the Europeans on the basis of U.S. "desire for maximum partnership in the post-Apollo program consistent with mutual desires and capabilities." This came to mean to NASA, Europe, and the State Department, a partnership in the development and construction of the shuttle, with possible involvement in the tug or the sortie can version of RAM. It was also understood that the U.S. would guarantee to use the particular European product, if that product was completely satisfactory to us. Talks have continued between U.S. and European technical groups to define areas of possible cooperation, meanwhile the Europeans have spent roughly $5M studying the shuttle and tug in order to decide where their work might be concentrated. They are now expanding their tug studies and are also studying RAM (sortie can).

The initial U.S. stipulations to cooperation were that there be no exchange of funds and that the management/technology level of the European undertaking be in keeping with their current capability and not rely on technology infusion from the U.S. A later stipulation was that the Europeans would have to contribute a significant portion of the effort (10% of the program's cost). This stipulation was dropped, however, after the U.S. decided on separating the issues of post-Apollo and launch assurances. (The launch assurance issue involved Europe's concern about obtaining U.S. launches of their payloads. The U.S. has now agreed to launch any European payload having a peaceful

purpose, except where we believed the payload violated international agreements ((e.g., military systems or those competing with Intelsat)). These launches would use our present boosters and the costs would be reimbursed.) Our most recent stipulation is that they would have to commit themselves to a "package deal" for the development of the tug or RAM before we would settle on their government-supported "subcontractual" involvement in the shuttle. An implied stipulation was that neither Europe nor we would try to recover our respective development costs through amortization in the unit or use prices.

There has been growing concern in the Executive Office and with top NASA management that we are getting ourselves involved in a situation that is not advantageous. A recent informal sounding of Presidential desire indicated that his interest would be almost fully served through joint use of space, and partnership construction of complex space hardware is not a strong motivation. In some response to these feelings, NASA has been directed to attempt to shift European interest away from the shuttle and onto the tug or RAM.

Present status is as follows: the Europeans are now trying to decide whether or not to develop a tug or RAM. If their decision is affirmative, they have been led to believe that they can, if they wish, develop a few prescribed, "simple" parts of the shuttle, with certain restrictions on funding control. The Europeans must make up their minds by early summer if they wish to avail themselves of this "package deal". The decision is very hard for them because they have not thoroughly studied what is involved in the development of the tug or RAM, and they are going to have to decide with major technical and cost uncertainties facing them. Meanwhile, our change in signals on aerosat has caused them additional concern as to our motives in space, and has produced some European "threats" against post-Apollo; apparently they believe us to be eager for their involvement.

Options for U.S.-European Involvement

The four main options, some having suboptions, that are open to the U.S. are listed below in increasing order of complexity as far as program management is concerned (except possibly for 4b).

1. Complete Disengagement. The most obvious option is to disengage and have no international participation in our space program, other than at the scientific level as we already have. This option guarantees no technology or dollar outflow, does not restrict our future political or programmatic decisions, and adds no technical and management complications to an

already complex program. This, in fact, may be the outcome anyway, since European interests may well not be sufficiently strong to underwrite an expensive program having a nebulous quid pro quo. But if we force this option, the Europeans will correctly view this as a major shift away from the commitment they accepted from U.S. officials as our government's policy. Foreign relations harm may result and, in fact, may have wider effects than space matters usually do because this would closely follow other unsatisfactory space negotiations in the European view and also may seem to show a quixotic approach to policy formulation in the U.S.

2. International Cooperative Payloads. This option is to indicate that our interest in international participation is focused on the usage of the shuttle for mutual benefit, including manned flight, and not on development of the hardware. This option probably should be emphasized whatever else we jointly undertake because it appears to be at the heart of the President's actual desire. However, the Europeans will probably not view this as a significant concession since we are talking about events eight years from now, and furthermore the Europeans may believe this already to be U.S. policy.

3. European Development of an Element of the Post-Apollo Program Other than the Shuttle (Tug or Sortie Can Version of RAM). A third option is to allow the present situation to continue to the extent that Europe is free to choose between the development of a tug or sortie can, with a U.S. guarantee to use the item if it meets our required specifications. Either would meet Europe's perception of the U.S. commitment. The possible advantages to us of their undertaking the tug is the savings of a substantial R&D cost and the availability of the system several years earlier than otherwise. A possible other advantage is that the diversion of European funds to the tug would preclude their development of Europa III, and thus limit the expansion of their independent launch capability. (Any lesser commitment of European funds to post-Apollo, such as doing a RAM-sortie can and/or parts of the shuttle, would leave open the possibility of doing Europa III. However, it is possible that the cost and difficulty of Europa III will discourage the Europeans from undertaking it regardless of their post-Apollo involvement; and if undertaken it is even more possible that it would not be completed, as greater realization of its relative inadequacy became more apparent.) Any advantages to the U.S. of a European tug project seem to be more than offset by several disadvantages: the probability of Europe producing an unacceptably low performance system, the likelihood of technology outflow, the enhancement of their own booster capability, the dollar outflow to buy production units (perhaps up to $500M), and the difficulty in accommodating DOD's unwillingness to rely on a foreign supplier.

Concerning the other side of this option, the advantages of Europe developing the sortie can version of RAM is that the task clearly can be within their capabilities, has minimum risk of technology transfer, could contribute a useful element to the post-Apollo program, and has no military implication. The cost to the U.S. to buy units from Europe would depend on the degree of equipping but may be fairly nominal, in the range of $20 to $60M over a period of several years. This expenditure would be offset by European purchase of the other versions of RAM produced in the U.S.

Given that the tug is an unacceptable European project for several reasons, and that the sortie can would be acceptable, a difficult problem faces us in causing redirection of European interests. We could easily end up with the foreign relations disadvantages listed under 1 even though we are trying to take a conciliatory approach in offering a moderate program of participation. This problem is discussed further under "Tactical Considerations", but anticipating that discussion, no fully satisfactory tactic is evident.

4. European Involvement in the Development of the Shuttle. This option is in two parts: the first being a continuation of the current position and the second a possible fallback maneuver as a possible foreign relations concession.

a. European Government-Supported "Subcontracts". This option is also a continuation of the current situation, namely, to accept Europe as a limited partner in the development of the shuttle, with them building at their expense certain "simple" parts of the hardware. The advantage to us in this arrangement is that it further meets European understanding of our commitment. It had been a NASA position that sufficiently simple tasks had been identified to make this arrangement feasible, however, many now feel that the increased risks and technology/management outflow may well more than offset the dollar or good will value of a European government-supported contribution to the shuttle. There is also serious concern that the normal supplier problems in big and complicated development programs would, on occasion, be elevated into international disputes, thereby producing the reverse of the President's desire for good will. Furthermore, this arrangement amounts to a U.S. government guarantee to supply certain components to our prime contractor, thus removing some of our government's leverage and some of the contractors overall responsibility for the integration and management function. During the course of the program, the prime contractor could well use this as an excuse for schedule, cost, or design changes. Withdrawing this option, however, will have a negative effect on European attitude toward the U.S., and a possible concession to lessen this impact is suggested by the following option.

b. Normal Commercial Subcontracts (A possible foreign relations concession to offset the negative impact of withdrawing shuttle participation as an option). If some European involvement in shuttle development was felt to be necessary as a foreign relations concession due to our past stimulation and commitments, a possible fallback from the above government arrangement would be for the prime contractor to do some nominal amount of normal commercial subcontracting with qualified bidders in Europe, once Europe has committed to a RAM or tug. This would partially satisfy their industry's desire to do some work on the shuttle, and would not have the serious disadvantage of involving their governments directly in the arrangements, nor of having European participation in the management of the overall system. Also, the U.S. might benefit by some minor technology flow in our direction. To mitigate outward dollar flow, some balancing amount of work might be subcontracted by Europe in the U.S. on their RAM or tug, though this may happen anyway depending upon the degree of assistance they need on their task, or balancing might be achieved through other offset arrangements to achieve no net exchange of funds. This alternative is not favored by NASA, but if directed to choose between 4a and 4b for foreign relations reasons, this latter alternative is less odious and is doable.

A Proposed Program

A program agreeable to NASA, and which attempts to maximize the net advantage to the U.S. and at the same time appears to be reasonably attentive to our commitment to Europe, has been selected from parts of the above options.

System Use: European operational involvement with us in some joint manned orbital missions, plus reimbursable use of our space transportation system to orbit their science and applications satellites, as a natural continuation of our present launch assurances.

System Development: If European interest continues to include working on hardware development, we should agree only to their building the sortie can version of the family of RAM's. We would agree to buy from them the basic components of this item, while other versions of RAM would be built by the U.S. and would be for sale to the Europeans.

The second part of the above program, system development, has the most immediate impact and also major difficulties associated with it in a foreign relations sense. In visibly removing the tug and shuttle from the list of acceptable projects for participation, we will antagonize the Europeans, even if they were not going to opt for these projects. Coming on top of the bad deals they believe they have been dealt in aerosat and Intelsat, a narrowing of our post-Apollo policy in this fashion may well have serious repercussions in a broader context: we may be increasingly seen as unreliable partners and allies. For this reason, some concession may be in order, and the views of NSC and State would help to guide the policy in this regard. A concession could be made either re the tug or shuttle. However, because of the difficulty of developing a satisfactory tug and the potential for sizable technology and dollar outflow, and also because of DOD's concern in this area, we should preclude European development of this project. We would simply be trading off a short-term foreign relations problem for a longer-term one. In regard to shuttle involvement, the management and foreign relations problems associated with government-to-government subcontracting are unacceptable, but we might accept European subcontracting on a normal company-to-company basis. Though not to their liking, NASA could informally direct our U.S. shuttle contractors to select and use qualified, low-bid European subcontractors on tasks the prime contractors choose, perhaps up to the level of $50 to $100M out of a $3 to $4B shuttle contract. Dollar outflow could be balanced by our requirement that the Europeans subcontract at least a compensatory amount in the U.S. for their RAM development, if the two to three year delay in balancing is acceptable to us. Otherwise, balancing can be achieved through other offset arrangements. NASA would prefer not to make a foreign relations concession of this nature because of their long-standing adherence to an internal rule against exchange of funds and its potential political impact. If, however, State and NSC urge this concession, NASA sees this arrangement as less odious than government-to-government subcontracting, and could implement it.

Strategy and Tactics for Implementing the Proposed Program

Two levels of action should be pursued: a longer-term (months) strategic move to gain European political appreciation of and accommodation to the differences in European and U.S. motivations re space, and a short-term (weeks) tactical move to decide on and offer to the Europeans a moderate program of participation in the post-Apollo development phase, having net advantage to the U.S.

1. Strategic Considerations.

Complicating our discussions on space cooperation with the Europeans are the differences in our respective backgrounds and orientations with respect to space. To those who ran the U.S. space program, particularly the Apollo program, and conducted our side of the talks with the Europeans, space has been a non-commercial venture encompassing exploration, science, and technology, and space's commercial value has played only an emerging role in their thinking. Commercial utilization has been handled by our

private sector; while in Europe both the exploration and utilization of space are government functions. European interest in post-Apollo is more in the vein of commerce than adventure. Obtaining a mutually satisfactory cooperative program has been difficult because the two sides have seen it as offering different payoffs. Therefore, our strategy must not simply be to bring a shift in emphasis on what piece of hardware Europe might supply, but should develop a basic accommodation through mutual understanding and acceptance of objectives.

