TRW SPACE LOG

WINTER-1968-69



OCTOBER 11 Apollo 7 carried astronauts Schirra, Eisele, and Cunningham into the first manned flight of the Apollo spacecraft. Objectives achieved during the successful 10.8-day mission were manual control of the S-IVB, operational checkout of spacecraft systems, rendezvous and simulated docking with the S-IVB, photography, and medical experiments.

OCTOBER 26 Soyuz 3, carrying kosmonaut Beregovoy, was launched into a mission which included automatic rendezvous with -- and manual approach to -- Soyuz 2, launched the preceding day. Soyuz 2 re-entered on October 28; Soyuz 3 re-entered on the following day, landing in northern Kazakhstan after nearly 4 days in orbit.

HIGHLIGHTS FOURTH 1968

NOVEMBER 8 Pioneer 9, fifth in the current series of interplanetary Pioneers, was launched into solar orbit. Also carried aboard the Thrust-Augmented Improved Delta was NASA's second Test and Training Satellite, TETR 2, inserted into low earth orbit to exercise the Apollo tracking and communications network.

NOVEMBER 10 Zond 6, an unmanned variant of a manned lunar spacecraft, was launched from parking orbit into a lunar transfer trajectory, circling the moon at a minimum altitude of just over 1500 miles, and returning via skip-lob re-entry to a soft landing in the Soviet Union. Payload for the 6.8-day mission included biological specimens for radiation experiment, meteorite recorder, automatic camera.

DECEMBER 7 OAO 2, carrying telescopes, tv cameras, and star trackers, was launched to observe and map over 700 stars daily.

DECEMBER 18 Intelsat 3A was launched toward a geosynchronous orbit. Put into service 6 days after launch and stationed off coast of Brazil, the spacecraft marks the initial increment of the first global commercial communication satellite system.

DECEMBER 21 Apollo 8, bearing astronauts Borman, Lovell, and Anders, was launched in man's first journey to the moon. Spacecraft spent 20 hours in 10 lunar orbits beginning on Christmas Eve before initiating transearth burn. Splashdown, after 6.1 days in flight and double-skip re-entry maneuver, was at 8° 8′ N., 165°W.

TRW SPACE LOG

Winter 1968-69 Vol. 8 No. 4

COVER

Front: Cover stories in *Izvestia* for 24 September 1968 and *Pravda* for 23 September 1968 feature the return of Zond 5, Russia's -- and the world's -- first circumlunar return mission.

Back: Heroic aspect of manned space flight is dramatized in this litho reproduced from the 27 October issue of *Pravda*, which featured the flight of Soyuz 3.

Photo credits - USAF: 31; TRW: 32, 49, 53; M.I.T. Lincoln Lab.: 33; McDonnell Douglas: 36; North American Rockwell: 40: NASA: 41, 42, 45; ESSA: 55.

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THE SOVIET SPACE PROGRAM

A GROWING ENTERPRISE

Charles S. Sheldon II

Acting Chief, Science Policy Research Division Legislative Reference Service, Library of Congress*

INTRODUCTION

The TRW Space Log provided its readers in the spring of 1965 a comprehensive review of the Soviet space program to that time, with tables of flights and drawings of spacecraft. Subsequent issues have brought particulars of those flights on which the Russians have announced details. Even without announcements, the Soviet program for the most part is made up of recurrent launchings which fit identifiable patterns of activity and presumably of purpose.

Since 1965, the Soviet program has shown a marked advance in number of launchings, although only a few have been sufficiently spectacular to catch the attention of the world press. The United States program in these three years has also had remarkable achievements signaling that our program, too, is coming of age. But budget reductions

have been matched by a slackening of our launch rate.

The numbers and variety of Soviet space flights have been so great that they can be described conveniently only through the device of statistical groupings. For those who wish some details on the original data by individual flights, the Condensed Log carried in this issue of TRW Space Log provides basic orbital parameters, place of launch, probable launch vehicle, payload weight (where known), and payload status.

*The views expressed here are personal and are not necessarily those of the Legislative Reference Service.

The purpose of this review is not only to update the details provided 3 years ago, but to show how much can be comprehended of flight details and program directions, even in the absence of Soviet announcements, by an awareness of the interactions of available information on launch vehicles, launch sites, time of launch, and orbital parameters. In this necessarily brief account, the sections which follow will be concerned primarily with launch sites, launch vehicles, and major program elements. Reference will be made at the end to more detailed sources for those readers who want to examine these matters in greater depth.

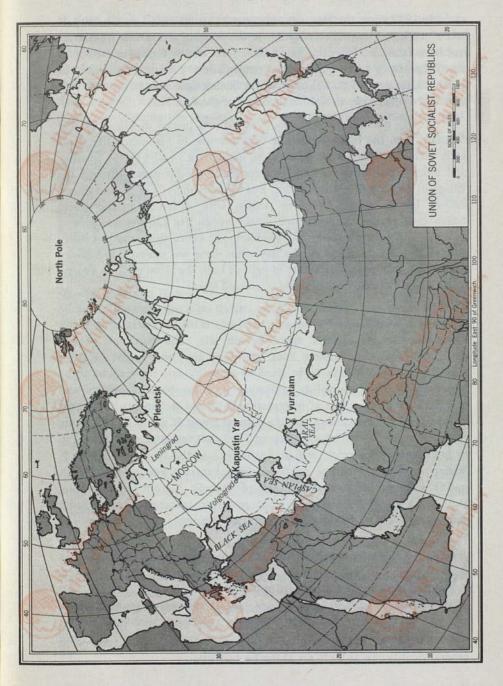
SOVIET LAUNCH SITES

In the early 1950's, Aviation Week revealed that the United States had a capability based in Turkey for tracking Soviet vertical probes and intermediate range missiles launched from a site on the Volga River below Stalingrad. Presumably aircraft flights of the U-2 kept the United States abreast in the late 1950's of further expansion of Soviet missile and then space ground support facilities, but official reticence in discussing such matters has tended to obscure the facts and has led to a certain confusion in press speculation on such matters.

Our own experience in building ground support equipment leads to the supposition that Soviet launch pads are probably specialized to the needs of each model of launch vehicle currently active. Because pads and their supporting equipment are expensive, we can also assume the Russians have built no more than they believe they require for effective operations, and that these would tend to be grouped in a relatively small number of areas. Most launches are probably made at a fixed azimuth to avoid the inefficiencies of dog-legging. Hence, "walking back" the ground trace of the initial orbit on successive flights, when keyed to particular classes of launch vehicles, is important to finding the launch site. If the time of launch is known, or if flights occur at different inclinations so as to establish a nodal point, the launch site can be identified with a good deal of confidence of accuracy. In the absence of Russian names for some of these places, nearby villages or towns have sufficed for our naming purposes.

Tracking space objects by both visual and radio means is within easy reach of private individuals in all countries, to supplement whatever more elaborate tracking may be done by some governments with active radars or CW radio barriers. Therefore, even in the absence of Soviet corroboration, all three existing Soviet launch sites are well known through unclassified analysis.

SOVIET LAUNCH SITES



Tyuratam

In 1957 when the Russians announced that Sputnik 1 was in orbit, it was a quick and natural assumption in the Western world that this device had been launched from the long-familiar test site in European Russia on the Volga. Only a few paid heed to calculations promptly published in Japan which showed that the link of the launch time and the ground trace moved the launch site to Kazakhstan, east of the Aral Sea.

It was not until 1961 when Gagarin was placed in orbit that the Russians gave the name Baykonur Cosmodrome to his launch site. Most early Soviet satellites were flown at an inclination of 65° to the equator, and indeed, the initial ground trace for such an orbit passes through the village of Baykonur in Kazakhstan. But Western analysis of ground traces, known launch times, and later flights with different ground traces consistently carries the postulated Soviet launch site 230 miles southwest of Baykonur to the vicinity of Tyuratam, and hence this name is usually applied to the launch site. If the Baykonur name was intended as a Soviet subterfuge, its purpose is obscure in light of both the flight of Gary Powers in 1960 and the many calculations of ground traces.

With our assumptions that most launch pads are designed to handle repetitively launches of the same vehicle, one is led to certain conclusions about the original Soviet space launch site. The hardstand, flame deflectors, fuel and oxidizer lines, gantry if any, and height of work platforms would all have to be sized to accommodate the vehicles to be launched. Western specialists reviewing data on tracked objects and searching for obscure bits of information in Soviet statements had pretty well reached the conclusion that the original Soviet ICBM of 1957 became the basic space launch vehicle. Late in 1967 that was confirmed explicitly in Soviet public histories, and in April 1967 at the launch of Soyuz 1, Soviet journalists remarked on the historical marker alongside its launch pad which memorialized the launch of Sputnik 1 from the same site. Movie film released in 1968 of many historical launches up to Soyuz 3 showed elements of the same launch site and fittings.

Tyuratam has been used over the years not only for ICBM tests and the early Sputniks, but also for many other R & D flights, all manned flights, all lunar and planetary attempts, and all communications satellites. Located at 45.63° N. Lat. and 63.27° E. Long., it is most easily thought of as the Soviet equivalent of Cape Kennedy. Proliferation of programs and launch vehicles beyond the original one, while the first vehicle continues in use, suggests that there are other launch pads in the same general vicinity just as there are at the Florida site.

Kapustin Yar

In 1962, the Soviet Union announced a new program of launchings of Kosmos payloads to come from several cosmodromes, although the added ones have never been specifically identified in Soviet announcements. In light of the earlier test work with smaller vehicles detected near the Volga River, it was not surprising that ground traces of the first Kosmos craft led back to this test site, which is near Kapustin Yar. The economics of using the standard launch vehicle with a first stage thrust of over 1.1 million pounds for all space launchings were not ideal. So the Russians took a much more modest existing military IRBM, gave it an upper stage, and probably were able to launch it from an existing stand at this European site, whose location is approximately 48.520 N. Lat. and 45.80° E. Long. In contrast to the ultimate variety of inclinations and vehicles used at Tyuratam, suggesting large scale space operations, Kapustin Yar has a very modest space role. Every payload has had an inclination to the Equator of close to 490, and most of the payloads have been of modest size, spin-stabilized. The combination of vertical probe work and modest orbital flights reminds one respectively of White Sands, New Mexico, and Wallops Island, Virginia, Although the approximation is crude, it may help the reader in orientation.

Plesetsk

The team of British school boys directed by Head Science Master G. E. Perry at the Kettering Grammar School has for some time done a remarkably fine job of tracking Soviet spacecraft. In their early years this was accomplished with a surplus radio worth about \$80, a considerable dedication, and logic in applying known principles of physics. They were the first private citizens to disclose early in 1966 that Kosmos 112 was not only placed at a higher inclination than previous spacecraft, but that the initial ground trace was well to the west of both Tyuratam and Kapustin Yar. Some months later when another Kosmos payload also with a more westerly ground trace was put up at a different inclination, the ground trace crossed the earlier ground traces near Plesetsk at 62.70 N. Lat. and 40.350 E. Long. This has since been confirmed as a nodal point for many flights, and with enough variety of probable launch vehicles to lead to the supposition of several different launch pads. Thus the Kettering group deserves credit for identification of a key site not yet acknowledged by the Russians, although it had been rumored in the West as a possible missile site.

This complete Soviet silence and the repetitive nature of military support flights from this location suggest an operational role similar to that of Vandenberg Air Force Base, California. The parallel is extended by its use for launch of weather satellites, as well as other payloads, at much more extreme inclinations to the equator than come from the other two launch sites.

Thus, there is a rough correspondence, sometimes uncannily close, to the pattern of three launch sites in the United States. And in the Soviet case, knowledge of the launch site is therefore an important first clue to the nature of the mission and the launch vehicle used. If one is not able to construct his own ground trace of orbits, often the clue to pinpointing the site for those flights at an inclination of about 65° which may come from either Tyuratam or Plesetsk, lies in the launch time. Plesetsk flights usually go up later in the day so that they may be brought back to the recovery zone in Kazakhstan at the same morning hour preferred for Tyuratam launches. Again, much of this detail has come from Kettering studies of beacons on the Soviet recoverable craft, Doppler shifts in their signals with retrofire, and changes in signal strength with parachute deployment after reentry, with ground contact, and with final recovery (signal end).

SOVIET LAUNCH VEHICLES

Only since 1967 have any Soviet launch vehicles for orbital flight been put on public display, together with moderately extensive statistics on their performance. In earlier years, some bits and pieces were released, usually in a form which did not permit adequate calculations of the nature of the vehicles in question. One upper stage was revealed in 1959, and some rocket engines in escape payloads also were seen in intermediate years. Even now, there are finer points of the engineering which are not made wholly explicit, and some vehicles which have not been unveiled.

In the absence of adequate Soviet names and descriptions, or even of a public Western nomenclature system, a synthetic classification has been invented for purposes of this article. The basic launch vehicles, often military rockets, will be assigned letters; the upper stages, if any, which make them useful orbital flight systems, will be assigned numbers; any final stages needed for escape or special re-entry will be assigned letters; and finally, those which cannot be determined from public sources will be marked X.

Six basic launch vehicles are hypothesized: A, B, C, D, F, and G, with X used for the unknowns. The added upper stages, which may or may not be specialized to serve a single class of launch vehicle, will be designated 1, 2, 3, etc. One category, which may have employed either 1

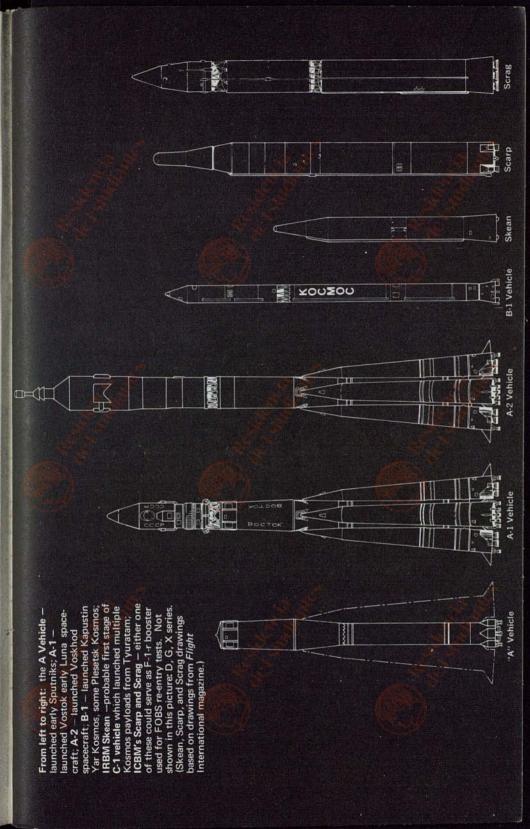


Table of Launch Vehicles

Designator	Characteristics	Typical Payload							
A	Core vehicle in orbit	Sputnik 1, 2, 3							
A-1	Separated upper stage	Luna 1, 2, 3; Vostok							
A-2	Separated longer upper stage	Voskhod							
A-2-e	Orbital launch platform	Luna 4 on; Zond 1, 2, 3; Venera; Mars; Molniya 1							
A-1/2	Public data lacking on separated stage length; may be A-1 or A-2	Some Kosmos							
A-m	Maneuverable with no separated stage; may be A-1-m	Polet							
A-X	Possibly maneuverable with no separated stage; may be A-m or A-1-m	Kosmos 102, 125							
B-1	Small, spin-stabilized, and usually with separated stage	Kapustin Yar Kosmos and some Plesetsk Kosmos							
C-1	Multiple payloads or circularized orbit single payload	Tyuratam Kosmos at 560 and Plesetsk Kosmos at 740							
D	Possibly core vehicle in orbit	Proton							
D-1	Large payload in earth orbit	Kosmos 146, 154							
D-1-e	Orbital launch platform	Zond 4 on							
F-1-r	Fractional orbit platform	FOBS Kosmos							
G-1; G-1-e	Very heavy launch systems	Postulated Webb's giant							
X-1-m	Maneuverable system and variants; could be A-1-m, F-1-m, or a new system, H-1-m	Kosmos 185, 198, 209, 217, 248, 249, 252							

or 2, will be marked 1/2. The escape rocket (often a fourth stage) will be labeled e; any extra maneuverable stage will be marked m; and any special reentry rocket will be marked r.

"A" Series: Vostok - the Standard Soviet Launch Vehicle

During the period 1954-57, the Gas Dynamics Laboratory in Leningrad developed an engine called the RD-107, which with its variant, the RD-108, became the basis of the original Soviet ICBM. The first ICBM was launched from Tyuratam in Kazakhstan on August 3, 1957; and on October 4 that year, the first satellite, Sputnik 1, was placed in earth orbit with this vehicle. The same was true of Sputniks 2 and 3.

The original Soviet ICBM was designed before the thermonuclear breakthrough was a practical certainty, and is therefore a very large vehicle. It consists of a central core liquid stage 91.8 feet long and 9.7 feet in diameter, a plain cylinder through its lower portion, then flaring and tapering again at the upper end in a hammerhead effect. Grouped around the plain cylinder portion are four liquid stage strap-ons, each 62.3 feet in length and 9.8 feet maximum diameter, each tapering toward the upper end as modified elongated cones. When all five sets of tanks are assembled, the result is a fluted pyramid effect which is rather graceful, with a maximum base diameter, including four stubby fins, of 33.8 feet.

The four strap-ons carry the RD-107 engine, which burns liquid oxygen and a hydrocarbon, operating a single shaft turbine assembly to pump the oxidizer and fuel to four conical exit nozzles and to two steering rockets. There are auxiliary systems to pump a hydrogen peroxide gas generator and to run a liquid-nitrogen-to-nitrogen-gas pressure supply. Operating at 60 atmospheres pressure, the system produces a vacuum thrust of over 224,800 pounds with an I_{SP} of 314 seconds. The chambers are double wall regeneratively cooled, with an inner lining of copper. The RD-108 engine which powers the central core sustainer apparently differs from the RD-107 only by having four steering rockets instead of two, and a longer burning time. All four strap-ons and the core ignite before liftoff, and after the four strap-ons drop away, the core continues to burn. This gives a combined thrust (vacuum equivalent) of over 1,124,000 pounds. At lift-off, there are 20 main thrust chambers plus 12 steering nozzles all in action.

When this ICBM was used to orbit the first three Sputniks, it was not used very efficiently, lacking an added stage. In the case of Sputnik 3, the payload was 2926 pounds. The entire core vehicle went into orbit, very much in the manner of the early Atlas Project Score launch. For purposes of the present classification, this basic vehicle will be designated A.

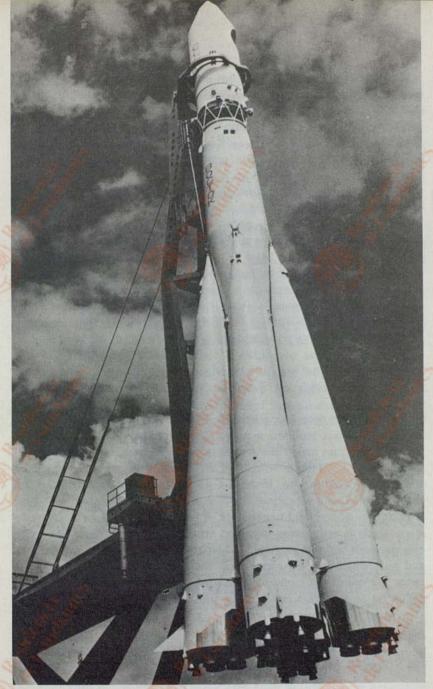
When the Russians were ready to send their first direct-ascent unmanned payloads to the moon, the A vehicle was used, plus an added stage, so that it will be designated the A-1. At burnout this final stage weighed about 3500 pounds, including the payload which weighed about 800 pounds. This added upper stage was the first space propulsion vehicle to be put on display by the Russians, soon after the flights in 1959.

By study of the Vostok manned craft displays first shown in 1965, it seems a good hypothesis that this same lunar upper stage was also used as the final stage for the orbiting of these craft. The Russians call the whole vehicle assembly Vostok, although the name originally was applied to the payload itself.

Added Soviet details are available about the total vehicle. Its height to the tip of the shroud over the payload is 125 feet (33 feet beyond the basic vehicle). The combined thrust of all stages is 1,323,000 pounds, which by subtraction gives us a final stage thrust of 199,000 pounds from the single nozzle in that stage. Before the Russians revealed the particulars quoted above, they described the Vostok vehicle as having a power output of 20 million horsepower — not a particularly useful measure, but pertinent to a later step in this analysis. In earth orbit, the A-1 vehicle as used for Vostok lifts about 10,400 pounds, not counting the separated final stage whose burnout weight is about 3200 pounds.

Another interesting feature of the A-1 vehicle is its rugged construction. It was first seen in the West in 1967 when it came in segments by ship to Rouen, France, and was trucked to Le Bourget for assembly. With cables attached to the extreme ends of sections, men could walk up and down the length of the suspended sections without damaging them. According to a Soviet movie, the total vehicle is assembled in Tyuratam in the horizontal position attached to a strongback. It is moved by rail to the launch pad, where it is tilted to a vertical position over a flame deflector pit, and big arms at the pad swing up to steady it until launch, when they swing back again. One arm has an elevator to carry checkout crews or cosmonauts to the top of the vehicle.

After the A-1 version appeared, a still more complete exploitation of the basic launch vehicle was obtained by building an improved upper stage which has the same cross section as the earlier stage, but is longer. The actual hardware has not been put on display and only fleeting views have appeared in Soviet movies. This stage may be about 20 feet in length instead of the approximately 6.5 feet of the earlier vehicle. The Russians claim that this improved vehicle involves a total assemblage of seven engines instead of six as used for Vostok. Its original use was for orbital platform launches to the planets, and for that purpose the added stage can be understood. But it has also been used for the Voskhod and Soyuz earth



Shown at the U.S.S.R. Exhibition of Economic Achievement in 1967 was the Vostok (A-1) booster, identified as the vehicle which carried Cosmonaut Yuri Gagarin into man's first earth orbit in 1961. Evolved from the original Soviet ICBM, the basic "A" version, without upper stages, orbited the early Sputniks. Configuration shown above has the basic 1½-stage first stage plus first-generation orbital stage.

orbital flights as well. The Russians ascribe a total thrust of 1,433,000 pounds to the improved version, which suggests some combination of 309,000 pounds divided between the last two stages, probably mostly in the longer third stage. The Russians have claimed for this combination a total lift capacity of 16,500 pounds, compared with a first successful use in 1961 of 14,292 pounds (a platform intended to launch a Venus probe from orbit).

The orbiting platform technique has been used for all Luna flights since 1963, the Molniya 1 series, the Zond flights, and Mars and Venera flights. Although the Russians claim an extra engine in the Voskhod series, no second spent rocket casing appears in orbit, so this improvement over the A-1 will be designated the A-2, while the orbiting platforms which then fire a probe stage will be designated the A-2-e.

Because the Russians have credited Kosmos series flights with weights up to 16,500 pounds, the A-1 and A-2 may both be in use within the Kosmos program. Without sufficient optical tracking data on empty rocket casings, there is no public way to identify which has been used on each flight; so those of uncertain classification will be labeled A-1/2. Exactly when the A-2 was first introduced is not known, so assuming the A-1 was used through the Vostok period, the A-1 label is made specific that far.

There have been four flights from Tyuratam for which no separated carrier rocket was reported in orbit. Their occurrence relatively early in the space program makes the A vehicle the best guess for a booster. Two of these were Polet flights with an advertised capability of maneuver. They will be designated as A-m. If the A-1 was involved, the penultimate stage was suborbital, and we cannot establish the correct designation as A-1-m. If there was no standard upper stage, it was replaced with a maneuverable stage which in either case remained attached to the payload. The other two payloads without separated carrier rockets in orbit were Kosmos 102 and 125, which had perigees in the Southern Hemisphere. This at least raises the question of possible maneuver, and whether they represent a follow-on to the Polet series. They will be labeled A-x because the final stage cannot be determined from the record. Again, they could be A-1-x or A-m or A-1-m, but this is not known.

The Russians themselves have said the Elektron series was put up by the Vostok or A-1 rocket, so this designation requires no further analysis.

"B" Series: Kosmos - the Small Launch Vehicle

After Tyuratam had been used for some time with launch vehicles of ICBM-size, a second cosmodrome was opened at the earlier vertical probe

and IRBM test site of Kapustin Yar on the Volga. These modest payloads, variously estimated as weighing between 285 and 1000 pounds, are more nearly akin to the Explorer satellites of NASA, and have been used in a fairly steady but unspectacular program of science, component testing, and perhaps for obscure military purposes. In 1967, this vehicle was finally put on display in the Moscow museum. Previous Western estimates proved correct that it was the IRBM coded Sandal by NATO, plus an upper stage. The Russians themselves label this launch vehicle the Kosmos.

Earlier in 1967, the Russians revealed at the Paris Air Show the upper stage power plant of their small Kosmos. It is designated the RD-119, and was developed between 1958 and 1962 by the Leningrad Gas Dynamics Laboratory. In concept it is not unlike the RD-107 and RD-108, and the Russians point to its great efficiency. It operates at a pressure of 80 atmospheres, has a thrust of 24,250 pounds, and a vacuum I_{sp} of 352 seconds. It burns liquid oxygen and dimethyl hydrazine. The single nozzle is bell-shaped, and a single shaft turbo pump system drives the fuel and oxidizer supplies as well as a fairly elaborate set of auxiliary nozzles for roll, pitch, and yaw.

The total vehicle combination, which we will designate the B-1, is 98 feet long and 5.4 feet in diameter. Most of the payloads it puts up are spin-stabilized, and then the carrier rocket is separated. A few do not separate; in one case there were two payloads; and in another, a special aerodynamic stabilization system was used.

"C" Series: Skean - the Intermediate Vehicle

Within the Kosmos series have come launches of multiple payloads from Tyuratam at an inclination of 56°. The Russians said a new and different launch vehicle had been used. Some of these orbits have been circularized at various heights into long life orbits. The numbers put up at one time and the orbits attained might well be beyond the capability of the B-1, Sandal-based system. Also, optical studies of these payloads give no indication that they are put up by the A-1 class large vehicle.

Accordingly, a search of the known stable of Soviet military missiles which with an added upper stage would do this task suggests the NATO-named medium range ballistic missile, Skean, as the likely candidate for the first stage. But this launch vehicle has not been put on display in any space museum, so final confirmation is not possible as could be done with the Sandal. This postulated third vehicle will be designated the C-1. First it put up three payloads at a time, then five at a time, all at 56° inclination. Then came later launchings at the same inclination (apparently unique to this launch vehicle) which carried single payloads only. Assuming that the developmental phase typical of many Tyuratam

launches was over, a new series of operational flights — with the same apogee and perigee characteristics but at a 74° inclination from Plesetsk — have followed, and could have been made with the same vehicle. Recently after a long pause, another payload from Tyuratam was launched with an inclination of 56°.

"D" Series: Proton - a Non-Missile Space Launch Vehicle

In 1965, the Soviet Union announced the launch of a scientific payload named Proton by means of a new launch vehicle which has never been pictured or displayed. The payload weighed 26,896 pounds, and according to the Soviets the launch vehicle had a total output of over 60 million horsepower. They drew the further parallel that it had three times the capacity of their Vostok (the A-1).

It was rather curious that a vehicle whose first stage might easily have 3,300,000 pounds of thrust would put up only double the payload of the Vostok vehicle. When this inefficiency was coupled with visual observations of an accompanying rocket casing of about 90 feet in length and 16 feet in diameter (by British calculation), the implication was strong that in this first test, and the two subsequent ones, a central core vehicle had been placed in orbit, and that later versions would have better staging and hence a much higher lift capability. We shall designate this block one version the D launch vehicle.

In 1967 came two Kosmos test launches which were then quite obscure as to purpose. British optical measurements of a large payload, in addition to a more moderate carrier rocket, suggested a possible weight for the payload of almost 66,000 pounds, since it was about 46 feet long by 10 feet in diameter. These figures would square with a reasonable assumption for the capacity of a D-1 version of Proton, with a first stage thrust of 3,300,000 pounds, as 40,000 to 60,000 pounds. Such a vehicle would be capable of supporting a manned circumlunar flight.

Consequently it was not too surprising when Zond 4, 5, and 6 came along, and in late November of 1968 were officially described as precursors to such a manned flight. The circumlunar version is probably best designated as D-1-e. Such a vehicle should be able to send from 9900 to 15,400 pounds around the moon based upon the comparative ability of the A-2-e to send over 3300 pounds to the moon. Likewise, the D-1-e may be able to send planetary probes of 6600 to 8800 pounds, compared to the A-2-e capacity to send over 2200 pounds on such flights.

