



# The next steps towards the moon

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A few hours before dawn on Wednesday, September 18, the radio telescope at Jodrell Bank was pointing in the direction of the moon. The signals arriving in the laboratory near by were not from a distant galaxy, but from the Soviet spacecraft Zond 5. As the coordinates of the telescope moved into near coincidence with those of the moon other data indicated that the probe was under the close gravitational attraction of the moon.

The measurements were similar to those which we have made many times previously on the Soviet luniks and there was little margin for misinterpretation. We heard with astonishment a few hours later that a Soviet spokesman described our observation as a canard.

This rapid response, the denial of an observation which the Soviets confirmed two days later, and the extreme vagueness and reticence about Zond 5 is extraordinary. The attempt to piece together the attitudes and the meagre facts into a coherent picture of Zond and Soviet intentions in space is like trying to solve a jigsaw puzzle with most of the pieces missing.

As a starting point for a solution we may take the Luna spacecraft of 1966-67—the probes with which the Soviets achieved the historic firsts of soft landing instruments on the lunar surface in February, 1966, and shortly afterwards of placing a spacecraft in orbit around the moon. The capsule of Luna 9 which transmitted the photographs from the moon's surface in February, 1966, weighed 220lb. This was ejected from a carrier stage near the moon. The total weight which the Soviets carried to the moon in that series is probably represented by that of a later Luna orbiter, where separation may not have occurred, and which weighed one and a half tons.

Then on April 2, 1967, after a long halt in manned space flight, following the successes with the Vostoks and Voskhods, the Soviets launched an entirely new manned spacecraft—Soyuz. This vehicle weighed six tons and it was in this spaceship that astronaut Komarov was killed during re-entry. There have been no further manned flights from the Soviet Union since that tragedy.

## GREAT ACHIEVEMENT

The Soyuz craft is not significantly heavier than the Voskhods but there seems little doubt that its design facilitates the automatic rendezvous and linkage in orbit which has been demonstrated successfully. In any case it appears to be a reasonable assumption that it was a Soyuz type craft which was launched, as Zond 4, on March 2, 1968, with the cryptic announcement that it was "to study outlying regions of near earth space and improve new systems and units aboard the station". Western observers of the Soviet space scene believe that an attempt was made to recover this Zond after an elliptical trajectory into space. But no information seems to be available as to the result of this attempt.

So to Zond 5, which we believe to be a Soyuz type vehicle, implying that the

Russians now have rocket capacity to convey six tons to the lunar vicinity—four times more than in the Luna series. Furthermore, the splash down in the Indian Ocean on Saturday, September 21, demonstrates a recovery potential of a six-ton vehicle approaching earth at a terminal velocity of about 25,000 m.p.h.—a truly astonishing achievement. A minor error in the re-entry angle would either have plunged the spacecraft to destruction in the atmosphere or sent it skipping out again into an uncontrollable orbit.

We know from our own observations on Zond 5 that the data transmission system was far more complex than in the Lunas. The system has television transmission capabilities as against the cruder facsimile system of the Lunas.

The recorded or responded voice transmission was also an entirely new feature. In this the Soviets have at last showed their hand more clearly than in any other part of the exercise. Voice transmission of this type is meaningless unless it is a communication test for a human being. Thus, at least a part of the puzzle seems to fit. A six-ton spaceship, of the type which carried the ill-fated Komarov into earth orbit, has been recovered on earth after a journey around the moon. The strange denial of our statement on September 18 is thus seen in perspective as an intention to make no further announcement on Zond 5 had it been unsuccessful in its primary purpose as a test of the re-entry and recovery techniques. The question remaining appears to be not if, but when, the Russians will repeat this mission with a human being aboard.

## MANNED FLIGHT NEXT

The whole history of the Soviet space enterprises illustrates their extreme care in establishing new techniques by repetition before moving on to the next stage. If Zond 4 was successfully recovered it may be that they now feel sufficiently confident after two successes to risk a human being. If Zond 4 was unsuccessful then there is certain to be more trials of unmanned vehicles before the human flight. In any event it would seem to be a reasonable judgment that we are now within months of the attempt to recover a human being after a round trip to the moon.

Zond 5 is evidence, too, of the rather narrow lead which Russia continues to maintain over America in the space field. The Luna soft landers and orbiters of 1966 were followed within months by the American Surveyors. The Americans now plan to test their three man Apollo spacecraft in earth orbit in mid-October with the hope of a circumlunar flight by the end of 1968 or early in 1969. If this is, indeed, achieved the Russians can hardly advance on this timescale by more than a month or two.

Beyond the circumlunar manned flights there remains a wide field for speculation about Soviet intentions. The American Apollo timetable is well publicized. If the programme now goes smoothly there could be an American on the moon by the end of 1969, or

early in 1970. Considering the fact that the first test of the Apollo spacecraft has not yet been made, and in view of the hazardous and complex series of manoeuvres in the Apollo concept, one feels that the maintenance of this timetable would represent a miracle of management and technology. Nevertheless the great N.A.S.A. organization with appreciable slices of American industry is now bent to this task in fulfilment of President Kennedy's pledge of 1961 that the nation would get an American on the moon by 1970.

The Americans are spurred on in this task by the belief that the Russians are determined to place a man on the moon before them. Is there any evidence at all for this belief. Although there is little reason to doubt that the Soviets intend to proceed eventually to the next stage of landing a man on the moon, it is hard to find evidence that they regard themselves as competing in a race with the American 1969-70 date. Unless the estimates made here of the Zond 5 mission grossly underestimate the size of the spacecraft and the launched capability, it seems impossible that the Soviets could proceed through all the essential steps with their customary caution on this kind of time scale. This assessment may, of course, be wrong. If it is, then Zond 6 when it comes, will contain far greater surprises than Zond 5.

As earthbound spectators of these incredible adventures into the unknown we are subject to a variety of emotions. There is a predominant admiration for the inconceivable courage of the men in the Soviet Union and America who have volunteered to subject themselves to the most perilous and uncertain journey which man will ever undertake. There is, on the other hand, a despair and fear at this prostration of man's technical ability to ends which are essentially political in the name of science. The huge cost of the enterprises—Apollo must have cost at least \$50,000 million and even three years ago more roubles were spent on Soviet space efforts than on their housing programme—has little relevance to research in the space sciences.

## FIRST LUNAR ROCKS

The cost of the epic discoveries in space made since the launching of Sputnik, 11 years ago, represents a mere fraction of the budget for the manned lunar programmes. The marvellous workings of the unmanned probes to the moon and the planets have demonstrated clearly that the presence of a human being on the moon is unnecessary for the further prosecution of the astronomer's interest in that body. It may well be that the first samples of lunar material to be returned to earth will be those brought back by an unmanned probe landing on the moon and returning to earth. But controlled by man on earth. At least that move seems to lie within the scope of Soviet technique, and a fair judgment based on public knowledge might be that they are in competition for the first lunar rocks, if not for the first man on the moon.