We must attempt, for example, to stimulate recognition in European science-minister/political leaders, and their staffs, of the political-prestige value of manned space flight. No significant effort has been made by the U.S. to determine the latent political interest in manned flight, nor has any coordinated attempt been made to guide them persuasively into the program. NASA seems to have taken the European view at face value, and all of our negotiations on cooperation have generally reflected our axiomatic acceptance of European disinterest in manned space flight. We also should try to obtain an understanding with Europe that the development of launchers duplicates skills and equipment that already are well developed in the U.S., does not really enhance the direct derivation of benefits from space given the availability of launches, and does heighten U.S. concern because of technology flow and security considerations. There is some doubt that Europe can learn our management skills simply by sitting in on the shuttle management, but it is a risk to us for reasons of future competitive posture. We should attempt to make it clear that we expect them to join us in a cooperative space program primarily for non-commercial reasons, and they should disabuse themselves of the idea of making money from us or learning our technology and know-how. They may feel that it is their financial contribution to the program that motivates U.S. interest in cooperation, and hence they are entitled to get something significant and tangible out of the program. They are wrong on both counts, and we must clarify this matter to them. Discussion should begin informally and individually, not group-wise, recognizing, however, that the prospects of evangelizing are not great, a priori.

1. Tactical Considerations.

The most immediate problem is to persuade the European space technocrats that a RAM-sortie can is a challenging and important task, and that it opens the part of the post-Apollo program having the greatest direct benefit,

namely, payload development and use. The tug should be ruled out because of its difficulty and its high potential for technology and dollar outflow. If the Europeans insist on also participating in shuttle development, we can, on grounds of avoiding government involvement in contractor-subcontractor disputes, offer the possibility of their industry functioning as normal commercial subcontractors to our U.S. prime contractor at a moderate level ($50 to $100M). The Europeans have purportedly inquired about this possibility last month, and so a change in our position of this nature can be offered as acquiescence to their proposal. There would be an understanding with Europe that the dollar flow inherent in this arrangement would have some balance through European subcontracting in the U.S. for parts of its RAM, or through other offset arrangements.

The fact must be faced that the European technicians have been strongly motivated toward tug; it is the biggest and most challenging post-Apollo project available to them, and has the greatest technology stimulation and spin-off to other high technology capabilities. Moreover, nothing the U.S. has said to the Europeans in almost two years would indicate anything other than our desire for them to undertake the tug. And at our encouragement they have spent $1 to $2M studying their capability for its development. Changing signals is therefore going to be difficult without irritating them (justifiably). Because it postpones the problem, there have been suggestions that we wait for Europe to come to its own understanding or demonstration of its inability to build an acceptable tug. The Europeans' anger and frustration would increase, though, in proportion to the amount of time and money they waste on a project we reject. It may be that the best course is to take the flak now and admit our concern over their abilities and over the technology/dollar outflow we envision, and withdraw the tug from consideration. In order to ease the foreign relations impact and some of the pressure their industry is applying to their governments to undertake development tasks that are unacceptable to us (tug or European-contributed shuttle work), we might allow them some normal subcontractor participation in the shuttle as qualified bidders.

The timing of these tactics is a major difficulty. We would have to get these messages across and obtain European agreement by July if European subcontractors are to be used on the shuttle; our prime contractor cannot wait past that period. If Europe only undertakes a RAM-sortie can, timing is no longer critical to us, but the Europeans themselves say they must decide by mid-summer because of the coupling with their decision on whether or not to go ahead with Europa III.

The State Department is now reviewing the post-Apollo policy, and the receipt of directions to propose a modified program to the Europeans would be most timely. Some resistance within our government to an alteration in direction can be anticipated, if for no other reason than the psychological momentum of the people that have been involved in obtaining European participation. Considering the many factors involved, no more time should lapse before a decision is made and guidance given.

Mansur's comments.

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U.S. Motivations and Objectives in Post-Apollo Cooperation

It has been U.S. policy and President Nixon's desire to promote international cooperation in space and to share the benefits (and burdens) of space with all mankind. It has also been U.S. policy to strengthen our allies and alliances, and to foster a sense of community among the Europeans and to encourage their joint undertakings. The desire to implement these policies and also to make a new program more attractive to Congress (and also less cancelable), led NASA to seek European partnership in the post-Apollo space program over two years ago. The prospect of a European financial contribution to our program was thought to be a further plus. There was, however, ambivalence in our understanding of how much of the Administration's desire for international participation in space focused on joint usage and how much on joint development of space hardware. In recent weeks there has been some clarification of Presidential preference; his interest is primarily in European involvement in the use of space, coming from the development of payloads and operations rather than from big joint engineering projects, and specifically to share in the use of our post-Apollo space systems for international manned operations.

Whatever cooperative program is devised, we seek maximum benefit for ourselves in terms of (1) creating togetherness and good will, or at least minimizing any ill will, (2) drawing their interest away from undertaking separate space systems (e.g., the Europa III booster, aerosat, or those competitive with Intelsat), and (3) gaining some technology from areas of European special qualification, and possibly obtaining some minor components at a lower cost. At the same time, we want to minimize (1) increased risk and management complexity of our development program, (2) technology/dollar/job outflow, and (3) foreign relations impairment resulting from disputes as the program progresses.

European Motivations and Objectives in Post-Apollo Cooperation

A major European objective is to gain large systems management capability and some technology. Their government/industry technocrats were very impressed by our success with Apollo, and they belive that by participating with us in a major systems development, such as the shuttle, they can learn how to better manage and build their own big technical projects (Europa III being a possible example). Their willingness to pay for the development of part of our shuttle is, in their view, a ticket to participate in or at least get a front row seat to our management process. A second European objective is to have the use of the world's most advanced space system, the shuttle, to carry out more complex science and applications programs in space, and, in spite of no explicit European plans at this time, there may be awakening interest in sharing in the prestige and greater capabilities of manned flight. Finally, the science-technology ministers and the international space organizations are looking for big projects that their respective governments will support (bureaucratic empire building). Also, of course, the European aerospace industry, which is in a decline analogous to ours, wants to get some business, particularly if that business might have fallout that would improve their competitive posture in other high technology areas. The direct business prospect appears to them as twofold: the R&D money from European governments and then the sale of production items to both European and U.S. users.

The History of the U.S. Commitment to Post-Apollo Cooperation

It has been a U.S. attitude that space like Antarctica is inherently international, only to be explored for humanitarian reasons. Whatever benefits that derive from being in space can be benefits to all mankind, except, of course, where military utility is involved. The one challenge, thus far, to this viewpoint has been in the use of satellites for communications, where commercial exploitation exists for point-to-point communications and is in dispute for mobile usage (aerosat). Such challenges will become more common as the shuttle opens up the commercial utilization of space. All Presidents since the inception of the space program have called for international cooperation in space, many in Congress favor it, and the Space Act, which formed NASA, urges it. President Nixon publicly promoted it in his statement of March 7, 1970.

NASA has had an international outlook and has engaged other nations in many useful joint science projects. Partially because of this international orientation and partially because of the desire to make the program more attractive (and less cancelable), Tom Paine in private discussions with President Nixon at the time of Apollo 11 raised the issue of seeking greater international participation in our space program after Apollo. Paine reported that the President concurred in the desirability of this course of action, though it was not made clear as to the relative preference between participation in hardware development or participation in manned flight and science payloads. Paine then went to Europe to test and stimulate the Europeans' interest, and at the same time he narrowed the candidates for cooperation to the joint development and use of the space station or shuttle, and then only to the latter when the space station was dropped from our plans due to funding reductions. NASA did report to the White House on its progress in obtaining European involvement, and these reports elicited acknowledgments which were possibly of a somewhat perfunctory nature. NASA, however, accepted these acknowledgments as direction to continue. Operating from the same background and with stimulation from NASA and in response to European overtures, the State Department conducted two minister-level exploratory talks with the Europeans on the basis of U.S. "desire for maximum partnership in the post-Apollo program consistent with mutual desires and capabilities." This came to mean to NASA, Europe, and the State Department, a partnership in the development and construction of the shuttle, with possible involvement in the tug or the sortie can version of RAM. It was also understood that the U.S. would guarantee to use the particular European product, if that product was completely satisfactory to us. Talks have continued between U.S. and European technical groups to define areas of possible cooperation, meanwhile the Europeans have spent roughly $5M studying the shuttle and tug in order to decide where their work might be concentrated. They are now expanding their tug studies and are also studying RAM (sortie can).

The initial U.S. stipulations to cooperation were that there be no exchange of funds and that the management/technology level of the European undertaking be in keeping with their current capability and not rely on technology infusion from the U.S. A later stipulation was that the Europeans would have to contribute a significant portion of the effort (10% of the program's cost). This stipulation was dropped, however, after the U.S. decided on separating the issues of post-Apollo and launch assurances. (The launch assurance issue involved Europe's concern about obtaining U.S. launches of their payloads. The U.S. has now agreed to launch any European payload having a peaceful

purpose, except where we believed the payload violated international agreements ((e.g., military systems or those competing with Intelsat)). These launches would use our present boosters and the costs would be reimbursed.) Our most recent stipulation is that they would have to commit themselves to a "package deal" for the development of the tug or RAM before we would settle on their government-supported "subcontractual" involvement in the shuttle. An implied stipulation was that neither Europe nor we would try to recover our respective development costs through amortization in the unit or use prices.

There has been growing concern in the Executive Office and with top NASA management that we are getting ourselves involved in a situation that is not advantageous. A recent informal sounding of Presidential desire indicated that his interest would be almost fully served through joint use of space, and partnership construction of complex space hardware is not a strong motivation. In some response to these feelings, NASA has been directed to attempt to shift European interest away from the shuttle and onto the tug or RAM.

Present status is as follows: the Europeans are now trying to decide whether or not to develop a tug or RAM. If their decision is affirmative, they have been led to believe that they can, if they wish, develop a few prescribed, "simple" parts of the shuttle, with certain restrictions on funding control. The Europeans must make up their minds by early summer if they wish to avail themselves of this "package deal". The decision is very hard for them because they have not thoroughly studied what is involved in the development of the tug or RAM, and they are going to have to decide with major technical and cost uncertainties facing them. Meanwhile, our change in signals on aerosat has caused them additional concern as to our motives in space, and has produced some European "threats" against post-Apollo; apparently they believe us to be eager for their involvement.

Options for U.S.-European Involvement

The four main options, some having suboptions, that are open to the U.S. are listed below in increasing order of complexity as far as program management is concerned (except possibly for 4b).

1. Complete Disengagement. The most obvious option is to disengage and have no international participation in our space program, other than at the scientific level as we already have. This option guarantees no technology or dollar outflow, does not restrict our future political or programmatic decisions, and adds no technical and management complications to an

policy processes should be pointed out elsewhere in the paper.

already complex program. This, in fact, may be the outcome anyway, since European interests may well not be sufficiently strong to underwrite an expensive program having a nebulous quid pro quo. But if we force this option, the Europeans will correctly view this as a major shift away from the commitment they accepted from U.S. officials as our government's policy. Foreign relations harm may result and, in fact, may have wider effects than space matters usually do because this would closely follow other unsatisfactory space negotiations in the European view and also may seem to show a quixotic approach to policy formulation in the U.S.

2. International Cooperative Payloads. This option is to indicate that our interest in international participation is focused on the usage of the shuttle for mutual benefit, including manned flight, and not on development of the hardware. This option probably should be emphasized whatever else we jointly undertake because it appears to be at the heart of the President's actual desire. However, the Europeans will probably not view this as a significant concession since we are talking about events eight years from now, and furthermore the Europeans may tacitly believe this already to be U.S. policy.