The most common Western assumption about the Soviet program is that to this point the Russians have not switched to use of hydrogen or other high energy fuel. This is signaled by the relatively low announced weights of payloads compared with the high thrust of the vehicles. It was somewhat surprising, then, in November of 1968, to have a Proton 4 flight, after a lapse of some years, with an announced payload weight of over 37,000 pounds. This might have been a D-1 vehicle, with a performance on the very low edge of Western estimates of its capacity. Or it might represent a markedly improved version of the D vehicle such as would be occasioned by a redesign of the core to use a high energy fuel. Public data are too scanty at this point to resolve such questions, and as usual, the Russians are not saying.

"F" Series: Scrag or Scarp - a Military Launch Vehicle

The Russians have paraded in Moscow two different weapons which were described by them as capable of orbital delivery of nuclear weapons to any spot on earth. One was a three-stage liquid fueled rocket, with the stages linked by a lattice structure. It was nicknamed Big Brother by the Western press, and called Scrag by NATO. In a later year, a second rocket was paraded. It was also liquid-fueled, perhaps with two stages, although the precise points of division were not wholly certain. It was bottle-shaped, and the smaller diameter warhead end may have incorporated a third stage. This rocket was labeled by the Western press the SS-9, and NATO calls it the Scarp.

Since 1966, a series of Kosmos flights have shown characteristics quite different from all others. The first two were not even announced the first such lapse in almost 4 years. When more came in 1967, the Soviet press release format was different, particularly leaving out any reference to an orbital period. This suggested that the payload was up for less than one orbit, although some debris was usually up for several orbits, and in a form suggestive of the launch platforms used for escape missions rather than low earth orbital flights. Moreover, these were the lowest of any Soviet flights. Together these facts — the low orbit, the presence of both a platform and a separated carrier rocket, and the early recall of the payload with no period announced - all signaled re-entry tests. But the purpose of these tests was obscure. Some Westerners thought of Soyuz experiments to overcome the troubles experienced by Komarov; but if so, why was the orbit selected so different in inclination and altitude? Rumors of a weapons relationship, to give credibility to the parade claims, circulated for many months. It was clear the Russians were doing nothing to hide the fact of re-entry tests. Secretary McNamara finally tagged them, not conclusively, but with a fairly high order of probability, as FOBS (fractional orbital bombardment system) tests.

It is not possible from any obvious public clue to settle whether these flights are made by Scrag or the newer Scarp. The use of a unique

inclination (50°) suggests a different launch pad at Tyuratam and therefore a different rocket from the A-1/2. Hence this military rocket will be coded the F-1-r, to indicate a new launch vehicle, an orbital stage, and a reentry stage.

"G" Series: a Possible Very Heavy Lift Launch Vehicle System

Unless the Russians flight-test new vehicles, it is difficult to be positive about their existence from public sources, since they do not permit visits to factories, test stands, or launch sites. There has long been speculation that the Soviet lead in larger launch vehicles would not be surrendered willingly; and since the time table for our Saturn V was well known, we could expect a corresponding Soviet system in roughly the same time scale.

From 1967 on, James E. Webb, Administrator of NASA, testified before Congress that such a Soviet system was being prepared, that it would probably have more thrust than Saturn V, and that in its full development it would have a greater lift capacity. These reports were amplified in 1968 both by George Mueller and Wernher von Braun, both prominent in the NASA organization. There has been no public statement on such a Soviet launch vehicle from either the President or the Department of Defense. Some press writers have doubted the reality of this vehicle, ascribing the statements to the budget needs of NASA.

The Russians have not settled the matter for us so far, although they have long talked in general terms of the need for still larger vehicles to support manned flight to the planets. The only reference found is a claim in the Czech magazine *Student* for October 4, 1967, page 3, purportedly quoting Soviet General Kaminin and Cosmonaut Popovich as saying such a large vehicle is in an advanced stage of development.

Tentatively then, until the Russians make a flight or unveil details, the designator for Webb's Soviet giant will be G-1, and if used for escape missions, then G-1-e.

"X" Series: Unidentified Launch Vehicle

Through techniques discussed in this article — i.e., relating orbit characteristics, launch site, and mission information — almost all classes of launch vehicles can be estimated with a fair consistency.

About the only remaining hard-to-classify cases are seven Kosmos flights from Tyuratam which seem to be of a group. At least some have maneuvered, having generally first been put into a low circular orbit, then

moved to a higher circular orbit. The last two such flights ended up in a still higher eccentric orbit. The purpose of these flights is not yet apparent. The launch vehicle, which may or may not be new, will be designated for the time being as X-1-m.

SOVIET PROGRAM ELEMENTS

An extensive discussion of program details would take more space than this article will permit. The table which follows attempts to supply, by year of launch, data on each named type of Soviet payload, along with an identification of the launch site and the launch vehicle. Because the Kosmos label covers so many programs, its elements are subdivided into probable missions in order to match the detail already supplied on non-Kosmos flights. For convenience, subtotals are shown for Kosmos flights; for earth orbital flights and escape flights (some earth orbital listings were escape mission failures); and for the three launch sites. With this as a guide, it should be possible to refer to the details by individual flights listed in the Condensed Log.

The table on pages 20 and 21 reveals a fairly extensive program aimed at scientific objectives in earth orbit, mostly done with the small B-1 class rocket. Failure to announce missions for many of these flights leaves the possibility that they also fulfill some military support role. The heavy D class flights described as scientific are equally likely to be primarily engineering tests of the launch vehicle.

Practical applications of Soviet flights are aimed at weather reporting, communications, and navigation (perhaps also including military electronic ferreting). These applications came later in the Soviet program than in the United States, and many early flights were apparent failures, but now performance is improving.

The largest single element in the Soviet program is the conduct of military photographic observation missions, although these flights may also carry secondary payloads part of the time. One Soviet military program goes beyond passive support, and that is their FOBS, for which there is no U.S. equivalent.

Of obscure purpose are at least three series of different vehicles whose common thread is the fact or the suggestion of maneuver. These may include engineering tests of components for incorporation in other craft. Various Western observers have pointed to such disparate ultimate goals as building space stations, maneuvering near the moon, conducting satellite inspection, and even leading toward a full orbital bombardment capability. But no real answer is possible now without more Soviet disclosures.

SUMMARY IDENTIFICATION OF SOVIET SPACECRAFT

Category	Launch Site	Probable Vehicle	Payload Names	1957	1958	8 1959	196	0 196	1 1962	1963	3 1964	1965	1966	5 196	7 1968	Total	S
Scientific, or unidentifiable test or military application	Tyuratam Tyuratam Tyuratam Tyuratam Kapustin Yar	A A-1 D A-2-e B-1	Sputnik — Elektron — Proton — Kosmos —	2	- 1						4	2	- 1	1	-1	— 3 — 4 — 4	
Weather-related	Plesetsk Tyuratam Kapustin Yar Plesetsk	B-1 A-1/2 B-1 A-1/2	Kosmos — Kos								_1	<u> </u>	<u> </u>	6 1	— 8 - — 2 -	— 14 — 5	
Communications-related	Tyuratam Tyuratam	A-2-e A-2-e	Kosmos — Molniya 1					200		-1	-1		200	1			
Possible navigation and/or electronic ferret	Tyuratam Plesetsk	C-1 C-1	Kosmos — Kos	And the same				201	100	LIVAU!	_ 3	22 -		1	—1- —5	27	
Military observation	Tyuratam Plesetsk	A-1/2 A-1/2	Kosmos — Kos	110					5	-7	- 12	- 17	-15	- 8	— 14 — 15 -	- 78	
FOBS weapons test	Tyuratam	F-1-r	Unannounced or Kosmos -	THE RESERVE											-2		
Probable maneuverable	Tyuratam Tyuratam Tyuratam	A-m A-X X-1-m	Polet					Sales Francis		-1	-1	1	1		5-	2	
Manned and precursors	Tyuratam Tyuratam Tyuratam Tyuratam Tyuratam	A-1 A-1 A-2 A-2 A-2	Korabl Sputnik — Vostok — Kosmos — Voskhod — Soyuz — Voskhod — Soyuz — Voskhod — Soyuz — Voskhod — Kosmos — Voskhod — Vo				3 -	2 2	2	<u> </u>	1 1	— 1 — 1	_ 2	<u></u> 3		5 6 10 2	
Launch platforms	Tyuratam Tyuratam	A-2-e D-1-e	Tyazheliy Sputnik — Tyazhe				The St	1.	1	-1	-3	9 .	_ 7	- 6		33	
Lunar missions	Tyuratam Tyuratam Tyuratam Tyuratam Tyuratam	A-1 A-2-e A-2-e D-1 D-1-e	Luna — Unannounced or Kosmos — Luna — Kosmos — Zond — Zond	10	2	_ 3 -		0.25		<u> </u>		— 1 - — 4	_ 1 -	2		-3 -3 -11 -2	
Planetary missions	Tyuratam Tyuratam Tyuratam Tyuratam	A-2-e A-2-e A-2-e A-2-e	Unannounced or Kosmos ——————————————————————————————————			3 13 15 15		_1	<u> </u>			2		_1		9 4	
Subtotals:		TO THE REAL PROPERTY.			100	33139	000	100		K (B)	URS I	FEE	NAME OF TAXABLE PARTY.	BIVE	1196		
Kosmos —				727			N 317		-12	12	27	52	34	61	64	262	
Earth orbit — Escape				2	1		3	6	20	17	36	66	46	71	79	347	
Tyuratam —	SDOWN BURNE	Shirt	MAN THE RESERVE TO THE PARTY OF	2		- 3	1	1	//1	1	2	7	5	1	3	24	
Kapustin Yar —				2	1	3	3	7	14	14	30	66	38	39	44	261	
Plesetsk —			· · · · · · · · · · · · · · · · · · ·	- Saked	SIL			and the		4	8	7	7	7	8	48	
Totals	THE PARTY			2	1	3	3	7	21	18	38	73	- 6 51	26 72	30 82	62 371	

Manned flights and their precursors up to 1968 through Soyuz were all conducted with the A family of vehicles. Now we have the Soviet announcement that the larger D (Proton) family is also being groomed for such work, tested under the Zond label.

After Luna 3, all Soviet escape missions and also their communications satellites in eccentric earth orbit have used the technique of launch from an orbiting platform. These are termed Tyazheliy Sputnik by the Russians (e.g., Tyazheliy Sputnik 5 launched Venera 1). Hence lines are provided for the count of these platforms.

Lunar and planetary failures which attained earth orbit were not always named in the earlier years, but now are given Kosmos cover names; both categories are included in the table.

SOVIET GOALS

Soviet space objectives include not only the seeking of scientific knowledge for its own sake, but several other important purposes. One is the practical application of space flight to civil and military ends. Another is to gain the indirect spillover of advanced space technology into general industrial advance and systems management. Not least is to create a political effect both on their people at home and on the rest of the world through an image of leadership and progress in matters technological. There may also be a certain mystical belief inherent in their thought that the universe is there to be explored and ultimately mastered.

ADDED SOURCES

A considerable volume of useful material, including Soviet announcements and scientific literature, is available to explain many of the specifics of the Soviet space program. A number of Western writers have put together analytical compendia for those without time to search original materials. At the risk of slighting others omitted, special attention is drawn to such British writers as Kenneth W. Gatland, A. V. Cleaver, J. A. Pilkington, and G. E. Perry. Their material has appeared in Spaceflight, Flight International, and The Aeroplane. In this country recent useful reviews have been the Battelle Institute study edited by George E. Wukelic: Handbook of Soviet Space Science Research (London: Gordon & Breach, 1968); as well as U. S. Congress, House of Representatives Committee on Science and Astronautics, report prepared by the Legislative Reference Service, Library of Congress: "Review of the Soviet Space Program with Comparative United States Data" (Washington: G.P.O., 1967), and updated by this writer in an edition, New York: McGraw-Hill,

1968. See also the paper given at the AIAA Annual Meeting in October, 1968, by A. J. Kullas, entitled "Duress for Technology" (Preprint 68-1106); and the article by G. Harry Stine, "How the Russians Did It in Space," Analog Science Fiction/Science Fact, August 1968.

Dr. Charles S. Sheldon II shared in the drafting of both the National Aeronautics and Space Act of 1958 and the Communications Satellite Act of 1962. Earlier he co-authored a study of the Soviet economy for the Joint Economic Committee of Congress, He served as Technical Director of the House Science and Astronautics Committee until 1961. then on the staff of the President's Space Council until 1966. Since then he has been Acting Chief of the Science Policy Research Division, Legislative Reference Service, Library of Congress, as well as their Senior Specialist in Space and Transportation Technology. He is the author of more than thirty published studies, including the 1967 Congressional report, "Review of the Soviet Space Program with Comparative United States Data." He is a Fellow of the American Astronautical Society, a Fellow of the British Interplanetary Society, an Associate Fellow of the American Institute of Aeronautics and Astronautics, and a Distinguished Traveling Lecturer for AIAA (1968-69).



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L. R. Magnolia

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All items are available to the public. Journal articles, conference papers, and books may be consulted at public and university libraries. Documents, also included in the bibliography, may not be available in some libraries, hence the sales agency and paper copy price for each document are indicated. Those bearing CFSTI prices may be purchased from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151, and those bearing GPO prices may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Documents with CFSTI or GPO paper copy prices may also be purchased in microfiche form at \$0.65 each.

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SPACECRAFT DETAILS

This section includes descriptions of all announced U.S. spacecraft launched during the second half of 1968 — except those under DoD security restriction — and all Soviet launches on which sufficient information has been made available. Brief program summaries, arranged alphabetically, are given for each primary payload, followed by descriptions of primary and secondary payloads for each launch.

AEROSPACE RESEARCH SUPPORT PROGRAM

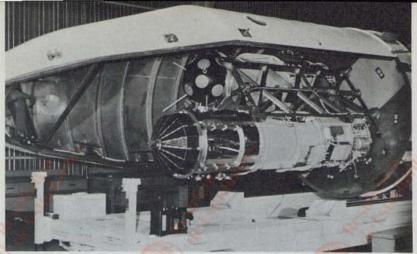
The Aerospace Research Support Program is a joint AFSC-OAR effort to provide low-cost satellites and probes for Air Force scientific and research experiments. Two Orbiting Vehicle (OV) programs were initiated in 1965, two in 1966, and a fifth in 1967.

OV1 15, 16

LAUNCH VEHICLE 390,000-pound-thrust Atlas booster. Radio guided. Height: 87 feet.

SPACECRAFT DESCRIPTION OV1 15: basic OV1 satellite — cylindrical, with multifaceted domes covered by solar cells on each end; 27 inches in diameter and 54 inches in overall length. Satellite support systems (power, PCM telemetry, data storage, command and control) mounted inside domes. Experiments and C-band beacon contained in 32-inch cylindrical section. Weight: 470 pounds. OV1 16: 23-inch sphere. Power, PCM telemetry, command and control, as well as C-band beacon and experiments, were mounted internally, with only the antennas and launch support stubs external to the surface. Weight: 600 pounds. A 5977-pound-thrust solid propellant rocket motor was mounted on each spacecraft. OV1 15 was spin stabilized; OV1 16 was random tumble.

PROJECT OBJECTIVES OV1 15 experiments were to identify the cause of the large and sudden fluctations observed in Air Force satellite trajectories, with the ultimate goal being an ability to predict the occurrence and magnitude of such fluctuations. Method of accomplishing the objective was to make several types of measurements, ground and satellite-based, which would provide comprehensive data on an entire



Air Force's OV1 15 and 16, shown mounted in ejection mechanism inside fairing prior to mating with Atlas booster, were orbited from Vandenberg AFB, carried atmospheric density experiments.

atmospheric event. **OV1 16** was used to measure the time and space variations of atmospheric density at altitudes as low as 75 miles. This was accomplished directly by measurements of aerodynamic tracking and indirectly by analysis of the satellite's orbital dynamics.

SPACECRAFT PAYLOAD OV1 15 included a microphone density gauge, ion gauges, mass spectrometers, energetic particle detectors, solar X-ray and ultraviolet flux monitors, an ionosphere monitor, and a triaxial accelerometer. OV1 16 contained a triaxial accelerometer. Propulsion module for each spacecraft contained H₂O₂ attitude control, guidance programmer, PCM telemetry, and C-band beacon subsystems. OV1 16 was powered solely by internal batteries.

PROJECT RESULTS OV1 15 and 16 were launched on 11 July 1968 from Vandenberg AFB and placed in nominally low elliptic orbits. This launch represented the first which permitted the OV1 spacecraft to drift down from booster apogee and propel themselves into orbit from a low perigee. OV1 15 achieved an orbit of 94/1074 miles at 89.8°; OV1 16 reached an orbit of 88/316 miles at 89.7°. Both spacecraft were successful. OV1 15 decayed on 6 November 1968; OV1 16 decayed on 19 August 1968.

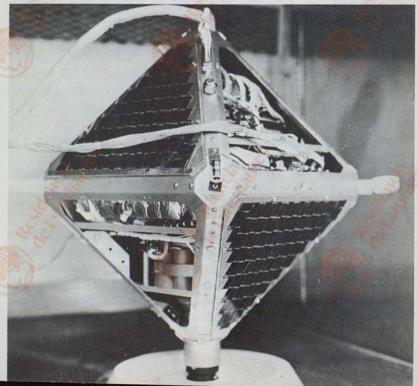
MAJOR PARTICIPANTS Spacecraft management: AF Office of Aerospace Research (OAR); OV1 15 spacecraft and launch vehicle prime contractor: General Dynamics; OV1 16 spacecraft prime contractor: AF Cambridge Research Laboratories (AFCRL), OAR; OV1 15 experiments: AFCRL, AF Space and Missile Systems Organization (SAMSO)/Aerospace Corp.; OV1 16 experiments: AFCRL.

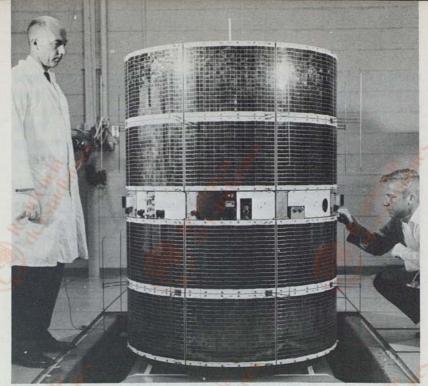
OV2 5, OV5 2, OV5 4, LES 6

LAUNCH VEHICLE Titan IIIC: two "zero" stage 120-inch strap-on solid boosters at 1.2 million pounds of thrust each; 470,000-pound-thrust core first stage; 100,000-pound-thrust second stage; 16,000-pound-thrust third stage (Transtage). All inertial guidance system. Height: 127 feet.

SPACECRAFT DESCRIPTION OV2 5: main body a 22-inch cube carrying sensors and spacecraft support systems. Double folding arm-like boom extended from each of four upper corners, bearing solar paddle and one or more sensors. Other appendages included two Orbis High antennas, two transmitter antennas, two receiver antennas, two plasma probes, two magnetometers, and an all-sky Lyman alpha. Span across outer edges of solar paddles: 7.6 feet. Weight: approximately 450 pounds. OV5 2: standard Environmental Research Satellite configuration - octahedron, with eight triangular 12-inch sides mounted on a gold-plated aluminum frame and each side covered by solar cells. Two transmitting tape antenna sections deployed at ejection. Spin stabilized at 12-17 rpm. Weight: 21.5 pounds. OV5 4: like OV5 2, octahedral, with eight triangular solar panels measuring 12 inches on a side. Four command/transmitter antenna

OV5 4 contained a unique experiment to determine how the low gravity conditions of space affect the transfer of heat in fluids.





Experimental communications satellite LES 6 is designed for tri-service radio communication tests among ships, aircraft, and portable and mobile ground terminals, to aid development of a tactical communication satellite system for Department of Defense.

sections deployed at ejection. Passive attitude control (no spin, random slow tumble). Weight: 27.9 pounds. LES 6: cylindrical in shape, 48 inches in diameter and 68 inches in length. Outer surface covered with solar cells except for 6-inch-wide band around equator, on which were mounted four plasma microthrusters, each at 90°, as well as optical and infrared sensors and other devices. Satellite electronics mounted on a stiff, flat, circular honeycomb platform inside sensor band. Eight pairs of dipole antennas and eight pairs of cavity-backed slot antennas equally spaced around periphery. Monopole telemetry stub antenna extended from one end of spacecraft along line of spin axis. Spin-stabilized at about 10 rpm. Weight: 360 pounds, including 25 pounds for mounting, spin-up, and ejection mechanism.

PROJECT OBJECTIVES OV2 5: collect data on space environment at synchronous orbit altitude, including cosmic rays, trapped particle fluxes, and changes in fluxes arising from solar and geomagnetic disturbances. OV5 2: monitor electron and proton environments along spacecraft's elliptical path. Measurements taken by OV5 2 at apogee were to be

correlated with those taken by OV2 5 as a further means of mapping radiation. OV5 4: obtain experimental data on heat transfer in a liquid under zero-g conditions, to support design of propellant systems for operation in space environments. LES 6: experimental military comsat designed to aid development of tactical satellite communication system for DoD.

SPACECRAFT PAYLOAD OV2 5: eleven separate experiments utilized proton and electron spectrometers, dE/dX range telescope, low-energy Faraday cup, electron detector fan, VLF signal antenna, Lyman-alpha scanning photometer, magnetometer, positive and negative plasma sensors, Orbis-High beacon antenna, together with associated electronics and data storage and transmission devices. OV5 2: three sets of omnidirectional spectrometers, Geiger tubes, and directional detectors formed a single experiment for monitoring electron environment in energy range from 40 kev to 5 mev and proton fluxes between 5 and 100 mev. OV5 4: test tank containing heating elements immersed in freon fluid, and an expandable bellows externally pressurized with a fluid mixture to permit constant vapor pressure measurements. Instrumentation measured fluid pressures and temperatures at different tank locations under various power level input to the heater element. Analog-to-digital telemetry provided temperature data in test fluid to an accuracy of 0.1 percent. LES 6: new, high-efficiency electrical power supply system enables radio transmitter to produce maximum possible RF power throughout lifetime of satellite. First electronically despun, switched-beam UHF-band antenna system produces circular polarization to eliminate fading, and concentrates radio energy to produce stronger signals at ground terminals. First completely automatic, self-contained stationkeeping system incorporated solidpropellant (teflon) pulsed plasma microthrusters (with ammonia gas thrusters for backup). Self-contained automatic spin-axis orientation system incorporated additional provisions for adjusting spin rate and spin axis orientation by ground signal. Radio frequency interference experiment measured strength of UHF-band signals from earth at frequencies between 290 and 315 mHz (similar to experiment carried on LES 5 which covered frequencies of 255-280 mHz). Other experiments included radiation measurements, earth-albedo measurements, and a solar cell dosimeter and calibration experiment. Communication transponder included all-solid-state transmitter which utilized solar cell output to produce more than 120 watts, yielding (with the despun antenna) an erp of over 600 watts.

PROJECT RESULTS The four spacecraft were launched on 26 September 1968 from Cape Kennedy into separate orbits. OV5 2, first to be released,

was injected into a 109/22,203-mile orbit at 26.3° by the Transtage during ascent from parking orbit to synchronous orbit. OV5 4 and LES 6 were subsequently released into synchronous orbits, 22,230/22,236 miles at 3° and 22,119/22,236 miles at 3°, respectively. Transtage then decelerated slightly before releasing OV2 5 into a 21,820/22,255-mile orbit at 2.9°. All four spacecraft were successful and are returning good data.

MAJOR PARTICIPANTS OV2 5, OV5 2 spacecraft management: OAR; OV5 4 spacecraft management: Air Force Rocket Propulsion Laboratories; LES 6 spacecraft management: AFCRL; OV2 5 spacecraft prime contractor: Northrup; OV5 2, OV5 4 spacecraft prime contractor: TRW; LES 6 spacecraft prime contractor: MIT Lincoln Laboratories; OV2 5 experiments: AFCRL, SAMSO/Aerospace; OV5 2 experiments: SAMSO/Aerospace; OV5 4 experiment: TRW; launch vehicle management: SAMSO; launch vehicle prime contractor: Martin.

APOLLO

The Apollo Command and Service Modules were first successfully launched in sub-orbital missions on the Saturn IB (AS-201 and AS-202) in February and August of 1966. AS (Apollo-Saturn) 203, flown in July of 1966, was a four-orbit mission but incorporated none of the Apollo modules. In November of 1967, the Apollo 4 mission flew the SA (Saturn-Apollo) 501 in the first flight test of the Saturn V. Incorporating Block I (earth-orbit type) Command and Service Modules, Spacecraft Lunar Module Adapter, and Lunar Module Test Article, Apollo 4 successfully demonstrated the spaceworthiness of the Saturn V booster and the Command and Service Modules. Apollo 5 (AS-204), flown on the Saturn IB in January of 1968, was a test of the descent and ascent engines on the Lunar Module, as well as a demonstration of the spaceworthiness of the Lunar Module itself. Apollo 6, flown in April of 1968, was another test of the Saturn V.

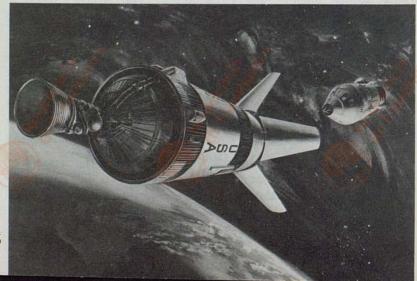
APOLLO 7

LAUNCH VEHICLE Saturn IB (AS-205): S-IB first stage containing eight H-1 engines producing a total first stage thrust of 1.6 million pounds; S-IVB second stage containing a single J-2 engine at 200,000 pounds of thrust. S-IVB incorporated new propellant lines to prevent early shutdown

as occurred on Apollo 6. Instrument Unit (IU), a cylinder 3 feet high and 21 feet 8 inches in diameter mounted atop second stage, contained electrical and mechanical equipment for guiding, controlling, and monitoring vehicle performance from liftoff until S-IVB/CSM separation (in the case of Apollo 7, a 25-minute period of manual control was programmed to occur prior to S-IVB/CSM separation). S-IB height: 80.2 feet; S-IVB height: 58.4 feet. Total height including Launch Escape System: 224 feet.

SPACECRAFT DESCRIPTION Launch Escape System (LES), Command Module (CM), Service Module (SM), and Spacecraft Lunar Module Adapter (SLA). No Lunar Module or Lunar Test Article was carried on Apollo 7. LES comprised an open-frame tower structure mounted atop CM, three solid-propellant motors: a 155,000-pound-thrust main LES motor, a 33,000-pound-thrust tower jettison motor, and a 3,000-pound-thrust pitch control motor for bending CM trajectory away from launch vehicle and pad area in case of abort. Two canard vanes located near top of tower for turning CM heatshield forward. Boost protective cover, composed of glass, cloth, and honeycomb, attached to base of LES to protect CM from exhaust gases. Height: 33 feet; weight: 8900 pounds. CM: a cone-shaped pressure vessel 12 feet high and 12 feet 10 inches in base diameter, encased in heatshields and consisting of three compartments. Forward compartment contained two negative pitch reaction control engines and components of earth landing system; crew compartment contained crew accommodations, controls and displays, and spacecraft systems; aft compartment housed ten reaction control engines and fuel tankage.

Artist's rendering of Apollo 7's rendezvous with S-IVB upper stage. First manned flight of Apollo spacecraft carried astronauts Schirra, Eisele, and Cunningham in 10.8-day mission.



Heatshields made of brazed stainless steel honeycomb filled with phenolic epoxy resin as ablative material, with thickness ranging from 0.7 to 2.7 inches, according to anticipated heat loads. CM inner structure made of aluminum honeycomb sandwich-bonded between sheet aluminum alloy, ranging in thickness from 0.25 inch at forward access tunnel to 1.5 inches at base. Weight of CM: 12,659 pounds. SM: a cylinder 12 feet 10 inches in diameter by 22 feet long, with outer skin formed of inch-thick aluminum honeycomb panels, and interior divided into six sections by milled aluminum radial beams. The six sections contained fuel cells and on-board consumables, and fuel and oxidizer tankage for service propulsion system and reaction control system. Weight of SM: 19,730 pounds. SLA: a truncated cone tapering from 260 inches diameter at base to 154 inches at forward end, where it mated with SM, with walls made of 1.75-inch thick aluminum honeycomb. On Apollo 7, SLA served as structural interstage between IU and SM. Weight of SLA: 3800 pounds.

PROJECT OBJECTIVES First manned flight of the Apollo spacecraft included examination of combined operation of Saturn IB, Apollo CSM, and Manned Space Flight Network. Early objectives included manual control of the S-IVB prior to separation, then separation and simulated docking (using the SLA as a target), followed by operational checkouts of environmental control, guidance and navigation, and service propulsion systems, and subsequent rendezvous with the S-IVB. Five experiments were performed: two photographic exercises — one of terrain, the other of global and local weather systems — and three medical experiments involving pre- and post-flight examinations to determine bone demineralization, cellular changes in blood, and changes in lower body negative pressure.

