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In 1972, the two expected principal users of the Space Transportation System, the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD), agreed that the program would require two launch sites, Kennedy Space Center (KSC) in Florida and Vandenberg Air Force Base in California. NASA's budget requests include additonal orbiters which would bring the total to five. The cost to construct and operate the Vandenberg complex to serve DOD activities during 1983-92 would be $3.8 billion. The needs for the second launch site and for five orbiters were questioned. Polar orbits from KSC are not practicable because launches from KSC involve unacceptable land overflight and could cause an adverse reaction from the Soviet Union. If the Shuttle is as reliable as expected, the overflight objections do not justify the need for the Vandenberg facilities. The concern over Soviet reaction is difficult to assess and further inquiry may be needed, but a 1971 United States-Soviet agreement could preclude problems in this area. The request for five orbiters is based on NASA's models which project up to 65 flights per year. These models have been questioned. The Congress should not fund Vandenberg modifications to accommodate the Shuttle unless compelling reasons present themselves. Three orbiters (102, 103, and the upgraded structural test orbiter) can accommodate a substantial increase in space activity during the next decade and, if a more significant increase is anticipated, orbiter 101 could be upgraded to operational capability. (HTW)

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STATEMENT OF
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PROCUREMENT AND SYSTEMS ACQUISITION DIVISION,
BEFORE JOINT HEARING OF THE SUBCOMMITTEE
ON DEFENSE, SUBCOMMITTEE ON HUD-INDEPENDENT
AGENCIES, SUBCOMMITTEE ON MILITARY CONSTRUCTION,
COMMITTEE ON APPROPRIATIONS,
UNITED STATES HOUSE OF REPRESENTATIVES
ON THE SPACE TRANSPORTATION SYSTEM

Mr. Chairman and Members:

I appreciate the opportunity to appear today and present our viewpoint on the Space Transportation System. The General Accounting Office (GAO) has issued six reports on the Space Transportation System (STS) since 1972. Generally, our past reports have dealt with the cost benefits and issues relating to cost, schedule, and performance that have been of ongoing interest since 1972 when the President and the Congress approved system development.

In 1972, the two expected principal users, the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD), agreed that the program, to be fully operational would require two launch sites--Kennedy Space Center (KSC) in Florida and Vandenberg Air Force Base in California. NASA's plans called for a total of five orbiters, operating interchangeably between the sites.

The program has progressed a long way since 1972. The contractor "rolled out" the first orbiter (101) in September 1976 for approach and landing tests. A second (102) is to be delivered in October 1978, for the first orbital flight the next year; and NASA's fiscal year 1978 budget included initial funds for a third orbiter (103). NASA's fiscal year 1979 budget request includes production funds for two additional orbiters, which will consist of the structural test orbiter upgraded to operational status and a new vehicle, orbiter 104. These two vehicles are expected to cost about $600 million and $850 million, respectively, in real year dollars, that is, actual amounts which will be paid, including inflation at 7 percent per year. This will bring the total number of orbiters to five. Under current planning the approach and landing test orbiter will not be refurbished and used as an operational vehicle.

NASA is constructing Shuttle facilities at KSC, the primary launch, landing, and orbiter refurbishment site. This is scheduled to become operational in mid-1980. The second site, Vandenberg, would be funded by DOD and is expected to become operational in June 1983 at a cost of about $1.2 billion. Additionally, $2.6 billion in manpower costs would be needed to operate the Vandenberg complex through 1992. DOD's fiscal year 1979 budget request includes funds to begin STS facility construction at Vandenberg. Thus, 1979 funding decisions will probably establish the operational parameters of the STS in terms of launch sites and the number of orbiters. These parameters, in turn, will influence the Nation's space activities throughout the next decade.

After learning that the cost to construct and operate Vandenberg to serve the DOD Shuttle activities during 1983-92 would be $3.8 billion, we decided to look into this matter. The DOD justified the Vandenberg site on the basis that it was needed for launching defense payloads into a polar orbit. The GAO, working with DOD and NASA, determined that it is possible to achieve a polar orbit from KSC and satisfy DOD's requirements. Thus, a KSC based Shuttle will be able to accommodate all the payloads currently projected--civil and military. We think the potential for saving $3.8 billion by not funding the construction at Vandenberg warrants your close attention. We also question the need for five orbiters to carry out the Shuttle missions as presently perceived by NASA and DOD. I would like first to address the launch site issue.

Why a Second Launch Site?

Kennedy Space Center is planned for Shuttle launches to the east; launches to polar orbits are presently scheduled to be from Vandenberg. Two principal arguments are offered by NASA, DOD and the State Department as to why polar orbits from KSC are not practicable, first, such launches from KSC involve unacceptable land overflight and secondly, such launches could cause an adverse reaction from the Soviet Union. We think these reasons should be critically examined.

Land Overflight Considerations

The first reason, land overflight considerations, centers around the possibility that injury to persons or damage to property could occur in the event of a mishap. Historically, the U.S. has used coastal launch sites to avoid having space vehicles ascend over the continental United States.