3. European Development of an Element of the Post-Apollo Program Other than the Shuttle (Tug or Sortie Can Version of RAM). A third option is to allow the present situation to continue to the extent that Europe is free to choose between the development of a tug or sortie can, with a U.S. guarantee to use the item if it meets our required specifications. Either would meet Europe's perception of the U.S. commitment. The possible advantages to us of their undertaking the tug is the savings of a substantial R&D cost and the availability of the system several years earlier than otherwise. A possible other advantage is that the diversion of European funds to the tug would preclude their development of Europa III, and thus limit the expansion of their independent launch capability. (Any lesser commitment of European funds to post-Apollo, such as doing a RAM-sortie can and/or parts of the shuttle, would leave open the possibility of doing Europa III. However, it is possible that the cost and difficulty of Europa III will discourage the Europeans from undertaking it regardless of their post-Apollo involvement; and if undertaken it is even more possible that it would not be completed, as greater realization of its relative inadequacy became more apparent.) Any advantages to the U.S. of a European tug project seem to be more than offset by several disadvantages: the probability of Europe producing an unacceptably low performance system, the likelihood of technology outflow, the enhancement of their own booster capability, the dollar outflow to buy production units (perhaps up to $500M), and the difficulty in accommodating DOD's unwillingness to rely on a foreign supplier.

great

Concerning the other side of this option, the advantages of Europe developing the sortie can version of RAM is that the task clearly can be within their capabilities, has minimum risk of technology transfer, could contribute a useful element to the post-Apollo program, and has no military implication. The cost to the U.S. to buy units from Europe would depend on the degree of equipping but may be fairly nominal, in the range of $20 to $60M over a period of several years. This expenditure would be offset by European purchase of the other versions of RAM produced in the U.S.

yes

Given that the tug is an unacceptable European project for several reasons, and that the sortie can would be acceptable, a difficult problem faces us in causing redirection of European interests. We could easily end up with the foreign relations disadvantages listed under 1 even though we are trying to take a conciliatory approach in offering a moderate program of participation. This problem is discussed further under "Tactical Considerations", but anticipating that discussion, no fully satisfactory tactic is evident.

4. European Involvement in the Development of the Shuttle. This option is in two parts: the first being a continuation of the current position and the second a ~~possible~~ fallback maneuver as a possible foreign relations concession.

a. European Government-Supported "Subcontracts". This option is also a continuation of the current situation, namely, to accept Europe as a limited partner in the development of the shuttle, with them building at their expense certain "simple" parts of the hardware. The advantage to us in this arrangement is that it further meets European understanding of our commitment. It had been a NASA position that sufficiently simple tasks had been identified to make this arrangement feasible, however, many now feel that the increased risks and technology/management outflow may well more than offset the dollar or good will value of a European government-supported contribution to the shuttle. There is also serious concern that the normal supplier problems in ~~big and complicated~~ development programs would, on occasion, be elevated into international disputes, thereby producing the reverse of the President's desire for good will. Furthermore, this arrangement amounts to a U.S. government guarantee to supply certain components to our prime contractor, thus ~~removing some of our government's leverage and some of~~ compromising the contractors overall responsibility for the integration and management function. During the course of the program, the prime contractor could well use this as an excuse for schedule, cost, or design changes. Withdrawing this option, however, will have a negative effect on European attitude toward the U.S., and a possible concession to lessen this impact is suggested by the following option.

b. Normal Commercial Subcontracts (A possible foreign relations concession to offset the negative impact of withdrawing shuttle participation as an option). If some European involvement in shuttle development was felt to be necessary as a foreign relations concession due to our past stimulation and commitments, a possible fallback from the above government arrangement would be for the prime contractor to do some nominal amount of normal commercial subcontracting with qualified bidders in Europe, once Europe has committed to a RAM or tug. This would partially satisfy their industry's desire to do some work on the shuttle, and would not have the serious disadvantage of involving their governments directly in the arrangements, nor of having European participation in the management of the overall system. Also, the U.S. might benefit by some minor technology flow in our direction. To mitigate outward dollar flow, some balancing amount of work might be subcontracted by Europe in the U.S. on their RAM or tug, though this may happen anyway depending upon the degree of assistance they need on their task, or balancing might be achieved through other offset arrangements to achieve no net exchange of funds. This alternative is not favored by NASA, but if directed to choose between 4a and 4b for foreign relations reasons, this latter alternative is less odious and is doable.

A Proposed Program

A program agreeable to NASA, and which attempts to maximize the net advantage to the U.S. and at the same time appears to be reasonably attentive to our commitment to Europe, has been selected from parts of the above options.

System Use: European operational involvement with us in some joint manned orbital missions, plus reimbursable use of our space transportation system to orbit their science and applications satellites, as a natural continuation of our present launch assurances.

System Development: If European interest continues to include working on hardware development, we should agree only to their building the sortie can version of the family of RAM's. We would agree to buy from them the basic components of this item, while other versions of RAM would be built by the U.S. and would be for sale to the Europeans.

The second part of the above program, system development, has the most immediate impact and also major difficulties associated with it in a foreign relations sense. In visibly removing the tug and shuttle from the list of acceptable projects for participation, we will antagonize the Europeans, even if they were not going to opt for these projects. Coming on top of the bad deals they believe they have been dealt in aerosat and Intelsat, a narrowing of our post-Apollo policy in this fashion may well have serious repercussions in a broader context: we may be increasingly seen as unreliable partners and allies. For this reason, some concession may be in order, and the views of NSC and State would help to guide the policy in this regard. A concession could be made either re the tug or shuttle. However, because of the difficulty of developing a satisfactory tug and the potential for sizable technology and dollar outflow, and also because of DOD's concern in this area, we should preclude European development of this project. We would simply be trading off a short-term foreign relations problem for a longer-term one. In regard to shuttle involvement, the management and foreign relations problems associated with government-to-government subcontracting are unacceptable, but we might accept European subcontracting on a normal company-to-company basis. Though not to their liking, NASA could informally direct our U.S. shuttle contractors to select and use qualified, low-bid European subcontractors on tasks the prime contractors choose, perhaps up to the level of $50 to $100M out of a $3 to $4B shuttle contract. Dollar outflow could be balanced by our requirement that the Europeans subcontract at least a compensatory amount in the U.S. for their RAM development, if the two to three year delay in balancing is acceptable to us. Otherwise, balancing can be achieved through other offset arrangements. NASA would prefer not to make a foreign relations concession of this nature because of their long-standing adherence to an internal rule against exchange of funds and its potential political impact. If, however, State and NSC urge this concession, NASA sees this arrangement as less odious than government-to-government subcontracting, and could implement it.

Strategy and Tactics for Implementing the Proposed Program

Two levels of action should be pursued: a longer-term (months) strategic move to gain European political appreciation of and accommodation to the differences in European and U.S. motivations re space, and a short-term (weeks) tactical move to decide on and offer to the Europeans a moderate program of participation in the post-Apollo development phase, having net advantage to the U.S.

1. Strategic Considerations.

Complicating our discussions on space cooperation with the Europeans are the differences in our respective backgrounds and orientations with respect to space. To those who ran the U.S. space program, particularly the Apollo program, and conducted our side of the talks with the Europeans, space has been a non-commercial venture encompassing exploration, science, and technology, and space's commercial value has played only an emerging role in their thinking. Commercial utilization has been handled by our

private sector; while in Europe both the exploration and utilization of space are government functions. European interest in post-Apollo is more in the vein of commerce than adventure. Obtaining a mutually satisfactory cooperative program has been difficult because the two sides have seen it as offering different payoffs. Therefore, our strategy must not simply be to bring a shift in emphasis on what piece of hardware Europe might supply, but should develop a basic accommodation through mutual understanding and acceptance of objectives.

We must attempt, for example, to stimulate recognition in European science-minister/political leaders, and their staffs, of the political-prestige value of manned space flight. No significant effort has been made by the U.S. to determine the latent political interest in manned flight, nor has any coordinated attempt been made to guide them persuasively into the program. NASA seems to have taken the European view at face value, and all of our negotiations on cooperation have generally reflected our axiomatic acceptance of European disinterest in manned space flight. We also should try to obtain an understanding with Europe that the development of launchers duplicates skills and equipment that already are well developed in the U.S., does not really enhance the direct derivation of benefits from space given the availability of launches, and does heighten U.S. concern because of technology flow and security considerations. There is some doubt that Europe can learn our management skills simply by sitting in on the shuttle management, but it is a risk to us for reasons of future competitive posture. We should attempt to make it clear that we expect them to join us in a cooperative space program primarily for non-commercial reasons, and they should disabuse themselves of the idea of making money from us or learning our technology and know-how. They may feel that it is their financial contribution to the program that motivates U.S. interest in cooperation, and hence they are entitled to get something significant and tangible out of the program. They are wrong on both counts, and we must clarify this matter to them. Discussion should begin informally and individually, not group-wise, recognizing, however, that the prospects of evangelizing are not great, a priori.

1. Tactical Considerations.

The most immediate problem is to persuade the European space technocrats that a RAM-sortie can is a challenging and important task, and that it opens the part of the post-Apollo program having the greatest direct benefit,

namely, payload development and use. The tug should be ruled out because of its difficulty and its high potential for technology and dollar outflow. If the Europeans insist on also participating in shuttle development, we can, on grounds of avoiding government involvement in contractor-subcontractor disputes, offer the possibility of their industry functioning as normal commercial subcontractors to our U.S. prime contractor at a moderate level ($50 to $100M). The Europeans have purportedly inquired about this possibility last month, and so a change in our position of this nature can be offered as acquiescence to their proposal. There would be an understanding with Europe that the dollar flow inherent in this arrangement would have some balance through European subcontracting in the U.S. for parts of its RAM, or through other offset arrangements.

The fact must be faced that the European technicians have been strongly motivated toward tug; it is the biggest and most challenging post-Apollo project available to them, and has the greatest technology stimulation and spin-off to other high technology capabilities. Moreover, nothing the U.S. has said to the Europeans in almost two years would indicate anything other than our desire for them to undertake the tug. And at our encouragement they have spent $1 to $2M studying their capability for its development. Changing signals is therefore going to be difficult without irritating them (justifiably). Because it postpones the problem, there have been suggestions that we wait for Europe to come to its own understanding or demonstration of its inability to build an acceptable tug. The Europeans' anger and frustration would increase, though, in proportion to the amount of time and money they waste on a project we reject. It may be that the best course is to take the flak now and admit our concern over their abilities and over the technology/dollar outflow we envision, and withdraw the tug from consideration. In order to ease the foreign relations impact and some of the pressure their industry is applying to their governments to undertake development tasks that are unacceptable to us (tug or European-contributed shuttle work), we might allow them some normal subcontractor participation in the shuttle as qualified bidders.

The timing of these tactics is a major difficulty. We would have to get these messages across and obtain European agreement by July if European subcontractors are to be used on the shuttle; our prime contractor cannot wait past that period. If Europe only undertakes a RAM-sortie can, timing is no longer critical to us, but the Europeans themselves say they must decide by mid-summer because of the coupling with their decision on whether or not to go ahead with Europa III.

The State Department is now reviewing the post-Apollo policy, and the receipt of directions to propose a modified program to the Europeans would be most timely. Some resistance within our government to an alteration in direction can be anticipated, if for no other reason than the psychological momentum of the people that have been involved in obtaining European participation. Considering the many factors involved, no more time should lapse before a decision is made and guidance given.

One final comment - I think this paper may underestimate the value of an immediate initiative re manned flight for the Europeans. If the US proceeds as you recommend, we should not carry tactical tool in our bag and manned flight is one I believe. Also think one trauma is better than two so think this whole proposal should be tabled in near term since issues and viewpoints are precisely the same in Aerosat and post-Apollo.

Hell of a good paper. GM.

OFFICE OF TELECOMMUNICATIONS POLICY

Log In No. _____

3/2/72

INFORMATION MEMORANDUM

To: Tom

From: Jack Thomell

Brief Summary of the Material:

NASC Proposing activities relating to reduction of launch risk for communcial satellite operations.

Why it is worthwhile to read:

OTP is intenested and will be involved.

Form OTP 11
January 1972

March 1, 1972

Colonel Jack Morris
National Aeronautics and Space Council
Executive Office of the President
Washington, D.C. 20502

Dear Jack,

Thanks much for the info copy of the letter from Miller to Mathews. I discussed the general issues contained in the letter with Tom Whitehead and he agrees that OTP has a significant interest. This interest existing primarily because reduction of launch risk could significantly affect the future of communication satellite activities both nationally and internationally.

I haven't done significant study into the issues but consider it appropriate that OTP be briefed on the NASC plans at your convenience. Because of other activities in our Office, mid-March would be an appropriate time for us.

