Missiles and Spaceflight . . .

AMERICA'S AIMS IN SPACE

BY KENNETH OWEN

THE National Aeronautics and Space Administration is currently looking for 2,000 more scientists and engineers to work in its nine main research centres and in its headquarters offices. US Government spending on space over the next ten years may well exceed fifty thousand million dollars. The first step along the American road to the Moon—an Earth-orbital flight by Mercury astronaut John Glenn—is about to be taken. The year 1961 has been one of changing emphasis and complete reorganization for United States space activity. What overall picture emerges, and what are the lines along which the US space programme is now directed?

A clear outline of the main lines of present thought and future action was given in three panel sessions at the recent American Rocket Society meeting in New York, and in a number of interviews with leading American space authorities in New York and Washington. A logical approach is to discuss in turn the missions, the vehicles employed, and the global effects.

Within the overall objective of the exploration of space, the missions fall into four main groups:—

(1) Scientific research, a continuation of traditional investigations in both the physical sciences and the life sciences but with the measuring instruments placed outside the Earth's atmosphere and beyond the Earth's magnetic fields.

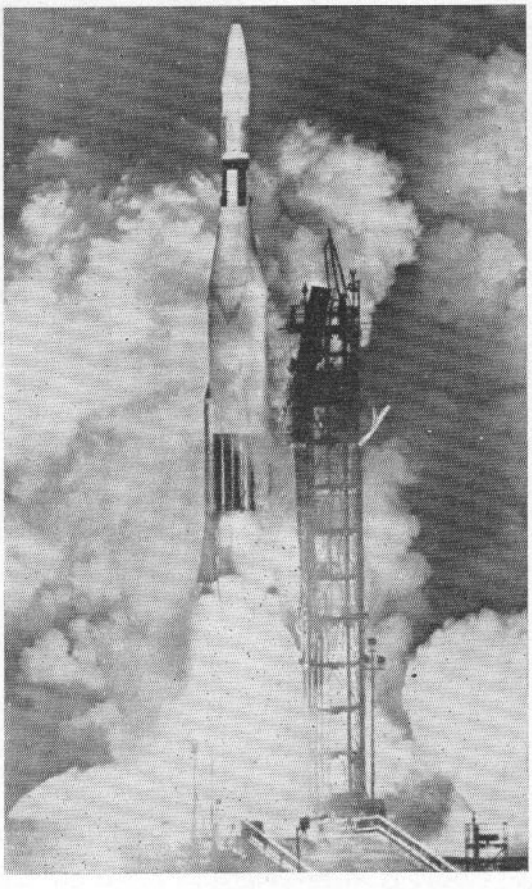
(2) Direct exploration, which could be included under scientific research but which involves the landing of exploratory equipment on the surfaces of the Moon, then Mars and Venus, and then the more-distant planets.

(3) Manned spaceflight, and

(4) The development of immediate-use or "application" spacecraft such as communication, meteorological and navigation satellites.

This view of the mission spectrum has been reflected in the reorganization of NASA into four main offices, which came into effect only last month. The first two groups listed above come under the Office of Space Sciences; there are separate offices for manned spaceflight and for applications; and the fourth of the new offices covers advanced research and technology in both aeronautics and space. As far as space missions are concerned, the situation is not static, and it has been suggested by Dr Arthur R. Kantrowitz, director of the Avco Everett Research Laboratory, that America's ability to conceive new missions will be the pacing factor in the country's space progress. At present the cost of placing satellites in orbit remains high, and only when the cost per pound in orbit decreases significantly will the number of commercially possible missions increase.

Atlas-Agena B launch of Ranger 2 from Cape Canaveral, November 18; mission aborted because of second-stage fault



Scientific Research The sophisticated orbital observatories now being developed for NASA's programme of basic scientific research, it was emphasized by Dr Herbert Friedman of the US Naval Research Laboratory, were building on the foundations laid on a more modest scale in the decade before the launching of Sputnik 1, when a great deal of space-science work had been done by means of sounding rockets. "Thank God for the Aerobee rocket," Dr Friedman commented, showing by means of slides the increased amount of data now obtainable even by the modest sounding rockets (an Aerobee firing in August 1961 had provided an ultra-violet frequency spectrum of the Sun in which 5,000 lines were observable, compared with some two dozen lines in a 1949 firing).

Many scientific unknowns in the region between the Earth and the Sun are now being discovered, identified and measured by means of satellites and space probes. Among the major results have been the discovery of the Van Allen radiation belts, the mapping of the geomagnetic field, the determination of the slight "pear shape" of the Earth, a new insight into the Earth's heat balance, and new information on solar effects on the upper atmosphere and the electron distribution in the upper ionosphere.

A continuing trend in scientific spacecraft is the development towards larger craft carrying more instrumentation. Typical of the advanced equipment now being developed are the Orbiting Solar Observatory, Orbiting Geophysical Observatory family, and the Orbiting Astronomical Observatory. The OGO family is typical also of another trend; towards a standardized vehicle into which a variety of experiments can be fitted as required.

Although not customarily grouped together with the application satellites such as those for communications and meteorology, the scientific satellites and probes mentioned are all essentially communication spacecraft, in that they receive electromagnetic radiations (either man-made or natural), record the information in some way and transmit it to receiving stations on Earth. There is no actual contact with other planets.

In this type of spacecraft the main effort goes into the instrumentation that is carried to do these jobs. The craft themselves are generally placed in relatively simple orbits—either circular, elliptical or highly elliptical—around the Earth, around the Sun, or conceivably around the Moon or the other planets. The next step is the more difficult job of landing spacecraft first on the Moon and then on the planets, for what might be considered a more massive-scaled exploration of the solar system.

Direct Exploration NASA's programme of unmanned exploration of the lunar surface, using the second-generation spacecraft Ranger, Surveyor and Prospector, was summarized by Dr William H. Pickering, Director of the Jet Propulsion Laboratory, Pasadena, as shown below. The dependence of any spacecraft on its launch vehicle, incidentally, was illustrated ironically by Rangers 1 and 2. Both of these extremely sophisticated spacecraft, developed and built by JPL, were unable to complete their planned missions because of defects in the second stage of the Atlas-Agena vehicle. (Dr Friedman, whose own satellite payloads are usually dependent not only on the launch vehicle but also on getting a piggyback ride on another satellite, spoke of "the traumatic experience, as a space scientist, to have one of my experiments on a vehicle that fails.")

NASA LUNAR PROGRAMME SUMMARY

Objectives: (1) to assist and support manned operations; (2) space technology and lunar science

Ranger (*Atlas-Agena B*) rough impact	Spacecraft development; survival capsule; high-resolution approach reconnaissance	Nine flights, 1961-63
Surveyor (*Centaur*) soft landing	Scientific stations: reconnaissance orbiter	Seven flights, 1963-65
Prospector (*Saturn*) precision landing and return	Mobile surface craft; logistic support craft for manned programme	Unknown number of flights, 1966-70