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WEEKLY SUMMARY

Special Report

The Soviet Space Program Ten Years After Sputnik I

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THE SOVIET SPACE PROGRAM TEN YEARS AFTER SPUTNIK I

October 4th marked the tenth anniversary of the flight of Sputnik I, the world's first artificial earth satellite. What have the Soviets tried to achieve during this period, what have they actually accomplished, how did they do it, and what are the prospects in the years to come?

Some see the Soviet space program as only a scheme to capture spectacular headlines, some consider it an exclusively military effort, and still others view the past ten years as an orderly unfolding of a long-range master plan with neither false steps nor blind alleys. The Soviets themselves frequently have characterized their program as purely scientific and not competitive with that of the US.

None of these diagnoses is completely right or wrong. The Soviet space program has looked a good deal like that of the US and has featured a mixture of scientific, military, and commercial ventures. It has gained world-wide headlines with spectacular achievements; a creditable number of Soviet flights, on the other hand, quietly made solid contributions to man's understanding of the cosmos. Certain segments of the program have indeed exhibited a high degree of orderly planning and intelligent execution; but there have been dead ends, blunders, and even disasters.

Early Sputniks

The orbiting of Sputnik I on 4 October 1957 was a tremendous achievement for its day. Whether the timing of the launch was determined by a desire to beat the US into space or reflected an independent Soviet schedule is unclear. The Soviet program already had been in existence several years. The USSR's permanent Interdepartmental Commission for Interplanetary Travel was set up four

or five years before the US created its National Aeronautics and Space Administration, and in 1954 the USSR established the Tsiolkovsky Gold Medal, to be awarded for accomplishments in interplanetary communications.

Sputnik II, launched in November 1957 with the dog Laika aboard, represented the second major Soviet achievement and provided a clear indication of the USSR's strong interest in developing means of sustaining life in space. The Soviets next showed the world their weight-lifting capability by launching Sputnik III, a capsule weighing nearly 3,000 pounds. The use of the very large, first generation SS-6 ICBM as a space booster made such launches possible. This booster is still the mainstay of the Soviet program and has been used to launch the majority of the more than 250 Soviet satellites put into orbit thus far.

The Interplanetary Program

Outstanding among the differences between the Soviet and US programs has been the greater emphasis the USSR has put on unmanned exploration of the moon and, especially, the planets. The Soviets have taken advantage of eight of the nine Mars or Venus "launch windows" open since the fall of 1960, when they made their first attempt to launch an interplanetary probe. Most of the attempted flights ended in failure. Nine payloads failed to eject from earth orbit into interplanetary trajectories. Most frustrating to the Soviets has been the fact that every probe put into an interplanetary trajectory suffered a communications failure prior to reaching its objective.

The interplanetary story continues: a probe recently launched toward Venus is operating properly and is expected to reach the planet on 18 October. It is very likely that shots will be attempted in January 1969, when the Venus window will again be open, and in February 1969, when firings to Mars will be possible.

Lunar Probes

The Soviets unmanned lunar program started spectacularly but soon lapsed into a long dry spell. Their solid initial accomplishments subsequently were eclipsed by more spectacular US successes.

The USSR started launching probes toward the moon soon after its initial venture into space. Luna 1 was successfully ejected toward the moon on 2 January 1959. Although Luna 1 missed the moon by a wide margin, the operation represented a significant step orward. Later the same year the Soviets hit the moon, with Luna 2, and photographed its hidden side--a brilliant achievement--with Luna 3.

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All of the early lunar shots were flown on a relatively simple direct-ascent trajectory, but subsequent probes were made to circle the earth in a "parking" orbit before being blasted out toward the moon. This procedure--more complex but permitting the use of heavier payloads--has become standard for all lunar, interplanetary, and deep-space launches. The Soviets also put a more powerful third stage on their launch vehicle.

Far Side of Moon Taken From Lunik 3

The lunar program, using the parking orbit technique, resumed in 1963 with the goal of orbiting the moon and of soft-landing a payload on the surface. Lunas 4, 5, 6, 7, and 8 all missed the moon or crashed onto it, and six other launches either failed to attain the parking orbit or to eject from it, before Luna 9 soft-landed in January 1966. The Soviets were surprisingly slow in correcting the deficiencies plaguing this program, a failing that has been noted in other parts of the space effort, too. After the flight of Luna 9, however, they successfully placed three probes into lunar orbits--Lunas 10, 11, and 12--and made a a second landing with Luna 13. Since Luna 9, only one lunar probe has failed. The quality and number of pictures taken by the Soviet probes compares very poorly with those obtained soon after by the US Surveyors and Lunar Orbiters.