Sincerely,

Jack M. Thornell

cc: Tom Whitehead
George Mansur
Brom Smith

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

DEPUTY DIRECTOR

February 3, 1972

TO: Tom

FROM: George GM

Things are moving very rapidly concerning European cooperation with the space shuttle and for broader post-Apollo cooperation.

The Walsh activity which has been focused on the space shuttle is about to give birth to guidance to NASA which would restrict European participation to completely separable subsystems of the space shuttle. Specifically, the guidance will direct NASA to minimize European participation in subsystems which are an integral part of the shuttle and will encourage the Europeans to build such things as sortie cans or RAMS.

Walsh plans to obtain Kissinger's stamp of approval on behalf of the President.

In addition to the above activity, I have discussed with Walsh and Anders the need for a well conceived and planned post-Apollo program which will meet the President's desires for space cooperation and yet will be consistent with other U. S. Administration objectives. If we renegotiate Aerosat and alter our course of action on space shuttle, I believe it is necessary for the U. S. to fill the resulting void.

Anders has been quietly working behind the scenes with Fletcher, Low, and other acquaintances in NASA to define a new program. A NASA delegation headed by Arnold Frutkin plans to leave this week end for further "technical" discussions with the Europeans, and I believe that this meeting is crucial -- Frutkin is ill equipped to handle it properly. Anders has discussed both his plan and the Frutkin problem with George Low, suggesting that Low should head the delegation. Both Low and Fletcher are tied up with Congressional budget hearings and will not be able to do so. Low has tentatively requested that Anders head the delegation. Low has changed his mind.

Assuming that a decision is made to renegotiate Aerosat now, I believe giving the Europeans a peek at a new post-Apollo program would be very beneficial. I think we should endorse both the Anders program and Anders heading the delegation. Anders believes it would be helpful if we express our views to Low tomorrow. no longer proposed.

His program consists of three basic elements:

a. European participation in manned space flight in 1975-76.

b. European built sortie cans.

c. Continuation and expansion of our scientific activity.

Bill believes that this program would consume all the funds that the Europeans would be willing to provide. Bill is a good salesman and if his pitch is refined it is good enough to sell the Europeans.

Since action not now required, this memo is for info only.

The Washington Post

AN INDEPENDENT NEWSPAPER · FRIDAY, JANUARY 14, 1972 PAGE A22

GW

The Space Shuttle

With the President's announcement that he will support NASA's request for funds to develop a space shuttle, you can bet on a confrontation in Congress this year not unlike last year's battle over the supersonic transport. Senator Mondale, for example, has already called the President's decision "another example of perverse priorities and colossal waste in government spending." To be sure, Senator Mondale has tried unsuccessfully in the past to eliminate planning funds for the space shuttle from the budget, but the attempt to kill the program, in the House as well as in the Senate, will be far more vigorous this year because this is the point at which a real choice can be made.

The choice involves, in large measure, the kind of space program the United States will have in the future. A decision to build the space shuttle would mean this country's proceeding to develop both manned and unmanned space equipment as recommended a couple of years ago by the President's Science Advisory Committee. A decision not to build the shuttle at all or to postpone a start on it for several years would almost certainly mean that the country would go out of the *manned* space business before the end of this decade. Thus, many of the arguments heard in the next few months will sound like reruns of the SST debate. However, the issues are quite different.

The space shuttle is a vehicle designed to deliver a cargo of men and equipment into earth orbit and then be flown back to earth for use again. It would be employed to supply floating laboratories, when and if they are developed. It could also be used to service, repair, set in place and retrieve satellites like those now in orbit for communications and other purposes. In addition, it might have military uses about which NASA does not speak, since the shuttle is a joint military-civilian project. Finally, its development would provide some of the technology required for manned exploration of other parts of the solar system.

The justification set forth for starting to build the space shuttle now combines technical and economic factors. A perfected shuttle would reduce the costs of each space launching since the same craft could be used over and over; eventually, the booster rocket would also be flown back to earth and reused, further cutting costs. At the same time, one shuttle could place several satellites in position, thus reducing the number of launchings. (The United States has sent up around 700 satellites in the last 10 years and the Air Force puts up a new one every couple of weeks.) According to the spacemen, this aspect of the shuttle alone would make its development worthwhile. It would increase costs in the next few years but cut them sharply in the 1980s and '90s. The opponents of the shuttle, on the other hand, dispute NASA's economic analysis, claiming NASA has underestimated shuttle costs and overestimated long-run savings.

The second basic justification for starting the program now rests in the role of man in space. The spacemen see this as a great future field, with men in laboratories conducting all kinds of scientific work and, eventually, going in spaceships to explore other parts of the solar system. They claim that without the space shuttle, the American manned flight capability will have to be given up about the middle of this decade because of the high costs of the Apollo missions and that once given up, this capability will be hard to retrieve at a later date. For their part, the opponents think man does not now have, and may never have, a legitimate role in space; rather, they believe that machines can be designed to do whatever jobs need doing at a cost far less than that involved in maintaining a manned space capability. The President's committee said two years ago that no one knew enough to predict accurately what man's role in space ought to be and until more is known the decision should be left open.

After these two principal arguments come others, which you will be hearing this spring. On the one hand, it will be argued that the nation's industry needs the technological spur of this space program to maintain its place in the world, that the country needs the jobs the program would create, and that the Russians will take over space if the United States stops now. On the other, it will be said that this program is only a gimmick to save the aerospace industry and that there is little or nothing of practical value to be learned from space research.

None of these arguments on either side is error-free since the major ones rest on projections into the future which are exceedingly difficult to make and others rest on basically undemonstrable assumptions about the quest for knowledge. Part of the difficulty springs from the fact that no one can know what space-based research will discover. Is the key to the hydrogen atom and thus to unlimited energy out there, as some scientists think? Will the world some day need to import minerals from space to sustain life here? Will man have to be in space to accomplish things such as these or can machines do them all? Above all, where does this kind of program fit in a national budget that cannot provide for doing all the things at home that ought to be done?

It is owing to questions like these that this year's debate over the space shuttle will be quite different in character and significance from last year's debate over the SST, although they will bear some superficial resemblances. The standards applied to a project which involves scientific research and military considerations, as does the space shuttle, must be somewhat different from those applied to a project, such as the SST, which involved only another way to move people from place to place.

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

DEPUTY DIRECTOR

December 17, 1971

To: Tom Whitehead

From: George Mansur

Apparently you won't be in tomorrow and your commitments to respond to the space shuttle inquiries are not known to me. Shall I follow up? The arguments on space shuttle are long, but I think the result is that the options on bay size are very limited.

Specifically, if one adopts the reusable tug principle for transfer from earth orbit to synchronous orbit and return without staging and without payload, a tug weight of 40,000 pounds is required with dimensions approximately 13 by 35. To place 3,000 pounds in synchronous orbit and retreive 3,000 pounds from synchronous orbit will require a tug weight of about 52,000 pounds with dimensions of roughly 14 x 50.

The only other option is to discard the reusable tug and the ability to retreive space craft from synchronous orbit by using a throw away transfer booster such as Centaur. (Centaur today is $8 million per fueled vehicle.)

NASA claims that the difference in development costs between a 10 x 30 or 14 x 50 shuttle is only about $600 million because the difference between the two is structural and both require the same control subsystem. IDA, on the other hand, on the basis of parametric studies claims that the cost differential is substantially larger.

One final fact which I shall check out in the morning is the DOD has a high usage mission requiring a 60 foot payload.

The choice is difficult, but considering the lower cost per pound in orbit, my view is that the trend should be toward the larger bay size even thoug the $600 million additional development costs may be on the low side. (I guess $1 billion.)

P.S. In discussions with the Department of Defense this morning, DOD concludes that the existing economic analyses of the space shuttle are suspect. There are two views in the DOD:

1. Packard and Foster both have a gut feel that the space shuttle is good and that the larger shuttle is desirable. This feeling persists not on economic grounds, but on the belief that given a suitable vehicle many more uses will evolve.

2. Benington of DDR&E personally believes that the smaller shuttle without tug is more sound economically even though it will handle only about 30 percent of the DOD missions and the remainder would have to be handled by expendable boosters such as Titan. All believe that the opposition (foreign) is spending significantly more on research and development, and the U.S. must support a high technology program in that area.

Benington also notes that the DOD has not been asked for their formal opinion on space shuttle and is curious as to why.

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

December 2, 1971

DIRECTOR

MEMORANDUM FOR MR. FLANIGAN

As you know, I get involved occasionally with Jim Fletcher, Don Rice, Bill Anders, and Ed David on the future NASA program. The following brief comments are offered for whatever use you may want to make of them.

We succeeded when we first came into office in averting NASA's high flying plans for space stations and Mars trips, and in bringing the budget down to a more realistic level consistent with the President's wishes. It was, however, our intention not to continue to erode NASA's budget indefinitely, but to induce them to come up with a sound, forward-looking evolutionary space program for the coming decade that would not lock the President into excessively large budgets now or in the future.

Over the last few months, OMB and NASA have been bickering, principally about the space shuttle. I held a series of meetings bringing the various Executive Office groups together and met with Jim Fletcher, I hope to some constructive effect. Most recently, Jim has done what I believe to be an outstanding job of devising a space shuttle concept that is consistent with reasonable budget levels and sensible technology, and still builds for the future. Without burdening you with all of the ins and outs of how we got from there to here, the debate is now focused around two shuttles both using the same system design concept, but one capable of carrying 60,000 pounds payload, the other 35,000 pounds. The larger shuttle is somewhat more expensive to develop, but has lower operating costs. I tend to believe the larger shuttle is the more prudent course, but the differences are so small that the choice should reasonably be left to NASA's discretion. However, I suspect OMB will try to push fairly hard for the smaller version. NASA might buy this as a last choice, but the impact on their morale and that of the aerospace industry would be unnecessarily negative -- especially since Jim has been so responsive to our concerns. (Attached is a sheet I asked Bill Anders to prepare which tells more than you ever wanted to know about the shuttle configurations; the two marked with asterisks are the ones I have referred to.)

Aside from the shuttle, the only significant issues remaining are the hiatus of manned space flights between now and 1976 when the shuttle would first be tested. I believe Jim Fletcher's idea for three to four manned missions for that interim period between Skylab and Shuttle are well reasoned and well worth the money involved. I also think that a decision on Apollos 16 and 17 should be made with more careful Presidential deliberation than OMB is likely to initiate. To the best of my knowledge, Henry Kissinger has not been significantly involved in the debate on these issues, and I believe he should be.

Finally, I am disturbed that nobody is developing for Henry or the President really sensible initiatives for international cooperation in space. This is to a large extent behind Henry's interest in the ridiculous proposals thrown up by the bureaucrats, such as space shuttle cooperation and aerosat. You might consider, with some blessing from Henry, turning Fletcher loose on the subject together with OMB and OST to get something moving in this area. Otherwise, I don't see it happening, and I think that would be unfortunate.

I am attaching a list of six items that looks fairly sensible for international cooperation and also have some public appeal; summary in the works. Others are just bouncing around.

Tom

Clay T. Whitehead

Attachments

- New initiative for a wide range of scientific satellite experimentation.
- Expanded cooperation in the Earth Resources Satellite program.
- Establishment of International Space Science Centers.
- An Apollo/Soyuz docking in space in 1975.
- Invitations to foreign astronauts to participate in the next generation of manned flights.
- Broader launch commitments for other nations.

December 2, 1971

To: Jon

From: Tom

FYI. The chart attached to Pete's copy of the memo lays out the issues discussed at the top of page 4 of Bill Anders' memo, as we discussed.

Attachments

Memo to Peter Flanigan dtd 12/2 re NASA programs - Attachments

December 2, 1971

MEMORANDUM FOR MR. FLANIGAN

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Clay T. Whitehead

Attachments

CTWhitehead:lmc
cc:
DO Records
DO Chron
Mr. Whitehead (2)
Dr. Mansur

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- Invitations to foreign astronauts to participate in the next generation of manned flights.
- Broader launch commitments for other nations.