In our opinion, given the nature of the Shuttle--which is a partially reusable and man-rated vehicle, with commensurate high reliability--an absolute land overflight constraint seems unwarranted. Generally, launches over water are considered relatively safe but those over land masses purportedly involve more risk. While there are no official criteria for acceptable risk, the most critical factor involves assessing the statistical probability of mission failure during powered flight--that is, during ascent into orbit.

Casualty expectation statistics for the Shuttle show a relatively low risk of launching from KSC to high inclination orbits. For instance, a study by a DOD contractor cites a 1 in 166,667 chance of an individual on the ground being harmed during a northerly Shuttle launch from KSC. In comparison, the worldwide casualty expectation associated with random re-entry of low orbital debris from a KSC launched Titan IIIC is 1 in 6,250. Thus, the re-entry of debris from a Titan launch presents a much greater risk of harming people on the ground than does a Shuttle launch.

Actual Space Shuttle reliability, of course, must be demonstrated. By June 1983, however, when polar Shuttle launches are scheduled to begin from Vandenberg, the STS will have had over 3 years' experience, entailing over 50 Shuttle flights. This would seem to be sufficient experience to gauge the Shuttle's reliability. From the standpoint of land overflight considerations, it seems questionable to us that there will be a need for STS facilities at Vandenberg if the Shuttle is as operationally reliable as expected by NASA and DOD.

Actually, while the land overflight issue is raised with respect to northerly launches from KSC, even the routine easterly launches will overfly land areas--either Africa or Europe and the Middle East. These launches purportedly pose fewer risks because the overflown land areas are far from the launch site. Regardless of launch direction, however, Shuttle experts agree the most critical phase of a Shuttle launch is between lift-off and solid rocket booster (SRB) separation. The critical phase of northerly launches from KSC will be over the approximately 345 miles of ocean between KSC and the coast of South Carolina. In fact, the critical phase will have been completed long before land overflight occurs because the SRBs are jettisoned approximately 31 miles from the launch site. Then the orbiter and external tank will continue ascending over the remaining 314 miles of ocean and be about 70 miles high when land overflight begins. Moreover, for all phases of powered ascent, the Shuttle has been designed to return the orbiter, crew, and payload safely to the launch site for those failures which have the highest probability of occurring, such as loss of a main engine.

International Implications

The second concern about northerly Shuttle launches from KSC operations is how the Soviet Union might react to the orbiter and external tank coming over the North Pole's horizon. During a normal northerly KSC flight the orbiter, after separating from the external tank over the Great Lakes region, would continue ascending. The external tank would continue halfway around the world, over the Soviet Union, and splashdown in the Indian Ocean. Because the Arctic area is of special strategic importance in terms of nuclear missile targeting, a concern has been voiced that northerly Shuttle launches could perhaps be misconstrued. This concern, according to State Department officials, would remain even if Russia's early warning radars are sufficiently sophisticated to specifically identify the orbiter and external tank and not misinterpret them as hostile missiles. DOD officials have also said that northerly Shuttle launches from KSC could be disconcerting and perhaps objectionable to the Soviets, even with prior launch notification and no matter how sophisticated the Soviet radars.

Accepting the State Department's view that northerly KSC launches could raise a radar misinterpretation issue, we feel that resolution through multilateral cooperation should be thoroughly explored before spending large sums on Vandenberg. In this regard, there is a 1971 U.S.-Soviet agreement which seems very applicable to this issue.

The bilateral understanding, officially known as the "1971 Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War between the United States of America and the Union of Soviet Socialist Republics", established procedures for prior notification in situations where unidentified objects could activate early warning systems. Because all STS missions require advance planning, there would seem to be ample time for notifying the proper Soviet authorities as called for in the agreement, especially since less than 14 polar missions per year are required. Furthermore, it should be noted that the STS is international in scope and will be even more so during the operational phase, involving many cooperative space endeavors. The U.S. and the Soviet Union are presently discussing prospects for joint Shuttle missions.

Nevertheless, the concern over Soviet reaction to Arctic overflight is difficult to assess conclusively because the issue involves essentially unquantifiable foreign policy or national security considerations. Further congressional inquiry may be needed to determine if this concern is sufficiently serious to justify the cost of the Vandenberg site. As previously noted, we believe the 1971 agreement provides a mechanism for precluding problems in this area.

Conclusions and Recommendations

Considering the information just presented, we believe that the Congress should not fund Vandenberg modifications to accommodate the Shuttle unless there are compelling international or technical reasons for the West-coast STS site that are unknown to us.

Orbiter Fleet Size

Turning now to the fleet size issue, how many orbiters are needed depends upon the extent of STS traffic that can reasonably be expected during the next decade. Traffic levels, in turn, will depend upon congressional willingness to fund space projects and applications because most payloads (as many as 80 percent) will require Congressional appropriation and authorization.