SPACECRAFT PAYLOAD Command Pilot Walter M. Schirra, 45; Donn F. Eisele, 38; Walter Cunningham, 36. Photographic equipment included 70 mm Hasselblad still camera and two 16 mm Maurer sequence cameras, together with color and black and white film, window mounting brackets, mirror attachments, ultraviolet filter, as well as a 4.5-pound hand-held tv camera equipped with 160- and 9-degree lens. Spacecraft systems: guidance, navigation, and control system included inertial measuring unit and associated power and data components, digital computer and associated display and keyboard panels, scanning telescope, sextant for celestial or landmark navigation. Stabilization and control system backed up guidance system, provided displays for crew-initiated maneuvers; consisted of attitude reference, attitude control, and thrust vector control subsystems. Thrust for large velocity changes and de-orbit burn provided

by service propulsion system - a gimbal-mounted 20,500-pound-thrust hypergolic engine using nitrogen tetroxide oxidizer and a 50-50 mixture of unsymmetrical dimethyl hydrazine and hydrazine fuel. SM reaction control system contained four identical quads of four 100-pound-thrust hypergolic engines, mounted 90 degrees from one another near top of SM. CM reaction control system consisted of two independent six-engine subsystems of 94 pounds thrust each; one subsystem used for attitude control during re-entry, the other maintained for backup. Helium pressurized, hypergolic propellants were monomethyl hydrazine fuel and nitrogen tetroxide oxidizer. Three 31-cell Bacon-type hydrogen-oxygen fuel cell power plants located in SM provided 28-volt DC power, together with three 28-volt DC zinc-silver oxide main storage batteries, two pyrotechnic batteries, and three 115-200-volt 400-cycle three-phase AC inverters powered by main 28-volt DC bus. Environmental control system regulated spacecraft atmosphere, pressure, temperature; managed water. Telecommunications provided by PCM telemetry for relaying crew and spacecraft systems data to Manned Space Flight Network, VHF/AM and unified S-band tracking transponder, air-to-ground voice communications, onboard television. Landing system and recovery aids included drogue and main parachutes, swimmer interphone connections, sea dye marker, flashing beacon, VHF recovery beacon and transceiver, compressorinflated bags to turn spacecraft upright in case of landing apex down.

PROJECT RESULTS Apollo 7 was launched from Cape Kennedy on 11 October 1968 into a 142/177-mile orbit at 31.64°. All mission objectives were met including rendezvous with and separation from S-IVB second stage in simulated rescue operations. All spacecraft systems were successfully tested under operational conditions. Among eight SPS burns was a 66-second burn on eighth day - longest to date. No serious difficulties were encountered; problems included dropout of AC bus from spacecraft electrical system, reduced performance in battery charger, deteriorating cabin window visibility, formation of ice particles - apparently from water vented to space - which interfered with optical navigation fixes. Head cold developed by astronaut Schirra soon spread to Eisele and Cunningham, led to decision not to wear helmets during re-entry and splashdown so as to allow crew to equalize pressure on ear drums as cabin pressure changed during descent. Splashdown occurred at 27º 32.5' N., 640 4' W. after logging 163 revolutions, 260 hours in flight. Following splashdown, spacecraft rolled over in a nose-down position, submerging recovery antennas and hampering efforts to locate spacecraft; crew was forced to use flotation bags. Visual contact was made 22 minutes after splashdown.

MAJOR PARTICIPANTS Program management: NASA Office of Manned Space Flight; spacecraft management: NASA Manned Spacecraft Center; spacecraft prime contractor, Command and Service Modules: North American Rockwell; launch vehicle management: NASA Marshall Space Flight Center; first stage prime contractor: Chrysler; second stage prime contractor: McDonnell Douglas; Instrument Unit: IBM; launch operations: NASA Kennedy Space Center; Manned Space Flight Network management: NASA Goddard Space Flight Center.

APOLLO 8

LAUNCH VEHICLE Saturn V: S-IC first stage at 7,570,000 pounds of thrust, S-II second stage at 1,000,000 pounds of (mean) thrust, S-IVB third stage at 230,000 pounds of thrust. All three stages inertially guided. Instrument Unit, a cylinder 3 feet high and 21 feet 8 inches in diameter mounted atop third stage, contained vehicle electronics for navigation, guidance and control, measurement of vehicle performance and environment, telemetry, command reception, checkout and monitoring of vehicle functions, power generation and distribution, and preflight checkout and launch. Major innovation for the flight included new helium prevalve cavity pressurization system on S-IC to clamp out pogo effect, new J-2 engines on S-IVB stage capable of 230,000 pounds of thrust, use of helium heater as repressurization system on S-IVB, early cutoff of center F-1 engine on S-IC to hold acceleration below 4 g's, software changes in Instrument Unit permitting 2-degree outward cant of outboard F-1 engines to reduce load on spacecraft in event of premature cutoff of F-1. Height: 363 feet

SPACECRAFT DESCRIPTION AS-103: Launch Escape System (LES), Command Module (CM), Service Module (SM), Spacecraft Lunar Module Adapter (SLA), Lunar Module Test Article (LTA) B. LES, CM, SM, SLA essentially identical to those used on Apollo 7. Flown for first time was the high-gain steerable S-band antenna — four 31-inch-diameter parabolic dishes mounted on folding boom at aft end of SM, deployed at right angles to longitudinal axis after S-IVB/CSM separation. Weight of LES: 8900 pounds; weight of CM: 12,392 pounds; weight of SM: 51,258; weight of SLA: 4150 pounds. LTA-B carried only for ballast.

PROJECT OBJECTIVES Overall mission objectives included demonstration of coordinated performance of Apollo crew, Apollo CSM, and support facilities during a manned Saturn V mission; demonstration of

translunar injection; demonstration of CSM navigation, communications, and midcourse corrections; demonstration of consumables assessment and passive thermal control. Detailed test objectives were to refine systems and procedures relating to future lunar operations.

SPACECRAFT PAYLOAD Command Pilot Frank Borman, 40; James A. Lovell, Jr., 40; William A. Anders, 35. Photographic equipment same as that carried on Apollo 7: two 70 mm Hasselblad still cameras, a 16 mm Maurer movie camera, and a 4.5-pound hand-held tv camera. Large quantity of film of various types was carried for lunar surface photos, other items of interest during course of mission. Spacecraft systems essentially identical to those carried on Apollo 7.

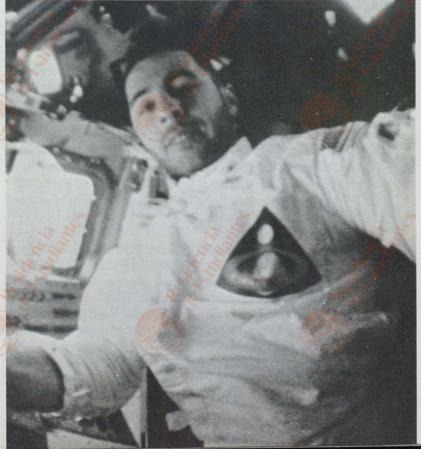
PROJECT RESULTS Apollo 8 was launched from Cape Kennedy on 21 December 1968 into a 114/118-mile parking orbit at 32.6°. During second revolution, at 02:50:00 ground elapsed time (GET), S-IVB was restarted

Artist's rendering of Apollo 8 as it orbited the moon in man's first lunar flight.



for a 5-minute 17-second burn, initiating translunar coast. Following S-IVB/CSM separation at 03:21:00 GET, a 1.5-fps radial burn of SM reaction control engines was initiated to establish sufficient distance for S-IVB propellant dumping. Following propellant dumping, however, which sent the stage into diverging trajectory and solar orbit, separation distance was still deemed inadequate and a second SM reaction control burn of 7.7 fps was performed. First midcourse correction came at approximately 10 hours 55 minutes into the mission, provided a first check on SPS engine prior to committing spacecraft to lunar orbit insertion. Second and final midcourse correction prior to lunar orbit insertion came at 61:08:54 (two intermediate midcourse corrections were eliminated as unnecessary). Loss of signal occurred at 68:58:45, when Apollo 8 passed behind moon. First lunar orbit insertion burn, at 69:08:52, lasted 4 minutes 2 seconds, reduced spacecraft's 8400-fps velocity by 2994 fps, resulting in initial lunar orbit of 70/193 miles. Orbit was circularized at 70 miles by second lunar orbit insertion burn of 135 fps, performed at start of third

Astronaut Anders shown during Apollo 8 lunar orbit mission. Photo was made from movie film taken by on-board 16mm motion picture camera.





Lines from the aircraft carrier U.S.S. Yorktown are attached to the Apollo 8 spacecraft in preparation for hoisting it aboard.

revolution, again on back side of moon, at 73:35:05. During the 20-hour period in lunar orbit, crew conducted a full, sleepless schedule of tasks including landmark and landing site tracking, vertical stereo photography, stereo navigation photography, and sextant navigation. At end of 10th lunar orbit (89:19:16), a 3-minute 23-second transearth injection burn was conducted, adding 3522 fps. Only one midcourse correction, a burn of 5 fps conducted at 104:00:00, was required instead of the three scheduled. Six telecasts were conducted during the mission - two during translunar coast, two during lunar orbit, two during transearth coast - all of excellent quality. Voice communications were also exceptionally good throughout mission. Separation of CM from SM occurred at 146:31:00. Double-skip maneuver conducted during re-entry steering phase resulted in altitude gain of 25,000 - 30,000 feet. Entry velocity was 24,696 mph, with heatshield temperatures reaching 5000°F. Splashdown at 8° 8' N., 165° W., after 147 hours 11 seconds in flight, was within 5000 yards of planned point.

MAJOR PARTICIPANTS Program management: NASA Office of Manned Space Flight; spacecraft management: NASA Manned Spacecraft Center; spacecraft prime contractor, Command and Service Modules: North American Rockwell; launch vehicle management: NASA Marshall Space Flight Center; first stage prime contractor: Boeing; second stage prime contractor: North American Rockwell; third stage prime contractor: McDonnell Douglas; Instrument Unit: IBM; launch operations: NASA Kennedy Space Center; Manned Space Flight Network management: NASA Goddard Space Flight Center.

APPLICATIONS TECHNOLOGY SATELLITE

Testing advanced components and techniques for future communications, meteorological, and navigation satellites is the broad mission objective for NASA's Applications Technology Satellite (ATS) program. ATS 1 was launched successfully in December of 1966, ATS 2 in April of 1967, and ATS 3 in November of 1967. ATS 1 and 3 are still operating. ATS E, the final launch in the current series of five, is scheduled for 1969. Currently under competitive design is a follow-on series, ATS F and G, which will feature a 30-foot-diameter deployable antenna.

ATS 4

LAUNCH VEHICLE Atlas-Centaur: 388,000-pound-thrust Atlas first stage with two 670-pound-thrust vernier engines for roll directional control; 30,000-pound-thrust Centaur second stage. First stage radio guided, second stage inertially guided. First use of Atlas-Centaur combination for mission other than Surveyor. Height (not including payload): 107 feet.

SPACECRAFT DESCRIPTION Cylindrical, 72 inches long and 56 inches in diameter, with circular exterior covered by 21,864 n-on-p solar cells except for experiment band around midsection containing magnetometer sensor, ion and hydrazine gas jets. Appendages included eight quarter-wave whip antennas extended fan-like from forward end, four motor-driven gravity-gradient booms mounted inside experiment band, each extendable to 123 feet and forming a giant X when extended, and two damper booms, also mounted inside center band, each extendable to 45 feet. 6250-pound-thrust apogee motor extended from aft end. Weight (after apogee motor burnout and jettison): 864 pounds.

PROJECT OBJECTIVES Evaluate gravity-gradient stabilization for future synchronous operation; evaluate simultaneous transmission of voice, tv, telegraph, and digital data to several ground stations; flight test of image orthicon camera; evaluate stationkeeping capabilities of ion engine.

SPACECRAFT PAYLOAD Gravity-gradient booms were made of thin beryllium copper strips, silver-coated, 2 inches wide and coiled like a carpenter's tape on motor driven drums, extended to form 1/2-inch diameter boom, each with an 8-pound weight at tip. Each pair of booms forming the X was capable of opening or closing like a pair of scissors from 11 to 30°. Each boom also carried a 9-inch disc at tip to provide focusing

target for tv camera. Microwave communications experiment, carried on all ATS spacecraft to date, consisted of two microwave repeaters, two slotted waveguide planar arrays mounted flush with solar panels on earth-facing side. Image orthicon camera was a meteorological tv camera (885 lines) specifically designed for gravity-gradient stabilized spacecraft in geostationary orbit, capable of taking pictures of equatorial area 1150 miles on a side with 2-mile resolution at picture center. Ion engine experiment consisted of two 5- to 20-micropound microthruster units, each comprising a cesium contact ion microthruster, propellant storage and feed system, and control logic power conditioning unit. Telemetry data carried by four 2-watt transmitters, two encoders; command data carried by two cross-strapped receivers, two encoders.

PROJECT RESULTS ATS 4 was launched from Cape Kennedy on 10 August 1968. Centaur's first burn injected spacecraft into initial parking orbit of 115/475 miles at 29°. After a 61-minute coast period, Centaur failed to re-ignite for second burn, and spacecraft remained in parking orbit attached to Centaur in tumbling mode. Both ion engines were successfully operated, however, in five separate tests for a total of 23 hours. Atmospheric drag resulting from low perigee caused ATS 4 to decay on 17 October 1968.

MAJOR PARTICIPANTS Spacecraft management: NASA Goddard Space Flight Center; spacecraft prime contractor: Hughes; experiments: GE, Electro-Optical Systems, Hazeltine Corp., Hughes; launch vehicle management: NASA Lewis Research Center; launch operations: NASA Kennedy Space Center; launch vehicle prime contractor: General Dynamics.

EXPLORER

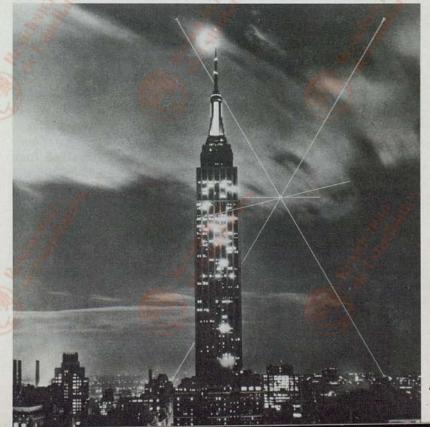
Begun by ARPA and transferred to NASA with that agency's formation in October of 1958, the Explorer program has included a variety of scientific research spacecraft, among them Explorer 1, the first U.S. satellite. Explorer 38 is the first of two Radio Astronomy Explorer spacecraft designed to monitor radio emissions in space during the next two years. A previous Air-Density/Injun Explorer combination (Explorers 24 and 25) was orbited in November of 1964 (the first NASA dual launch) to coincide with the International Quiet Sun Year.

EXPLORER 38 (RADIO ASTRONOMY EXPLORER 1)

LAUNCH VEHICLE Thrust Augmented Improved Delta (TAID): Thor first stage with three Castor I strap-on solid-propellant motors and total thrust of 333,500 pounds, 7700-pound-thrust second stage, and 6200-pound-thrust FW-4 solid-propellant third stage. First and second stages radio guided, third stage spin stabilized. Height: 92 feet.

SPACECRAFT DESCRIPTION Cylindrical aluminum structure with four 5-foot-long helical solar panels deployed around sides, apogee motor nozzle extended from aft end. Sensors and telemetry antenna mounted on outer edges of solar panels. Appendages (extended after reaching final orbit) included two 3/4-pound yo-yo weights attached to 27-foot wires for despinning spacecraft from initial 92 rpm to 2 rpm before being cut loose (final despinning accomplished by three electromagnetic coils); 630-foot-

Quarter-mile-long antennas of RAE 1 are compared with the 1472-foot-high Empire State Building. The huge "X" formed by the two "V" arrays measures 1300 feet from top to bottom, 1500 feet from corner to corner. RAE 1's receiver antenna system is designed to monitor low-frequency radio signals from sources in space which cannot penetrate earth's ionosphere.



long (maximum) vibration damper extending from forward end (toward earth); 120-foot-long dipole antenna extended in two 60-foot sections from sides along earth horizontal; four 750-foot-long antennas arranged in two 60°0 angle V's, one V extending toward earth, the other toward space. Each antenna boom stored as 0.002-inch-thick beryllium-copper alloy tape, deployed from motor-driven reels to form 1/2-inch-diameter tubes. Gravity-gradient stabilized. Weight: 417 pounds.

PROJECT OBJECTIVES Monitor low-frequency radio signals from cosmic sources, from our own solar system, and from earth's magnetosphere and radiation belts. Monitor the strong, sporadic radio bursts from region of Jupiter, for correlation with simultaneous high-frequency observations made by global Jupiter Monitoring Network.

SPACECRAFT PAYLOAD Upper V antenna array measures intensity of radio signals from solar system and cosmic sources as a function of frequency, direction, and time. Lower V array monitors low-frequency radio emissions from earth's environment. Four slow-scan tv cameras mounted on spacecraft monitored boom deflection during deployment. Instrumentation associated with V antennas includes three nine-step radiometers measuring frequencies between 0.45 and 9.2 mHz. Dipole antenna monitors low-frequency radio bursts from Jupiter, the sun, and other possible sources. Associated with dipole is a fourth nine-step radiometer covering same frequency band as the other three, together with two burst receivers — one a 32-step receiver covering the 0.2 — 5.53 mHz range, the other a sweep-frequency unit covering 0.245 - 3.93 mHz. Also included was an electron trap for measuring plasma environment around spacecraft.

PROJECT RESULTS Explorer 38 was launched on 4 July 1968 from Vandenberg AFB into temporary elliptical orbit. Apogee motor was ignited 3 days later, achieving a 3636/3641-mile orbit at 120.80 inclination. Resulting retrograde orbit causes satellite to remain in sunlight for 6 months of the year, avoids thermal shock of passing into and out of earth's shadow daily. Spacecraft was despun on 8 July. Antennas were extended in increments, beginning on 22 July, with final extensions completed 8 October 1968. Status: fully operational and returning good data.

MAJOR PARTICIPANTS Spacecraft and launch vehicle management: NASA Goddard Space Flight Center; spacecraft prime contractor: Fairchild Hiller; launch vehicle prime contractor: McDonnell Douglas.

EXPLORERS 39 and 40 (Air Density/Injun Explorer C)

LAUNCH VEHICLE Solid-propellant Scout: 100,944-pound-thrust Algol IIB first stage; 60,764-pound-thrust Castor II second stage; 20,942-pound-thrust Antares third stage; and 5746-pound-thrust FW-4S fourth stage. First three stages inertially guided, fourth stage spin stabilized. Height: 72 feet.

SPACECRAFT DESCRIPTION Explorer 39: 12-foot polka-dotted sphere made of four alternating layers of 0.0005-inch-thick (1/2 mil) aluminum foil and 0.0005-inch-thick Mylar, the foil comprising the outer layer. Sphere was constructed by bonding together 40 flat triangular sections. Sphere divided at equator by a strip of plastic, allowing both metallic hemispheres to serve as antennas for tracking beacon. Inflated in orbit with nitrogen gas, which is then allowed to escape, allowing Explorer 39 to maintain its shape using its own rigidity. Weight: 20.8 pounds. Explorer 40: hexagonal cylinder 29 inches tall and 30 inches across widest dimensions, with outside surfaces covered by solar cells. Mounted inside and extending slightly beyond forward end was a cylindrical tube in which Explorer 39 was carried folded into orbit, together with ejection and inflation equipment. Appendages included five hinged booms, carried folded during launch. Weight: 157 pounds.

PROJECT OBJECTIVES Coordinated, dual-satellite experiment to measure particle flux and energy, VLF emissions, and atmospheric density. Measurements were to be performed at the same time and in the same general location, during active portion of solar cycle, to investigate possible correlation between energetic particle bombardment and fluctuations in upper atmospheric density.

SPACECRAFT PAYLOAD Explorer 39: radio tracking beacon, to supplement optical tracking, mounted inside skin along with a group of nickel-cadmium batteries. Power provided by four groups of solar cells, which were protected from radiation damage by quartz windows. Small telemeter carried to report skin temperatures, internal temperatures, and solar cell voltages. Passive thermal control provided by 4000 2.5-inch-diameter white spots made of zinc oxide paint, evenly distributed and covering about one fourth of total surface. Explorer 40: three boommounted antennas and two boom-mounted particle analyzers, with ten other particle sensors mounted inside, comprising four major groupings of experiments. Low Energy Proton Electron Differential Energy Analyzer (LEPEDEA) experiment included three detectors and three Geiger-Mueller

tubes, measured low-energy particles down to 5 electron volts. Solid State Detector experiment included a proton-electron telescope and an alpha particle (helium nuclei) detector. VLF experiment comprised a magnetic receiver with a loop antenna carried on a 9-foot folding boom and two spherical antennas mounted on two shorter booms, measured radio emissions at frequencies between 30 Hz and 10 kHz. Spherical Retarding Potential Analyzer experiment consisted of two spherical analyzers mounted on folding booms; one recorded electrons, the other positive ions. Command and telemetry provided by command receiver, two-channel tape recorder, 250-milliwatt telemeter, and 800-milliwatt telemeter. Dry nitrogen gas system and magnetic damping rods employed for despinning and stabilization.

PROJECT RESULTS Explorers 39 and 40 were launched on 8 August 1968 from Vandenberg AFB into nearly identical orbits, Explorer 39 reaching a 418/1574-mile orbit at 80.6° and Explorer 40 a 423/1574-mile orbit at the same inclination. Both spacecraft are operating satisfactorily.

MAJOR PARTICIPANTS Project management, Explorer 39 spacecraft management and fabrication, launch vehicle management: NASA Langley Research Center; Explorer 40 prime contractor: Univ. of Iowa; experiments: AFCRL, NASA Langley Research Center, Smithsonian Astrophsical Observatory, Univ. of Iowa; launch vehicle prime contractor: LTV.

INTERNATIONAL TELECOMMUNICATIONS SATELLITE CONSORTIUM

The International Telecommunications Satellite Consortium (Intelsat) comprises a partnership currently of some 63 nations formed to establish a global commercial communications satellite system. The U.S. participant in Intelsat is the Communications Satellite Corporation (Comsat), who acts as manager on behalf of the consortium. The space segment of the system is owned by Intelsat, and earth stations are owned by public and private organizations in countries where the stations are located. NASA launches the satellites and is reimbursed for launch service costs. Intelsat 1 (Early Bird) was launched in April of 1965. Intelsat 2A (Lani Bird) was launched in October of 1966, Intelsat 2B (Pacific 1) in January 1967, Intelsat 2C (Atlantic 2) in March of 1967, and Intelsat 2D (Pacific 2) in September of 1967. The first attempt in the current series failed to orbit when, in September of 1968, a launch vehicle malfunction forced the range safety officer to destroy the vehicle in flight.

INTELSAT 3A

LAUNCH VEHICLE Long-Tank Delta: modified Thor first stage at 172,000 pounds of thrust, augmented by three first stage strap-on solid-propellant Castor I rockets for a combined total first stage thrust of 333,500 pounds (Long-Tank Delta has the same thrust as TAID but features longer first-stage burn time); 7700-pound-thrust second stage; 5600-pound-thrust FW-4 solid-propellant third stage. Height (not including payload): 106.5 feet.

SPACECRAFT DESCRIPTION Magnesium cylinder 41 inches tall and 56 inches in diameter, circular exterior covered with solar cells. Both aft and forward surfaces enclosed except for slight extension of apogee motor skirt aft, mechanically despun communications antenna, shaped like a cone with base cut at 45°, extending 33.6 inches forward. Overall height: 78 inches. Mounted around base of communications antenna was a

View of Intelsat 3 showing cone-shaped mechanically despun antenna. Spacecraft has a designed capacity of 1200 circuits, is capable of carrying up to four tv programs simultaneously.



doughnut-shaped omnidirectional telemetry and command antenna. Two axial thrusters mounted aft, two radial thrusters mounted at side. Earth and sun sensors mounted at side. Supporting subsystem equipment mounted inside on circular aluminum honeycomb platform. Spin stabilized at 90 rpm. Weight at liftoff: 642 pounds.

PROJECT OBJECTIVES Initial increment of the first global commercial communications satellite system; was to be placed in geostationary orbit over Atlantic Ocean, off coast of Brazil.

SPACECRAFT PAYLOAD Communications subsystem utilizes mechanically despun directional antenna and dual transponders receiving at 5930 to 6420 mHz, transmitting at 3705 to 4195 mHz; has a designed capacity of 1200 circuits, is capable of carrying up to four tv programs simultaneously. Five-year electrical power of 130 watts supplied by 10,720 solar cells, plus rechargeable 20-cell nickel-cadmium battery for periods of operation during earth's shadow. Solid-propellant 3140-pound-thrust apogee motor. Spacecraft attitude control and stationkeeping performed by two nitrogen-pressurized monopropellant hydrazine-fueled propulsion systems, each system employing a pair of tanks to supply one radial and one axial thruster.

PROJECT RESULTS Intelsat 3A was launched from Cape Kennedy on 18 December 1968 into an elliptical transfer orbit. Orbit was circularized 2 days later at 22,257/22,244 miles, with an inclination of 0.71°. Spacecraft went into operation on 24 December 1968.

MAJOR PARTICIPANTS Spacecraft management: Comsat Corp.; spacecraft prime contractor: TRW; launch vehicle management: NASA Goddard Space Flight Center; launch vehicle prime contractor: McDonnell Douglas.

ORBITING ASTRONOMICAL OBSERVATORY

NASA's Orbiting Astronomical Observatory (OAO) program, originally planned as a series of five launches, is the forerunner of large, fully automated space telescopes designed to help astronomers learn more about the evolution and structure of the universe. OAO 1, launched aboard an Atlas-Agena on 8 April 1966, experienced a battery failure and probable high-voltage arcing in the star tracker during its second day in orbit. Following the current launch of OAO A2 (OAO 2 in orbit), OAO's B and C are scheduled for flights in late 1969 and 1970.

LAUNCH VEHICLE Atlas-Centaur: same as that used for ATS 4, above.

SPACECRAFT DESCRIPTION Octagonal aluminum cylinder 10 feet long and 7 feet across, with experiments mounted in 4-foot inner cylinder running length of body, trapdoor-like sun shutter attached to top for shielding experiments from direct solar rays. With solar arrays unfolded on each side, wingspread reached 21 feet. Other appendages included two 9.5-foot balance booms extending outward one from each side at top. Weight: 4446 pounds.

PROJECT OBJECTIVES Observe young, hot stars in ultraviolet spectrum; observe interstellar gas; survey and produce pictorial maps of over 700 stars daily — all from the vantage point of a precisely stabilized platform above the obscuring and distorting effects of earth's atmosphere.

SPACECRAFT PAYLOAD Two groups of experiments: one, a 450-pound package, contained seven telescopes to make spectrophotometric measurements in ultraviolet between 1000 and 3000 Å; second experiment group weighed about 500 pounds, employed four large-aperture tv cameras with broad-band photometers to scan between 1050 and 3000 Å. Six gimballed star trackers, each one a small 3.5-inch reflecting telescope mounted in mechanical gimbals, provided images for conversion to error signals used to drive torque motors in gimbal axes. Stabilization provided by nitrogen gas jet system. The three-axis gyro stabilization system, added on OAO 2, provided pointing accuracy of 1 minute of arc \pm 15 arc seconds for 50 minutes. Power system featured 10 percent greater solar cell area than on OAO 1, addition of undervoltage detector, and a change from sequential to parallel charging of batteries to avoid overcharging as occurred on OAO 1. Louvres were added on five electronics bays for active thermal control. Command storage doubled to 256 instructions.

PROJECT RESULTS OAO 2 was launched from Cape Kennedy on 7 December 1968 into a near-nominal 479/485-mile orbit at 34.9970. Both groups of experiments are operating, and performance has been excellent.

MAJOR PARTICIPANTS Spacecraft management: NASA Goddard Space Flight Center; spacecraft prime contractor: Grumman; experiments: Univ. of Wisconsin, Smithsonian Astrophysical Laboratory; launch vehicle management: NASA Lewis Research Center; launch vehicle prime contractor: General Dynamics.