Configuration	Payload	Development Cost (RDT&E)	Recurring Operational Cost (Based on 40 flights per year)	Other Characteristics	Remarks
Fully Reusable (Fat Albert)	15'x60' bay 65,000 lbs.	$10B	$4.5M	Fully reusable, hypersonic manned flyback of both booster and orbiter, reusable thermal protection, high pressure H_2-O_2 engines in both booster and orbiter, advanced avionics.	Most likely candidate to replace current booster stable. Large technology step. Probably largest cost uncertainty.
Baseline	15'x60' bay 65,000 lbs.	8.5	5	Differs from fully reusable system in that orbiter H_2 tank discarded and supersonic booster flyback.	Acceptable increase in recurring cost to still effect replacement. Slower booster return simplifies considerably thermal protection problem.
Mk I/Mk II-1	15'x60' bay 65,000 lbs. in ultimate Mk II, but less in initial Mk I	6.1	6.5	Mk I-Upgraded Apollo engines in flyback booster and orbiter, discarded H_2-O_2 orbiter tanks, available avionics, replaceable ablator. Mk II-Changes from Mk I:High pressure H_2-O_2 orbiter engine, advanced avionics, reusable thermal protection.	May have very minimum payload capacity and constitute only a demonstration project. Recurring costs higher because booster engines not suitable for 100-flight use and expended orbiter tanks cost $1-3M.
Mk I/Mk II-2	15'x60' bay 65,000 lbs.	5.1-5.7*	11.4-7.3*	High pressure H_2-O_2 orbiter engine, replaceable ablator, available avionics, unmanned booster either liquid pressure-fed or solids with possible recovery of the pressure-fed engines. Likely sub-configuration:booster unguided.	Lowest cost option that accommodates all projected payloads and has recurring cost competitive with or better than current boosters.
Reduced-size Mk I/Mk II-2	12'x40' bay 30,000 lbs.	4.7-5.1*	7.5-6.7*	Same as Mk I/Mk II-2 except smaller vehicle and engines.	Would accommodate about half of projected payloads, although variations in bay size would improve this situation. 14x42 ft. would capture 80% of the payloads at little cost increase.
T III L 6/ T III L/Glider	12'x40' bay 30,000 lbs.	3.6	20-35**	Unmanned and expendable booster and second stage. Booster growth (4x) of Titan family.	Too high recurring cost to replace any current boosters.
Booster/second stage/small glider-IDA (Weird Harold)	10'x20' bay 10,000 lbs.	2.5-3	16	Booster and second stage not specified; booster presumed to be recoverable and reusable. Development and recurring costs do not include increment for configuring for unmanned usage. Cost estimated by IDA.	Too high recurring cost to replace any current boosters. Too small a payload bay to be used by DOD. Simply demonstration project.

* First cost is for solid rocket booster, second cost is for pressure-fed liquid booster. The safety and reliability aspects of using solid rockets for manned flights is yet to be assessed.

** The second cost is for 5 launches per year which is more realistic for the usage of this configuration.

NATIONAL AERONAUTICS AND SPACE COUNCIL
EXECUTIVE OFFICE OF THE PRESIDENT, WASHINGTON 20502

November 23, 1971

Tom,

Just after we chatted over the phone I came across a rather recent NASA description of the various kinds of "shuttles": all-up configurations to small research glider. One configuration, the so called Mk I/II-Parallel-staged Pressure-fed Booster, is the one I have come to believe might represent a reasonable compromise.

Though NASA has been using Mk I/II to designate phased subsystems for some time, the parallel-staged/small orbiter is a relatively new twist. The fact that Jim Fletcher is shifting toward this scope of system is a very positive sign. Perhaps we have been able to impress him that NASA had to take a more responsive look at intermediate options.

The other stuff I mentioned is attached.

Bill

November 23, 1971

THE SPACE SHUTTLE

WARNING: There are three space shuttle concepts being discussed, and confusion can occur. There is a "fully reusable" or "all-up" shuttle that NASA and the Air Force have pushed until recently. This system or its near derivatives would have the highest development cost but lowest recurring operating cost. A cheaper second configuration is a more evolutionary development which retains many of the characteristics that would make it operationally useful. It is this configuration that NASA, under Jim Fletcher's leadership, has recently developed. This system could be either a viable alternative to the fully reusable system or a reasonable step in its evolution. A third and cheapest configuration is being favored by OMB and will possibly be supported by some members of PSAC. It is a smaller glider spacecraft that would be too small to have much if any operational usefulness, and would be more in the nature of a demonstration project.

The shuttle concept has fairly broad support, and the issue at hand seems mainly to center on the choice of configuration.

What Is It and Why Do We Want It?

A space shuttle is a concept and not a specific piece of hardware. The idea is to make access to outer space relatively inexpensive and rather routine, as compared to the current situation where each flight is a noteworthy, expensive, high adventure. A shuttle is intended to be a move toward simplicity. The system would be partially or fully reusable rather than expended on each flight, which would bring recurring cost down and allow us ultimately to eliminate virtually all of the various expendable boosters in our current stable. A shuttle would provide a safe, "soft" ride so that technicians with a month or two training could accompany their experiments and instruments

into space, rather than requiring highly selected people trained for years as is now the case. Much of the cost and slowness of deriving benefits from our space program are due to the elaborate and lengthy preparation which go into the development of untended or remotely controlled satellites. The ability to test and change equipment and techniques in orbit, called the "sortie" mode of operation, will considerably accelerate our utilization of space for practical benefits.

An indirect benefit of a shuttle will be the focus and push it gives to U.S. technology and the challenge it presents to our aerospace specialists. Our experience during the 1960's shows that broad, across-the-board technological advance can be paced and driven by the space program.

Why Do We Need It?

There is one fundamental reason for a shuttle: it is believed that this new capability will be needed in order to provide significant improvements in our next generation of space activities; activities which involve utilization of space for practical benefits (e.g., weather forecasting, communications systems, airline and ship navigation, earth resources monitoring and management, direct global broadcasting), for projects relating to national prestige, for exploitation of space for scientific opportunities, and for several military space programs.

In addition to supporting foreseen space activities, it is very likely that a shuttle will be demand generating for profitable applications and also will meet presently unforeseen needs. These are speculative considerations, however, and although they could quite conceivably be the most important ten years from now, they are secondary to the justification of a decision today.

What Would Happen If We Didn't Have One?

The consequences of not having a space shuttle are difficult to assess because we can, in principle, do everything proposed with our present boosters. But these endeavors would often be so difficult and expensive that we would not undertake them. Without some kind of shuttle, it is doubtful that a manned space flight program could be reasonably pursued.

The USSR gives every indication of working toward a large, permanently manned space station in earth orbit. Our shuttle would be a counterpoise to such an eventuality. If the U.S. decides, after a USSR space station is launched, that our prestige is still at stake and we cannot turn space over to the Russians, an evenly paced shuttle development will undoubtedly be cheaper than playing catch-up again.

The Decision to Proceed

Inasmuch as the rationalization for a shuttle rests on a continuing U.S. space program, basic to the decision on whether or not to go ahead with a shuttle is the question of our commitment to a continuing space program. Measured in dollars, it would seem that if NASA were not to be supported at or above $3 billion/year, it would not be sensible to go ahead with a shuttle.

NASA has made a detailed cost/benefit analysis of a shuttle, and the results indicate that the development investment could be paid off over a decade through lower launch costs and through the recovery and reuse of satellites that are now one-shot affairs. This favorable economic finding included a very healthy discount rate of 10%, which OMB required. The uncertainties in any analysis of this kind are: is the estimate of development cost to be believed, will the number and type of space missions forecast actually materialize, will the recurring cost ever be low enough to cause us to shut down the production of virtually all other boosters, will satellite recovery and reuse actually be significant or will the desire to update the payloads lead to new satellites being built anyway, and will the launches become cheap enough and frequent enough to make the "sortie" mode practical? The answers to these questions are sufficiently uncertain that the decision to proceed or not will have to be made in ignorance of them. Rather, the commitment would have to be made to a concept or to opening a new option. With this viewpoint, committing now to the fully reusable system would seem undesirable. If the decision is made to proceed, evolutionary steps would be appropriate, thereby allowing evaluation at several points in the program. It must be recognized, however, that such an approach will probably cost more in the long run, and will delay the time at which the full benefits of a shuttle might be realized if the findings of the present studies are fully borne out.

Various shuttle configurations have been studied and restudied to such a point that the aerospace industry believes, and we tend to concur, that we are in the area of diminishing returns as far as understanding the system any better. NASA and the aerospace industry believe that the time for a decision has come.

What Does It Look Like?

There are several configurations of shuttle-type spacecraft presently under study. They differ in the trade-off between direct versus evolutionary development. Rather than burdening this brief paper with a description of all of these, we will describe a configuration which, in our estimation, may represent a good compromise in the direction of evolutionary development. This shuttle consists of: (1) a winged spacecraft which glides back from orbit and is landed at an airfield by its crew; (2) attached rocket engines with drop tanks to thrust the spacecraft into orbit; and (3) a payload compartment that can take satellites to orbit or bring them back for repair and reuse, or can be used as an experimentation bay itself. Large but simple "JATO"-type rockets would assist the shuttle in the beginning of the flight, and these are recovered and reused. An important difference between this configuration and the smaller glider mentioned earlier is that the rocket engines are returned as part of the spacecraft, saving perhaps as much as $15 million per flight.

What Does It Cost?

The development cost of the shuttle described above would be about $5 billion, spread over six years. The recurring operational cost is estimated to be about $10 million per launch, although this would depend on how much of the operating and institutional base were charged to the shuttle operation. Two other candidate configurations are the full reusable system with development costs of about $10 billion, and the simplest possible step in the direction of the shuttle concept, a smaller glider spacecraft costing $3 billion plus. This latter configuration has not been as fully examined as the other configurations, and its costs are considerably less certain and probably optimistic.

Who Is For It and Who Is Against It

There is general support for the concepts underlying a shuttle; the main issue is size and configuration. NASA initially proposed the most operationally oriented system, that is, the one which would ultimately be the most useful. This system is also the largest and most expensive and the greatest technology leap. Lately, under Jim Fletcher's leadership, NASA has moved to more evolutionary configurations with smaller funding and technology steps, but which keeps open the option for easy future development of the fully operational shuttle concept.

The aerospace industry is much in favor of a shuttle, and in fact it has committed $100-200 million of its own money to study and test the various alternatives. This investment and the continuing commitment is another reason that a decision should not be postponed.

The Air Force has supported the program and says that if the projected operational capabilities are realized, it will be a valuable capability for them. The Air Force has not, however, put up any money because of internal commitments to its higher priority programs.

OMB has taken a preliminary internal position that the shuttle should go through the cheaper and smaller step of a small glider, at a development cost of some $3 billion. There is no well-defined shuttle configuration connected with this cost figure, but any shuttle based only on a small glider precludes direct or easy evolution to a future operationally useful system. Also, a smaller shuttle would not appear to be useful for DOD operations, which are about one-half of the projected U.S. missions.

Congressional support for a shuttle appeared ample in the FY 1972 appropriation vote. The appropriation was for $100 million to continue studies and to start engine construction. Senator Mondale tried specifically to strike these funds in the authorization cycle, but failed. It is possible, however, that resistance could increase as the annual funding request for a shuttle increases.

The scientific community is somewhere between neutral and hostile to a shuttle, but this is not surprising in light of their criticism of the Apollo program. It has only been since the values of lunar exploration and the return of lunar material have become apparent that general scientific support has developed for that program.

Employment Impact

For the middle-level shuttle configuration discussed in this paper, employment in the aerospace industry would rise 50,000 to 60,000 by 1977. The rate of job build up is illustrated in the attached table. The employment impact of the glider configuration has not been projected, but it might roughly be one-half or two-thirds of the 50,000 to 60,000 figure above.

