EARLY LUNAR ACTIVITIES OF THE USA, AND AN AMERICAN VIEW OF THE EARLY SOVIET LUNAR PROGRAM

James D. Burke,
Jet Propulsion Laboratory, California Institute of Technology
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ABSTRACT
This paper summarizes the starting phase of American robotic lunar programs. It includes comments on the then-prevailing political situation within the United States, and it also touches on the effects of competition between the US and the USSR in the immediate aftermath of Sputnik. It is appropriate now to look back at those times, especially as some of the relevant data in both countries, previously secret, have now been declassified and released for public use. Though the early lunar missions yielded only limited scientific information, they did set both nations' programs on a path toward later great advances in our understanding of the Moon.

I. INTRODUCTION
By about 1950 it was evident to many people that launching Earth satellites would soon be technically possible, and that then the next logical step would be robotic missions to the Moon. The intellectual foundations had been laid by Konstantin Tsiolkovsky, Hermann Oberth, and Robert Goddard.
Scientific incentives for exploring the Moon had been manifest for centuries, and the human aspects had been explored by serious science-fiction writers including Johannes Kepler, Robert Heinlein, Arthur C. Clarke, Isaac Asimov and many others. Thus when, in the mid-fifties, it was decided in both the US and the USSR to launch scientific satellites as part of the International Geophysical Year, the stage was set for planners to begin thinking about lunar missions.

II. THE POLITICAL ENVIRONMENT
After the launch of Sputnik on 4 October 1957, there was a great release of pent-up energy among space enthusiasts in the United States. Suddenly it was possible to offer proposals for space missions that had been only dreams until then. At the same time, however, long-standing disputes among agencies jockeying for position (conspicuously the US Army, Navy and Air Force) came to include arguments over which organization would dominate American efforts to sail on the great new ocean of space. Everybody knew that this peaceful, idealistic venture would have to be based on military technology, but there was a strong desire to keep the program's public posture a civilian one. Thus the Vanguard satellite project was chosen instead of the Army/JPL/Von Braun team's competing proposal for the project that did ultimately launch Explorer I, the first US satellite.
Meanwhile the US Air Force, looking ahead to a possible role not only in near-Earth orbit but also for lunar missions, sponsored publication of a great

photographic atlas of the lunar near side, prepared by Gerard P. Kuiper and colleagues at the University of Arizona.
Sorting out these various efforts took some time. The contests were not settled by the Space Act of 1958 that established NASA, because regardless of how the program was organized it would still have to depend on military rockets. Meanwhile both the Army team and the Air Force team prepared missions intended to escape Earth orbit,to impact on the Moon, and to place spacecraft in lunar orbit. The first attempts predated NASA; the later ones were made under the NASA title.
All scientific space missions of that time had to be fitted into a program with another, secret objective of much higher priority; namely, the highly-classified goal of satellite imaging over the USSR.

III. EARLY LUNAR MISSIONS TO 1962

References 1 and 2 summarize, respectively, lunar program launchings of the US and the USSR in the period 1958 - 1962. Reference 3 is a detailed and well-illustrated history of those and the later lunar missions to be discussed below.
The early record shows clearly that the lunar teams in both countries were pushing the competitive pace at a rate too fast for the capabilities of the then-existing technology. However, the Soviet program did achieve historic early "firsts": reaching the second cosmic speed, impacting on the Moon, and photographing its far side.

IV. AMERICAN INTELLIGENCE GATHERING

With the beginning of strategic ballistic missile developments in both countries a high-priority need arose for American monitoring of Soviet activities in this field. Rocket telemetry was a prime source of information. To obtain the data, listening stations were established around the periphery of the USSR and encrypted communications were provided between these sites and analytical organizations in the United States. As a sideline to these intelligence efforts, it became possible to use some of the military facilities for tracking Soviet lunar and planetary probes. Though everyone believed that those missions were entirely peaceful and scientific, there was still some justification for watching them to gather information about military Earth satellites using the same technologies. Also, of course, the scientific lunar and planetary missions were part of the larger Cold-War geopolitical contest between the US and the USSR.
Now that much of the relevant information has been declassified in both countries, it is interesting to compare what was known at the time with the full story as it is now being described in historical publications. Reference 4, a 1966 publication now available in the US National Archives at College Park, Maryland, is typical of such declassified documents. It describes American efforts to understand the progress of Soviet lunar and planetary missions up to the landing of Luna 9, the first spacecraft to send signals and images from the surface of the Moon.