PIONEER

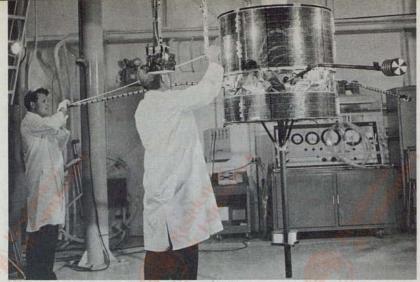
Begun by USAF in 1958 and transferred to NASA in October of the same year, the Pioneer program is intended to explore the solar atmosphere and return data on solar physics. Pioneer 1, orbited in 1958, was the first NASA spacecraft. Predecessors in this current series of five interplanetary probes: Pioneer 6 (orbited in 1965), Pioneer 7 (orbited in 1966), and Pioneer 8 (orbited in 1967). Pioneers, the only currently active U. S. interplanetary satellites, have begun to forecast solar weather — an important task in protecting astronauts en route to the moon. Pioneers give up to 15 days warning of solar activity. Launched piggyback with Pioneer 8 was NASA's first Test and Training Satellite, used successfully for exercising the Apollo unified S-band ground stations and shipboard crews in spacecraft acquisition and telemetry reception.

PIONEER 9, TETR 2

LAUNCH VEHICLE Thrust Augmented Improved Delta (TAID): same as that used for Explorer 38, above.

SPACECRAFT DESCRIPTION Pioneer 9: same basic configuration as Pioneers 6, 7, and 8 — cylinder 37 inches in diameter and 35 inches high, with sides covered by solar cells except for narrow circular band around middle containing apertures for four experiments and five sun sensors. Three 64-inch booms deployed at 120-degree intervals from circular band, 52-inch command and telemetry antenna extended from center of one end, experiment antenna mounted on rim of the other end. Spacecraft structure primarily aluminum. Spin stabilized at 60 rpm. Weight: 148 pounds. TETR 2: similar to its predecessor TTS 1 — octahedron 11 inches on a side, with solar cells covering each of the eight sides. Top apex supported an S-band antenna with mast; VHF transmitter antenna sections extended from two opposing apexes in center plane; launch and ejection fitting mounted at bottom apex. Also located near bottom apex was the VHF command telemetry antenna section. Weight: 40 pounds.

PROJECT OBJECTIVES Pioneer 9: acquire additional data on solar plasma, energetic particles, and magnetic fields propagated by sun towards earth, for use in studying solar processes, interplanetary medium, and effects of solar activity on earth's environment. Like Pioneer 6 — and unlike Pioneer 7 and 8 — intended to fly an "in" mission inside earth's orbit. TETR 2: orbiting target for a series of tracking and communications exercises by ground stations of NASA's Manned Space Flight Network.



Two technicians are shown preparing an interplanetary Pioneer spacecraft for testing. Pioneers are orbiting the sun to study the far regions of space and methods of predicting solar flares.

SPACECRAFT PAYLOAD Pioneer 9: eight experiments included an improved three-axis magnetometer, mounted on one of the radial booms, which continuously measures strength and direction of interplanetary magnetic field in three axes, and two sets of collector plates and instruments to measure the solar wind, cosmic ray particles, electron density, electric fields, and cosmic dust. A new celestial mechanics experiment tracks data from all of the Pioneers to refine measurements of the earth-moon mass ratio, sun-earth distance, and planet orbits, and to check the theory of general relativity. Cosmic ray telescope similar to that carried on Pioneer 8 which made the first measurements of fluorine among galactic cosmic ray particles. Electric field experiment is also similar to that flown on Pioneer 8, which found very large waves in the solar wind. Communications maintained by two-way S-band at about 2300 mHz utilizing two radio receivers, two command decoders, command distribution unit. Attitude control supplied by nitrogen gas jet at the end of one of the radial booms, with thrusts timed by a sun sensor, and wobbling rotation eliminated by flexibility of all three radial booms and by a damper consisting of two small balls in two cylinders at the end of one boom. Power supply of 60 watts supplied by 10,368 silicon n/p solar cells. Passive heat control achieved by heat-reflective coatings on exterior; active control provided by 20 spring-actuated louvres at spacecraft base. TETR 2: S-band transponder, receiving at 2101.8 mHz and transmitting at 2282.5 mHz. Signals contain ranging, telemetry, voice, and biomedical information to simulate data that would ordinarily emanate from Apollo spacecraft. Satellite Tracking and Data Acquisition Network (STADAN) stations are responsible for triggering the transponder and for placing it in standby status when not in use; Manned Space Flight Network stations conduct the exercises. Electrical power furnished by rechargeable battery and some 900 solar cells. Magnetically stabilized.

PROJECT RESULTS Pioneer 9 and TETR 2 were launched from Cape Kennedy on 8 November 1968. TETR 2 was ejected from its cannister aboard the Delta second stage into a 232/587-mile orbit at 32.8°. Transponder was exercised by ground stations in first pass over U.S. and continues to operate successfully. Pioneer 9's sun orientation was accomplished automatically, followed by earth orientation 2 days later. Booms were deployed, and all systems were reported performing nominally. Pioneer 9's current position is about 9 million miles from earth; was expected to pass between sun and earth on 30 January 1969. Its 0.75/1.0 AU orbital path will bring it within 70 miles of the sun in early April of 1969.

MAJOR PARTICIPANTS Pioneer 8 spacecraft management: NASA Ames Research Center; TETR 2 spacecraft management: NASA Goddard Space Flight Center; Pioneer 8 and TETR 2 spacecraft prime contractor: TRW; Pioneer 9 experiments: JPL, NASA Ames Research Center, NASA Goddard Space Flight Center, Stanford Univ., TRW, Univ. of Adelaide, Univ. of Minesota; launch vehicle prime contractor: McDonnell Douglas.

TIROS OPERATIONAL SATELLITE (TOS) SYSTEM

The TOS system, financed by the Environmental Science Services Administration (ESSA) of the Department of Commerce and operated by ESSA's National Environmental Satellite Center, provides daily cloud-cover pictures — both local and global. New launches are scheduled as needed to assure both types of coverage. The system, based upon Tiros technology, began operating in February of 1966 with the launching of ESSA 1 and ESSA 2. About 400 receiving stations are now in operation around the world. Weather services of 45 foreign countries — as well as 26 universities, 25 to 30 U.S. tv stations, and an undetermined number of private citizens who have built their own receivers — receive and use the photos every day.

Two types of tv cameras on ESSA satellites are currently in use: Automatic Picture Transmission (APT) and Advanced Vidicon Camera System (AVCS). APT cameras continuously transmit their field of view during daylight to any receiving station within line-of-sight range. AVCS cameras store picture data for bulk transmission to specific ground command-control facilities for relaying to ESSA's National Environmental Satellite Center and subsequent distribution.

ESSA 7

LAUNCH VEHICLE Long-Tank Delta: same as that used for Intelsat 3A, above, but without third stage.

SPACECRAFT DESCRIPTION Standard Tiros-ESSA configuration: hatbox-shaped 18-sided polygon, 22 inches high and 42 inches in diameter. Covered by 10,020 n-on-p solar cells. Single 18-inch receiving antenna projected from top, four 22-inch transmitting antennas extended from bottom. Two 1-inch Advanced Vidicon Camera System (AVCS) cameras mounted 180° apart on side of spacecraft. Spin stabilized at 9.2 rpm. Weight: 320 pounds.

PROJECT OBJECTIVES Replace ESSA 5 as the primary stored data satellite in the TOS system, providing global pictures to aid in weather forecasting and warning. Picture readout occurs at ESSA's Command and Data Acquisition Centers at Fairbanks, Alaska and Wallops Island, Virginia for transmission to ESSA's National Environmental Satellite Center where digital mosaics are projected on maps and distributed internationaly.

SPACECRAFT PAYLOAD Two 1-inch AVCS cameras, programmed to take 800-line pictures every 260 seconds while satellite is in daylight. From 865-mile altitude, resolution is about 2 miles per scan line at picture center, with each picture covering an area of about 2000 miles on a side.

ESSA 7, shown here during testing, replaced ESSA 5 as the primary stored data satellite in the TOS system.



Each picture is retained by the layer on face of vidicon tube for about 7 seconds while being converted to signals for storage on magnetic tape recorder. Two cross-connected tape recorders, each capable of storing 48 frames for later transmission. Two arrays of radiometer sensors mounted 180° apart measure global distribution of solar radiation reflected by earth and earth's atmosphere, as well as long-wave radiant energy emitted by earth. Power from solar cells stored in 63 nickel-cadmium batteries.

PROJECT RESULTS ESSA 7 was launched on 16 August 1968 from Vandenberg AFB into a retrograde, sun-synchronous orbit ranging from 889 to 913 miles at 101.7° inclination. One AVCS has failed.

MAJOR PARTICIPANTS Project management: ESSA; spacecraft and launch vehicle management: NASA Goddard Space Flight Center; spacecraft prime contractor: RCA; launch vehicle prime contractor: McDonnell Douglas.

ESSA 8

LAUNCH VEHICLE Two-stage Long-Tank Delta, same as that used for ESSA 7.

SPACECRAFT DESCRIPTION Same as ESSA 7 except that APT cameras were carried instead of AVCS. Weight: 290 pounds.

PROJECT OBJECTIVES Provide daily coverage of local weather systems for weather stations around the world equipped with APT receivers.

SPACECRAFT PAYLOAD Camera system similar to that carried on ESSA 6: two 1-inch APT cameras capable of photographing areas of about 2000 miles on a side with 2-mile resolution at picture center. APT system designed to take and transmit a picture every 352 seconds while satellite is in daylight, allowing a typical APT station to receive 8-10 pictures every day. On-board triggering system programs cameras to take pictures only when facing earth. Position and spin stabilization maintained by magnetic attitude coils. Powered by nickel-cadmium batteries and 10,020 n-on-p solar cells.

PROJECT RESULTS ESSA 8 was launched from vandenberg AFB on 15 December 1968 into a 880/910-mile orbit at 101.80 inclination. Status: both cameras are operational and providing local readout.

MAJOR PARTICIPANTS Same as those for ESSA 7.

EUROPEAN SPACE RESEARCH ORGANIZATION

The 10-nation European Space Research Organization (ESRO) was formally organized in 1964. Initial plans included ESRO 1, which would study the polar ionosphere and aurorae, and ESRO 2, which would study solar astronomy and cosmic rays. Both spacecraft were to be launched by Scout vehicles through a co-operative agreement with NASA. In May of 1967, the initial attempt to launch ESRO 2 (since designated 2A) was unsuccessful, due to a booster malfunction. ESRO 2B was successfully orbited in May of 1968. A mission similar to the current HEOS 1 (Highly Eccentric Orbit Satellite) is contemplated for 1971.

ESRO 1

LAUNCH VEHICLE Scout: same as that used for Explorers 39 and 40, above.

SPACECRAFT DESCRIPTION Cylindrical body with shallow truncated cones at each end, 60 inches in height and 30 inches in diameter, with surface covered by solar cells except for band around middle. Three experiment booms — one 20 inches long extended from top along spin axis, two others 39 inches long extending from bottom of spacecraft perpendicular to spin axis. Four telemetry antennas extended from top rim. Weight: 185 pounds.

PROJECT OBJECTIVES Measure energies and pitch angles of particles impinging on polar ionosphere during magnetic storms and quiet periods. Effects to be measured included production of visible light during auroral events and changes in electron and ion densities and temperature distributions.

SPACECRAFT PAYLOAD Eight experiments included five particle measuring experiments, one auroral photometry experiment, an ion probe, and an electron probe. Power supply of 23 watts provided by 7120 solar cells and 16-cell battery. Telemetry system employed low-power transmitter (0.2 watt, 136-137 mHz) for continuous data transmission, high-power transmitter (1.2 watts, 136-137 mHz) for real-time transmission and for 3-minute playback of the single tape recorder. Spacecraft initially spin-stabilized at about 148 rpm, then despun to 1 rpm by yo-yo mechanism housed in narrow band around middle. Final despinning and stabilization accomplished by magnetic system.

PROJECT RESULTS ESRO 1 was launched from Vandenberg AFB on 3 October 1968 into a 161/949-mile orbit at 93.7°. All systems were reported performing nominally.

MAJOR PARTICIPANTS Spacecraft management: European Space Research Organization; spacecraft prime contractor: Laboratoire Central de Telecommunications; experiments: Radio and Space Research Station (Slough, U.K.), Kiruna Observatory (Sweden), Bergen Univ., Norwegian Defense Research Establishment, Norwegian Institute of Cosmic Physics, University College (London); prelaunch support: NASA Kennedy Space Center (Western Test Range Office); launch vehicle management: NASA Langley Research Center; launch vehicle prime contractor: LTV.

HEOS 1

LAUNCH VEHICLE Thrust Augmented Improved Delta (TAID): same as that used for Explorer 38, above.

SPACECRAFT DESCRIPTION Sixteen-sided cylindrical structure 100.4 inches high and 51.2 inches in diameter, with sides covered by solar cells. Sensor boom extended parallel to spin axis, mounted on tripod at forward end, with four antennas deployed perpendicular to spin axis from apex of tripod. Length of tripod plus boom: 63 inches. Weight: 238 pounds.

PROJECT OBJECTIVES Study magnetic fields, cosmic radiation, and solar wind outside of earth's magnetosphere and shock wave during a period of high solar activity.

SPACECRAFT PAYLOAD Eight experiments: S-16, to be conducted about 2 months after launch, involved optical observation from ground stations of an ion cloud to investigate magnetic and electric fields within magnetosphere, employed a cannister containing barium-copper oxide mixture to be ejected from spacecraft. Mixture was to be ignited about $2\frac{1}{2}$ hours after ejection, releasing a cloud of barium ions and atoms which would be further ionized by solar radiation. Ground observation of cloud's motion was to yield information about magnetic field. S-24A measured magnetic fields in the range of \pm 64 gammas with an accuracy of 0.5 gamma, utilized three-axis magnetometer at end of boom. S-24B used telescope arrangements of Cerenkov scintillation counters to observe high-energy cosmic ray protons and to detect directional anisotropies which may be correlated with results of S-24A. S-24C observed solar protons, employed radial sensors, four-element solid-state-detector tele-

scopes. S-58 and S-73 employed a hemispherical electrostatic analyzer and a Faraday cup to measure energy distribution and angular distribution of proton component of solar wind. S-72 measured electrons, protons, and alpha particles of solar and galactic origin, used a four-element solid-state-detector telescope. S-79 measured spectrum of high-energy cosmic ray electrons, used a four-element telescope and a gas Cerenkov detector. Electrical power provided by 8576 solar cells and a 5-ampere-hour silver-cadmium battery (all systems except command receiver were to be shut down during long eclipses). Real-time telemetry system transmitted 12 bits per second, operated on 136.65 mHz at 5.5 watts. Spin stabilization regulated by nitrogen gas jets. Passive thermal design.

PROJECT RESULTS HEOS 1 was launched from Cape Kennedy on 5 December 1968 into a 2696/13,453-mile orbit at 28.2°. All systems were reported operating nominally.

MAJOR PARTICIPANTS Spacecraft management: European Space Research Organization; spacecraft prime contractor: Junkers Flugzeug und Motorenwerke GmbH; experiments: Centre D'Etudes Nucleairs de Saclay, Imperial College (Britain), Max Planck Institute for Extraterrestrial Physics, Univ. of Brussels, Univ. of Florence and Rome, Univ. of Milan; launch operations management: NASA Kennedy Space Center; launch vehicle prime contractor: McDonnell Douglas.

U.S.S.R.

The tempo of Russian launch activity continued to increase during the last 6 months of 1968, with a record 40 spacecraft orbited (34 Russian satellites were orbited during the first half of the year). Two more Molniya 1's were added to the Orbita system, for a total of 10 operational comsats announced to date. Soyuz 3, Russia's first manned flight since the death of kosmonaut Komarov in Soyuz 1 (April, 1967), accomplished a rendezvous within some 650 feet of the unmanned Soyuz 2. The two successful unmanned circumlunar flights — Zond 5 and Zond 6 — appeared to constitute further evidence of Soviet attempts to man-rate a system for lunar missions. Little has been released on Proton 4, whose announced mission was the continuation of cosmic ray research. Proton 4's weight was announced as 17 metric tons (37,500 pounds) — 10,500 pounds heavier than each of the three previous Protons.

MOLNIYA 1J

LAUNCH VEHICLE Vostok-2-e: 1½-stage first stage consisting of RD-108 sustainer core and four strap-on modules, each utilizing clusters of four RD-107 engines, for a total first stage thrust of 1,124,000 pounds; improved second stage; and escape stage. Combined stage total thrust: 1,433,000 pounds. Height: 140.4 feet.

SPACECRAFT DESCRIPTION Russia has announced no changes to the basic Molniya 1 configuration: cylindrical body with conical top; solar panels mounted on six fold-out panels extending from base; twin 3-foot-diameter parabolic antennas mounted at 180° on powered, articulated arms also attached to base. Solar and earth orientation units contained in upper end; orbital correction engine attached to base. Thermal control provided by half-cylinder radiators encircling satellite body and flatring heater mounted behind solar panels. Weight: over 2200 pounds.

PROJECT OBJECTIVES Augmentation of Russia's Orbita system initiated with Molniya 1A in April of 1965.

SPACECRAFT PAYLOAD Communication system included a 40-watt primary transmitter, two backup transmitters, command receiver, and two redundant, circularly-polarized, directional parabolic antennas with 22° apertures. Spacecraft also carried four traveling wave tubes — three active and one on standby. Sun and earth sensors and gyrostabilizer maintained three-axis stabilization. Liquid-fueled, restartable orbital correction engine had 441 pounds of maximum thrust, 65-second total firing time. Spacecraft capable of carrying one tv channel and multi-channel audio; some of the telephone channels can be multiplexed for VHF telegraphy, photofacsimile, and audio. Television transmitted at 3400-4100 mHz, telecommunications equipment operated at 800-1000 mHz.

PROJECT RESULTS Molniya 1J was launched on 5 July 1968 from Tyuratam into a 292/24,712-mile orbit at 65° inclination. Molniya orbits occur over the Northern Hemisphere, providing maximum visibility over Russia. Color tv programs have been transmitted between Moscow and the Far East. Molniya satellites are also providing cloud cover photos and transmitting weather charts, digital data, and telephone conversations.

MOLNIYA 1K

LAUNCH VEHICLE Vostok-2-e: same as used for Molniya 1J.

SPACECRAFT DESCRIPTION Same as Molniya 1J.

PROJECT OBJECTIVES Same as Molniya 1J.

SPACECRAFT PAYLOAD Same as Molniya IJ.

PROJECT RESULTS Molniya 1K was launched on 5 October 1968 from Tyuratam into a 304/24,606-mile orbit at 65°0 inclination.

SOYUZ 2, 3

LAUNCH VEHICLE Vostok-2: same as used for Molniya 1J and 1K but without escape stage.

SPACECRAFT DESCRIPTION Soyuz 3: cylindrical in overall shape, consisting of two spherical, habitable modules (orbital compartment and command module) connected in tandem to cylindrical service module, with docking probe extending forward from front module. Overall dimensions estimated at 34.3 feet in length including 9-foot docking probe, diameter ranging from 7.5 to 9.75 feet. Two large, wing-like solar panels deployed (in orbit) at 1800 near aft end of service module, with single whip antenna extending forward from leading edge near tip of each panel. Communications and rendezvous radar antennas mounted on forward module similar to those on Kosmos 186. Soyuz 2: announced as identical to Soyuz 3 (no announcement was made concerning docking collar).

PROJECT OBJECTIVES Checkout of Soyuz flight hardware, automatic approach and manual rendezvous with Soyuz 2. Soviet announcements have consistently stressed importance of manned orbiting platform to their future space plans.

SPACECRAFT PAYLOAD Kosmonaut Georgi Timofeyevitch Beregovoy, 47, flew Soyuz 3. Orbital compartment (forward sphere) had total volume estimated at 221 cubic feet, served as working and sleeping area with sufficient room for cosmonaut to stand up; contained control and instrumentation console, foodstuffs, cosmonaut's couch. Connected to orbital compartment via hermetically sealable access hatch was command module, estimated at about 173 cubic feet in total volume, utilized during launch, rendezvous, and re-entry. Command module capable of aerodynamic control during re-entry. Total working volume of both modules announced as 318.6 cubic feet. Four ty cameras were carried — two inside

and two outside. Low-thrust rockets used for orientation and maneuvering. Service module contained two redundant, restartable, liquid-fueled 880-pound-thrust rockets for retrofire and major changes in orbit. Parachute system and solid-propellant rockets used for landing. Direction-finder transmitter used to aid search parties, transmitting one signal during descent and another after landing.

PROJECT RESULTS Soyuz 2 was launched from Tyuratam on 25 October 1968 into a 115/139-mile orbit at 51.70 inclination. Sovuz 3. carrying kosmonaut Beregovoy, was launched on the following day - also from Tyuratam - into a 127/130-mile orbit at 51.4°. During Soyuz 3's first orbit, automatic rendezvous was conducted with Sovuz 2 to approximately 650 feet. Beregovoy then assumed manual control – but no announcement was made as to how much closer the two spacecraft came. A second approach and rendezvous was made on the second day, but again the final proximity was not announced. Voice and tv communications were maintained within zones of visibility. Under ground control, Sovuz 2 re-entered on 28 October. On the following day, after a 145-second retrofire burn (also initiated and controlled by ground station), Soyuz 3 re-entered, landing near outskirts of city of Karaganda in northern Kazakhstan, about 600 miles northeast of the Tyuratam launch site, after logging 64 revolutions during 94 hours, 51 minutes. Spacecraft's aerodynamic re-entry incurred loads of 3 to 4 g's.

ZOND 5

LAUNCH VEHICLE Proton-1-e: estimated 3.3-million-pound-thrust first stage plus orbital and escape stages.

SPACECRAFT DESCRIPTION Soyuz-type command module and cylindrical service module with wing-like solar panels and trajectory correction engine, plus (as indicated by Soviet drawings) a large parabolic antenna. Photos of container of recovered command module suggest a diameter of around 8 feet, similar to Soyuz.

PROJECT OBJECTIVES Investigate effects of space environment on biological specimens, as well as perform a circumlunar flight and recovery of an automatic variant of a manned lunar spacecraft, with flight checkout of guidance, stabilization, communication, and re-entry systems.

SPACECRAFT PAYLOAD Biological specimens included turtles, fruit flies, mealworms, spiderwort plants with buds, and seeds of wheat, pine,

and barley. Other specimens included chlorella in various nutritive media, and lysigenous bacteria of different types. Instrumentation included direct readout gages, thermoluminescent glass, dosimeters, and nuclear emulsions providing radiation readouts during flight. Soviet announcements have mentioned optical sensors, radio transmitter, orientation and stabilization system, trajectory correction engine, heat regulation and power supply systems, plus aerodynamic braking capabilities, heatshield, and parachute system for descent capsule.

PROJECT RESULTS Zond 5 was launched from Tyuratam on 15 September 1968 into a 116/136-mile parking orbit at 51.50 inclination. At 67 minutes after launch, during initial orbit, booster escape stage ignited, placing spacecraft into lunar trajectory before final staging, Following a trajectory correction at T + 53.5 hours, Zond 5 flew around the moon on a free return trajectory on 18 September at a minimum distance of 1212 miles. Lunar and earth photos were taken during flight, for later recovery and processing. Total of 36 communication sessions were held, including reported voice transmissions calling out instrument values. Second trajectory correction was made during return flight, changing velocity by about 1.2 fps. Re-entry capsule separated from service module prior to re-entry, and aerodynamic braking slowed spacecraft for parachute deployment at about 23,000 feet. Splashdown - first Soviet water recovery - after 162.4 hours in flight occurred in Indian Ocean at 320 38' S., 650 33' E. Capsule was recovered on the following day by the Soviet recovery vessel Vasily Golovnin, shipped to Bombay, and from that point flown to Soviet Union.

ZOND 6

LAUNCH VEHICLE Proton-1-e: same as that used for Zond 5.

SPACECRAFT DESCRIPTION Command module described by Soviets as an axially symmetric truncated cone, capable of creating lift by displacing center of gravity relative to axis of symmetry. Soviet drawings indicate that command module was attached to a service module containing trajectory correction engine and having wing-like solar panels — similar in overall configuration to Zond 5.

PROJECT OBJECTIVES Unmanned flight checkout of a manned lunar spacecraft, including guidance and re-entry. Specifically mentioned objectives were improvement of descent control system and improvement of aerodynamic shape and performance characteristics of descent module

(command module). Other objectives included radiation measurements and lunar photography.

SPACECRAFT PAYLOAD Like Zond 5, Zond 6 carried biological specimens for radiation investigations (type of specimens for Zond 6 not divulged). Cosmic radiation experiment to obtain data on highly charged cosmic rays at distances from earth on the order of hundreds of thousands of miles. A meteorite recorder was employed to measure distribution and energy of meteorites. Automatic camera for lunar photography used a 400-mm lens, produced frames of 5.25 x 7 inches.

PROJECT RESULTS Zond 6 was launched from Tyuratam on 10 November 1968 into a 115/130-mile parking orbit at 51.4°. As occurred with Zond 5, final stage ignited during first orbit to insert Zond 6 into escape trajectory. Spacecraft then separated from booster final stage and oriented itself to maintain solar panels in sunlight. First midcourse correction came at T + 34:29:30, about 153,000 miles from earth. On November 14, Zond 6 flew around moon, reaching a minimum altitude of about 1504 miles. Lunar photos were taken while in proximity to moon. Two additional midcourse corrections were made during return trajectory - one at T + 131:28:30, the other at T + 154:24:30. Following final trajectory correction, command module separated from service module and approached Soviet Union from Southern Hemisphere - "southern entry variant." In Zond 6's "skip-lob re-entry," spacecraft made initial re-entry at about 24,500 mph in a relatively shallow angle, reducing speed through atmospheric friction to about 8500 mph. Then, through aerodynamic lift, Zond 6 bounced back above atmosphere in ballistic trajectory, re-entering a second time at a speed of about 16,900 mph. Parachute system deployed at 24,600 feet, and spacecraft accomplished soft landing in territory of Soviet Union. Time and coordinates of touchdown point were not announced. Time of initial entry into atmosphere was announced as 1658 hours Moscow time (T + 162:46:30).

