

Dr. NAUGLE. Mr. Gehrig, we are still working on the final definition of the 1973 mission. We are trying to do as much as we can with the funding available in fiscal year 1969 and the time available between now and the launch date in 1973 to accomplish the scientific objectives we have laid down for this mission.

Present cost estimates for spacecraft and support vary between about \$320 million and the \$385 million that we told the Senate about last spring when we were testifying.

Mr. GEHRIG. In the new mission, as I understand it, the lander part of the mission will be scaled down somewhat from what we had been given earlier.

Dr. NAUGLE. The lander may have to be scaled down. It depends upon the resources that we will have available to us in fiscal year 1970 and later years as to precisely what we will be able to accomplish.

We still hope to be able to accomplish the minimum scientific objectives that the Space Science Board planetary panel, chaired by Dr. Gordon MacDonald, recommended last spring.

Mr. GEHRIG. What launch vehicle are you now intending to use for the Mars 1973 mission?

Dr. NAUGLE. We are still planning to use a Titan launch vehicle for the 1973 mission.

Mr. GEHRIG. That would be the Titan III launch vehicle?

Dr. NAUGLE. Yes.

MERCURY-GRAND TOUR MISSIONS

Mr. GEHRIG. I have some additional questions having to do with the Mercury swing-by mission and the grand tour mission that I would like to put in the record at this point.

The CHAIRMAN. Without objection it is so ordered.

(The questions and answers submitted are as follows:)

Question 1. What is the status of "swing-by" and "grand tour" mission planning to Mercury and Jupiter respectively to take advantage of the favorable opportunities which will present themselves in the 1970's?

Answer. Studies are being conducted of missions to Mercury in 1973 using a swing-by of Venus and multiple outer planet swing-bys (the "Grand Tour" mission) in the 1976-1979 time period. These studies include consideration of scientific objectives as well as trajectory, mission, and spacecraft design studies. In addition, advanced technology effort of appropriate spacecraft and instrumentation subsystems is underway. Current efforts are consistent with the potential launch dates noted above.

Question 2. If we do not take advantage of these opportunities, when do we get the chance again?

Answer. Venus-Mercury swing-by opportunities have been identified in 1973, in 1975 with an extra mid-course correction, and then not again until 1981. The Jupiter-Saturn-Uranus-Neptune Grand Tour Swing-by opportunities exist in 1976, 1977, 1978, and 1979. The 1976 opportunity requires a dangerously close swing-by at Jupiter, while launch energy requirements and trip times are undesirably high in 1979. Thus, 1977 and 1978 are the favorable opportunities. The Grand Tour opportunity to all four planets does not appear again for 179 years.

Question 3. Do you think that the Soviets are likely to pass up these opportunities?

Answer. It is very difficult to predict the Russian plans. However, since 1960 they have missed very few opportunities. While multiple planet missions require very advanced guidance techniques, and the US is believed to be more advanced in this technology, the recent Soviet circumlunar flight attests to their potential to perform swing-by missions.