NASA: Rein on Budget May Stiffen Competition for Funds Between Manned Program, Space Sciences

The National Aeronautics and Space Administration has been doing the pruning of programs necessary to live within the income Congress has assigned it this year, and one of the first announced results has been the lopping off of five flights of Ranger unmanned spacecraft, which are designed to gather information about the surface of the moon.

The Rangers are the first family of instrumented spacecraft intended to provide data on the moon for the Project Apollo manned-lunar-landing program. So far the Ranger program has been an ill-starred one. The first five shots failed, for a variety of reasons to garner the data desired (*Science*, 12 July). Four more shots, Rangers 6 through 9, however, still are on the schedule, and these spacecraft, carrying television cameras, are being counted on to take the first high-resolution pictures of the lunar surface as they go in for hard (crash) landings on the moon. The Ranger 6 shot is scheduled for early 1964.

The five canceled shots would be Rangers 10 through 14, which were scheduled to carry more varied instrumentation—for radiation, radar-ray reflectivity, and seismology experiments, for example. These later Rangers were in the design stage at the Jet Propulsion Laboratory in Pasadena, home of the Rangers. Cancellation of the block of five Rangers will save an estimated $90 million and apparently signals the end of the Ranger program, which was tentatively scheduled for some two dozen flights.

Impetus for the action came from the $600 million cut by Congress in the $5.7 billion requested by NASA for fiscal year 1964. While the $5.1 billion NASA appropriation which Congress finally sent to the White House this month is some $1.3 billion higher than NASA's budget for 1963, well-informed people in both Congress and the executive branch feel that the legislators, henceforth, will refuse to grant the large annual increases which have been the pattern for NASA over the past 4 years, and that the lid is being put on the NASA budget at $5 billion to $5.5 billion a year.

If this proves to be the case it will be highly significant for NASA financing and management, and the agency will be living in a climate similar to the prevailing one of agonizing reappraisal and hard choices which produced the Ranger cuts.

The primary fact of life for NASA is that it is committed to accomplishing a manned round trip to the moon by the end of the decade. As the deadline draws nearer, expense curves for engineering and construction work on the manned lunar program will inevitably rise. With luck, these costs can be absorbed, but the history of the nation's defense and space programs shows that both time and cost estimates on sophisticated hardware are generally outrun.

Unless Congress raises the budget ceiling or the deadline is pushed into the 1970's, the unoptimistic view is that NASA's manned landing program will take an increasing share of the agency's budget and that other efforts, such as space sciences, applications of space research to non-Appollo projects, and the NASA education program, will inevitably suffer.

In this period when NASA is absorbing its budget cuts and reassessing its whole program in the light of new fiscal facts, the action to bobtail the Ranger program raises two questions: (i) What are the general prospects for the space sciences? (ii) Will the unmanned investigations of the lunar surface now planned produce enough information early enough for making the engineering decisions necessary for a successful manned landing on the moon by 1970?

Role of the Space Sciences

The first question is difficult to answer, in part, because the role of space sciences research in the national space program has never been clearly defined.

In a fairly typical statement in a speech a year ago, Homer E. Newell, director of the NASA Office of Space Sciences, said, "The NASA program of space science is basic research. Its principal object is the advancement of knowledge. The motivation of the scientists who participate in the program is that disciplined curiosity leads them to investigate, explore, and dig into the innermost workings of the universe about them. To them the attraction of space science is its breadth and scope, the opportunity it affords to tackle some of the most important and fundamental problems on the frontiers of science today."

Newell went on to say that, "because of the many scientific problems [space science] encompasses, we must have a sound and vigorous space science program if we intend to maintain our position of leadership in world science."

Unlimited scientific horizons in space and the magnitude of the NASA budget have led some scientists to assume that the agency's space-sciences program had a guaranteed status, a kind of parity with the manned landing program, which, after all, was put into high gear only in 1961.

NASA's history gave some encouragement to the advocates of science for science's sake, since the agency in its first 4 years had launched 157 sounding rockets, 55 satellites, and nine space probes, in experiments which yielded very valuable scientific results.

Space science as an end in itself, however, seems not to have a clear charter, either in the legislation creating NASA or in agency policy. The rise of the lunar landing program left no doubt as to priorities.

A number of highly competent scientists interested in space research acknowledged that the lunar landing project should take precedence, in a well-known "summer study" on space research held at Iowa City in 1962 and sponsored by the National Academy of Sciences' space science board.

In the report, the conferees endorsed the overall NASA space sciences program, with some qualifications, but in their findings said that engineering design information must be given priority over basic scientific information.

The scientists concentrated on the unmanned investigations of the lunar surface, noting that, "If the Apollo schedule is to be met, data acquisition necessary to support engineering decisions for this mission must take precedence over the acquisition of other data of possibly greater scientific interest. Overriding priority, therefore, must be assigned to the *early* and *reliable* return of information of practical importance. Absolutely essential to designing for the Apollo mission is information concerning the hazard due to extreme surface roughness, the hazard due to deep electrostatically charged dust or to extreme surface crushability, and the hazard due to shrapnel-like secondary fragments from meteorite impacts."

While some information about the moon's surface has been gleaned from ground-based observation, NASA officials agree that a massive ignorance still prevails about details of the topog-

raphy and characteristics of the lunar surface.

