SOYUZ

Clues to Russian moon plans

Because of the secrecy of the Soviet space program, speculation still abounds about its goals and techniques. One theory has been that Russia's moon-landing plans call for a huge rocket, perhaps a third more powerful than the U.S. Saturn 5, to go directly from earth to lunar surface and back. This contrasts with the parking orbits and docking maneuvers around the earth and moon that the U.S. will use.

Evidence against that theory, however, is mounting. The latest addition is the flight of the first Soviet cosmonaut in 18 months.

The major cause for doubt is the questionable existence of the giant booster itself. Almost the only allusions to it in the U.S. are warnings from National Aeronautics and Space Administration officials at budget time. There have been no test flights, at least not of the first stage which would probably provide as much as 90 percent of the big booster's total thrust. Finally, some U.S. experts believe, the Russians have not yet demonstrated the high-energy fuels that would be necessary for even such a super-booster to make a direct surface-to-surface moon flight.

Another reason for believing that the Russians plan to use the parking orbit technique is their considerable practice with it. Although some have failed, almost three dozen Soviet space probes have been placed first in a low orbit around the earth, then launched outward to their destinations, which have included the moon, Mars, Venus, orbits around the sun and high orbits around the earth.

On a manned moon-landing, use of a parking orbit would mean that the main booster would only need to be strong enough to get the man-carrying spacecraft 100 or so miles above the earth. Then the spacecraft's own engines, or the booster's small upper stage, would be enough to send it on its way. Without the rumored super-booster, parking orbits could be the only answer.

On the lunar end of the flight, if the Russians want to minimize the weight that must be lifted from the moon's surface, they might choose, as the U.S. has done, to keep part of the spacecraft in a lunar parking orbit while another part descends to the surface, then returns to dock with the waiting portion for the trip home. The U.S. is far ahead of Russia in docking experience—Gemini astronauts coupled and uncoupled with their Agena target vehicles 10 times—but the Soviets are obviously working on the problem.

A year ago, Russia's unmanned

Cosmos 186 satellite maneuvered and docked with Cosmos 188. The operation, almost certainly run from the ground, provided Soviet mission controllers with their first flight experience in the technique. Six months later, the feat was repeated with Cosmos 212 and 213.

Now cosmonaut Georgy Beregovoi has tried, if not the actual coupling, at least the close-in maneuvering necessary for a docking operation. On Oct. 25, the day before Beregovoi was launched aboard the Soyuz 3 spacecraft, Russia secretly fired Soyuz 2, unmanned, into orbit to await him. Before he had completed his first orbit, Beregovoi was within 650 feet of his target; later he approached Soyuz 2 again.

Russia made no immediate announcement of how close he had come either time, but his precise piloting was the tightest by any Soviet cosmonaut. The closest any previous manned Russian spacecraft had come to another, manned or otherwise, was 3.1 miles, when cosmonauts Valery Bykovskiy and Valentina Tereshkova passed each other during a double flight in Vostoks 5 and 6 in 1963.

One use of docking that could be part of Soviet plans, according to some observers, might be to launch three spacecraft segments separately into earth orbit using relatively small boosters, then couple them together and use their joint power to get to the moon.

Russian space officials claimed no actual docking for Beregovoi's flight, however, and whether that was a scheduled, but unaccomplished, part of the mission remained unknown.

Another much-asked question was why Beregovoi was the sole occupant of the presumably multi-man spacecraft. The Soviet space program has been proceeding at a cautious pace since the last cosmonaut, Vladimir Komarov, was killed when his Soyuz 1 spacecraft's parachute fouled during reentry. Some observers believe that the fouling was due to the vehicle's then newly designed hatch, which may have either heated excessively during reentry, scorching the chutes, or else caused so much turbulence and buffeting that they could not open properly. If the hatch was to blame, its redesign could have accounted for much of the delay between Komarov's and Beregovoi's flights and made the spacecraft designers cautious enough to want to risk only one man until the new hatch proved itself. ◇

PHYSICS, CHEMISTRY

Nobel Prizes to Alvarez and Onsager

The Nobel Prizes in physics and chemistry, traditionally announced together, have only one recipient each this year. The chemistry prize goes to professor Lars Onsager of Yale for work in theoretical chemistry. The physics prize goes to Prof. Luis W. Alvarez of the University of California at Berkeley for experimental work in particle physics.

Although he was trained as a chemical engineer in his native Norway, Dr. Onsager's interests have always been more for the basic and mathematical aspects of chemistry than the practical engineering aspects.

University of California

Dr. Alvarez: 10^{-22} seconds.

He has given an especial amount of study to chemical processes involving electricity and heat, especially the so-called irreversible processes, those whose effects cannot be undone by reversing the action. Humpty Dumpty falling off the wall is a trivial example, but important ones continually occur in thermodynamics.

Prof. Onsager's first major contribution, done when he was still a graduate student, was a clarification of the theory of electrical conduction in solutions of electrolytes, in which he explained the strong conduction that occurs in certain cases by connecting it to the random motion of the dissolved ions in the solution.

In other papers published early in his career, he showed that when two irreversible processes are going on at the same time, the mathematical equations that describe them are simply and predictably related to each other. This is the Onsager relation specifically mentioned in the Nobel citation.

Dr. Onsager was born in Oslo in 1903. He graduated from the Norwegian Technical Institute at Trondheim