November 19, 1971

Employment for Mk I/Mk II Shuttle (Total)

	6/71	12/71	6/72	12/72	6/73	12/73
Option 1						
First orbital flight in 1978. FY1973 authorization $200M. Contract let 8/22.	2400	2300	2600	3400	5600	14,300
Option 2						
First orbital flight in 1977. FY1973 authorization $400M. Contract let 4/72.	2400	2300	4400	8800	19,200	24,000

Employment for Mk I/Mk II Shuttle (By Region)

Option 1						
East	200	200	100-200*	200-400	400-1000	1300-3000
Plains	200	200	100-300	100-400	100-700	200-3200
South	200	200	400-600	700-800	1000-2000	4400-6300
Far West	1800	1700	1700-1800	1600-2100	1900-2900	3200-6200
Option 2						
East	200	200	250-350	600-1000	2000-2700	2600-3800
Plains	200	200	150-200	300-600	400-1600	500-2300
South	200	200	600-800	1600-2400	4700-6400	6200-9000
Far West	1800	1700	3100-3400	4800-6300	8500-12,000	9500-14,700

*Range of employment represents the high and low extremes that would occur for various outcomes of contractor selection.

BUDGET STORY

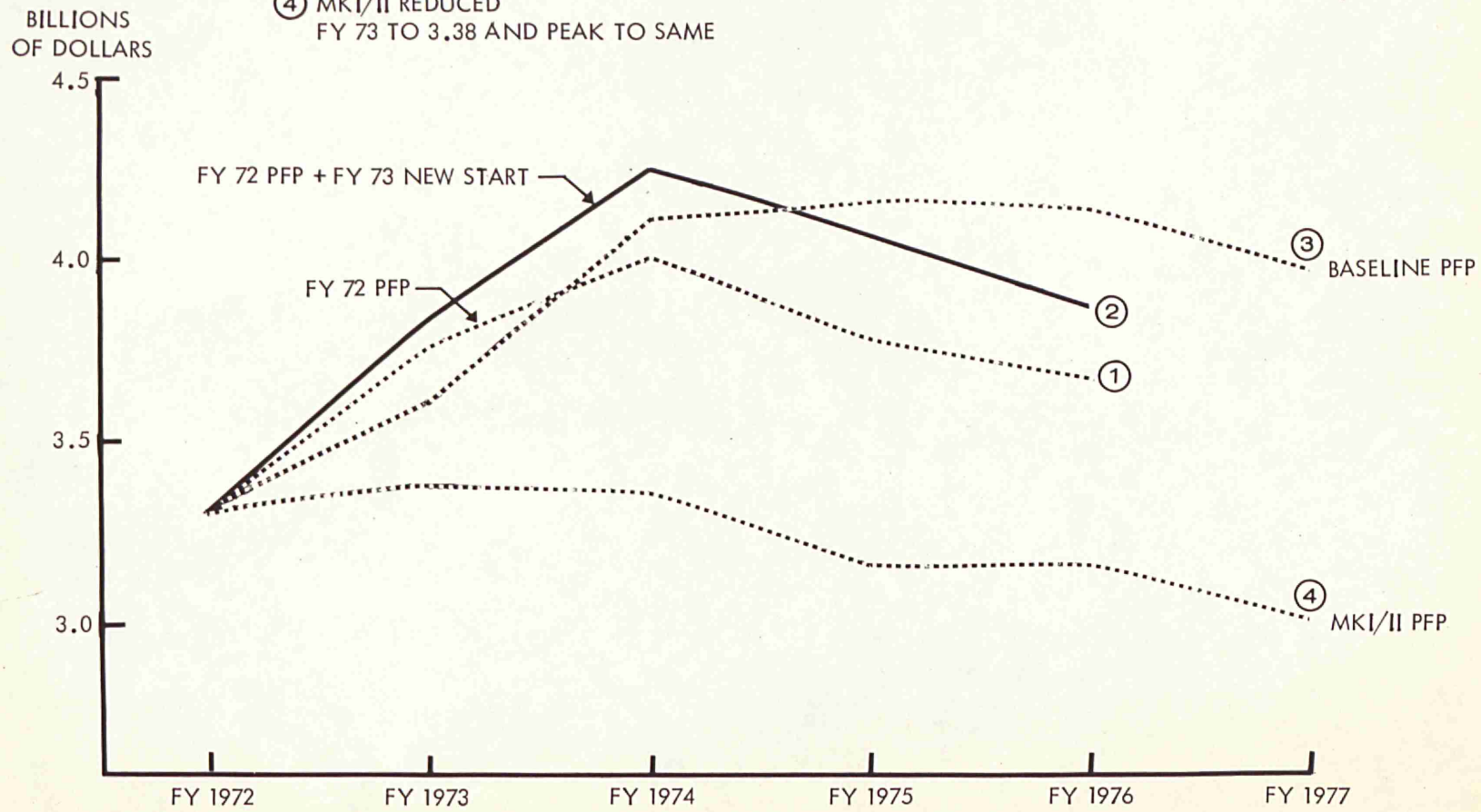
TO DESCRIBE WHAT WE DID IN OUR FY 73 BUDGET SUBMISSION:

① FY 72 PFP ALREADY PEAKED AT 4.0B (IN FY 74)

② WITH FY 73 NEW STARTS (AND OVERRUNS) NEW PFP PEAKED AT 4.25B

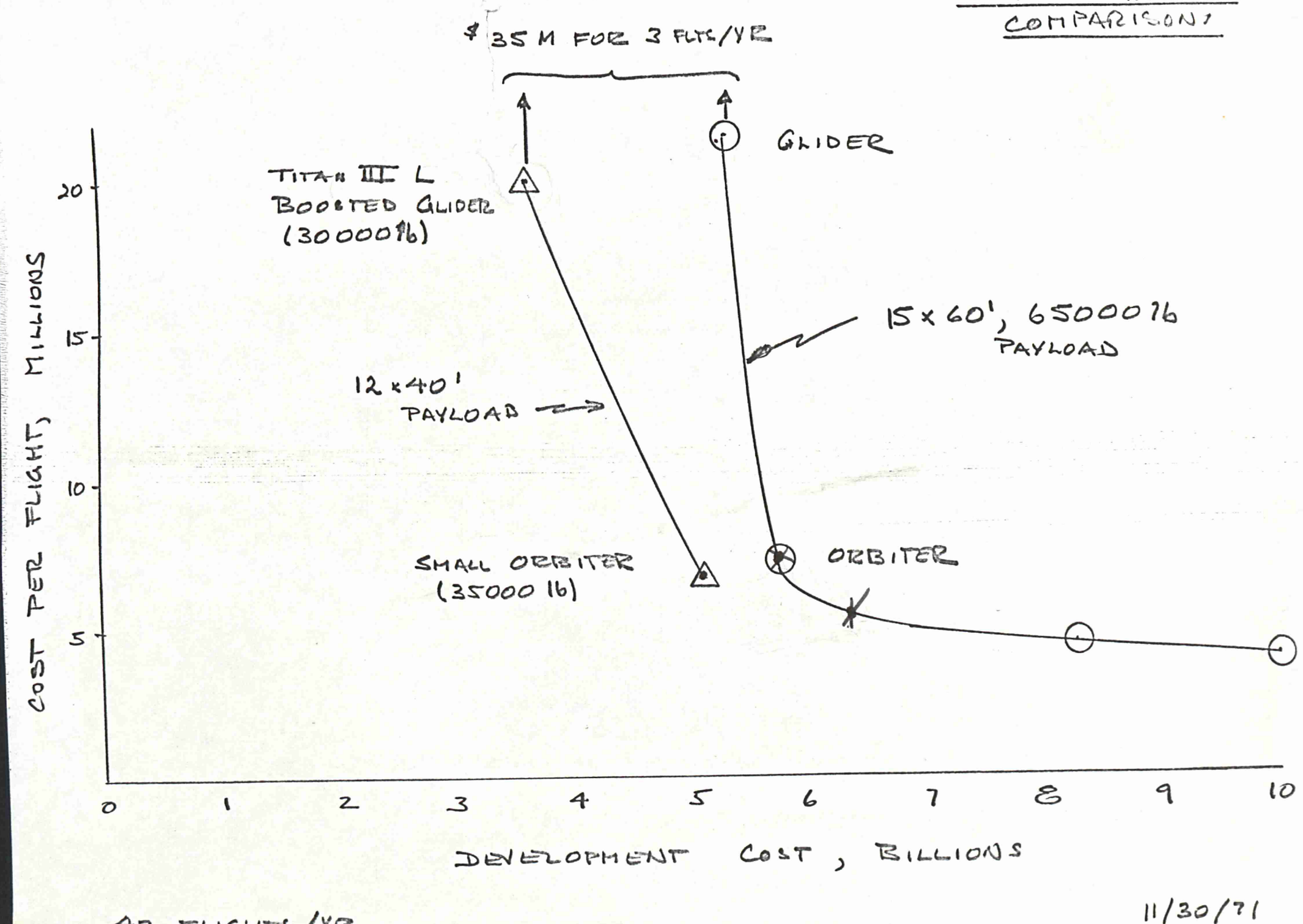
③ BY UNLOADING FRONT END AND MOVING COSTS TO 1976, FY 73 COST DROPPED FROM 3.85 TO 3.75 PEAK NOW DOWN TO 4.15