NASA 1969 TARGET LAUNCH SCHEDULE

As of 16 January 1969

OSO F	ETR	Thrust-Augmented Delta
ISIS A	WTR	Long-Tank Delta
Intelsat 3B	ETR	Long-Tank Delta
Mariner F (Mars '69)	ETR	Atlas-Centaur
TOS G	WTR	Long-Tank Delta
Apollo 9 (earth-orbit mission; CSM 104, LM 3)	ETR	Saturn V (SA 504)
Mariner G (Mars '69)	ETR	Atlas-Centaur
OGO F	WTR	TAT-Agena
Biosatellite D (30-day primate)	ETR	Thrust-Augmented Delta
Nimbus B-2	WTR	LTTAT-Agena D
Apollo 10 (lunar mission; CSM 106, LM 4)	ETR	Saturn V (SA 505)
Tiros M	WTR	Thrust-Augmented Delta
Pioneer E	ETR	Thrust-Augmented Delta
Intelsat 3C	ETR	Long-Tank Delta
Apollo 11 (lunar mission; CSM 107, LM 5)	ETR	Saturn V (SA 506)
Intelsat 3D	ETR	Long-Tank Delta
OSO G	ETR	Thrust-Augmented Delta
IMP G	WTR	Long-Tank Delta
ATSE	ETR	Atlas-Centaur
SERT 2A	WTR	TAT-Agena
Skynet A	ETR	Thrust-Augmented Delta
Apollo 12 (lunar mission; CSM 108, LM 6)	ETR	Saturn V (SA 507)
ITOS A	WTR	Thrust-Augmented Delta
OFO A (Orbiting Frog Otolith)	WI	Scout
OAO B	ETR	Atlas-Centaur Atlas-Centaur
TOSH	WTR	Long-Tank Delta
GRS A (German Research Satellite)	WTR	Scout
Apollo 13 (lunar mission; CSM 109, LM 7)	ETR	Saturn V (SA 508)
Skynet B	ETR	Thrust-Augmented Delta

Condensed Log of 1957-68 Space Projects

	INT'L	PROJ.	LAUNCH DATA				11	INITIAL ORBITAL DATA			STATUS	
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT		Perigee	Apogee	Incl.	THE STATES	
Sputnik 1	1957 A2	USSR	Oct 4, 1957	Tyuratam	A	184	96.2	141	588	65.1	Decayed 1-4-58: first artificial satellite, transmitted 21 days	
*********	1957 B1	USSR	Nov 3, 1957	Tyuratam	A	1121	103.7	140	1038	65.3	Decayed 4-14-58: carried dog Laika, transmitted 7 days	
	None	USN	Dec 6, 1957	ETR	Vanguard	3	20	-	-	41	Failed to orbit: lost thrust after 2 seconds	
AND DESCRIPTION OF THE PERSON NAMED IN COLUMN 1	1958 A1	USA	Jan 31, 1958	ETR	Jupiter C	31	114.7	224	1584	33.3	In orbit: transmitted until 5-23-58, discovered Van Allen belt	
Vanguard TV 3	None	USN	Feb 5, 1958	ETR	Vanguard	3	2	_	-	-	Failed to orbit: control system malfunction	
	None	USA	Mar 5, 1958	ETR	Jupiter C	32	-	-	-	72	Failed to orbit: unsuccessful fourth stage ignition	
	1958 B2	USN	Mar 17, 1958	ETR	Vanguard	3	134.3	405	2462	34.3	In orbit: transmitted "pear-shaped" earth data until 5-64	
terrane de la constant de	1958 Г1	USA	Mar 26, 1958	ETR	Jupiter C	31	114.7	117	1739	33.5	Decayed 6-28-58: radiation, micrometeoroid data until 6-16-58	
	None	USN	Apr 28, 1958	ETR	Vanguard	22	-	-	-	-	Failed to orbit: third stage ignition malfunction	
	1958 △2	USSR	May 15, 1958	Tyuratam	A	2926	105.8	140	1168	65.2	Decayed 4-6-60: variety of scientific data returned up to decay	
SOUD DAYAR	None	USN	May 27, 1958	ETR	Vanguard	22	1 -	44	- 4	-	Failed to orbit: improper third stage trajectory	
	None	USN	June 26, 1958	ETR	Vanguard	22	20	- T	_	-	Failed to orbit: premature second stage cutoff	
	1958 E1	ARPA	July 26, 1958	ETR	Jupiter C	38	110.1	163	1372	50.1	Decayed 10-23-59: mapped Project Argus radiation until 10-6-58	
Thor-Able 1 (Pioneer)		USAF	Aug 17, 1958	ETR	Thor-Able	84	-	-	-	_	Lunar probe failed: initial lunar attempt, first stage failed	
	None	ARPA	Aug 24, 1958	ETR	Jupiter C	38		-	-	->	Failed to orbit: upper stages fired in wrong direction	
	None	USN	Sept 26, 1958	ETR	Vanguard	22	-	-	-	-:	Failed to orbit: insufficient second stage thrust	
	1958 H1	NASA	Oct 11, 1958	ETR	Thor-Able	84			70,717		Decayed 10-12-58: failed to reach moon, sent 43 hrs of data	
CAMPAGE CO.	None	NASA	Oct 23, 1958	ETR	Jupiter C	9	25	- 2			Failed to orbit: upper stages separated prior to burnout	
DEPENDENT TO THE PARTY OF THE P	None	NASA	Nov 8, 1958	ETR	Thor-Able	87	-	=	-	- 411	Lunar probe failed: third stage ignition unsuccessful	
Pioneer 3	1958 ®1	NASA	Dec 6, 1958	ETR	Juno II	13			63,580	102	Decayed 12-7-58: failed to reach moon, provided radiation data	
STATE OF THE PARTY	1958 Z1	ARPA	Dec 18, 1958	ETR	Atlas B	8750	101.5	115	914	32.3	Decayed 1-21-59: first comsat, tx taped messages for 13 days	
	1959 M1	USSR	Jan 2, 1959	Tyuratam	A-1	797	450 days	.9766AU	1.314AU	0.01'	In solar orbit: lunar probe, passed within 3728 mi of moon	
Vanguard 2	1959 A1	NASA	Feb 17, 1959	ETR	Vanguard	22	125.9	347	2064	32.9	In orbit: transmitted 18 days, satellite wobble degraded data	
Discoverer 1	1959 B1	ARPA	Feb 28, 1959	WTR	Thor-Agena A	1300	96.0	114	697	90.0	Decayed 3-5-59: first polar orbit, no re-entry capsule	
Pioneer 4	1959 N1	NASA	Mar 3, 1959	ETR	Juno II	13	398 days	.9871AU	1.142AU	1.30	In solar orbit: lunar probe, passed within 37,300 mi of moon	
Discoverer 2	1959 T1	ARPA	Apr 13, 1959	WTR	Thor-Agena A	1600	90.6	152	225	90.0	Decayed 4-26-59: capsule ejected on orbit 17, lost in Arctic	
Vanguard SLV 5	None	NASA	Apr 13, 1959	ETR	Vanguard	23	-	-	_		Failed to orbit: second stage damaged at separation	
Discoverer 3	None	ARPA	June 3, 1959	WTR	Thor-Agena A	1600	-	_	-	-,,	Failed to orbit: Agena fired, no satellite signals received	
Vanguard SLV 6	None	NASA	June 22, 1959	ETR	Vanguard	23	-		_		Failed to orbit: second stage propulsion malfunction	
Discoverer 4	None	ARPA	June 25, 1959	WTR	Thor-Agena A	1600	-			_	Failed to orbit: insufficient second stage velocity	
Explorer S-1	None	NASA	July 16, 1959	ETR	Juno II	92	-	7	2		Failed to orbit: districted second stage verocity	
Explorer 6	1959 Δ1	NASA	Aug 7, 1959	ETR	Thor-Able	143	768	157	26,366	47.0	Decayed before 7-61: first earth photo, radiation data to 10-6-59	
Discoverer 5	1959 E1	ARPA	Aug 13, 1959	WTR	Thor-Agena A	1700	94.1	135	456	80.0	Decayed 9-28-59: capsule orbited; decayed 2-11-61	
Beacon 2	None	NASA	Aug 14, 1959	ETR	Juno II	10	-	-	-	00.0	Failed to orbit: first stage, upper stage malfunctions	
Discoverer 6	1959 Z1	ARPA	Aug 19, 1959	WTR	Thor-Agena A	1700	95.2	131	528	84.0	Decayed 10-20-59: capsule ejected orbit 17, recovery failed	
Luna 2	1959 Z1	USSR	Sept 12, 1959	Tyuratam	A-2	860		******	34.0 hours	04.0	Impacted on moon: first probe to hit the moon	
Transit 1A	None	ARPA	Sept 17, 1959	ETR	Thor-Able	265		ingine time.	04.0 110013	-	Failed to orbit: third stage ignition malfunction	

The Condensed Log section in this issue includes all known orbital launches. The next complete Condensed Log (1957-69) will appear in the Winter 1969-70 issue. This section was compiled from the public announcements of the agencies responsible for project direction, and from the Goddard Space Flight Center Satellite Situation Report, Royal Aircraft Establishment Table of Artificial Earth Satellites, and the UN Committee on the Peaceful Uses of Outer Space reports. Some assumptions were made in correlating this information; therefore, accuracy of the resulting data cannot be assured.

Launch date: local time at launch site Period: minutes

Perigee and apogee: statute miles Inclination: degrees from the equator 1 statute mile=1.609344 km=0.86839 n. mi.

': inclination from the ecliptic

AU: Astronomical Unit WTR: Western Test Range ETR: Eastern Test Range SLV: Satellite Launching Vehicle TV: Test Vehicle

A: 1%-stage booster -- constituted 1st stage of vehicle used to launch Vostok spacecraft.

A-1: 1½-stage booster with 1st generation upper stage (Vostok vehicle)

A-2: 1½-stage booster with 2nd generation upper stage

Soviet launch vehicle designations are adopted from those presented in "The Soviet Space Program – a Growing Enterprise," pp.2-23, this issue.

- Juny	11/1				-	1.11.		Analysis and the			
NAME	INT'L	PROJ.		LAUNCH D	ATA	WEIGHT	100		BITAL DATA	-	- STATUS
WANE	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT	Period	Perigee	Apogee	Incl.	340
Vanguard 3	1959 H1	NASA	Sept 18, 1959	ETR	Vanguard	100	130.2	317	2329	33.3	In orbit: radiation, micrometeoroid data until 12-11-59
Luna 3	1959 ®1	USSR	Oct 4, 1959	Tyuratam	A-1	614	6.2 days	25,257	291,439	76.8	Decayed 4-20-60: photographed moon's far side for 40 min
Explorer 7	1959 11	NASA	Oct 13, 1959	ETR	Juno II	92	101.2	346	676	50.3	In orbit: magnetic field, solar flare data until 8-24-61
Discoverer 7	1959 K1	ARPA	Nov 7, 1959	WTR	Thor-Agena A	1700	94.6	99	519	81.6	Decayed 11-26-59: poor stabilization, capsule not ejected
Discoverer 8	1959 A1	USAF	Nov 20, 1959	WTR	Thor-Agena A	1700	103.7	120	1032	80.6	Decayed 3-8-60: capsule overshot recovery area on orbit 15
Atlas-Able 4 (Pioneer)	None	NASA	Nov 26, 1959	ETR	Atlas-Able	372	-	-	=	-	Lunar probe failed: payload shroud broke away after 45 sec
Discoverer 9	None	USAF	Feb 4, 1960	WTR	Thor-Agena A	1700	-	-	-	-	Failed to orbit: premature first stage cutoff
Discoverer 10	None	USAF	Feb 19, 1960	WTR	Thor-Agena A	1700	-		-	-	Failed to orbit: destroyed by range safety officer
Midas 1	None	USAF	Feb 26, 1960	ETR	Atlas-Agena A	4500	175	-	-	-	Failed to orbit: second stage failed to separate
Pioneer 5	1960 A1	NASA	Mar 11, 1960	ETR	Thor-Able		312 days	.8061AU	.995AU	3.35	In solar orbit: solar system data to 22.5M mi until 6-26-60
Explorer S-46	None	NASA	Mar 23, 1960	ETR	Juno II	35 '	-		-		Failed to orbit: apparent upper stage ignition malfunction
Tiros 1	1960 B2	NASA	Apr 1, 1960	ETR	Thor-Able	263	99.2	430	468	48.3	In orbit: first metsat, sent 22,952 photos up to 6-17-60
Transit 1B	1960 Г2	ARPA	Apr 13, 1960	ETR	Thor-Able Star	265	95.8	232	463	51.3	Decayed 10-5-67: initial navsat, transmitted until 7-12-60
Discoverer 11	1960 △1	USAF	Apr 15, 1960	WTR	Thor-Agena A	1700	92.3	103	375	80.1	Decayed 4-26-60: capsule ejected orbit 17, recovery failed
Echo A-10	None	NASA	May 13, 1960	ETR	Delta	132	-		=	-	Failed to orbit: second stage attitude control malfunction
Sputnik 4	1960 E1	USSR	May 15, 1960	Tyuratam	A-1	10,009	91.3	194	229	65.0	Decayed 9-5-62: Vostok prototype, recovery failed 5-19-60 as cabin went high orbit, cabin decayed 10-15-65
Midas 2	1960 Z1	USAF	May 24, 1960	ETR	Atlas-Agena A	5000	94.4	299	321	33.0	In orbit: data link quit 2nd day
Transit 2A	1960 H1	OUAI	may 24, 1000	LIN	Atlas Ayella A	223	101.7	389	665	66.7	In orbit: returned navigation, geodetic data until 8-62
Solrad 1	1960 H2	USN	June 22, 1960	ETR	Thor-Able Star	42	101.6	382	657	66.8	In orbit: first sub-satellite, returned solar data until 4-61
Discoverer 12	None	USAF	June 29, 1960	WTR	Thor-Agena A	1700	-	-	-	17	Failed to orbit: second stage attitude instability
Discoverer 13	1960 ®1	USAF	Aug 10, 1960	WTR	Thor-Agena A	1700	94.1	157	431	82.8	Decayed 11-14-60: first recovery, from ocean on orbit 17
Echo 1	1960 11	NASA	Aug 12, 1960	ETR	Delta	166	118.2	941	1052	47.2	Decayed 5-24-68: first passive comsat, relayed voice, TV signals
Discoverer 14	1960 K1	USAF	Aug 18, 1960	WTR	Thor-Agena A	1700	94.5	113	502	79.6	Decayed 9-16-60: first mid-air capsule recovery, on orbit 17
Courier 1A	None	ARPA	Aug 18, 1960	ETR	Thor-Able Star	500	-	-	-	-	Failed to orbit: booster exploded 2.5 min after launch
Sputnik 5	1960 Δ1	USSR	Aug 19, 1960	Tyuratam	A-1	10,141	90.7	190	211	65.0	Re-entered 8-20-60: dogs Belka, Strelka recovered on orbit 18
Discoverer 15	1960 M1	USAF	Sept 13, 1960	WTR	Thor-Agena A	1700	94.2	125	469	80.9	Decayed 10-18-60: capsule ejected 17th pass, lost in ocean
Atlas-Able 5A (Pioneer)	None	NASA	Sept 25, 1960	ETR	Atlas-Able	387	7	-	-	-	Lunar probe failed: second stage oxidizer system malfunction
Courier 1B	1960 N1	USA	Oct 4, 1960	ETR	Thor-Able Star	500	106.9	586	767	28.3	In orbit: first active-repeater comsat, operated for 17 days
None	None	USSR	Oct 10, 1960	Tyuratam	A-2-e	500	C	777-	-	-	Mars probe failed: announced by U.S. in 1962
Samos 1	None	USAF	Oct 11, 1960	WTR	Atlas-Agena A	4100	(2)		-	-	Failed to orbit: second stage ignited but didn't reach orbit
None	None	USSR		Tyuratam	A-2-e	4100	1	_	121		Mars probe failed: announced by U.S. in 1962
Discoverer 16	None	USAF	Oct 14, 1960	WTR		2100	-	-	-	_	Failed to orbit: second stage, booster failed to separate
Explorer 8	1960 E1	NASA	Oct 26, 1960 Nov 3, 1960	ETR	Thor-Agena B Juno II	90	112.7	285	1422	50.0	In orbit: ionospheric research satellite, tx until 12-28-60
Discoverer 17	1960 01				The state of the s	2100	96.4	113	614	81.9	Decayed 12-29-60: mid-air capsule recovery on orbit 31
Tiros 2	1960 II1	NASA	Nov 12, 1960	WTR	Thor-Agena B	278	98.3	387	452	48.5	In orbit: returned 36,156 cloud cover photos until 12-4-61
Transit 3A/ Solrad 2	None	USN	Nov 23, 1960 Nov 30, 1960	ETR	Delta Thor-Able Star	203/40	-	-	-	AU	Failed to orbit: destroyed by range safety officer
Sputnik 6	1960 P1	USSR	Dec 1 1000	Tourston	A1/	10,060	88.6	116	165	65.0	Decayed 12-2-60: recovery attempt failed, canine cabin lost
Explorer S-56	Walter and		Dec 1, 1960	Tyuratam	A-1	10,000	-	-	-	_	Failed to orbit: second stage ignition malfunction
THE PARTY OF THE P	None	NASA	Dec 4, 1960	WI	Scout	2100	93.8	143	426	80.8	Decayed 4-2-61: mid-air capsule recovery on orbit 48
Discoverer 18	1960 Σ1	USAF	Dec 7, 1960	WTR	Thor-Agena B	2100			74.0	00.0	Decayor 42 of a minural capsula recovery on orbit 40

A-2-e: 11/4-stage booster with 2nd generation upper stage plus escape stage

WI: Wallops Island

13	INT'L	PROJ.		LAUNCH D	ATA	1		A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2000 Paris (2020)		
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT			BITAL DATA	20 11 11	- STATUS
Atlas-Able 5B	DEGIG.	5111.	5410		10	- Compar	Period	Perigee	Apogee	Incl.	
(Pioneer)	None	NASA	Dec 15, 1960	ETR	Atlas-Able	388	1-	-		All	Lunar probe failed: exploded 70 seconds after liftoff
Discoverer 19	1960 T1	USAF	Dec 20, 1960	WTR	Thor-Agena B	2100	93.0	128	390	82.8	Decayed 1-23-61: infrared experiments, no re-entry capsule
Samos 2	1961 A1	USAF	Jan 31, 1961	WTR	Atlas-Agena A	4100	95.0	300	350	97.0	In orbit: returned micrometeoroid impact data
Sputnik 7	1961 B1	USSR	Feb 4, 1961	Tyuratam	A-2-e	14,293	89.8	139	204	65.0	Decayed 2-26-61: believed to be Venus probe abort
Venus 1	1961 IT	USSR	Feb 12, 1961	Tyuratam	A-2-e	1419-	300 days	.7183AU	1.0190AU	0.58	In solar orbit: Venus probe, radio contact lost at 4.7M mi
Sputnik 8	1961 ГЗ					14,275	89.7	123	198	65.0	Decayed 2-25-61: launched Venus 1 from parking orbit
Explorer 9	1961 △1	NASA	Feb 16, 1961	WI	Scout	15	118.3	395	1605	38.6	Decayed 4-9-64: 12-ft balloon to study atmospheric density
Discoverer 20	1961 E1	USAF	Feb 17, 1961	WTR	Thor-Agena B	2450	95.4	177	486	80.4	Decayed 7-28-62: programmer failure, no capsule ejection
Discoverer 21	1961 Z1	USAF	Feb 18, 1961	WTR	Thor-Agena B	2100	93.8	149	659	80.7	Decayed 4-20-62: infrared experiments, no re-entry capsule
Transit 3B/ Lofti 1	1961 H1	USN	Feb 21, 1961	ETR	Thor-Able Star	250/57	94.5	117	511	28.4	Decayed 3-30-61: second stage, satellites failed to separate
Explorer S-45	None	NASA	Feb 24, 1961	ETR	Juno II	74	U 1	27-	-	-	Failed to orbit: third and fourth stage ignition malfunction
Sputnik 9	1961 ⊕1	USSR	Mar 9, 1961	Tyuratam	A-1	10,362	88.5	114	155	64.9	Re-entered 3-9-61: cabin with dog Chernushka recovered
Sputnik 10	1961 11	USSR	Mar 25, 1961	Tyuratam	A-1	10,351	88.4	111	153	64.9	Re-entered 3-25-61: dog Zvezdochka recovered after 1 orbit
Explorer 10	1961 K1	NASA	Mar 25, 1961	ETR	Delta	79-	112 hrs	100	145,000	33.9	Decayed 6-68: magnetic field data for planned 60 hrs
Discoverer 22	None	USAF	Mar 30, 1961	WTR	Thor-Agena B	2100-	12	=	_	_	Failed to orbit: second stage control system malfunction
Discoverer 23	1961 A1	USAF	Apr 8, 1961	WTR	Thor-Agena B	2100-	101.2	126	882	81.9	Decayed 4-16-62: capsule orbited; decayed 5-23-62
Vostok 1	1961 M1	USSR	Apr 12, 1961	Tyuratam	A-1	10,417	89.1	112	203	65.0	Re-entered 4-12-61: first manned space flight, cabin with Y. Gagari
Mercury- Atlas 3	None	NASA	Apr 25, 1961	ETR	Atlas D	2000	-		1621		recovered in USSR after 1 orbit, 1.8 hrs Failed to orbit: destroyed by range safety officer
Explorer 11	1961 N1	NASA	Apr 27, 1961	ETR	Juno II	82-	108.1	304	1110	20.0	1
Explorer S-45A	None	NASA	May 24, 1961	ETR	Juno II	75-	ALAMAS S	1.575,051	1113	28.8	In orbit: gamma ray counter returned data until 12-6-61
Discoverer 24	None	USAF	June 8, 1961	WTR	Thor-Agena B	2100-	-	_	-	-	Failed to orbit: second stage ignition malfunction
Discoverer 25	1961 三1	USAF	June 16, 1961	WTR	Thor-Agena B	2100	90,9	139	251	- 00.1	Failed to orbit: second stage ignition malfunction
Transit 4A	1961 01					175	103.7	534	251 623	82.1 67.0	Decayed 7-12-61: capsule recovered from ocean on orbit 33
Injun 1/	1961 02	USN	June 29, 1961	ETR	Thor-Able Star	FF.140	103.7	334	023	67.0	In orbit: first nuclear power supply, SNAP-3, still working
Solrad 3						55/40	103.8	534	634	67.0	In orbit: failed to separate, Injun sent radiation data until 3-6-63;
Explorer S-55	None	NASA	June 30, 1961	WI	Scout	187	-	_			Solrad returned solar X-ray data until late 1961
Discoverer 26	1961 III	USAF	July 7, 1961	WTR	Thor-Agena B	2100	95.0	146	503	82.9	Failed to orbit: third stage ignition malfunction
Tiros 3	1961 P1	NASA	July 12, 1961	ETR	Delta	285	100.4	461	506		Decayed 12-5-61: capsule recovered in mid-air on orbit 32
Midas 3	1961 Σ1	USAF	July 12, 1961	WTR	Atlas-Agena B	3500	160.0	2130		47.8	In orbit: returned 35,033 photos up to 2-27-62
Discoverer 27	None	USAF	July 21, 1961	WTR	Thor-Agena B	2100	-		2130	91.1	In orbit: first Midas launch from West Coast
Discoverer 28	None	USAF	Aug 3, 1961	WTR	Thor-Agena B	2100	-		7.7		Failed to orbit: destroyed by range safety officer
Vostok 2	1961 T1	USSR	Aug 6, 1961	Tyuratam	A-1	10,430	88.6	111	100	- CA O	Failed to orbit: second stage control system malfunction
Explorer 12	1961 T1	NASA	Aug 15, 1961	ETR	Delta	82	1585	182	160	64.9	Re-entered 8-7-61: G. Titov landed after 17 orbits, 25.3 hrs
Ranger 1	1961 Φ1	NASA	Aug 23, 1961	ETR	Atlas-Agena B	675	91.1	105	48,000	33.3	Decayed 9-63: radiation and solar wind data until 12-6-61
Explorer 13	1961 X1	NASA	Aug 25, 1961	WI	Scout	187	97.3		313	32.9	Decayed 8-30-61: attempt to reach deep space orbit failed
Discoverer 29	1961 11	USAF	Aug 30, 1961	WTR	Thor-Agena B	2100	91.0	175	606	36.4	Decayed 8-28-61: micrometeroid satellite, orbit too low
Samos 3	None	USAF	Sept 9, 1961	WTR	Atlas-Agena B	4200	-		345	82.1	Decayed 9-10-61: capsule recovered from ocean on orbit 33
Discoverer 30	1961 Ω1	USAF	Sept 12, 1961	WTR	Thor-Agena B	2100	92.4	154	- 24E	- 02.0	Failed to orbit: exploded on launch pad
Mercury- Atlas 4	1961 AA1	NASA	Sept 13, 1961	ETR	Atlas D	2700.		154	345 159	82.6 32.6	Decayed 12-11-61: capsule recovered in mid-air on orbit 33 Re-entered 9-13-61: recovered from ocean after 1 orbit
Discoverer 31	1961 AB1	HEAE	Cont 17 1001	WTD	They Asses D	2100					
Discoverer 32	1961 AF1	USAF	Sept 17, 1961 Oct 13, 1961	WTR	Thor-Agena B	2100	91.0	152	255	82.7	Decayed 10-26-61: capsule separation failed
Midas 4	1961 AΔ1				Thor-Agena B		90.8	147	246	81.7	Decayed 11-13-61: mid-air capsule recovery on orbit 18
IVIII GGS 4	1301 AΔ1	USAF	Oct 21, 1961	WTR	Atlas-Agena B	3000	166.0	2058	2324	95.9	In orbit: West Ford ejected but dipoles failed to disperse

- 20	INT'L	PROJ.		LAUNCH D	ATA	109		UTIAL ORI	DITAL DAT		5000
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT			Apogee	A Incl.	STATUS
Discoverer 33	None	USAF	Oct 23, 1961	WTR	Thor-Agena B	2100	Period	Perigee	Apogee	IIIGI.	Edited to sabite bounds orbitals about down accounts orbitals
Mercury- Scout 1	None	NASA	Nov 1, 1961	ETR	Scout	150				16	Failed to orbit: launch vehicle shut down prematurely Failed to orbit: destroyed by range safety officer
Discoverer 34	1961 AE1	USAF	Nov 5, 1961	WTR	Thor-Agena B	2100			200		
Discoverer 35	1961 AZ1	USAF	Nov 15, 1961	WTR	Thor-Agena B	2100	97.2	134	637	82.7	Decayed 12-7-62: malfunction prevented capsule ejection
Transit 4B	1961 AH1	Town Warrier				190	89.8	147	173	81.6	Decayed 12-3-61: capsule recovered in mid-air on orbit 18
Traac	1961 AH2	USN	Nov 15, 1961	ETR	Thor-Able Star	240	105.6	582	700	32.4	In orbit: transmitted until 7-62, SNAP-3 operated 8 months
Ranger 2	1961 A®1	NASA	Nov 18, 1961	ETR	Atlas-Agena B	675	105.6	562	720	32.4	In orbit: gravity gradient experiment boom failed to extend
Vone	None	USAF	Nov 22, 1961	WTR	Atlas-Agena B		88.3	98	147	33.3	Decayed 11-20-61: attempt to reach deep space orbit failed
Mercury- Atlas 5	1961 AI1	NASA	Nov 29, 1961	ETR	Atlas D	2900	88.5	100	148	32.5	Failed to orbit: classified payload Re-entered 11-29-61: chimp Enos recovered after 2 orbits
Discoverer 36	1961 AK1					2100	91.5	148	280	01.2	Description of 2 0 62; seconds account from a constitution of the CA of the
Oscar 1	1961 AK2	USAF	Dec 12, 1961	WTR	Thor-Agena B	10	2399			81.2	Decayed 3-8-62: capsule recovered from ocean after 64 orbits
None	1961 A A1	USAF	Dec 22, 1961	WTR	Atlas-Agena B	-0	91.1	146	258	81.2	Decayed 1-31-62: first ham satellite, transmitted for 18 days
Discoverer 37	None	USAF	Jan 13, 1962	WTR	Thor-Agena B	2100	94.5*	145	467	89.6	Decayed 8-14-62: classified payload
Composite 1	None	USN	Jan 24, 1962	ETR	- Thor-Able Star	219	-	2		12	Failed to orbit: malfunction following second stage ignition
Ranger 3	1962 A1	NASA	Jan 26, 1962	ETR	Atlas-Agena B	707	ADC A dave				Failed to orbit: low second stage thrust, carried 5 satellites
Tiros 4	1962 B1	NASA	Feb 8, 1962	ETR	Delta	287	100.4 days	0.9839AU 441	1.163AU 525	0.3988	In solar orbit: lunar probe, missed moon by 22,862 miles
Mercury-					1 1		100.4	441	525	48.3	In orbit: returned 32,593 cloud cover photos up to 6-10-62
Atlas 6	1962 [1	NASA	Feb 20, 1962	ETR	Atlas D	2987	88.5	100	163	32.5	Re-entered 2-20-62: first U.S. manned orbital mission, J. Glenn and "Friendship 7" recovered after 3 orbits, 4.9 hrs
Vone	1962 △1	USAF	Feb 21, 1962	WTR	Thor-Agena B	2400	89.7	104	233	82.0	Decayed 3-4-62: classified payload
Discoverer 38	1962 E1	USAF	Feb 27, 1962	WTR	Thor-Agena B	2100	89.7	208	308	82.2	Decayed 3-21-62: capsule recovered in mid-air after 65 orbits
OSO 1	1962 Z1	NASA	Mar 7, 1962	ETR	Delta	458	96.2	344	370	32.8	In orbit: transmitted data on 75 solar flares until 8-6-63
Vone	1962 H1	USAF	Mar 7, 1962	WTR	Atlas-Agena B		93.9	147	428	90.9	Decayed 6-7-63: classified payload
Kosmos 1	1962 ⊕1	USSR	Mar 16, 1962	Kap. Yar	B-1		96.4	135	609	49	Decayed 5-25-62: numerous scientific objectives announced as Kosmos research satellite series initiated
Kosmos 2	1962 11	USSR	Apr 6, 1962	Kap. Yar	B-1		102.5	132	969	49	Decayed 8-19-63: returned radiation belt, cosmic ray data
None	1962 K1	USAF	Apr 9, 1962	WTR	Atlas-Agena B		153.0	1731	2116	86.7	In orbit: classified payload
None	1962 A1	USAF	Apr 17, 1962	WTR	Thor-Agena B		91.5	98	333	73.5	Decayed 5-28-62: classified payload
Ranger 4	1962 M1	NASA	Apr 23, 1962	ETR	Atlas-Agena B	730	Fli	ht time: 64	4.0 hours		Impacted on moon: timer failure, experiments inoperative
Kosmos 3	1962 N1	USSR	Apr 24, 1962	Kap. Yar	B-1		93.8	142	447	49.0	Decayed 10-17-62: returned radiation belt, cosmic ray data
Cosmos 4	1962 E1	USSR	Apr 26, 1962	Tyuratam	A-1		90.6	185	205	65.0	Re-entered 4-29-62: first announced Kosmos recovery
Ariel 1	1962 01	NASA/ UK	Apr 26, 1962	ETR	Delta	132	100.9	242	754	53.9	In orbit: joint ionospheric satellite, transmitted ionospheric, X-ray, and cosmic ray data until 11-64
Solrad 4B	None	USN	Apr 26, 1962	WTR	Scout	10,110	15	-	-	-	Failed to orbit: solar radiation satellite
Vone	1962 П1	USAF	Apr 26, 1962	WTR	Atlas-Agena B	0,00					Decayed 4-28-62: classified payload
Vone	1962 P1	USAF	Apr 28, 1962	WTR	Thor-Agena B	2 V	91.1	98	307	73.2	Decayed 5-26-62: classified payload
Anna 1A	None	USN	May 10, 1962	ETR	Thor-Able Star	355	9	-		- 4	Failed to orbit: second stage ignition malfunction
Vone	1962 Σ1	USAF	May 15, 1962	WTR	Thor-Agena B		94.0	180	401	82.5	Decayed 11-26-63: classified payload
Vone	None	USAF	May 23, 1962	WTR	Scout		-		11/1	100	Failed to orbit: classified payload
Mercury- Atlas 7	1962 T1	NASA	May 24, 1962	ETR	Atlas D	2975	88.3	100	167	32.5	Re-entered 5-24-62: "Aurora 7" and S. Carpenter recovered after 3 orbit 4.9 hours; landed 250 miles from target
	1000 T1	USSR	May 28, 1962	Kap. Yar	B-1	- 1	102.8	100			
Kosmos 5	1962 T1	USSN	May 20, 1302	Kap. 1 ai	D+1	1	102.8	126	994	49.1	Decayed 5-2-63: monitored Starfish artificial radiation

B-1: Sandal IRBM plus upper stage

OSO: Orbiting Solar Observatory

Kap. Yar: Kapustin Ya

^{*}Initial orbital data was not released; data for this and subsequent classified payloads was obtained from periodic GSFC and RAE reports.