Manned Space Flights

The beginning of the full-systems test phase of the Soviet manned space program was signaled by the launch of a 10,000-pound payload containing an instrumented dummy in May 1960. Six more tests of spacecraft carrying dogs led to the electrifying flight of Yuri Gagarin in Vostok 1 on 12 April 1961. Here, as elsewhere, the Soviets used an "all-up" test philosophy in preparing for their first manned orbital flight. At

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the earliest opportunity, they tested a vehicle-payload combination that was essentially the same as the one ultimately flown by Gagarin. This philosophy is characteristic of the Soviets and contrasts with the frequent US practice of preparing for a complex mission by a progression of tests of increasing complexity.

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Voskhod 2, launched in March 1965, carried two men and featured the walk-in-space by Leonov.

Titov's one-day flight took place four months after Gagarin's milestone single orbit. The next year saw the dual flights of Vostoks 3 and 4, whose launches--a day apart--were timed so that the two ships passed within three miles of each other. Although not a true rendezvous--because the spaceships were in different orbital planes--this operation indicated that the Soviets could control flight trajectory and launch times precisely enough to perform a rendezvous. The dual flight of Vostoks 5 and 6 took place in 1963. This operation was basically a repeat of the Vostok 3 and 4 flights, with the added wrinkle that one of the spaceships contained a female cosmonaut, Valentina Tereshkova.

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Vostok 1

Late in 1964 the USSR put up Voskhod I, a capsule containing three cosmonauts.

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The two-year pause in the Soviet manned flight program following the orbiting of Voskhod 2 was ended by the ill-fated Soyuz-1 flight of Vladimir Komarov. There has been no clear explanation for the long hiatus. It appears that the Soviets had done about as much as they could with the Vostok capsule and that more complex missions would require a new spaceship. (A two-year delay also occurred between the US Mercury and Gemini flights.) The Vostok afforded the pilot poor visibility and was ill-suited for modification for rendezvous and docking experiments of the type performed by the Geminis.

The only unexploited capability of the Soviet craft was its capacity to support a long-duration flight. It appears that the Soviets could have exceeded the Gemini record of 14 days in space had they chosen to do so. Why they failed to try is not clear.

Soyuz-1 was indeed a new spaceship, although it weighed about as much as Voskhod and was put up by the same booster - upper stage combination.

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Scientific Satellites

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The Soviet scientific satellite program has featured launches of small (500-pound), nonrecoverable payloads using SS-4 MRBMs equipped with upper stages. The Soviets have designated these launches as the Cosmos series. Firings have been occurring at a rate of about seven per year.

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A variety of interesting experiments and significant contributions to science have been made by this program, even though it does not enjoy high priority within the Soviet space effort or compare favorably with US scientific achievements in space.

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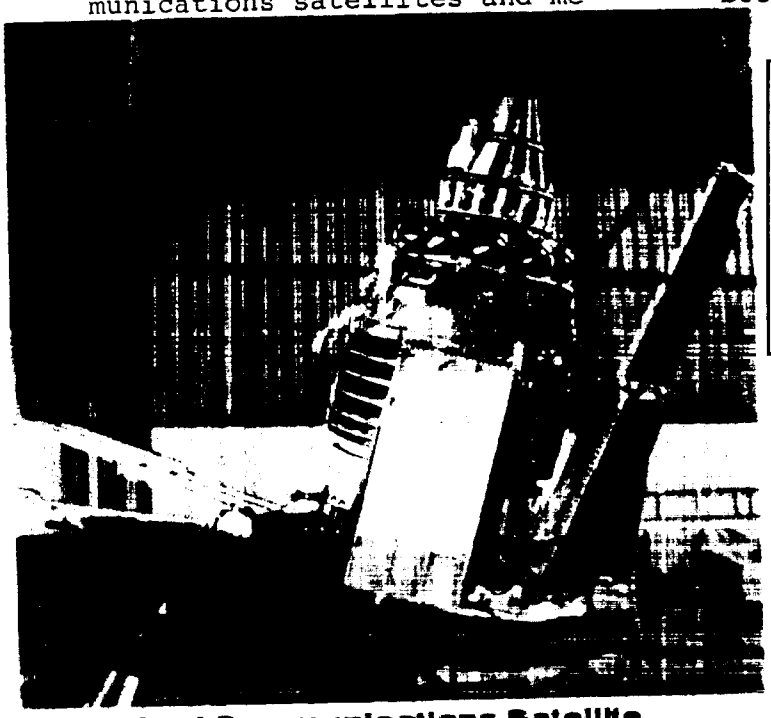
teorological payloads for weather forecasting have been orbited successfully. These programs so far have been much less extensive than US efforts. It appears that the Soviets are finding it difficult to put up payloads having an acceptably long operating life.