④ MKI/II REDUCED
FY 73 TO 3.38 AND PEAK TO SAME



FY 72 PFP	3.300	3.771	4.015	3.746	3.682	
MKI/II PFP	3.315	3.385	3.364	3.162	3.158	3.013

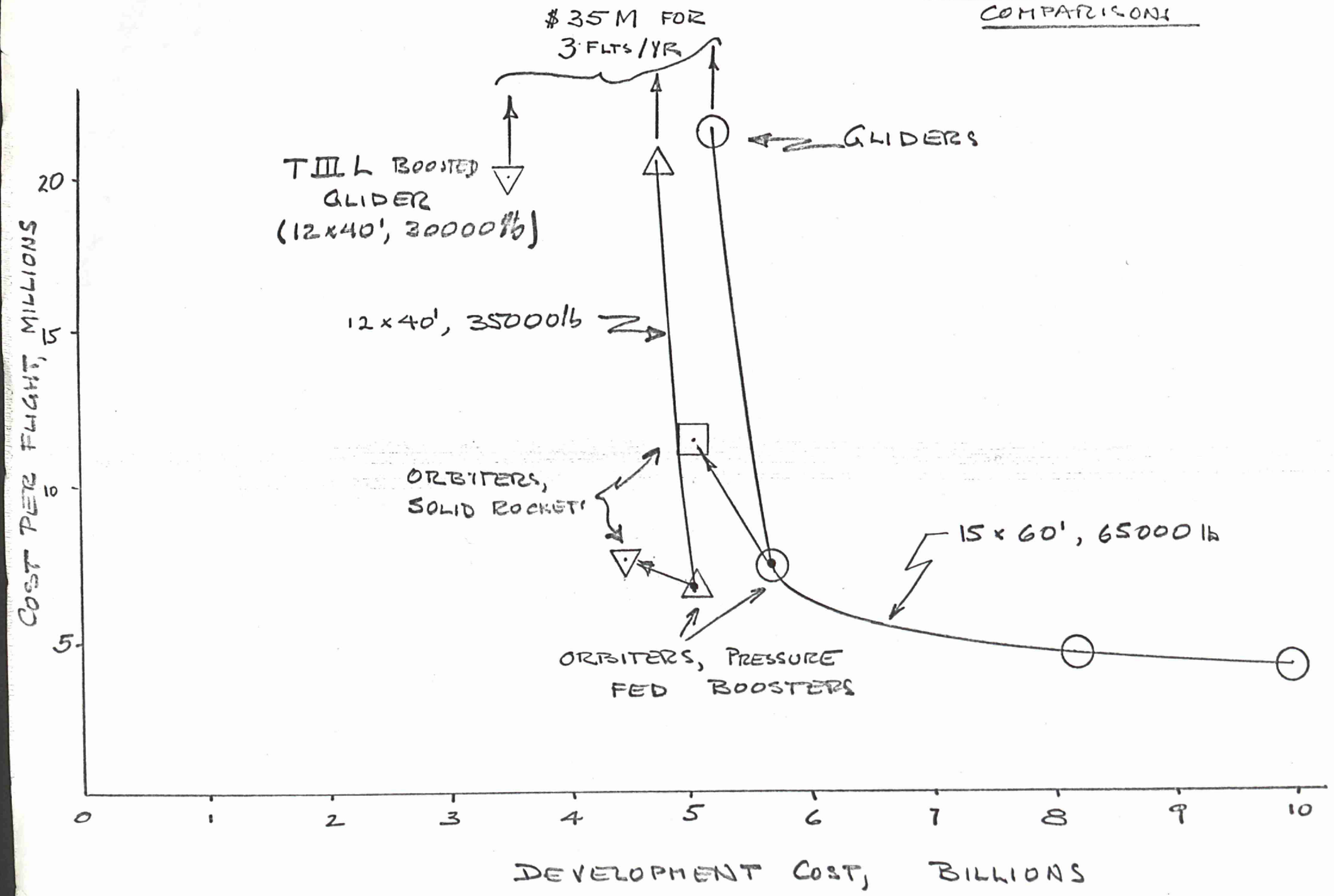
SPACE SHUTTLE COMPARISONS



42 FLIGHTS/YR

11/30/71

SPACE SHUTTLE COMPARISONS



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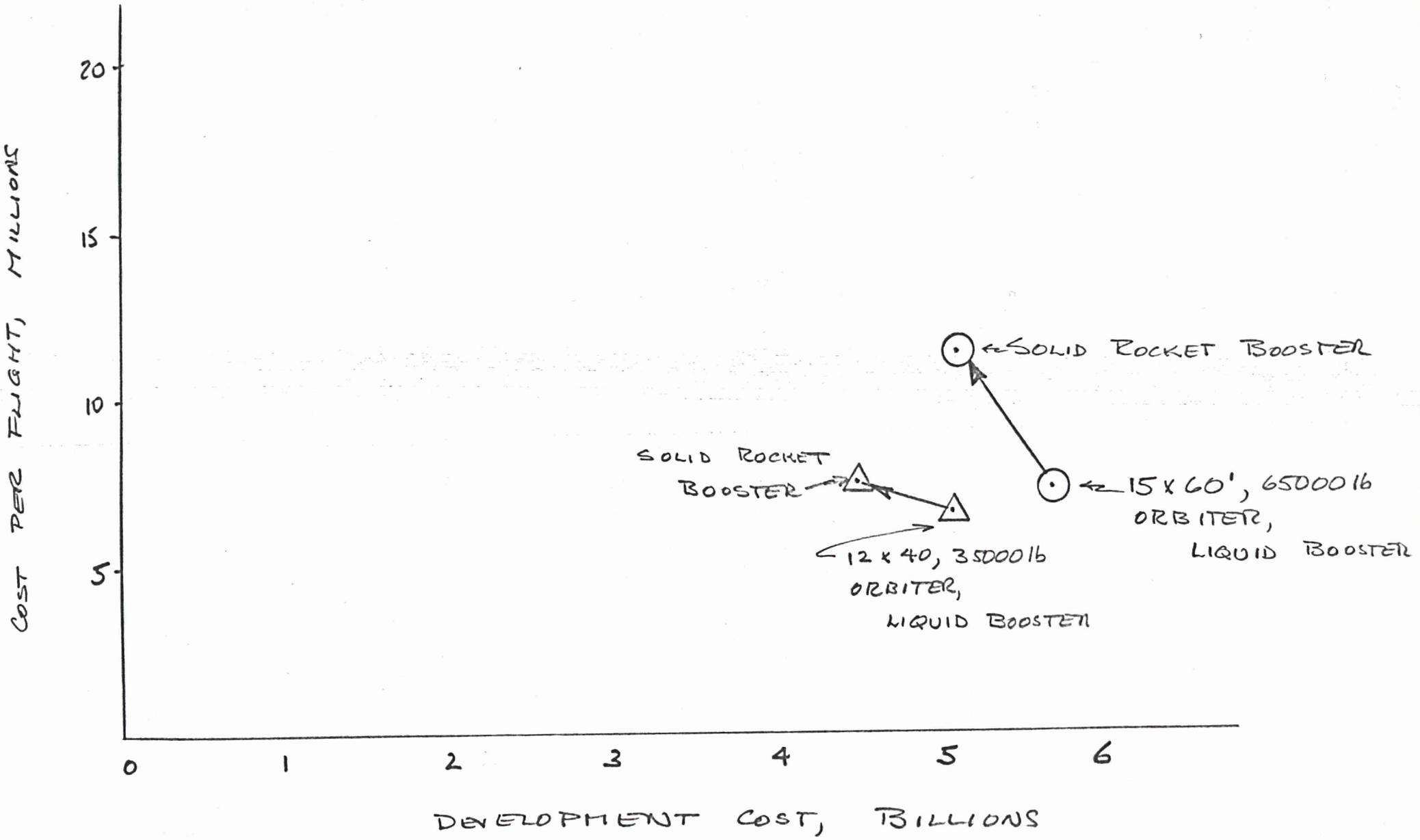


42 FLIGHTS / YR

11-30-71

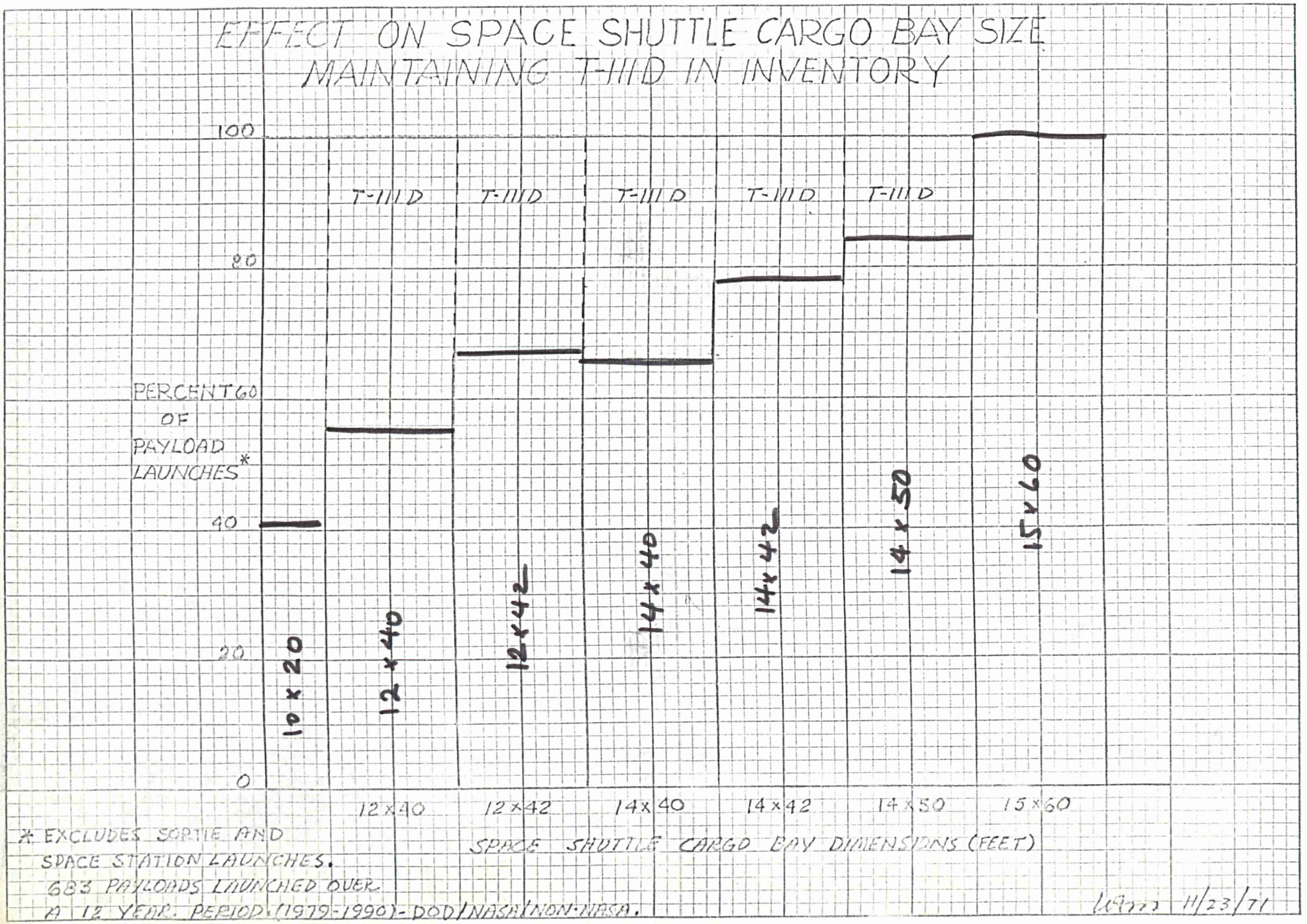
SPACE SHUTTLE COST DATA

	15 x 60' – 65,000 #			12 x 40'				
				35,000 #				30,000 #
	ORB. P.F.B. *	ORB. SRM	GLIDER	ORB P.F.B *	ORB SRM	GLIDER PFB	GLIDER SRM	GLIDER* TIII
ORBITER/GLIDER	4.4	4.3	3.5	3.9	3.8	3.1	3.0	3.1
BOOSTER	.8	.3	.8	.7	.2	.7	.2	.4
2ND STAGE	–	–	.5	–	–	.5	.5	.1
HI P_c ENGINE	.5	.5	.5	.5	.5	.5	.5	–
TOTAL	5.7	5.1	5.3	5.1	4.5	4.8	4.2	3.6
COST/FLT (42/yr)	7.3	11.4	21.4	6.7	7.5	20.5	20.0	20.0
COST/FLT (3/yr)			35			35	35	35
	$M1/mile^2$ approach #5.1 B #12.5 M	4.6 18.3			4.1 12.8		[redacted]	3.3 37.3

600/.6 1000 lbs 500 lbs. 10 900 12.5

11-29-71

EFFECT ON SPACE SHUTTLE CARGO BAY SIZE MAINTAINING T-IIID IN INVENTORY



* EXCLUDES SORTIE AND SPACE STATION LAUNCHES.
683 PAYLOADS LAUNCHED OVER A 12 YEAR PERIOD (1979-1990) - DOD/NASA/NON-NASA.

11/23/71

The RAND Corporation

RM, P No. RM-6244-PR

Copy No. Space

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Project No: 1490

Contract No:

Task Order No:

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to reduce funding limitation

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title IMPLICATIONS OF THE SPACE SHUTTLE AS AN ELEMENT IN THE NATIONAL SPACE PROGRAM

author(s) R. D. Shaver, D. J. Dreyfuss, and G. S. Levenson

date

*Please use this form as the temporary cover page for RM's and R's released to the Reports Department for publication. Final cover and title page will be prepared in the Reports Department from the information appearing on this sheet.

PRIVILEGED
INFORMATION

PREFACE

The President's Space Task Group (STG) has recommended that the Department of Defense and the National Aeronautics and Space Administration jointly develop a new, reusable, low-operating-cost space transportation system (STS). The STS concept promises both to revolutionize the transporting of men, materiel, and spacecraft into space and to reduce the cost per flight. However, important questions about the STS still must be resolved, particularly in view of the fact that a large number of flights will be required to amortize the R&D investment that would be required:

- Under what conditions is the STS economically justifiable?
- What should its size and operating characteristics be?
- When should it be built?
- What role should the Air Force play in managing and funding its development?
- How does the STS relate to the Air Force mission and to force structure?

This Memorandum concentrates on questions of economic justification of the STS. We believe that the economic issues discussed here will have important implications for future Air Force actions on the STS and/or on possible alternative booster programs, should STS development be long deferred.