Condensed Log of 1957-68 Space Projects (Cont.)

INT'L	PROJ.	LAUNCH DATA WEIGHT				10	IITIAL ORE	BITAL DATA	A	STATUS	
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT	Period	Perigee	Apogee	Incl.	STATUS
None	1962 X1	USAF	June 1, 1962	WTR	Thor-Agena B		90.5	131	241	74.3	Decayed 6-28-62: classified payload
Oscar 2	1962 X2	USAF	June 1, 1502	MILL COM	Thor-Agena b	10	90.5	129	240	74.3	Decayed 6-21-62: amateur radio satellite transmitted 18 days
None //	1962 ₩1	USAF	June 17, 1962	WTR	Atlas-Agena B				The T	1	Decayed 6-18-62: classified payload
None	1962 Ω1	USAF	June 18, 1962	WTR	Thor-Agena B		92.3	234	244	82.0	Decayed 10-29-63: classified payload
Tiros 5	1962 AA1	NASA	June 19, 1962	ETR	Delta	286	100.5	367	604	58.1	In orbit: returned 58,226 cloud cover photos until 5-4-63
None	1962 AB1	USAF	June 22, 1962	WTR	Thor-Agena B		89.0	130	150	75.1	Decayed 7-7-62: classified payload
None	1962 AT1	USAF	June 27, 1962	WTR	Thor-Agena D		93.6	131	398	76.0	Decayed 9-14-62: classified payload
Kosmos 6	1962 A△1	USSR	June 30, 1962	Kap. Yar	B-1		90.6	170	224	49	Decayed 8-8-62: unannounced payload
Telstar 1	1962 AE1	AT&T	July 10, 1962	ETR	Delta	170	157.8	593	3503	44.8	In orbit: active-repeater comsat, transmitted until 2-21-63
None	1962 AZ1	USAF	July 18, 1962	WTR	Atlas-Agena B		88.7	114	147	96.1	Decayed 7-25-62: classified payload
None	1962 AH1	USAF	July 20, 1962	WTR	Thor-Agena B		90.0	122	218	70.3	Decayed 8-14-62: classified payload
Mariner 1	None	NASA	July 22, 1962	ETR	Atlas-Agena B	446	75	4-	-	7.5	Venus probe failed: destroyed by range safety officer
None	1962 A®1	USAF	July 27, 1962	WTR	Thor-Agena B		90.7	129	251	71.1	Decayed 8-24-62: classified payload
Kosmos 7	1962 AI1	USSR	July 28, 1962	Tyuratam	A-1	1	90.1	130	229	65	Re-entered or decayed 8-1-62: returned radiation data
None	1962 AK1	USAF	Aug 1, 1962	WTR	Thor-Agena D	YO. V	90.2	121	227	82.3	Decayed 8-26-62: classified payload
None	1962 AA1	USAF	Aug 5, 1962	WTR	Atlas-Agena B	10 4	88.6	127	127	96.3	Decayed 8-6-62: classified payload
Vostok 3	1962 AM1	USSR	Aug 11, 1962	Tyuratam	A-1 20	10,410	88.5	114	156	65	Re-entered 8-15-62: A. Nikolayev landed by parachute after 64 orbits, 94.4 h part of first Soviet "group" flight
Vostok 4	1962 AN1	USSR	Aug 12, 1962	Tyuratam	A-1	10,423	88.5	112	158	65	Re-entered 8-15-62: P. Popovich landed by parachute after 48 orbits, 71.0 h came within 3.1 mi of Vostok 3 on orbit 1
Kosmos 8	1962 AE1	USSR	Aug 18, 1962	Kap. Yar	B-1		92.9	159	375	49	Decayed 8-17-63: unannounced payload
None	1962 AO1	USAF	Aug 23, 1962	WTR	Scout		99.6	388	526	98.6	In orbit: classified payload
None	1962 AII1	USSR	Aug 25, 1962	Tyuratam	A-2-e		88.7	107	157	64.9	Decayed 8-28-62: probable Venus probe failure
Mariner 2	1962 AP1	NASA	Aug 26, 1962	ETR	Atlas-Agena B	447	348 days	.7046AU	1.229AU	1.66	In solar orbit: 21,594-mi Venus flyby, data to 53.9M mi
None	1962 AΣ1	USAF	Aug 28, 1962	WTR	Thor-Agena D		90.4	114	250	65.2	Decayed 9-10-62: classified payload
None	1962 AT1	USSR	Sept 1, 1962	Tyuratam	A-2-e			1116			Decayed 9-6-62: probable Venus probe failure
None	1962 AT1	USAF	Sept 1, 1962	WTR	Thor-Agena B		94.4	189	418	82.8	Decayed 10-26-64: classified payload
None	1962 AФ1	USSR	Sept 12, 1962	Tyuratam	A-2-e						Decayed 9-14-62: probable Venus probe failure
None/ERS 2	1962 AX1	USAF	Sept 17, 1962	WTR	Thor-Agena B	1.5	92.8	124	383	81.9	Decayed 11-16-62: classified payload, failed to eject ERS
Tiros 6	1962 AΨ1	NASA	Sept 18, 1962	ETR	Delta	281	98.7	423	444	58.2	In orbit: returned 66,674 cloud cover photos until 10-11-63
Kosmos 9	1962 AΩ1	USSR	Sept 27, 1962	Tyuratam	A-1		90.9	187	219	65	Re-entered or decayed 10-1-62: returned radiation data
Alouette 1	1962 BA1	Canada	Sept 28, 1962	WTR	Thor-Agena B	320	105.4	620	638	80.5	In orbit: first Canadian satellite, sending ionospheric data
None	1962 BB1	USAF	Sept 29, 1962	WTR	Thor-Agena D	1	90.3	119	241	65.4	Decayed 10-14-62: classified payload
Explorer 14	1962 BT1	NASA	Oct 2, 1962	ETR	Delta	89	2184	174	61,190	32.9	In orbit: transmitted magnetosphere data until 10-8-63
Mercury-	1962 B△1	NASA	Oct 3, 1962	ETR	Atlas D	3029	89.0	100	176	32.5	Re-entered 10-3-62: "Sigma 7" with W. Schirra recovered within 5 miles of carrier after 6 orbits, 9.2 hours
None	1962 BE1	USAF	Oct 9, 1962	WTR	Thor-Agena B		90.9	103	291	81.5	Decayed 11-16-62: classified payload
Kosmos 10	1962 BZ1	USSR	Oct 17, 1962	Tyuratam	A-1		90.2	130	236	65.0	Re-entered or decayed 10-21-62: returned radiation data
Ranger 5	1962 BH1	NASA	Oct 18, 1962	ETR	Atlas-Agena B	755	366 days	.9490AU	1.052AU	.3901	In solar orbit: lunar probe, missed moon by 450 miles
Kosmos 11	1962 B®1	USSR	Oct 20, 1962	Kap. Yar	B-1		96.1	152	572	49.0	Decayed 5-18-64: unannounced payload
None None	1962 BI1	USSR	Oct 24, 1962	Tyuratam	A-2-e				UIL	70.0	
Starad	1962 BK1	USAF	Oct 26, 1962	WTR	Thor-Agena D	THE LOSS TO	147.8	120	3452	71.4	Decayed 10-29-62: probable Mars probe failure
	1962 BA1			ETR	Delta	98	312.0	194	10,760	18.0	Decayed 10-5-67: Starfish artificial radiation data until 1-18-63
Explorer 15	1307 RV1	NASA	Oct 27, 1962	cin	Delta	30	12.0	104	10,700	10,0	In orbit: transmitted Starfish data until 2-9-63

ERS: Environmental Research Satellite

Condensed Log of 1957-68 Space Projects (Cont.)

	INT'L	PROJ.		LAUNCH D	ATA	Vehicle WEIGHT -	INITIAL ORBITAL DATA				STATUS
NAME	DESIG.	DIR.	Date	ate Site V	Vehicle		Period	Perigee	Apogee	Incl.	STATUS
Anna 1B	1962 BM1	USN	Oct 31, 1962	ETR	Thor-Able Star	350	107.8	670	728	50.1	In orbit: continues to provide some geodetic data
Mars 1	1962 BN3	USSR	Nov 1, 1962	Tyuratam	А-2-в	1970	519 days	.9237AU	1.604AU	2.683	In solar orbit: Mars probe, lost earth lock at 65,9M mi
None	1962 BΞ1	USSR	Nov 4, 1962	Tyuratam	A-2-e		92.4	122	367	64.7	Decayed 11-5-62: probable Mars probe failure
None	1962 BO1	USAF	Nov 5, 1962	WTR	Thor-Agena B		90.7	130	250	75.0	Decayed 12-3-62: classified payload
None	1962 BII1	USAF	Nov 11, 1962	WTR	Atlas-Agena B	THE PARTY OF	88.7	128	128	96.0	Decayed 11-12-62: classified payload
None	1962 BP1	USAF	Nov 24, 1962	WTR	Thor-Agena B		89.8	129	202	65.2	Decayed 12-13-62: classified payload
None	1962 ΒΣ1	USAF	Dec 4, 1962	WTR	Thor-Agena D		89.2	119	175	65.0	Decayed 12-8-62: classified payload
None	1962 BT1						116.0	153	1724	70.4	Decayed 2-9-67: classified payload
Injun 3	1962 BT2					114	116.3	153	1729	70.3	Decayed 8-25-68: transmitted Starfish radiation decay data until 11-3-63
None	1962 BT3	USAF/	Dec 12, 1962	WTR	Thor-Agena D		115.6	139	1700	70.3	Decayed 7-1-63: classified sub-satellite
None	1962 BT4	USN					116.2	145	1728	70.4	Decayed 1-18-66: classified sub-satellite
None	1962 BT5					1	116.0	146	1718	70.3	Decayed 2-5-67: classified sub-satellite
Relay 1	1962 BY1	NASA	Dec 13, 1962	ETR	Delta	172	185.9	819	4612	47.5	In orbit: comsat; experiments conducted until 2-65
None	1962 Вф1	USAF	Dec 14, 1962	WTR	Thor-Agena D	17	90.5	126	241	70.0	Decayed 1-8-63: classified payload
Explorer 16	1962 BX1	NASA	Dec 16, 1962	WI	Scout	222	104.4	466	733	52.0	In orbit: transmitted micrometeoroid data until 7-22-63
None/ERS 3&4	None	USAF	Dec 17, 1962	WTR	Atlas-Agena B	10,011	-		-	-	Failed to orbit: classified payload, ERS sub-satellites
Transit 5A	1962 BΨ1	USN	Dec 18, 1962	WTR	Scout	135	99.2	432	455	90.7	In orbit: operational prototype, power failure first day
Kosmos 12	1962 ΒΩ1	USSR	Dec 22, 1962	Tyuratam	A-1	y V	90.5	131	252	65	Re-entered or decayed 12-30-62: returned radiation data
None	1963 1A*	USSR	Jan 4, 1963	Tyuratam	A-2-e	THE REAL PROPERTY.					Decayed 1-5-63: probable lunar probe failure
None	1963 2A	USAF	Jan 7, 1963	WTR	Thor-Agena D		90.5	130	244	82.0	Decayed 1-24-63: classified payload
None	1963 3A	USAF	Jan 16, 1963	WTR	Thor-Agena D	1311 - 13-1	94.7	297	322	82.0	In orbit: classified payload
Syncom 1	1963 4A	NASA	Feb 14, 1963	ETR	Delta	86	1426.6	21,195	22,953	33.5	In orbit: communication lost at orbital injection
None	1963 5A	USAF	Feb 19, 1963	WTR	Scout		97.8	304	496	100.5	In orbit: classified payload
None	None	USAF	Feb 28, 1963	WTR	TAT-Agena D		-		-	-	Failed to orbit: classified payload, first TAT use
None	None	USAF	Mar 18, 1963	WTR	TAT-Agena D		-	58	=	-	Failed to orbit: classified payload
Kosmos 13	1963 6A	USSR	Mar 21, 1963	Tyuratam	A-1		89.8	127	209	65.0	Re-entered or decayed 3-29-63: returned radiation data
None	1963 7A	USAF	Apr 1, 1963	WTR	Thor-Agena D		90.6	129	254	75.4	Decayed 4-26-63: classified payload
Luna 4	1963 8B	USSR	Apr 2, 1963	Tyuratam	A-2-e	3135		55,800	434,000	L. THUN	In barycentric orbit: lunar probe, missed moon by 5282 mi
Explorer 17	1963 9A	NASA	Apr 2, 1963	ETR	Delta	405	96.4	158	568	57.6	Decayed 11-24-66: atmospheric research data until 7-10-63
None	None	USAF	Apr 5, 1963	WTR	Scout		-	-	-	-	Failed to orbit: classified payload
Kosmos 14	1963 10A	USSR	Apr 13, 1963	Kap. Yar	B-1		92.1	165	318	49.0	Decayed 8-29-63: unannounced payload
Kosmos 15	1963 11A	USSR	Apr 22, 1963	Tyuratam	A-1	1	89.8	107	231	65.0	Re-entered or decayed 4-27-63: returned radiation data
None	None	USAF	Apr 26, 1963	WTR	Scout	1	(-)	-	_	24	Failed to orbit: classified payload
None -	None	USAF	Apr 26, 1963	WTR	Thor-Agena D	16,1	-	-	-	20	Failed to orbit: classified payload
Kosmos 16	1963 12A	USSR	Apr 28, 1963	Tyuratam	A-1	10 11	90.4	129	249	65.0	Re-entered or decayed 5-8-63: returned radiation data
Telstar 2	1963 13A	AT&T	May 7, 1963	ETR	Delta	175	225.0	604	6713	42.7	In orbit: active-repeater comsat, transmitted until 5-65
None	1963 14A	AIGI	may 7, 1000	2111	Dutta	-	166.6	2249	2290	87.4	In orbit: ejected West Ford dipoles, comm tests successful
ERS 5	1963 14A	USAF	May 9, 1963	WTR	Atlas-Agena B	1.5	166.5	2241	2297	87.4	In orbit: returned solar cell damage data for 92 days
ERS 6	1963 14C	JOAN	may 0, 1000	a Mail	Titlas Agoila D	1.5	166.5	2238	2282	87.3	In orbit: duplicate of ERS 5, returned data for 89 days
Mercury-	1963 15A	NASA	May 15, 1963	ETR	Atlas D	3033	10000	100	166	32.5	Re-entered 5-16-63: "Faith 7" with L.G. Cooper recovered after 22 orbit 34.3 hrs; completed Mercury program
Atlas 9	1963 16A	USAF	May 18, 1963	WTR	TAT-Agena D		91.1	95	301	74.5	Decayed 5-27-63: classified payload
None Vocase 17	1660				B-1		94.8	162	490	49	Decayed 6-2-65: unannounced payload
Kosmos 17	1963 17A	USSR	May 22, 1963	Kap. Yar	D-1	PARTY.		102	100	70	Decayed o'2-00, unannounced payroad

^{*}New international designation system initiated 1-1-63

TAT: Thrust Augmented Thor

NAME	INT'L	PROJ.		LAUNCH D	CONTRACTOR OF THE PARTY OF THE		- WEIGH	-	The State of the last	BITAL DAT	THE RESERVE THE PARTY NAMED IN	STATUS
I I I I I	DESIG.	DIR.	Date	Site	M.	Vehicle	WEIGH	Period	Perigee	Apogee	Incl.	
Kosmos 18	1963 18A	USSR	May 24, 1963	Tyuratam	A-1			89.4	130	187	65.0	Re-entered or decayed 6-2-63: returned radiation data
None/ERS 7&8	None	USAF	June 12, 1963	WTR	Atlas-A	gena B		-	-	- 17	(977	Failed to orbit: classified payload, ERS sub-satellites
None	1963 19A	USAF	June 12, 1963	WTR	TAT-A	gena D		90.7	127	263	81.9	Decayed 7-11-63: classified payload
Vostok 5	1963 20A	USSR	June 14, 1963	Tyuratam	A-1		10,40	88.4	112	146	65	Re-entered 6-19-63: V. Bykovsky landed by parachute after 81 orbits, 119.1 hr part of second "group" flight
Lofti 2A	1963 21B		and the said					95.2	109	550	69.9	Decayed 7-18-63: VLF experiment
Solrad 6	1963 21C							95.1	109	546	69.9	Decayed 8-1-63: solar radiation satellite
Radose	1963 21D	USAF/USN	June 15, 1963	WTR	Thor-A	gena D		95.2	109	549	69.9	Decayed 7-30-63: radiation dosimeter payload
None	1963 21E							95.0	109	541	69.9	Decayed 7-27-63: classified payload
Surcal 1B	1963 21F							94.9	114	533	69.9	Decayed 7-5-63: surveillance calibration satellite
None	1963 22A	USN	June 15, 1963	WTR	Scout			100.7	463	528	90.0	In orbit: active, gravity gradient stabilization system
Vostok 6	1963 23A	USSR	June 16, 1963	Tyuratam	A-1		10,39	88.3	5 114	145	65	Re-entered 6-19-63: V. Tereshkova landed by parachute after 48 orbits, 70.8 hi passed within 3 mi of Vostok 5
Tiros 7	1963 24A	NASA	June 19, 1963	ETR	Delta	-777	291	97.4	385	401	58.2	In orbit: still active, has provided over 125,000 photos
None	1963 25A	NE					CYA	90.5	124	242	81.6	Decayed 7-26-63: classified payload
Hitch-hiker 1	1963 25B	USAF	June 26, 1963	WTR	TAT-A	gena D	176	132.6	201	2571	82.1	In orbit: returned radiation data for more than 3 months
Geophysical Re- search Satellite	1963 26A	USAF	June 28, 1963	WI	Scout	10	221	102.1	267	808	49.8	In orbit: space gas experiment data ceased after 13 orbits
None	1963 27A	USAF	June 29, 1963	WTR	TAT-A	gena B		94.9	311	360	82.4	In orbit: classified payload
None	1963 28A	USAF	July 12, 1963	WTR		igena D	110	88.2	111	124	95.4	Decayed 7-18-63: classified payload; 100th Agena launched
None	1963 29A	USAF	July 18, 1963	WTR	Thor-A	-	111111	89,8	120	206	82.9	Decayed 8-13-63: classified payload
None/ERS 10	1963 30A			11	1//	3	1.5	167.9	2274	2316	88.4	In orbit: classified payload, failed to eject ERS
ERS 9	1963 30B	USAF	July 18, 1963	WTR	Atlas-A	ogena B	15	167.9	2276	2319	88.4	In orbit: returned radiation damage data for 111 days
None	1963 30D	1777				9		168.0	2270	2326	88.4	In orbit: classified payload
Syncom 2	1963 31A	NASA	July 26, 1963	ETR	Delta			1454	22,062	22,750	33.1	In orbit: synchronous comsat over Indian Ocean, used by DOD
None	1963 32A	USAF	July 30, 1963	WTR	TAT-A	gena D	1000	90.6	99	288	74.7	Decayed 8-11-63: classified payload
Kosmos 19	1963 33A	USSR	Aug 6, 1963	Kap. Yar	B-1			92.2	168	323	49	Decayed 3-30-64: unannounced payload
None	1963 34A	USAF	Aug 24, 1963	WTR	TAT-A	gena D		90.5	108	261	75.0	Decayed 9-12-63: classified payload
None	1963 35A							90.8	183	202	81.9	Decayed 11-7-63: classified payload
None	1963 35B	USAF	Aug 29, 1963	WTR	Thor-A	gena D		92.0	195	262	81.9	Decayed 9-28-63: classified payload
None	1963 36A	USAF	Sept 6, 1963	WTR	Atlas-A	igena D	745	89.1	104	163	94.4	Decayed 9-13-63: Classified payload
None	1963 37A	USAF	Sept 23, 1963	WTR	TAT-A	delenant et a	11	90.6	100	274	74.9	Decayed 10-12-63: classified payload
None	None	USAF	Sept 27, 1963	WTR	Scout		110	13.	-2	- 2	-	Failed to orbit: classified payload
None	1963 38B	USAF/	us various dias	General Control	2000		18	107.4	676	714	89.9	In orbit: classified payload with SNAP-9A power supply
None	1963 38C	USN	Sept 28, 1963	WTR	Thor-A	ble Star	12	107.4	667	705	89.9	In orbit: active radiation satellite
Vela 1	1963 39A				1 2	100	29	105 hrs	63,441	70,631	38.3	In orbit: nuclear detection satellite, continues to transmit
ERS 12	1963 39B	USAF	Oct 16, 1963	ETR	Atlas-A	gena D	4	39 hrs	129	64,531	36.7	In orbit: sub-satellite returned radiation data for 2 weeks
Vela 2	1963 39C						29 1	08.7 hrs	62,806	72,974	38.0	In orbit: second active nuclear detection satellite
Kosmos 20	1963 40B	USSR	Oct 18, 1963	Tyuratam	A-1/2	Test .		89.6	128	193	65	Re-entered or decayed 10-28-63: unannounced payload
None	1963 41A		16 STREET TO STREET	176	1			90.0	89	206	99.1	Decayed 10-29-63: classified payload
None	1963 41B	USAF	Oct 25, 1963	WTR	Atlas-A	igena D		88.7	75	181	99.1	Decayed 10-28-63: classified payload
None	1963 42A				7			90.9	173	218	89.9	Decayed 1-21-64: classified payload
None	1963 42B	USAF	Oct 29, 1963	WTR	TAT-A	gena D		93.4	193	350	89.9	Decayed 5-23-65: classified payload
Polet 1	1963 43A	USSR	Nov 1, 1963	Tyuratam	A-m			102.5	213	893	58.9	In orbit: first spacecraft with extensive maneuver capability
None	None	USAF	Nov 9, 1963	WTR	Thor-A	AMERICA SAL	1	-	-		=	Failed to orbit: classified payload

A-1/2: 11/2-stage booster with either 1st or 2nd generation upper stage.

NAME	INT'L	PROJ.		LAUNCH D	ATA	WEIGHT-	1	NITIAL OR	BITAL DATA		- STATUS
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGH	Period	Perigee	Apogee	Incl.	The second second
Kosmos 21	1963 44A	USSR	Nov 11, 1963	Tyuratam	A-2-e		88.5	121	142	64.8	Decayed 11-14-63: unannounced payload
Kosmos 22	1963 45A	USSR	Nov 16, 1963	Tyuratam	A-1/2		90.3	127	245	64.9	Re-entered or decayed 11-22-63: unannounced payload
Explorer 18	1963 46A	NASA	Nov 26, 1963	ETR	Delta	138	96.3 hrs	119	122,522	33.3	Decayed 12-65: IMP A, significant radiation data until 5-65
Atlas-Centaur 2	1963 47A	NASA	Nov 27, 1963	ETR	Atlas-Centaur	10,700	107.7	303	1093	30.4	In orbit: AC-2 second stage, not considered a spacecraft
Vone	1963 48A	USAF	Nov 27, 1963	WTR	Thor-Agena D		90.1	109	236	70.0	Decayed 12-15-63: classified payload
None	1963 49B	UCAT (UCA)	D- F 1002	WITD	Thor-Able Star		107.2	665	690	90.0	In orbit: active classified payload, SNAP-9A power supply
Vone	1963 49C	USAF/USN	Dec 5, 1963	WTR	I nor-Able Star		107.2	666	689	90.0	In orbit: classified payload
Kosmos 23	1963 50A	USSR	Dec 13, 1963	Kap. Yar	B-1		92.9	149	381	49	Decayed 3-27-64: unannounced payload
Vone	1963 51A	USAF	Dec 18, 1963	WTR	Atlas-Agena D	10 300	88.8	76	165	97.9	Decayed 12-20-63: classified payload
Cosmos 24	1963 52A	USSR	Dec 19, 1963	Tyuratam	A-1/2		90.5	131	254	65	Re-entered or decayed 12-28-63: unannounced payload
xplorer 19	1963 53A	NASA	Dec 19, 1963	WTR	Scout	18	115.9	366	1487	78.6	In orbit: 12-foot balloon identical to Explorer 9
iros 8	1963 54A	NASA	Dec 21, 1963	ETR	Delta	265	99.3	430	474	58.5	In orbit: has returned over 100,000 photos, still active
Vone	1963 55A	Charles Co				1	89.3	107	190	64.9	Decayed 1-8-64: classified payload
None	1963 55B	USAF	Dec 21, 1963	WTR	TAT-Agena D		91.7	196	245	64.5	Decayed 11-7-64: classified payload
None	1964 1A	110	- NEWSTERN		-1417	LEVIN	103.5	563	582	69.9	In orbit: classified payload
GGSE 1	1964 1B					10,10	103.5	560	585	70.0	In orbit: gravity gradient stabilization experiment
Secor 1	1964 1C	USN/USA	Jan 11, 1964	WTR	TAT-Agena D	40	103.5	563	582	69.9	In orbit: geodetic satellite to pinpoint Pacific islands
Solrad 7A	1964 1D				150	100	103.5	563	582	69.9	In orbit: solar radiation satellite, tx until 7-66
Vone	1964 1E				11.		103.5	555	591	69.9	In orbit: classified payload
None	1964 2B	Transmin	v				101.3	500	518	99.0	In orbit: classified payload
Vone	1964 2C	USAF	Jan 19, 1964	WTR	Thor-Agena D		101.3	501	514	99.1	In orbit: classified payload
Relay 2	1964 3A	NASA	Jan 21, 1964	ETR	Delta	172	194.7	1298	4606	46.0	In orbit: comsat, experiments conducted until 9-26-65
Echo 2	1964 4A	NASA	Jan 25, 1964	WTR	Thor-Ageria B	547	108.8	642	816	81.5	In orbit: passive comsat, first joint program with USSR
Saturn SA-5	1964 5A	NASA	Jan 29, 1964	ETR	Saturn I	37,700	94.8	164	471	31.5	Decayed 4-30-66: second stage, not considered a spacecraft
Elektron 1	1964 6A	0.0000	1 20112000	1227	14/12	EA.	727	252	4412	61	In orbit: to study inner Van Allen radiation belt
Elektron 2	1964 6B	USSR	Jan 30, 1964	Tyuratam	A-1		981	286	42,377	61	In orbit: to study outer belt; first dual Soviet launch
Ranger 6	1964 7A	NASA	Jan 30, 1964	ETR	Atlas-Agena B	804		Flight time:	65.6 hours		Impacted on moon: television system malfunctioned
Vone	1964 8A	USAF	Feb 15, 1964	WTR	TAT-Agena D		90.9	119	278	75.1	Decayed 3-9-64: classified payload
Vone	1964 9A	USAF	Feb 25, 1964	WTR	Atlas-Agena D		88.2	107	118	95.7	Decayed 3-1-64: classified payload
Cosmos 25	1964 10A	USSR	Feb 27, 1964	Kap. Yar	B-1		92.3	169	327	49	Decayed 11-21-64: unannounced payload
None	1964 11A	USAF	Feb 27, 1964	WTR	TAT-Agena D		94.6	302	319	82.1	In orbit: classified payload
None	1964 12A	USAF	Mar 11, 1964	WTR	Atlas-Agena D		89.8	89	240	95.8	Decayed 3-16-64: classified payload
Kosmos 26	1964 13A	USSR	Mar 18, 1964	Kap. Yar	B-1	1	91	168	250	49	Decayed 9-28-64: radiation satellite with new magnetometer
Beacon Explorer A	None	NASA	Mar 19, 1964	ETR	Delta	120	-	- 4	_	_	Failed to orbit: insufficient third stage thrust
Vone	None	USAF	Mar 24, 1964	WTR	TAT-Agena D	1	-	-	-	-	Failed to orbit: classified payload
Kosmos 27	1964 14A	USSR	Mar 27, 1964	Tyuratam	А-2-е	4	88.7	119	147	64.8	Decayed 3-28-64: probable Venus probe failure
Ariel 2	1964 15A	NASA/UK	Mar 27, 1964	WI	Scout	150	101.3	180	843	51.6	Decayed 11-18-67: returned data from British experiments until 11-64
Zond 1	1964 16D	USSR	Apr 2, 1964	Tyuratam	A-2-e	-0	4	Helioce	entric Orbit	Mill	In solar orbit: Venus probe, failed to return planetary data
Kosmos 28	1964 17A	USSR	Apr 4, 1964	Tyuratam	A-1/2		90.4	130	245	65	Re-entered or decayed 4-12-64: unannounced payload
Gemini-Titan 1	1964 18A	NASA	Apr 8, 1964	ETR	Titan II	11,400	89.2	100	204	32.6	Decayed 4-12-64: boilerplate Gemini and second stage
Polet 2	1964 19B	USSR	Apr 12, 1964	Tyuratam	A-m	-	92.4	193	311	58.1	Decayed 6-8-66: carried out maneuvers first day in orbit
				and the second s	The state of the s						