The Proton Booster

Among the most interesting Soviet space flights in the past few years have been those initiated with the orbiting of a 28,000-pound Proton satellite in July 1965. The Proton was twice as heavy as any payload previously put into orbit by the USSR and signaled the availability of a booster considerably larger than the SS-6. Three more Proton launches have been made [redacted] 25X1 25X1

More recently, Molniya communications satellites and me-



Molniya 1 Communications Satellite

The inefficiency of the Proton launch system was most puzzling. By adding a relatively small third stage, the Soviets could have doubled the weight put into orbit. It was expected that this change would be made very quickly, but instead the program lapsed after the launch of Proton-3 in July 1966. It seems likely that the performance of

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the booster fell short of the expectations of the Soviets and that they found it necessary to modify the vehicle and possibly its launch facilities.

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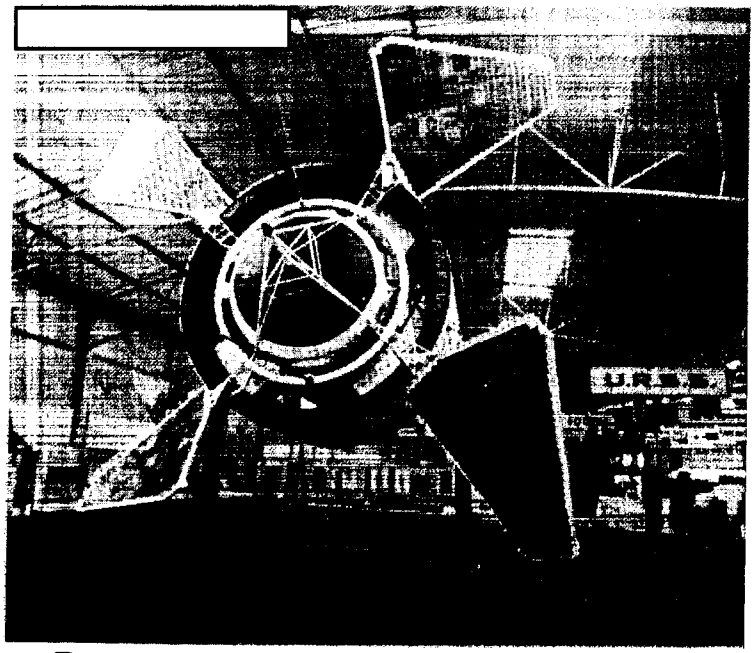

Proton at Paris Air Show

With continued testing, this new launch vehicle undoubtedly will be perfected and made reliable, giving the Soviets a number of interesting options. They could send a payload of 10,000 to 15,000 pounds toward the moon or the nearby planets. This weight is sufficient to allow a manned circumlunar trip--that is, a flight around the moon without landing and a return to earth. The weight is also great enough to permit the soft-landing of an unmanned payload on the moon to collect a sample of the surface. A rocket in the spacecraft would then return to earth.

In earth orbit, 50,000 to 60,000 pounds would be ample for a space station carrying six men for four months or more. The Soyuz ship could be used as a ferry for bringing up replacements and supplies.

Outlook

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The USSR is now believed to be constructing a massive launch facility

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The lack of interest the Soviets have shown in the use of high-energy propellants in the upper stages of their booster systems suggests that the new launch system will use conventional fuels. If this is the case, the first-stage booster will have to generate a thrust in excess of 10 million pounds if the

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Soviet payloads are to perform missions of the type planned for Saturn V. It seems clear that the Soviets will use this vehicle for manned flights, because no unmanned missions to the nearby planets require so large a booster. It is unlikely that manned flights to Mars or Venus will be tried in the next several years, however, because the round-trip times are too long.

The booster could be used to place a manned spacecraft weighing as much as a quarter of a million pounds into a low orbit around the earth. A manned lunar landing is, nevertheless, the most likely focus of Soviet attention in the next five-year period. [redacted] 25X1 25X1

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