The work reported here, however, is only the preliminary phase of a larger study that addresses the questions posed above. This Memorandum is thus intended as an interim report of progress to date. The results of the study will be reported in detail in a forthcoming Memorandum, after the investigation is completed.

A talk based on the text of this Memorandum will be presented at the AIAA Advanced Space Transportation Meeting in Cocoa Beach, Florida, on February 5, 1970.

SUMMARY

The space-shuttle program faces many problems. Past justifications of the system have emphasized a national space program that may be unreasonably expensive in the mid-1970s. Allowing slippage in either the shuttle or the 12-man orbiting space station planned for the late 1970s lessens the funding problems but brings into question the attractiveness of the shuttle.

The appropriate payload size for the shuttle is still subject to question. On the basis of cost savings alone, smaller-payload shuttles appear attractive. But other considerations--satellite cost savings, adaptability to uncertain future requirements, etc.--lead to larger shuttles being favored.

ACKNOWLEDGMENTS

The authors wish to thank D. Morris, P. Tamarkin, and T. M. Parker, of The Rand Corporation, for their aid in preparing this paper and their comments on an early draft.

CONTENTS

IMPLICATIONS OF THE SPACE SHUTTLE AS AN ELEMENT IN THE NATIONAL SPACE PROGRAM

INTRODUCTION

The Space Shuttle, as a relatively high cost project within any resource limited space budget, is in trouble.* Despite the expressions of support for expeditious shuttle development found in the President's Space Task Group (STG) report,[1] preceded by unequivocal support from the Department of Defense,[2] NASA,[3] and the President's own scientific advisory council (PSAC),[4] the near-term prospects for shuttle development do not appear bright. The long-range attractiveness of a low-cost reusable space shuttle development is broadly and enthusiastically acknowledged, together with the realization that only with the aid of such vehicles will the true potential of space be realized. However, the appropriateness and justification of immediate development is being challenged. Dissatisfaction with present shuttle development plans center on two issues, the technical risk associated with shuttle development and space funding priorities.[5] Congressional concerns are typified by Representative Karth[6] who questioned the depth and completeness of the analysis advocating near-term shuttle development. It can be anticipated that other, less friendly to space proposals, congressional critics will question both the shuttle's timeliness and worth.

Little would be gained by repeating all the adverse comments about shuttle development. Instead we shall review most of the basic factors

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*This paper will not deal with the important questions of which shuttle configuration and which design are the most attractive. We will use the descriptor "shuttle" to represent that class of launch vehicles which have fully reusable stages, rocket propulsion, vertical takeoff horizontal landing, and numerous other attractive features that make the shuttle operation more nearly conform to aircraft-like operations than to current launch vehicle checkout and launch procedures.

leading to the shuttle's recommendation, in an attempt to illuminate where trouble might lie. As the strongest case for the shuttle is made with regard to its economic attractiveness, the bulk of our remarks will deal with funding for space programs, with emphasis on the effects of shuttle development and operation.

Although the STG, DOD, NASA, PSAC, and a host of engineering and scientific organizations and societies (including the AIAA)[7] have each identified the shuttle as the key element in a balanced space program, at least five months have passed since these reports were made public and support for these proposals within the administration and Congress has not become evident. With the country facing serious economic problems in addition to widely recognized urban and environmental demands, it is only reasonable that both the administration and Congress be continually interested in reducing non-essential government spending. Space programs are particularly attractive, visible targets for cost reduction. Those space programs not having solid scientific worth or requiring large outlays of money are certain to face opposition. Still, there are also strong pressures for maintaining current U.S. manned spaceflight preeminence, and Congress would probably act favorably to an administrative proposal to support a civilian space program of modest size, possibly somewhat less than one-half of one percent of the GNP per year, on the grounds that it helps basic scientific research, maintains a viable national technology base, contributes to our national security, and builds national pride and prestige (see references 8, 9, and 10 for arguments supporting this position).

IS THE SHUTTLE ECONOMICALLY ATTRACTIVE?

Can the shuttle development costs be regained through operational savings in a reasonable period of time? To answer this question, the analyst must assume (1) space traffic rates (and hence national space plans), (2) particular shuttle designs (size, configuration, etc.), and (3) the availability of the requisite technology. We will put aside the question of the status of technology and its impact on shuttle attractiveness and its development philosophy (see reference 5 for a discussion of this topic). Furthermore, we will primarily restrict

our attention to a shuttle with a 50,000-lb payload capacity and a 10,000 cu ft cargo bay, although a 25,000-lb shuttle with the same size cargo bay will also be considered. To derive a traffic rate, we have selected the STG national space plan III,[1] the most conservative plan presented in the STG report, and the DOD plan B, a military space plan that emphasizes current, well-defined support missions. If a shuttle can be economically justified for these plans, then it will certainly be justified for the more ambitious plans found in both the STG and DOD reports.

By definition, the shuttle is economically attractive if the total savings in operational costs achieved over a specified duration exceed the costs of the shuttle's RDT&E and investment. Obviously, the total traffic is an important consideration in determining the shuttle's attractiveness; if it is high, the shuttle is most likely justified, if it is low, current (or new) expendible launch systems are likely to be preferred. To determine the traffic rates from the various space programs defined by the STG and DOD, care must be exercised to determine which payloads (and how many at one launch) can fit in the shuttle and what are realistically the number of launches required to support the various military, civilian unmanned and NASA manned programs (crew rotation requirements, logistics, fuel, etc).

Based on our tentative traffic estimates for NASA and DOD, an estimated shuttle RDT&E plus facilities cost of $9 billion, a 100 flight shuttle useful lifetime, and a two-week turn around, the shuttle recovers more money than it costs after 11 years of operation, or late in 1987.* The yearly savings in the late 1980s often exceed $1 billion per year. So long as these NASA and DOD traffic rates are acceptable, then the shuttle can be justified economically.** However, neither NASA or DOD has sufficient traffic to justify by 1990 separate shuttle development. For the shuttle to be attractive, it must be a national space transportation vehicle.

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*In most cases we shall compare the shuttle against current launch systems. When other launch systems are used as a comparison, we shall so note.

**For simplicity we shall ignore many important factors, including discount rates and inflation, in reaching such conclusions.

Were this analysis sufficient, acceptance of the shuttle development plans would be quickly forthcoming. However, there are several reasons for questioning the above space plan and in particular the relevance of the shuttle to it: (1) the average yearly expenditure required for this space plan is larger than the current space budget level, (2) the peak funding substantially exceeds current funding levels and may be unrealistically high, (3) this peak, occuring as early as 1975, is caused primarily by the development schedule of the shuttle itself.

As well as we can estimate at this time, the STG recommended space plan (non-military) cannot be implemented if the non-military (i.e., NASA) budget is limited to $4 billion or even to $5 billion per year (see Appendix A for a brief description of the major hardware items costed). Even ruling out all considerations of a manned flight to Mars or a follow-on manned lunar program, the joint funding of a shuttle development with that of an Earth-orbital space station would require a NASA budget in excess of $7 billion in 1975. Unless the mood of the country and Congress is expected to change substantially in favor of substantially increased space spending, this level of funding support for new systems seems unlikely.

Slippage of the shuttle IOC date past that of the space station would substantially help reduce any funding peak. However, it would also cause a serious perturbation in current space planning. Other hardware would have to be modified or developed to support manned flights to the planned space station. This new hardware would then tend to delay shuttle development even further by weakening the already insecure arguments concerning the shuttle's economic advantages. Not only would there be a desire to exploit the new hardware at least to the point of being able to amortize its development costs, but the existence of a new, cheaper (than current) launch system would increase the total traffic requirements for the shuttle to break even (hence, the breakeven point moves further into the already uncertain future). It is clear that past shuttle justifications depend explicitly on the acceptance of a large space funding peak in the mid-1970s. It may be that the shuttle's economic case has been based on a space plan that

cannot realistically be funded. If so, then shuttle attractiveness is still unresolved.

We can illuminate this question by extending our analysis of the shuttle's economic attractiveness to include alternate space plans that reflect a limit in peak funding, average funding, or both.

IS THE SHUTTLE ECONOMICALLY ATTRACTIVE IN ALTERNATIVE SPACE PLANS?

In order to generate additional space programs that still reflect the basic national objectives for U.S. space plans (as described by the STG), we have constructed several alternative plans by delaying, or eliminating various program elements in the basic plan. Seven alternative plans have been defined (see Table 1), three (2-4) aimed at reducing NASA's mid-'70 funding peak, and the remaining four (5-8) at reducing the overall space budget level by eliminating the lunar program (plan 1 is our basic plan mentioned above). Some plans achieve both aims, but only at the cost of providing the nation with a lesser space program. None of these alternatives constitute a recommendation for a space plan to replace those of the STG report; they are only used to further analyze the potential attractiveness of the shuttle. Obviously, many other important factors need to be considered when constructing viable national space program alternatives.

When considering these alternatives, several issues regarding the shuttle and its development arise: (1) Can a shuttle program be economically justified when the yearly non-military space budget is limited, and if so, then at what level of funding does it cease to be attractive? (2) Should the shuttle be developed simultaneously with the space station, and if not, which program should be given priority? (3) If the shuttle IOC is substantially delayed (say, into the 1980s), what if any are the impacts on the civilian and military space programs and should new launch vehicles be developed in the interim? The remainder of this paper will concern itself primarily with the first issue; we will touch on the latter two only in passing.

For ease of presentation we have subdivided the space plans into several, somewhat dependent programs:

Table 1

IOC DATES FOR MAJOR PROGRAM ELEMENTS

Major Program Elements	Plan							
	1	2	3	4	5	6	7	8
Space station	1977	1977	1981	1981	1977	1977	1981	1981
Space base	1984	1985	1987	1987	1984	1985	1987	1987
Lunar station	1981	1983	1983	1983	(a)	(a)	(a)	(a)
Lunar base	1983	1985	1985	1985	(a)	(a)	(a)	(a)
Shuttle	1977	1982	1977	1981	1977	1982	1977	1981
Nuclear Ferry	1981	1983	1983	1983	(a)	(a)	(a)	(a)
Lunar Tug	1983	1985	1985	1985	(a)	(a)	(a)	(a)

[a]Program eliminated.

- An Earth-orbital manned program.
- A manned lunar exploration program.
- A program containing all of the elements of the space transportation system (STS).
- A residual program including all other (unmanned) civilian programs and overhead costs.
- A military space program.

These five programs are defined in greater detail in Appendix B. Table 2 lists each of these programs and their major elements and launch schedules for the basic STG civilian program. We note that the costs of all but the manned portions of the total space program are taken directly from references 1 and 3. We shall not vary these costs as we examine alternate space plans, except as necessary because of changes in the STS, on the assumption that neither the scientific nor military programs will depend explicitly on the existence of the shuttle but will be funded on their own merits. We have also somewhat arbitrarily placed the shuttle's entire RDT&E and investment costs under NASA's budget, charging DOD nothing. This of course accentuates NASA's budget problems while minimizing those of the military.*

Figure 1 shows the breakdown in year-to-year costs for the various subprograms of the basic space plan. The already mentioned NASA funding peak of 1975 is evident, as is a somewhat lesser peak in 1981 (due to preparations for the lunar program and the space base). The total space program costs through 1990 are $141 billion, an average of 7.0 billion dollars per year (an average NASA budget of $4.9 billion per year). Figure 2 compares NASA yearly funding levels for plans 1-4 (those plans that include a lunar program). The attempts to reduce the mid-'70 funding peak by delaying various space programs are seen

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*It has been suggested that DOD support monetarily a portion of the shuttle development on the basis that it is responsive to their transportation needs. One cost-sharing plan would have DOD pay a percentage of the total costs commensurate with its projected usage rate. Another might have DOD and NASA share the costs at the same ratio as their anticipated launch cost savings. Regardless of the percent of total costs subsumed in the military budget, we still anticipate funding peak problems and, in fact, the burden may be shifted to two agencies rather than one.