GGSE: Gravity Gradient Stabilization Experiment

2	INT'L	PROJ.		LAUNCH D	ATA	19		NITIAL OR	BITAL DATA	Λ.	200
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT		And the second second	Apogee	Incl.	STATUS
None	1964 20A	USAF	Apr 23, 1964	WTR	Atlas-Agena D		Period	Perigee 93	209	103.6	Decayed 4-28-64: classified payload
Kosmos 29	1964 21A	USSR	Apr 25, 1964	Tyuratam	A-1/2	ge I	89.4	12.77	192	65.1	Re-entered or decayed 5-2-64: unannounced payload
None None	1964 22A	USAF	Apr 27, 1964	WTR	TAT-Agena D	_	89.5	127		80.0	Decayed 5-26-64: classified payload
Kosmos 30	1964 23A	USSR	May 18, 1964	Tyuratam	A-1/2		90.8	109	277		
None	1964 24A	USAF	May 19, 1964	WTR	Atlas-Agena D		90.2	128	238	64.9	Re-entered or decayed 5-26-64: unannounced payload
Saturn SA-6	1964 25A	NASA	May 28, 1964	ETR	Saturn I	37,300	89.7	88	236	101.1	Decayed 5-22-64: classified payload
None	1964 26A	USN	June 3, 1964	WTR	Scout	37,300	88.5	124	140	31.8	Decayed 6-1-64: boilerplate Apollo modules and second stage
None	1964 27A	USAF	June 4, 1964	WTR	TAT-Agena D		103.1	531	594	90.4	In orbit: active classified payload, tx on 150,400 mc
Kosmos 31	1964 28A	USSR	June 6, 1964	Kap. Yar	B-1	9	90.2	93	267	80.0	Decayed 6-18-64: classified payload
Kosmos 32	1964 29A	USSR	June 10, 1964	Tyuratam	A-1/2		91.6	142	316	49	Decayed 10-20-64: unannounced payload
		200000000000000000000000000000000000000					89.8	130	207	51.3	Re-entered or decayed 6-18-64: unannounced payload
None	1964 30A 1964 31A	USAF	June 13, 1964	WTR	TAT-Agena D		91.7	219	225	115.0	Decayed 7-2-65: payload included Star Flash experiment
None		USAF	June 17, 1964	WTR	Thor-Agena D		101.6	514	523	99.8	In orbit: classified payload
None	1964 318	HOAF	1 10	WITTE	TATA		101.6	515	523	99.8	In orbit: classified payload
None	1964 32A	USAF	June 19, 1964	WTR	TAT-Agena D	1	91.0	109	287	85.0	Decayed 7-16-64: classified payload
Kosmos 33	1964 33A	USSR	June 23, 1964	Tyuratam	A-1/2	10.1	89.4	130	182	65	Re-entered or decayed 7-1-64: unannounced payload
Environmental Sciences Re- search Satellite	None	USAF	June 25, 1964	WTR	Scout	176	-	-		-	Failed to orbit: second stage exploded
Atlas-Centaur 3	None	NASA	June 30, 1964	ETR	Atlas-Centaur	10,700	-	-	-0.	- 1	Failed to orbit: Centaur flight test, not considered a spacecraft
Kosmos 34	1964 34A	USSR	July 1, 1964	Tyuratam	A-1/2		90	127	224	65	Re-entered or decayed 7-9-64: unannounced payload
None	1964 35A	USAF	July 2, 1964	WTR	TAT-Agena D		94.9	310	329	82.1	In orbit: classified payload
None	1964 36A	USAF	July 6, 1964	WTR	Atlas-Agena D		89.4	. 75	215	92.9	Decayed 7-8-64: classified payload
None	1964 36B	USAF	July 6, 1964	WIR	Atlas-Agena D		90.9	179	216	93.0	Decayed 1-3-65: classified payload
None	1964 37A	USAF	July 10, 1964	WTR	TAT-Agena D		91.0	112	286	85.0	Decayed 8-6-64: classified payload
Elektron 3	1964 38A	USSR	July 11, 1964	Tuurntum	A-1/2		168	252	4374	60.9	In orbit: to monitor inner Van Allen belt radiation
Electron 4	1964 38B	USSN	July 11, 1304	Tyuratam	A-1/2		1314	285	41,156	60.9	In orbit: to simultaneously study outer belt magnetosphere
Kosmos 35	1964 39A	USSR	July 15, 1964	Tyuratam	A-1/2		89.2	135	167	51.3	Re-entered or decayed 7-23-64: unannounced payload
Vela 3	1964 40A			The state		319	100.3 hrs	63,369	65,024	39.5	In orbit: active experimental nuclear detection satellite
Vela 4	1964 40B	USAF	July 17, 1964	ETR	Atlas-Agena D		100.1 hrs	58,766	69,482	40.9	In orbit: identical to Vela 3, continues to transmit
ERS 13	1964 40C						39.2 hrs	120	64,886	36.7	In orbit: sub-satellite returned radiation data until 1-25-65
Ranger 7	1964 41A	NASA	July 28, 1964	ETR	Atlas-Agena D	806			: 68.6 hours	1000	Impacted on moon: first Ranger success, returned 4308 photos
Kosmos 36	1964 42A	USSR	July 30, 1964	Kap. Yar	B-1	Mary P.	91.9	161	313	49	Decayed 2-28-65: unannounced payload
None	1964 43A	USAF	Aug 5, 1964	WTR	TAT-Agena D		90.5	112	262	80.0	Decayed 8-31-64: classified payload
Kosmos 37	1964 44A	USSR	Aug 14, 1964	Tyuratam	A-1/2	AC A	89.5	127	186	65	Re-entered or decayed 8-22-64: unannounced payload
None	1964 45A	UO 4 E				10,010	89.0	93	191	95.5	Decayed 8-23-64: classified payload
None	1964 45B	USAF	Aug 14, 1964	WTR	Atlas-Agena D		127.4	163	2332	95.6	In orbit: P-11 radiation satellite
Kosmos 38	1964 46A				A COLUMN	13 10 11	95.2	130	544	56.2	Decayed 11-8-64: first Soviet triple payload launch
Kosmos 39	1964 46B	USSR	Aug 18, 1964	Tyuratam	C-1		95.2	130	544	56.2	Decayed 11-17-64: unannounced payload
Kosmos 40	1964 46C				768	- Inches	95.2	130	544	56.2	Decayed 11-18-64: unannounced payload
Syncom 3	1964 47A	NASA	Aug 19, 1964	ETR	TAD	86	1436.2	22,164	22,312	0.1	In orbit: synchronous comsat at 180°W, now under DOD control
None /	1964 48A	USAF	Aug 21, 1964	WTR	TAT-Agena D		91.6	217	226	115.0	Decayed 3-31-65: payload included Star Flash experiment
Kosmos 41	1964 49D	USSR	Aug 22, 1964	Tyuratam	A-2-e	A PARTY OF THE PAR	715	245	24,765	64	The state of the s
Kosmos 42	1964 50A			- yurutuili			97.8	144	683		In orbit: investigated geomagnetically trapped protons
Kosmos 43	1964 50C	USSR	Aug 22, 1964	Kap. Yar	B-1	The state of the s	97.8			49	Decayed 12-19-65: first double Cosmos launch
regalling 40	1004 000						37.6	144	683	49	Decayed 12-27-65: unannounced payload

C-1: Skean IRBM plus upper stage

MANE	INT'L	PROJ.		LAUNCH D	ATA	WEIGHT	10	IITIAL OR	BITAL DATA	A	STATUS
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGH	Period	Perigee	Apogee	Incl.	STATUS
Explorer 20	1964 51A	NASA	Aug 25, 1964	WTR	Scout	97	103.9	541	634	79.9	In orbit: returned ionospheric research data until 7-66
Nimbus 1	1964 52A	NASA	Aug 28, 1964	WTR	Thor-Agena B	830	98.3	263	579	98.6	In orbit: 27,000 cloud cover photos returned until 9-23-64
Kosmos 44	1964 53A	USSR	Aug 28, 1964	Tyuratam	A-1/2		99.5	384	534	65	In orbit; unannounced payload, probable metsat
Transtage	None	USAF	Sept 1, 1964	ETR	Titan IIIA		-	-	=		Failed to orbit: Titan IIIA test, not considered a spacecraft
0G0 1	1964 54A	NASA	Sept 4, 1964	ETR	Atlas-Agena B	1073	64.0 hrs	175	92,827	31.1	In orbit: spin-stabilized, 17 of 20 experiments returning data
Kosmos 45	1964 55A	USSR	Sept 13, 1964	Tyuratam	A-1/2		89.7	128	203	64.9	Re-entered 9-18-64: weather research film capsule recovered
None	1964 56A	USAF	Sept 14, 1964	WTR	TAT-Agena D		90.8	119	286	85.0	Decayed 10-6-64: classified payload
Saturn SA-7	1964 57A	NASA	Sept 18, 1964	ETR	Saturn I	36,700	88.4	114	141	31.7	Decayed 9-22-64: boilerplate Apollo modules and second stage
None	1964 58A	USAF	Sept 23, 1964	WTR	Atlas-Agena D		89.0	90	188	92.9	Decayed 9-28-64: classified payload
Kosmos 46	1964 59A	USSR	Sept 24, 1964	Tyuratam	A-1/2		89.2	134	168	51.3	Re-entered or decayed 10-2-64: unannounced payload
Explorer 21	1964 60A	NASA	Oct 3, 1964	ETR	Delta	136	35 hrs	122	59,253	33.5	Decayed 1-66: IMP B, apogee lower than planned, data until 10-13-65
None	1964 61A	USAF	Oct 5, 1964	WTR	TAT-Agena D		90.4	109	243	80.0	Decayed 10-26-64: classified payload
Kosmos 47	1964 62A	USSR	Oct 6, 1964	Tyuratam	A-2		90	110	257	64.8	Re-entered or decayed 10-7-64: probable manned precursor
None	1964 63B	The state of the s				1	106.6	657	673	89.9	In orbit: classified payload
None	1964 63C	USAF/USN	Oct 6, 1964	WTR	Thor-Able Star		106.6	655	674	89.9	In orbit: classified payload
None	1964 63E					10-16	106.6	657	673	90.0	In orbit: classified payload
None	None	USAF	Oct 8, 1964	WTR	Atlas-Agena D		14.		-	24	Failed to orbit: classified payload
Explorer 22	1964 64A	NASA	Oct 9, 1964	WTR	Scout	116	104.7	549	669	79.7	In orbit: transmitting ionospheric and geodetic data
Voskhod 1	1964 65A	USSR	Oct 12, 1964	Tyuratam	A-2	11,728	90,1	111	254	65	Re-entered 10-13-64: first three-man crew—V. Komarov, K. Feokistov, B. Yegoro landed after 16 orbits, 24.3 hours
Kosmos 48	1964 66A	USSR	Oct 14, 1964	Tyuratam	A-1/2		89.4	126	183	65.1	Re-entered or decayed 10-20-64: unannounced payload
None	1964 67A	USAF	Oct 17, 1964	WTR	TAT-Agena D		90.6	117	258	75.0	Decayed 11-4-64: classified payload
None	1964 68A		Balleton State		43/	D. C.	88.6	86	168	95.6	Decayed 10-28-64: classified payload
None	1964 68B	USAF	Oct 23, 1964	WTR	Atlas-Agena D		91.1	193	214	95.5	Decayed 2-23-65: classified payload
None	1964 68D						90.5	178	194	95.5	Decayed 10-29-64: classified payload
Kosmos 49	1964 69A	USSR	Oct 24, 1964	Kap. Yar	B-1		91.8	162	304	49	Decayed 8-21-65: measured earth's IR and UV radiation flux
Kosmos 50	1964 70A	USSR	Oct 28, 1964	Tyuratam	A-1/2		88.7	122	150	51.3	Decayed 11-5-64: unannounced payload, exploded on 8th day in orbit
None	1964 71A	USAF	Nov 2, 1964	WTR	TAT-Agena D		90.7	112	278	80.0	Decayed 11-28-64: classified payload
None	1964 72A	USAF	Nov 3, 1964	WTR	TAT-Agena D		95.0	318	327	82.0	In orbit: classified payload
Mariner 3	1964 73A	NASA	Nov 5, 1964	ETR	Atlas-Agena D	575	448.7 days	.6150AU	.8155AU	0.524	In solar orbit: shroud failure prevented Mars flyby
Explorer 23	1964 74A	NASA	Nov 6, 1964	WI	Scout	295	99.2	288	609	51.9	In orbit: 122 micrometeoroids recorded first year, tx until 7-66
None	1964 75A	USAF	Nov 18, 1964	WTR	TAT-Agena D		89.7	112	211	70.0	Decayed 12-6-64: included ORBIS experiment
Explorer 24	1964 76A	NAGA.	N 04 1004	WITT	Count	19	116.3	344	1551	81.4	Decayed 10-18-68: 12-foot balloon for atmospheric density studies
Explorer 25	1964 76B	NASA	Nov 21, 1964	WTR	Scout	96	116.3	345	1547	81.4	In orbit: radiation data until 12-66, first NASA dual launch
Mariner 4	1964 77A	NASA	Nov 28, 1964	ETR	Atlas-Agena D	575	567.2 days	1.1089AU	1.5730AU	2,540	In solar orbit: encountered micrometeoroids, tx ended 12-20-67
Zond 2	1964 78C	USSR	Nov 30, 1964	Tyuratam	A-2-e	100		C207 (46)	ntric Orbit	210 10	In solar orbit: Mars probe, failed to return planetary data
None	1964 79A	USAF	Dec 4, 1964	WTR	Atlas-Agena D	y V	89.7	94	222	97.0	Decayed 12-5-64: classified payload
Kosmos 51	1964 80A	USSR	Dec 10, 1964	Kap. Yar	B-1		92.5	164	344	48.8	Decayed 11-14-65: measured luminosity of starry sky
Transtage	1964 81A	USAF	Dec 10, 1964	ETR	Titan IIIA	9001	88	112	121	32.0	Decayed 12-13-64: Titan III test, not considered a spacecraft
Atlas-Centaur 4	1964 82A	NASA	Dec 11, 1964	ETR	Atlas-Centaur	650	87.9	101	107	30.6	Decayed 12-12-64: Centaur test, not considered a spacecraft
None	1964 83C			11	1/1	172		639	672	90.0	In orbit: returning magnetic field, celestial field UV data
STREET, ST. ST. ST.	1030000	USAF/USN	Dec 12, 1964	WTR	Thor-Able Star			-	(10775)	00,0	The state of the s

OGO: Orbiting Geophysical Observatory

	INT'L	PROJ.		LAUNCH D	ATA	WEIGHT		INITIAL OR	BITAL DATA	A	CTATUS
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT-	Period	Perigee	Apogee	Incl.	STATUS
San Marco 1	1964 84A	Italy	Dec 15, 1964	WI ///	Scout	254	94.9	128	510	37.8	Decayed 9-13-65: measured atmospheric density
None	1964 85A	USAF	Dec 19, 1964	WTR	TAT-Agena D		90.3	114	237	75.0	Decayed 1-14-65: classified payload
Explorer 26	1964 86A	NASA	Dec 21, 1964	ETR	Delta	101	456	190	16,280	20.2	In orbit: active radiation satellite, repeat of Explorer 15
None	1964 87A	USAF	Dec 21, 1964	WTR	TAT-Agena D		89.4	144	155	70.1	Decayed 1-11-65: classified payload
Kosmos 52	1965 1A	USSR	Jan 11, 1965	Tyuratam	A-1/2		89.5	127	189	65	Re-entered or decayed 1-19-65: unannounced payload
None	1965 2A	USAF	Jan 15, 1965	WTR	TAT-Agena D		90.5	112	261	75.0	Decayed 2-9-65: classified payload
None	1965 3A	USAF	Jan 18, 1965	WTR	Thor-Altair		97.7	293	511	98.8	In orbit: classified payload, first use of Thor-Altair
0V1 1	None	USAF	Jan 21, 1965	WTR	Atlas D	188 .	70	-	-	12	Failed to orbit: launch from side pod of ABRES vehicle failed
Tiros 9	1965 4A	NASA	Jan 22, 1965	ETR	Delta	305	119.2	435	1602	96.4	In orbit: "cartwheel" Tiros, one camera remains operational
None	1965 5A	USAF	Jan 23, 1965	WTR	Atlas-Agena D		88.9	91	181	102.5	Decayed 1-28-65: classified payload
Kosmos 53	1965 6A	USSR	Jan 30, 1965	Kap. Yar	B-1		98.7	141	741	48.8	Decayed 8-12-66: unannounced payload
OSO 2	1965 7A	NASA	Feb 3, 1965	ETR	Delta	545	96.5	343	393	32.9	In orbit: returned solar X-ray, gamma ray, UV data until 11-65
LES 1	1965 8C	USAF	Feb 11, 1965	ETR	Titan IIIA	69	147.7	1726	1744	32.2	In orbit: experimental comsat ejected after 3 Transtage burns
Pegasus 1	1965 9A	NASA	Feb 16, 1965	ETR	Saturn I	23,000	97.0	308	462	31.7	In orbit: micrometeoroid satellite, 2300 sq ft of sensors; silenced 8-68
Ranger 8	1965 10A	NASA	Feb 17, 1965	ETR	Atlas-Agena B	809	1	Flight time	: 64.9 hours		Impacted on moon: returned 7137 closeup lunar photos
Kosmos 54	1965 11A		a hallowed the			10,16	106.2	174	1153	56.1	Decayed 9-15-68: unannounced payload, second Soviet triple launch
Kosmos 55	1965 11B	USSR	Feb 21, 1965	Tyuratam	C-1		106.2	174	1153	56.1	Decayed 2-2-68: unannounced payload
Kosmos 56	1965 11C						106.2	174	1153	56.1	Decayed 11-2-67: unannounced payload
Kosmos 57	1965 12A	USSR	Feb 22, 1965	Tyuratam	A-2		91.1	109	318	64.8	Decayed 2-22-65: exploded, probable manned precursor
None	1965 13A	USAF	Feb 25, 1965	WTR	TAT-Agena D		90.1	110	234	75.1	Decayed 3-18-65: classified payload
Kosmos 58	1965 14A	USSR	Feb 26, 1965	Tyuratam	A-1/2		96.8	361	409	65	In orbit: unannounced payload, probable metsat
Atlas-Centaur 5	None	NASA	Mar 2, 1965	ETR	Atlas-Centaur	2100	-	-	-	-\	Failed to orbit: Centaur flight test, not considered a spacecraft
Kosmos 59	1965 15A	USSR	Mar 7, 1965	Tyuratam	A-1/2		89.7	130	211	65	Re-entered or decayed 3-15-65: unannounced payload
None	1965 16A	ment of the last				Maria III	103.5	564	584	70.1	In orbit: classified payload, first 8-payload launch
GGSE 2	1965 16B						103.5	562	583	70.1	In orbit: gravity gradient stabilization experiment
GGSE 3	1965 16C						103.5	562	583	70.1	In orbit: gravity gradient stabilization experiment
Solrad 7B	1965 16D	USN/	Mar 9, 1965	WTR	Thor-Agena D		103.4	562	583	70.1	In orbit: solar radiation satellite
Secor 3	1965 16E	USA/				40	103.4	562	583	70.1	In orbit: active geodetic satellite
Oscar 3	1965 16F	USAF				33	103.5	565	585	70.1	In orbit: amateur radio satellite, transmitted for 16 days
Surcal	1965 16G						103.5	564	585	70.1	In orbit: surveillance calibration satellite for Spasur system
Surcal	1965 16H						103.5	563	586	70.1	In orbit: "Dodecahedron" surveillance calibration satellite
None	1965 17A	USN/	M - 11 1005	METER	TI - 411 C	1	97.8	184	634	89.9	Decayed 6-14-65: classified payload
Secor 2	1965 17B	USA	Mar 11, 1965	WTR	Thor-Able Star	40	98.0	206	624	89.9	Decayed 2-26-68: geodetic satellite, failed to operate as planned
Kosmos 60	1965 18A	USSR	Mar 12, 1965	Tyuratam	A-2-e	ACT A	89.1	125	178	64.7	Decayed 3-17-65: probable lunar probe failure
None	1965 19A	USAF	Mar 12, 1965	WTR	Atlas-Agena D	10,011	8.88	93	178	107.6	Decayed 3-17-65: classified payload
Kosmos 61	1965 20A	14/			300	16	106	170	1141	56	Decayed 1-15-68: unannounced payload, third triple Kosmos launch
Kosmos 62	1965 20B	USSR	Mar 15, 1965	Tyuratam	C-1		106	170	1141	56	Decayed 9-24-68: unannounced payload
Kosmos 63	1965 20C				1		106	170	1141	56	Decayed 11-4-67: unannounced payload
None	1965 21A	USAF	Mar 17, 1965	WTR	Thor-Altair		97.7	326	475	99.1	In orbit: classified payload
Voskhod 2	1965 22A	USSR	Mar 18, 1965	Tyuratam	A-2	12,527	90.9	107	308	65	Re-entered 3-19-65: A. Leonov spent 20 min outside spacecraft, landed with P. Belyayev after 17 orbits, 26.0 hours
Ranger 9	1965 23A	NASA	Mar 21, 1965	ETR	Atlas-Agena B	809		Flight time:	64.5 hours	I Parket	Impacted on moon: 5814 photos, landed in crater Alphonsus
Gemini 3	1965 24A	NASA	Mar 23, 1965	ETR	Titan II	7111	B8.2	100	140	32.5	Re-entered 3-23-65: first manned orbital maneuvers, V. Grissom and J. Young landed after 3 orbits, 4.9 hours

OV: Orbiting Vehicle

LES: Lincoln Experimental Satellite

NAME	INT'L	PROJ.		LAUNCH D	ATA ATA	WEIGHT		INITIAL OF	BITAL DAT	ГА	CTATUS
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT	Period	Perigee	Apogee	Incl.	STATUS
Kosmos 64	1965 25A	USSR	Mar 25, 1965	Tyuratam	A-1/2		89.2	128	168	65	Re-entered or decayed 4-2-65: unannounced payload
None	1965 26A	USAF	Mar 25, 1965	WTR	TAT-Agena D		89.1	116	165	96.1	Decayed 4-4-65: classified payload
Snapshot	1965 27A	USAF/			1/1		111.5	805	826	90.2	In orbit: SNAP-10A operated at more than 500W for 43 days
Secor 4	1965 27B	USA	Apr 3, 1965	WTR	Atlas-Agena D	40	111.6	797	816	90.2	In orbit: geodetic satellite, failed to operate as planned
None	1965 27E						111.5	795	817	90.2	In orbit: classified payload
Early Bird	1965 28A	CSC	Apr 6, 1965	ETR	TAD	85	1436.4	21,748	22,733	0.1	In orbit: commercial communication service initiated 6-28-65
Kosmos 65	1965 29A	USSR	Apr 17, 1965	Tyuratam	A-1/2		89.8	130	213	65	Re-entered 4-25-65: weather research film capsule recovered
Molniya 1A	1965 30A	USSR	Apr 23, 1965	Tyuratam	A-2-e		708	309	24,470	65	In orbit: first Soviet comsat, period adjusted to 12 hours
None	1965 31A	USAF	Apr 28, 1965	WTR	Atlas-Agena D		88.7	95	171	95.7	Decayed 5-3-65: classified payload
None	1965 31B	50/11	14, 20, 100				95.0	303	349	95.3	In orbit: classified payload
Explorer 27	1965 32A	NASA	Apr 29, 1965	WI	Scout	132	107.8	584	819	41.2	In orbit: active geodetic and ionospheric research satellite
None	1965 33A	USAF	Apr 29, 1965	WTR	TAT-Agena D		91.0	114	291	85.0	Decayed 5-26-65: classified payload
LES 2	1965 34B	USAF	May 6, 1965	ETR	Titan IIIA	82	315.2	1757	9384	31.4	In orbit: experimental comsat launched by last Titan IIIA
LCS 1	1965 34C	50.11				75	145.6	1727	1737	32.1	In orbit: passive aluminum sphere for radar calibration studies
Kosmos 66	1965 35A	USSR	May 7, 1965	Tyuratam	A-1/2	YENY	89.3	122	181	65	Re-entered or decayed 5-15-65: unannounced payload
Luna 5	1965 36A	USSR	May 9, 1965	Tyuratam	A-2-e	3254		Flight time:			Impacted on moon: first USSR soft landing attempt failed
None	1965 37A	USAF	May 18, 1965	WTR	TAT-Agena D	2000	89.7	123	206	75.0	Decayed 6-15-65: classified payload
None	1965 38A	USAF	May 20, 1965	WTR	Thor-Altair		100.1	352	592	98.7	In orbit: classified payload
Pegasus 2	1965 39A	NASA	May 25, 1965	ETR	Saturn I	23,100	97.3	314	466	31.7	In orbit: meteoroid detection satellite; silenced 8-68
Kosmos 67	1965 40A	USSR	May 25, 1965	Tyuratam	A-1/2		89.9	129	217	51.8	Re-entered or decayed 6-2-65: unannounced payload
None	1965 41A	USAF	May 27, 1965	WTR	Atlas-Agena D		88.7	93	166	95.8	Decayed 6-1-65: classified payload
0V1 3	None	USAF	May 27, 1965	WTR	Atlas D	203	-	-	-	-\	Failed to orbit: scientific satellite, launch vehicle exploded
Explorer 28	1965 42A	NASA	May 29, 1965	ETR	Delta	130	8558	121	163,831	33.9	Decayed 7-4-68: IMP C, returning magnetic fields, radiation data
Gemini 4	1965 43A	NASA	June 3, 1965	ETR	Titan II	7879	89.0	100	175	32.0	Re-entered 6-7-65: E. White performed 21-min EVA experiment, landed wi J. McDivitt after 66 orbits, 97.9 hours
Luna 6	1965 44A	USSR	June 8, 1965	Tyuratam	A-2-e	3179		Helioce	entric Orbit		In solar orbit: lunar soft lander, missed moon by 100,000 mi
None	1965 45A	USAF	June 9, 1965	WTR	TAT-Agena D	THE STATE OF	89.9	109	221	75.1	Decayed 6-22-65: classified payload
Kosmos 68	1965 46A	USSR	June 15, 1965	Tyuratam	A-1/2		89.8	127	208	65	Re-entered or decayed 6-23-65: unannounced payload
Transtage	1965 47A	USAF	June 18, 1965	ETR	Titan IIIC	21,400	88.1	110	116	32.2	Decayed 6-29-65: Titan IIIC test, not considered a spacecraft
None	1965 48A	USN	June 24, 1965	WTR	Thor-Able Star	135	106.9	642	705	90.0	In orbit: active, augments operational navsat system
Kosmos 69	1965 49A	USSR	June 25, 1965	Tyuratam	A-1/2		89.7	131	206	65	Re-entered or decayed 7-3-65: unannounced payload
None	1965 50A	Tion to	1 05 1005	METER	A-1	1	94.7	309	316	107.7	Decayed 8-22-68: classified payload
None	1965 50B	USAF	June 25, 1965	WTR	Atlas-Agena D	20	88.8	94	176	107.6	Decayed 6-30-65: classified payload
Tiros 10	1965 51A	NASA	July 2, 1965	ETR	Delta	280	100.6	458	517	98.6	In orbit: sun-synchronous orbit, still operating
Kosmos 70	1965 52A	USSR	July 2, 1965	Kap. Yar	B-1	10,000	98.3	142	717	48.8	Decayed 12-18-66: unannounced payload
None	None	USAF	July 12, 1965	WTR	Atlas-Agena D	The same	2	4	J=X	1.7	Failed to orbit: destroyed by range safety officer
Kosmos 71	1965 53A				The state of the s	3	95,5	342	342	56.1	In orbit: unannounced payload, first Soviet five-satellite launch
Kosmos 72	1965 53B						95.5	342	342	56.1	In orbit: unannounced payload
Kosmos 73	1965 53C	USSR	July 16, 1965	Tyuratam	C-1	E	95.5	342	342	56.1	In orbit: unannounced payload
Kosmos 74	1965 53D		The state of the s	1000			95.5	342	342	56.1	In orbit: unannounced payload
Kosmos 75	1965 53E						95.5	342	342	56.1	In orbit: unannounced payload
Proton 1	1965 54A	USSR	July 16, 1965	Tyuratam	D	26,896	92.5	118	390	63.5	Decayed 10-11-65: physics "lab," heaviest Soviet payload yet
None	1965 55A	USAF	July 16, 1965	WTR	TAT-Agena D		94.4	291	320	70.2	Decayed 12-18-68: classified payload

