

Question 3. Does the phasing out of the Saturn IB make it more likely that NASA will have a requirement later on for the intermediate launch vehicle?

Answer. Not necessarily; it depends upon NASA's future mission requirements and upon the type of intermediate vehicle that is chosen. The launch vehicle one usually denotes by the term "intermediate" puts 100,000 pounds into orbit and provides a different kind of service than the Saturn IB. If such a vehicle could be downrated to 40 to 50,000 pounds payload in low orbit, it could replace the Saturn IB, but would be selected only if its cost were competitive.

Question 4. What is the earliest date in your judgment that NASA would need the intermediate booster of around 100,000 payload?

Answer. NASA might need an intermediate booster in the 1974-1975 period to put a six to nine man space laboratory into earth orbit, if such a project is authorized. This job could be done by a Saturn V launcher, but an intermediate vehicle might be more economical, especially if its development cost were low and if there were other uses for it.

Question 5. Dr. Paine, so that we may fully understand the meaning of discontinuing the Saturn V, will you please tell us how much it has cost to develop this vehicle?

Answer. The cost of developing the Saturn V launch vehicle and its associate F-1 and J-2 engines is approximately \$4.9 billion. This amount includes all costs not associated with the recurring hardware production and ground test costs for the fifteen flight vehicles. As was reported in February 1968, the average unit cost of producing and testing a Saturn V launch vehicle for the Apollo program is \$186 million.

Additionally, the total national investment in facilities, tooling, and equipment for the Saturn V launch vehicle is approximately \$1.3 billion. This includes an investment of \$625 million in LC-39 and associated facilities at Kennedy Space Center; and a \$286 million investment at Mississippi Test Facility.

Question 6. How much of this investment will be lost if, in fact, Saturn V production is not continued?

Answer. If production of Saturn V is not continued beyond the fifteen launch vehicles now on order, the direct return for the investment would, of course, be limited to those fifteen vehicles. However, the national goal of creating a capability to launch Saturn V class payloads into orbit will be achieved with these fifteen vehicles and, in that sense, none of the investment would be "lost". As we have indicated, it is our hope that production of the Saturn V can be continued, if it is, the national investment would be amortized over more launch vehicles. While some of the facilities and skills which have been created by this investment are unique to the Saturn V, much of what has been achieved is applicable to many other courses of action which the nation may follow and it is clear that every effort would be made to devote these facilities and skills to other ends. To the extent that this was not possible, then the investment could be considered lost.

Question 7. For the record, would you supply the current best estimate of the total cost of the Apollo Program and include discussion on how the actions you have had to take on the Apollo Applications Program affect this cost. Your tabulation and discussion should show how the total cost is affected by run-out costs that you might not otherwise have if the AAP could move forward at a higher level.

Answer. Information was supplied to the Committee on Aeronautical and Space Sciences on Feb. 27, 1968, which estimated the total cost of the Manned Lunar Landing Program to be \$23.896 billion.

We are presently experiencing increased cost rates in Apollo. The magnitude of these increases is under review. We are currently assessing the amount of funding required to complete the Apollo program, and we will be in a position to provide detailed cost estimates in our presentations on the FY 1970 Budget.

COST OF REVISED 1973 MARS MISSION

Mr. GEHRIG. With respect to the Lunar and Planetary Program, what is the estimated cost now of the revised 1973 Mars mission?

Dr. PAINE. I would like to ask Dr. Naugle to address himself to that.