V. LUNAR AND PLANETARY ROBOTIC MISSIONS, 1962 - 1966

After the failure of Ranger 5 in October 1962, the US robotic lunar program was reorganized and reoriented toward preparations for Apollo. Meanwhile both countries' space organizations had begun launching robotic missions toward Mars and Venus. The Soviets led the way with two Mars attempts, 10 and 14 October 1960, which failed. American telemetry analysis showed that each of these two launch vehicles carried a new, heavy upper stage, signaling a large commitment to a new class of deep-space missions. On 4 and 12 February 1961 two more heavy vehicles were launched for Venus. The first spacecraft remained in low Earth orbit, but the second escaped toward Venus, eventually failing enroute. East-West cooperation occurred when Alla Masevitch visited Jodrell Bank, in England, to assist in attempts to contact Venera 1. Other Jodrell Bank activities in tracking Soviet lunar and planetary missions are well described in Reference 3. The summer and fall of 1962 saw an all-out attempt by the Soviets to be first at Venus and Mars. Six of the heavy vehicles were launched, but only one spacecraft, Mars 1, escaped on a path toward its target, eventually failing enroute.

In the US, the 1962 Mars opportunity had to be abandoned for programmatic reasons but two launches were prepared for Venus. The first of these failed, but the second sent Mariner 1 on its way to a Venus fly-by that returned the first close-up scientific data on the planet.

On 4 January 1963 the Soviets resumed lunar mission attempts, now using the heavy vehicle to launch spacecraft of a new generation (Refs. 3 and 4, plus the bibliographies included). This was the beginning of a long effort, frustrated by many failures but stubbornly pursued until it finally succeeded with Luna 9, the first lunar lander, and Luna 10, the first lunar orbiter, in 1966.

In the same time frame, Venus and Mars missions were prepared for the 1964 launch opportunity. American analysts were astonished to see Soviet planetary missions launched within days of some of the lunar attempts. The sole Venus craft to depart Earth was called Zond 1, the Mars one was called Zond 2. Both failed enroute.

On the US side, Mariner 3 suffered a launch failure but Mariner 4 traveled to a Mars fly-by and returned the first close-up images of the planet.

During this period a US-sponsored, deep-space intelligence tracking station became operational at a site near Asmara, Eritrea. Its data, plus the unclassified information collected at Jodrell Bank, began to give Western analysts a window into Soviet lunar and planetary design and operations practices. Also, of course, the data gave reliable evidence of the high priority given by the Soviets to being first at each historic space opportunity. This provided a powerful stimulus to American efforts. Meanwhile the US Ranger lunar series was resumed, culminating (after the failure of Ranger 6 in early 1964) in the successful return of thousands of high-resolution images by Rangers 7, 8 and 9 in late 1964 and 1965.

Also in 1965, the Soviets launched Zond 3, believed by American analysts to be a remodeled Mars spacecraft, which returned good imagery of the part of the Moon's far side that had not been covered by Luna 3. In parallel with the Ranger project,

two other American robotic lunar projects were now underway, both oriented primarily toward Apollo suppport but also capable of returning important lunar scientific data. One was Surveyor, five of whose seven spacecraft successfully soft-landed on the Moon and gave close-up imaging plus the first detailed lunar compositional information via alpha-particle scattering. The other was Lunar Orbiter, whose five successful missions succeeded in mapping Apollo sites and later, almost the entire lunar surface. Thus by 1966 both nations' lunar and planetary teams had overcome many difficulties and were beginning to produce new scientific knowledge of the Moon. It is most fitting today to recognize those pioneering achievements and to join in saluting the people, in all of the countries involved, who contributed to their success.

VI. REFERENCES

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