The view at NASA, however, is that, with reasonable luck with the unmanned investigations now planned and no rug-pulling surprises, enough will be learned soon enough to answer the necessary engineering questions for Apollo.

In addition to the four Rangers on the ways, NASA has scheduled 17 flights of Surveyor unmanned spacecraft, a bigger and more sophisticated successor to Ranger, and five to ten lunar orbiters which will be designed primarily to fly photographic missions.

Officials in the lunar and planetary program are banking heavily on Surveyor, which is another Jet Propulsion Lab project with Hughes Aircraft serving as contractor. Precisely which experiments will be aboard the first Surveyors has not been decided, but the spacecraft is intended to demonstrate soft-landing techniques—a formidable maneuver which can be likened to a launching in reverse—and will probably carry the first movable TV cameras and instruments to test physical and chemical properties of the lunar surface at its landing point.

The Surveyor flights are scheduled to begin in 1965. Some observers outside NASA, however, suggest that a possible joker in the Surveyor deck is the new hydrogen-fueled Centaur rocket, which serves as the upper stage of the Atlas-Centaur launch vehicle for Surveyor. After initial difficulties, the Centaur has been performing promisingly in recent tests, but payload problems have arisen. Atlas-Centaur was first rated as able to lift 2500 pounds, but its maximum payload now stands at about 2100 pounds, a figure which limits quite sharply the instrumentation in any payload.

One reason the lag in obtaining results from the unmanned program is not regarded as crucial at this point is that the Apollo program has "slipped," so that the whole moon project has been set back substantially. An order to slow down development work on the Apollo Lunar Excursion Module and the Saturn 5 moon rocket, issued recently as a result of the economy drive, is likely to delay Apollo even more.

Going further, one scientist, who is not a NASA employee but is closely familiar with the unmanned-investigations program, says that planners responsible for the manned lunar landing are not counting on data from unmanned investigations at all and are insisting that Apollo lunar-orbit and landing hardware be designed according to a conception of the moon's surface so pessimistic that it would be possible to proceed without data from unmanned spacecraft.

NASA's lunar and planetary program, however, is going ahead on the assumption that information is wanted and needed. NASA officials feel that the projected series of Ranger, Surveyor, and orbiter flights provide a "balanced program" of unmanned lunar exploration, but they concede that some researchers interested in the space sciences might be disappointed because the Surveyors may focus on possible Apollo landing areas rather than range more widely over the surface of the moon.

The planetary part of the space-sciences program is likely to be affected more severely than the lunar part by the current budget squeeze. Mariner flybys of Venus set for 1964 have been canceled, and there are reports that two Mariners scheduled for a Mars probe next year also will be more lightly instrumented than was contemplated, in the interest of saving money.

As yet, however, there seem to be no clear signs that, as some have suggested, the space sciences are being sacrificed on the altar of economy. At the same time, informed persons inside and outside NASA agree that, as the Apollo program matures, choices in allocating limited funds between the manned program and space sciences will grow increasingly difficult.

Test is the Budget

It will be instructive, obviously, to see what funds are finally channeled this year into the main space-sciences category of unmanned investigations in space, which covers spacecraft development and operation, geophysics and astronomy, lunar and planetary exploration, bioscience, and launch-vehicle development. The budget for unmanned investigations has risen steadily year by year, reaching $547.2 million for fiscal 1963. The request for fiscal '64 was $754.7 million, but this has already been cut sharply by Congress, and final decisions within NASA will doubtless reduce it further.

Some of the pressures clearly would be relieved if, as some of the space industry magazines unconfirmably report, the administration is considering moving the moon date into the 1970's.

If, however, 1970 remains the target date, if the Russians make no sudden moves toward the moon, and if Congress maintains tension on the purse strings, pressures are likely to build inside the NASA budget for more funds for Apollo.

What happens, then, is up to top NASA management. NASA and the scientists need each other, and the space-sciences program has given NASA a solid and valuable link to the scientific community. A knowledgeable scientist, who has watched this relationship grow, credits key NASA administrators with earnestly seeking to understand what the scientists want and trying to give it to them. The years ahead are likely to put these administrators to a stern test.—JOHN WALSH

COMSAT: Europeans Wary of U.S. Plan for American-Dominated Commercial Satellite Enterprise

The main job now facing the Communications Satellite Corporation is to persuade the Europeans that joining with the U.S. in a U.S.-sponsored international satellite communications network is in their economic self-interest and not detrimental to their political prestige. A related task is to convince the underdeveloped countries that what is going on is not an imperialist plot to expropriate outer space but an attempt to make sensible, all-inclusive use of an exciting new turn in communications technology. Of the two jobs, convincing the Europeans to participate in the U.S. system is of more immediate economic consequence to COMSAT, for if the Europeans, either as a group or separately, decide to use traditional methods of international communication, or to launch a competing satellite system of their own, the volume of transatlantic business that flows through COMSAT's satellites might be reduced far below the profitable level.

Persuading the Europeans is not easy, for satellite-communications development is afflicted with a political tag that has never troubled traditional communications arrangements. For years, an international network of cables has linked a large part of the world in businesslike fashion, regardless of politics. A.T.&T. alone, for example, has over 175 technical agreements with other countries, including countries from which the U.S. has been estranged—the Soviet Union, Red