To date, specific space program objectives for the 1980s have not been set forth. However, it is obvious that space goals must be flexible so that program plans can be adjusted to meet changing fiscal, political, and technical circumstances. Flexibility is, to some extent, a function of the number of orbiters available. Acquiring too few orbiters and related support equipment could place undue constraints on the numbers and types of useful space exploration and applications programs. On the other hand, given a finite budget for space activity, the more funds allocated to investment in orbiters the less will be available to plan, design, and develop useful space payloads and programs--during early years of Shuttle operations as well as later. Procuring too many orbiters would be uneconomical in the sense that idle equipment would have to be maintained. More significantly, it could create pressures to utilize the available capacity, perhaps diluting the quality of space endeavors and impacting on other national priorities.

Both DOD and NASA say five orbiters are needed. This view is based largely on national payload mission models put together by NASA, which project up to 65 flights per year or more than one flight a week. Because this launch level represents a three-fold increase in space activity, the validity of NASA's models have been questioned by both the General Accounting Office (May 27, 1977 report "Space Transportation System: Past, Present, Future; PSAD-77-113) and the Congressional Budget Office.

Congressional Budget Office criticism of NASA's mission model prompted the space agency, in March 1977, to study reduced launch programs; the lowest program studied was 300 shuttle flights during 1980-92. NASA's study concluded that, even though three orbiters could support this level of activity, five orbiters would still be the most economical fleet size. Five orbiters are more economical than three, according to NASA, because a considerable number of expendable launch vehicles would be needed to backup and to supplement a three-orbiter fleet.

We believe three orbiters may be more than sufficient to provide a balanced and viable space program, and indeed, even a program which is a substantial increase over past activity.

For instance, the capacity of two orbiters alone is enough to fly more payloads than have been launched over the past 10 years. In justifying development of the STS, NASA stated in 1972 that three orbiters were adequate to perform a 581-flight mission model but two additional orbiters were needed to provide flexibility.

Based on NASA estimates of average mission duration and on such performance goals as ground turnaround time between missions, three orbiters could conceivably sustain over 50 launches a year. However, recent NASA and DOD studies project that a three-orbiter fleet can accommodate about 40 launches annually. This is an increase over present and past levels of about 26 to 35 expendable launch vehicle flights per year. Furthermore, every shuttle flight will have much greater payload and mission capability. To illustrate, the orbiter's large cargo bay (15 feet by 60 feet) offers the same payload-carrying capability as four Delta expendable launch vehicles. Assuming only two payloads per shuttle flight, three orbiters could launch 80 payloads a year, which is a doubling of the Nation's past activity. Furthermore, the payload-to-launch ratio will undoubtedly improve as new concepts evolve to exploit STS capabilities.

The shuttle provides a great deal of capability and capacity not yet fully understood; the study of cargo integration is only starting. Cargo integration presents formidable technical and managerial problems but has the potential of high payoff in terms of optimizing Shuttle payload operations.

The Shuttle's capabilities in comparison to present launch vehicles' can also be discussed in terms of mission modes. Two examples are the Spacelab and the Long Duration Exposure Facility. Both modes provide an opportunity to perform multiple experiments with a single flight. For example, the first Spacelab mission will carry up to 42 experiments--an activity level which might have required several expendable launch vehicles. Similarly, the Long Duration Exposure Facility can hold 76 experiment trays, with each tray having up to 6 experiments. The Facility is a 30-foot long, free-flying structure which is delivered by the Shuttle to Earth orbit, left for 6 months or more to perform experiments, and then retrieved.

Four-Orbiter Fleet

Considering the substantial capabilities of three orbiters, it is difficult to foresee needs beyond that fleet size. An additional orbiter obviously could provide an increased yearly launch rate--the total ranging from 53 to over 60 a year. The fourth orbiter would also provide a cushion for attrition--a subject difficult to precisely evaluate. Even though the technical design objectives call for each orbiter to perform 500 missions and have a minimum of 10 years' use, NASA officials have commented that the Shuttle program must endure the same development risk uncertainty during its early flights as face any technically complex program, no matter how carefully conceived.

The present Administration has decided to support a four-orbiter fleet, with consideration for a fifth orbiter in future years in the event that projected flight rates, or the accidental loss of an orbiter, warrant such an action. NASA's procurement strategy to achieve this fleet size position is not completely clear. In essence, four orbiters are already partially "in the stream"--101, 102, 103, and the structural test orbiter. Yet, NASA's fiscal year 1979 budget request includes funds for a completely new vehicle (orbiter 104), which NASA describes as the fourth orbiter. Under this plan, the optional or fifth orbiter will be either (a) orbiter 101, modified for orbital flight capability, or (b) another wholly new vehicle procured after orbiter 104.

CONCLUSIONS AND RECOMMENDATIONS

In summary, GAO's position is that three orbiters (102, 103, and the upgraded structural test orbiter) can accommodate a substantial increase in space activity during the next decade. If the Congress anticipates a more significant increase, or deems it necessary to provide for attrition in the three-orbiter fleet, then orbiter 101 could be upgraded to operational capability. We question the desirability of funding orbiter 104 at this time.

This concludes my statement, Mr. Chairman. I would be glad to answer any questions.