LCS: Lincoln Calibration Satellite

CSC: Communications Satellite Corporation

NAME	INT'L	PROJ.		LAUNCH D		WEIGHT		NITIAL OR	BITAL DAT	Α	STATUS
W. TIM	DESIG.	DIR.	Date	Site	Vehicle		Period	Perigee	Apogee	Incl.	STATUS
Zond 3	1965 56A	USSR	July 18, 1965	Tyuratam	A-2-e	2116			ntric Orbit		In solar orbit: re-transmitted photos taken during lunar flyby
None	1965 57A	USAF	July 19, 1965	WTR	TAT-Agena D		90.9	114	277	85.1	Decayed 8-18-65: classified payload
Vela 5	1965 58A					334	6713	66,476	72,234	35.2	In orbit: experimental nuclear detection satellite
Vela 6	1965 58B	USAF	July 20, 1965	ETR	Atlas-Agena D	334	6716	63,217	75,561	35.0	In orbit: lags Vela 5 by 180°, both continue to transmit
ERS 17	1965 58C		THE PERSON NAMED IN	THE THE	10	12	2595	129	69,723	35.0	In orbit: monitored radiation for 104 days
Kosmos 76	1965 59A	USSR	July 23, 1965	Kap. Yar	B-1	Was In	92.2	162	329	48.8	Decayed 3-16-68: unannounced payload
Pegasus 3	1965 60A	NASA	July 30, 1965	ETR	Saturn I	23,100	95.3	323	336	28.9	Inorbit: meteoroid detection satellite; silenced 8-68
Kosmos 77	1965 61A	USSR	Aug 3, 1965	Tyuratam	A-1/2	AR ST	89.3	124	181	51.8	Re-entered or decayed 8-11-65: unannounced payload
None	1965 62A	USAF	Aug 3, 1965	WTR	Atlas-Agena D	ALL VI	89.1	93	191	107.5	Decayed 8-7-65: classified payload
None	1965 62B	OSAI	Aug 5, 1505		Atles Ageila D		94.7	313	317	107.4	Decayed 6-17-68: classified payload
Secor 5	1965 63A	USA	Aug 10, 1965	WI	Scout	45	122,1	702	1503	69.2	In orbit: Scout flight test carried geodetic satellite
Atlas-Centaur 6	1965 64A	NASA	Aug 11, 1965	ETR	Atlas-Centaur	2100	31 days	105	509,829	28.6	In orbit: Surveyor model launched to simulated moon
Surcal	1965 65B	19 16			ALL S		108.1	680	738	90.0	In orbit: surveillance calibration satellite, failed to separate from second
Council	1005 050						100.1	000	700	00.0	stage, failed to deploy 200-ft antenna
Surcal	1965 65C	, una	40 4005	umo	Tr. 411 0.		108.1	680	738	90.0	In orbit: "Dodacahedron," extended 12 25-ft antennas
Surcal	1965 65E	USN	Aug 13, 1965	WTR	Thor-Able Star	100	108.1	680	738	90.0	In orbit: "Tempsat," 14-inch sphere painted dull black
None	1965 65F					135	108.1	680	738	90.0	In orbit: active navigation satellite, augments USN system
Surcal	1965 65H						108.1	680	738	90.0	In orbit: 14-inch white sphere to check Spasur system
Surcal	1965 65L		100000		7	<u></u>	108.1	680	738	90.0	In orbit: rectangular package with beacon transmitter
Kosmos 78	1965 66A	USSR	Aug 14, 1965	Tyuratam	A-1/2		89.8	128	204	69	Re-entered or decayed 8-22-65: unannounced payload
None	1965 67A	USAF	Aug 17, 1965	WTR	TAT-Agena D		90.4	112	253	70.0	Decayed 10-11-65: classified payload
Gemini 5	1965 68A	NASA	Aug 21, 1965	ETR	Titan II	7947	89.5	100	215	32.6	Re-entered 8-29-65: first extended U.S. manned flight, L.G. Cooper and C. Conrad landed after 128 orbits, 190.9 hours
REP	1965 68C					76	89.2	104	195	32.6	Decayed 8-27-65: pod ejected from Gemini 5
Kosmos 79	1965 69A	USSR	Aug 25, 1965	Tyuratam	A-1/2		90	131	223	64.9	Re-entered or decayed 9-2-65: unannounced payload
OSO C	None	NASA	Aug 25, 1965	ETR	Delta	620		-		-	Failed to orbit: premature third stage ignition
None	None	USAF	Sept 2, 1965	WTR	Thor-Agena D		-	-		_	Failed to orbit: destroyed by range safety officer
Kosmos 80	1965 70A						116.6	932	932	56	In orbit: unannounced payload, second five-payload launch
Kosmos 81	1965 70B						116.6	932	932	56	In orbit: unannounced payload
Kosmos 82	1965 70C	USSR	Sept 3, 1965	Tyuratam	C-1		116.6	932	932	56	In orbit: unannounced payload
Kosmos 83	1965 70D	00011	ocpt 0, 1000	. Janatani	0.1		116.6	932	932	56	In orbit: unannounced payload
Kosmos 84	1965 70E						116.6	932	932	56	
Kosmos 85	1965 71A	USSR	Sept 9, 1965	Tyuratam	A-1/2		89.6	132	198	65	In orbit: unannounced payload Re-entered or decayed 9-17-65: unannounced payload
None	1965 72A	USAF	Sept 9, 1965	WTR	Thor-Altair	ALC: Y	101.9	401	657	98.7	In orbit: classified payload
Kosmos 86	1965 73A	Challen	3001071000		Thor Parcun	10.10	116.7	857	1050	56	
Kosmos 87	1965 73B						116.7	857	1050	56	In orbit: unannounced payload, third five-payload launch In orbit: unannounced payload
Kosmos 88	1965 73C	USSR	Sept 18, 1965	Tyuratam	C-1		116.7	857	1050	56	
Kosmos 89	1965 73D	30011	Johr 10, 1000	- yurutulli	1 177		116.7	857	1050	56	In orbit: unannounced payload
Kosmos 90	1965 73E						116.7	857	1050	56	In orbit: unannounced payload
None	1965 74A	USAF	Sept 22, 1965	WTR	TAT-Agena D		90.0	119	226	80.0	In orbit: unannounced payload
Kosmos 91	1965 75A	USSR	Sept 22, 1965	Tyuratam	A-1/2	1000	89.8	132	213		Decayed 10-11-65: classified payload
None	1965 76A	USAF	Sept 23, 1965	WTR			88.8	98	164	65 0F C	Re-entered or decayed 10-1-65: unannounced payload
Luna 7	1965 77A	USSR	THE PERSON NAMED IN COLUMN	The state of the s	Atlas-Agena D	3320	0.0	- ST-765	-	95.6	Decayed 10-5-65: classified payload
OV1 2	1965 78A	USAF	Oct 4, 1965	Tyuratam	A-2-e	190	125.7		: 86.1 hours	All and the second	Impacted on moon: retros fired early, soft landing failed
UVIZ	1303 76A	USAF	Oct 5, 1965	WTR	Atlas D	180	120.1	256	2146	144.3	In orbit: first successful OV1, returned radiation data

REP: Radar Evaluation Pod

NAME	INT'L	PROJ.		LAUNCH D		WEIGHT	1	INITIAL OF	BITAL DAT	ГА	DE CONTRACTOR OF THE PERSON OF
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGH	Period	Perigee	Apogee	Incl.	STATUS
None	1965 79A	USAF	Oct 5, 1965	WTR	TAT-Agena D		89.8	126	201	75.1	Decayed 10-29-65: classified payload
Molniya 1B	1965 80A	USSR	Oct 14, 1965	Tyuratam	A-2-e		719	311	24,855	65	Decayed 3-17-67: 2nd Soviet comsat, USSR-France comm link
0G0 2	1965 81A	NASA	Oct 14, 1965	WTR	TAT-Agena D	1118	104.3	260	941	87.4	In orbit: geophysical satellite, deactivated 2-68
OV2 1/LCS 2	1965 82A	USAF	Oct 15, 1965	ETR	Titan IIIC	375/75	99.7	439	492	32.6	In orbit: Transtage broke up, failed to release payloads
Kosmos 92	1965 83A	USSR	Oct 16, 1965	Tyuratam	A-1/2	TO COLUMN	89.9	132	219	65	Re-entered 10-24-65: weather research film capsule recovered
Kosmos 93	1965 84A	USSR	Oct 19, 1965	Kap. Yar	B-1		91.7	137	324	48.4	Decayed 1-3-66: unannounced payload
Gemini 6 Target	None	NASA	Oct 25, 1965	ETR	Atlas-Agena D	7200	-	-	-	-	Failed to orbit: Agena exploded 6 min after launch
Kosmos 94	1965 85A	USSR	Oct 28, 1965	Tyuratam	A-1/2		89.3	131	182	65	Re-entered or decayed 11-5-65: unannounced payload
None	1965 86A	USAF	Oct 28, 1965	WTR	TAT-Agena D	A COLUMN TO SERVICE AND ADDRESS OF THE PERSON NAMED IN COLUMN TO SERVICE AND ADDRESS	90.6	107	268	75.0	Decayed 11-17-65: classified payload
Proton 2	1965 87A	USSR	Nov 2, 1965	Tyuratam	D	26,896	92.6	119	396	63.5	Decayed 2-6-66: complex high-energy physics laboratory
Kosmos 95	1965 88A	USSR	Nov 4, 1965	Kap. Yar	B-1		91.7	129	324	48.4	Decayed 1-18-66: payload broke up 3rd day in orbit
Explorer 29	1965 89A	NASA	Nov 6, 1965	ETR	TAD	385	120.3	693	1414	59.4	In orbit: GEOS geodetic satellite, active
None	1965 90A	DESCRIPTION OF THE PERSON OF T	A DE CARGO	William .	1 10 10 12 12 12 1	20	88.7	40	172	93.9	Decayed 11-11-65: classified payload
None	1965 90B	USAF	Nov 8, 1965	WTR	Atlas-Agena D			202	AVATA III		Decayed 11-9-65: classified payload
Venera 2	1965 91A	USSR	Nov 12, 1965	Tyuratam	A-2-e	2123		Heliocen	tric Orbit		In solar orbit: passed Venus 2-27-66, failed to return data
Venera 3	1965 92A	USSR	Nov 16, 1965	Tyuratam	A-2-e	2116			a: 105 days		Impacted on Venus 3-1-66: failed to return planetary data
Explorer 30	1965 93A	USN/ NASA	Nov 18, 1965	WI	Scout	125	102.8	440	548	59.7	In orbit: active solar radiation satellite, final IQSY monitor
Kosmos 96	1965 94A	USSR	Nov 23, 1965	Tyuratam	A-2-e		89.6	141	193	51.9	Decayed 12-9-65: suspected Venus probe left in parking orbit
Kosmos 97	1965 95A	USSR	Nov 26, 1965	Kap. Yar	B-1		108.3	137	1305	49	Decayed 4-2-67: payload included ammonia freg standard
A1 ///	1965 96A	France	Nov 26, 1965	Hammaguir	Diamant	92	108.7	328	1099	34.2	In orbit: first French satellite, transmitted for 2 days
Kosmos 98	1965 97A	USSR	Nov 27, 1965	Tyuratam	A-1/2		92	134	354	65	Re-entered or decayed 12-5-65: unannounced payload
Alouette 2	1965 98A	Canada				320	121.4	314	1856	79.8	In orbit: active ionospheric research satellite
Explorer 31	1965 98B	NASA	Nov 28, 1965	WTR	Thor-Agena B	218	121.3	314	1850	79.8	In orbit: ionospheric data until 12-66, complemented Alouette
Luna 8	1965 99A	USSR	Dec 3, 1965	Tyuratam	А-2-е	3422			e: 83.1 hour	Albaman.	Impacted on moon: retros fired late, soft landing failed
Gemini 7	1965 100A	NASA	Dec 4, 1965	ETR	Titan II	8076	89.2	100	204	28.9	Re-entered 12-18-65: F. Borman and J. Lovell went record 220 orbits, 330.6 h served as Gemini 6 rendezvous target
FR 1	1965 101A	France	Dec 6, 1965	WTR	Scout	132	99,9	458	484	75.9	In orbit: active VLF wave propagation research satellite
None	1965 102A	USAF	Dec 9, 1965	WTR	TAT-Agena D	API III	90.5	112	262	80.0	Decayed 12-26-65: classified payload
Kosmos 99	1965 103A	USSR	Dec 10, 1965	Tyuratam	A-1/2		89.6	124	199	65	Re-entered or decayed 12-18-65: unannounced payload
Gemini 6	1965 104A	NASA	Dec 15, 1965	ETR	Titan II	7817	88.5	100	162	28.9	Re-entered 12-16-65: W. Schirra and T. Stafford rendezvoused within 1 ft of Gemini 7, landed after 17 orbits, 25.9 hours
Pioneer 6	1965 105A	NASA	Dec 16, 1965	ETR	TAD	140 3	11,3 days	0.814AU	0.985AU	0.1695	
Kosmos 100	1965 106A	USSR	Dec 17, 1965	Tyuratam	A-1/2	1119	97.7	404	404	65	In solar orbit: returning good data; went behind sun 12-21-68
Kosmos 101	1965 107A	USSR	Dec 21, 1965	Kap. Yar	B-1		92.4	162	342	49	In orbit: unannounced payload, probable metsat
0V2 3	1965 108A	00011	500 21, 1000	, aprila		427	589.7	110	20,903	26.4	Decayed 7-12-66: unannounced payload
LES 4	1965 108B						589.6	124	20,890	26.6	In orbit: radiation satellite, Transtage separation failed
Oscar 4	1965 108C	USAF	Dec 21, 1965	ETR	Titan IIIC		587.5	101	20,847		In orbit: experimental all-solid-state comsat, tx in X-band
LES 3	1965 108D						581.0	121	A Commence of the Commence of	26.8	In orbit: amateur radio comsat
None	1965 109A	USN	Dec 21, 1965	WTR	Scout	The state of the s	105.0	564	20,477	26.5	Decayed 4-6-68: radio signal generator for comsat system tests
None	1965 110A	USAF	Dec 24, 1965	WTR	TAT-Agena D	27	90.7	112	675	89.1	In orbit: active classified payload, tx on 150 mc, 400 mc
Kosmos 102	1965 110A	USSR	Dec 28, 1965	Tyuratam	A-x	MILLION BY	89.2	135	269	80.0	Decayed 1-20-66: classified payload
Kosmos 102				CONTRACTOR AND ADDRESS OF THE PARTY.			98	11/2007	173	65	Decayed 1-13-66: unannounced payload
Masillas 103	1965 112A	USSR	Dec 28, 1965	Tyuratam	C-1	_	30	373	373	56	In orbit: unannounced payload, 52nd Kosmos orbited in 1965

A-x: 1%-stage booster with unidentified upper stage

TOTAL STATE OF THE	INT'L	PROJ.		LAUNCH D	ATA	A Princer		NITIAL OR	BITAL DAT	A	
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT	Period	Perigee	Apogee	Incl.	STATUS
None	None	USAF	Jan 6, 1966	WTR	Thor-Altair		170	2	128	194/11	Failed to orbit: classified payload
Kosmos 104	1966 1A	USSR	Jan 7, 1966	Tyuratam	A-1/2		90.2	127	249	65	Re-entered or decayed 1-15-66: unannounced payload
None	1966 2A	110.5	1 10 1000	ump 14	dild n		88.7	93	167	93.9	Decayed 1-25-66: classified payload
None	1966 2B	USAF	Jan 19, 1966	WTR	Atlas-Agena D		87.6	92	122	93.8	Decayed 1-23-66: classified payload
Kosmos 105	1966 3A	USSR	Jan 22, 1966	Tyuratam	A-1/2	No.	89.7	127	201	65	Re-entered or decayed 1-30-66: unannounced payload
Kosmos 106	1966 4A	USSR	Jan 25, 1966	Kap. Yar	B-1	11	92.8	174	350	48.4	Decayed 11-14-66: unannounced payload
None	1966 5A	USN	Jan 28, 1966	WTR	Scout		105.9	536	755	89.7	In orbit: active classified payload, tx on 150 mc, 400 mc
Luna 9	1966 6A	USSR	Jan 31, 1966	Tyuratam	A-2-e	3490	TIL	Flight time:	79.0 hours		Landed on moon: returned photos of lunar surface for 3 days
None	1966 7A	USAF	Feb 2, 1966	WTR	TAT-Agena D		90.6	115	264	75.1	Decayed 2-27-66: classified payload
ESSA 1	1966 8A	ESSA	Feb 3, 1966	ETR	Delta	305	100.2	432	521	97.9	In orbit: first operational metsat, one camera failed 7-25-66
None	1966 9A	USAF	Feb 9, 1966	WTR	TAT-Agena D	- 7007	94.8	316	318	82.1	In orbit: classified payload
Kosmos 107	1966 10A	USSR	Feb 10, 1966	Tyuratam	A-1/2	h- 1	89.7	127	200	65	Re-entered or decayed 2-18-66: unannounced payload
Kosmos 108	1966 11A	USSR	Feb 11, 1966	Kap. Yar	B-1	TO THE PARTY	95.3	141	537	48.9	Decayed 11-21-66: unannounced payload
None	1966 12A				ACHEA	W. 1/2	89.0	92	182	96.5	Decayed 2-22-66: classified payload
None	1966 12B	USAF	Feb 15, 1966	WTR	Atlas-Agena D	YEN	88.1	71	157	96.5	Decayed 2-16-66: classified payload
None	1966 12C					10.16	88.7	93	166	96.5	Decayed 2-22-66: classified payload
D1A	1966 13A	France	Feb 17, 1966	Hammaguir	Diamant	44	118.6	313	1711	34.0	In orbit: third French satellite, returning geodetic data
Kosmos 109	1966 14A	USSR	Feb 19, 1966	Tyuratam	A-1/2	2	89.5	130	192	65	Re-entered or decayed 2-27-66: unannounced payload
Kosmos 110	1966 15A	USSR	Feb 22, 1966	Tyuratam	A-2	-	95.3	116	562	51.9	Re-entered 3-16-66: two dogs recovered after 330 orbits
ESSA 2	1966 16A	ESSA	Feb 28, 1966	ETR	TAD	290	113.6	843	885	101.0	In orbit: completes initial ESSA global system, APT cameras
Kosmos 111	1966 17A	USSR	Mar 1, 1966	Tyuratam	A-2-e		88.6	119	140	51.9	Decayed 3-3-66: suspected lunar probe failure
None	1966 18A	USAF	Mar 9, 1966	WTR	TAT-Agena D		90.6	111	268	75.0	Decayed 3-29-66: classified payload
Gemini 8	1966 19A	NASA	Mar 16, 1966	ETR	Atlas-Agena D	7000	90.4	185	185	28.9	Decayed 9-15-67: target vehicle for first docking in space
Target	(152 FE005 - 17)	10000000	HOW AND THE COURT	Garage and Allert and		8351	88.8	100	169	28.9	Re-entered 3-16-66: initial docking test; due to short circuit, N. Armstron
Gemini 8	1966 20A	NASA	Mar 16, 1966	ETR	Titan II	0301	00.0	100	100	20.3	and D. Scott landed after 6.5 orbits, 10.7 hrs.
Kosmos 112	1966 21A	USSR	Mar 17, 1966	Plesetsk	A-1/2		92.1	133	351	72	Re-entered or decayed 3-25-66: new U.S.S.R. launch site
None	1966 22A			WATE .	4.0 4 4		89.0	91	187	101.0	Decayed 3-24-66: classified payload
None	1966 22B	USAF	Mar 18, 1966	WTR	Atlas Agena D		88.2	85	147	100.9	Decayed 3-23-66: classified payload
Kosmos 113	1966 23A	USSR	Mar 21, 1966	Tyuratam	A-1/2		89.6	130	203	65	Re-entered or decayed 3-29-66: unannounced payload
None	1966 24A	USN	Mar 25, 1966	WTR	Scout		105.3	554	701	89.7	In orbit: active classified payload, tx on 150 mc, 400 mc
0V1 4	1966 25A	10 10				193	103.9	550	630	144.5	In orbit: returned zero-g, thermal control experiment data
0V1 5	1966 25B	USAF	Mar 30, 1966	WTR	Atlas D	252	104.4	613	659	144.7	In orbit: optical radiation test, gravity-gradient stabilized
None	1966 26A	USAF	Mar 30, 1966	WTR	Thor-Altair	100	100.5	394	581	98.6	In orbit: classified payload
Luna 10	1966 27A	USSR	Mar 31, 1966	Tyuratam	А-2-в	3527	178.3*	217	632	71.9	In lunar orbit: lunar and circumlunar data until 5-30-66
Kosmos 114	1966 28A	USSR	Apr 6, 1966	Plesetsk	A-1/2		90.1	130	232	73	Re-entered or decayed 4-14-66: unannounced payload
None	1966 29A	USAF	Apr 7, 1966	WTR	TAT-Agena D	0	89.6	120	194	75.1	Decayed 4-26-66: classified payload
Atlas-Centaur 8	1966 30A	NASA	Apr 7, 1966	ETR	Atlas-Centaur	1730	89.6	109	198	30.8	Decayed 5-5-66: Centaur test, not considered a spacecraft
OAO 1	1966 31A	NASA	Apr 8, 1966	ETR	Atlas-Agena D	3917	100.9	492	500	35.0	In orbit: battery failed second day in orbit
None	1966 32A	USAF	Apr 19, 1966	WTR	Atlas-Agena D	5011	89.6	86	233	116.9	Decayed 4-26-66: classified payload
	1966 33A	USSR	Apr 20, 1966	Tyuratam	A-1/2	Value of the last	89.3	118	183	65	Re-entered or decayed 4-28-66: unannounced payload
Kosmos 115											

ESSA: Environmental Survey Satellite, Environmental Science Services Administration OAO: Orbiting Astronomical Observatory

*Lunar orbital elements

	INT'L	PROJ.	March 31	LAUNCH D	ATA	WEIGHT		NITIAL OR	BITAL DAT		_ STATUS
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHI	Period	Perigee	Apogee	Incl.	
Molniya 1C	1966 35A	USSR	Apr 25, 1966	Tyuratam	A-2-e		710	310	24,544	64.5	In orbit: comsat, also transmitted cloud cover photos
Kosmos 116	1966 36A	USSR	Apr 26, 1966	Kap. Yar	B-1	The second	92	183	297	48.4	Decayed 12-3-66: unannounced payload
None / / /	None	USAF	May 3, 1966	WTR	TAT-Agena D		-	77		-\	Failed to orbit: classified payload
Kosmos 117	1966 37A	USSR	May 6, 1966	Tyuratam	A-1/2		89.5	129	191	65	Re-entered or decayed 5-14-66: unannounced payload
Kosmos 118	1966 38A	USSR	May 11, 1966	Tyuratam	A-1/2		97.1	398	398	65	In orbit: unannounced payload, probable metsat
None	1966 39A	mate.	11 11 1000	WITTE	Ast - A D		89.4	81	222	110.5	Decayed 5-21-66: classified payload
None	1966 39B	USAF	May 14, 1966	WTR	Atlas-Agena D		95.4	323	345	109.9	In orbit: classified payload
Nimbus 2	1966 40A	NASA	May 15, 1966	WTR	TAT-Agena B	912	108.1	684	734	100.3	In orbit: returning TV and infrared cloud cover photos
Gemini 9 Target A	None	NASA	May 17, 1966	ETR	Atlas-Agena D	7170	-	-	-	-	Failed to orbit: Atlas control system malfunction
None	1966 41A	USN	May 19, 1966	WTR	Scout		103.4	535	610	90.0	In orbit: active classified payload, tx on 150 mc, 400 mc
None	1966 42A	USAF	May 23, 1966	WTR	TAT-Agena D		89.0	111	168	66.0	Decayed 6-9-66: classified payload
Kosmos 119	1966 43A	USSR	May 24, 1966	Kap. Yar	B-1		99.8	136	811	48.5	Decayed 11-30-66: unannounced payload
Explorer 32	1966 44A	NASA	May 25, 1966	ETR	Delta	495	116.0	173	1629	64.7	In orbit: six aeronomy experiments returned data until 12-66
Surveyor 1	1966 45A	NASA	May 30, 1966	ETR	Atlas-Centaur	596	-	Flight tim	ne: 63.6 hou	rs	Landed on moon: transmitted 11,150 photos up to 7-13-66
Gemini 9 Target B	1966 46A	NASA	June 1, 1966	ETR	Atlas D	1700	90.4	185	185	28.9	Decayed 7-11-66: ATDA fairing separation failed
ranger b	Market Marie	NO DESCRIPTION OF THE PARTY OF	and the second second	1000000		2	200	400	100	20.0	Re-entered 6-6-66: rendezvous and EVA tests carried out by T. Stafford an
Gemini 9	1966 47A	NASA	June 3, 1966	ETR	Titan II	8268	B8.8	100	169	28.9	E. Cernan; landed after 47 orbits, 72.3 hrs
None	1966 48A				P358()		B8.4	89	127	86.9	Decayed 6-9-66: classified payload
None	1966 48B	USAF	June 3, 1966	WTR	Atlas-Agena D		88.3	75	75	87.0	Decayed 6-9-66: classified payload
0G0 3	1966 49A	NASA	June 6, 1966	ETR	Atlas-Agena B	1135	2907.9	170	75,769	30.9	In orbit: 20 experiments returning geophysical data
Kosmos 120	1966 50A	USSR	June 8, 1966	Tyuratam	A-1/2		89.4	124	186	51.8	Re-entered or decayed 6-16-66: unannounced payload
None	1966 51A	-					124.8	108	2246	90.1	Decayed 12-3-66: classified payload
Secor 6	1966 51B	USAF/	June 9, 1966	WTR	Atlas-Agena D	38	125.1	104	2266	90.1	Decayed 7-6-67: geodetic satellite
ERS 16	1966 51C	USA		. 10.000	A CONTRACTOR CONTRACTOR	11	125.0	112	2251	90.0	Decayed 3-12-67: carried 5 metal-to-metal bonding expm'ts.
0V3 4	1966 52A	USAF	June 10, 1966	WI	Scout	173	143.2	399	2939	40.8	In orbit: active radiation research satellite
GGTS 1	1966 53A	- Corn				104	1334.2	20,913	21,051	0.1	In orbit: gravity gradient test satellite, two booms deployed
IDCSP 1	1966 53B					100	1334.7	20,923	21,053	0.1	In orbit: one of 7 initial defense communication satellites
IDCSP 2	1966 53C					100	1335.3	20,927	21,066	0.1	In orbit: initial defense comsat, all successfully separated
IDCSP 3	1966 53D	USAF	June 16, 1966	ETR	Titan IIIC	100	1336.6	20,936	21,088	0.1	In orbit: initial defense communication satellite
IDCSP 4	1966 53E		- Cano 10, 1000			100	1340.8	20,935	21,194	0.0	In orbit: initial defense communication satellite
IDCSP 5	1966 53F					100	1344.0	20,949	21,258	0.1	In orbit: initial defense communication satellite
IDCSP 6	1966 53G					100	1338.6	20,936	21,139	0.2	In orbit: initial defense communication satellite
IDCSP 7	1966 53H					100	1347.6	20,948	21,350	0.0	In orbit: initial defense communication satellite
Kosmos 121	1966 54A	USSR	June 17, 1966	Plesetsk	A-1/2		89.9	130	220	72.9	Re-entered or decayed 6-25-66: unannounced payload
None None	1966 55A	USAF	June 21, 1966	WTR	TAT-Agena D	0	90.2	121	228	80.1	Decayed 7-14-66: classified payload
Pageos	1966 56A	NASA	June 23, 1966	WTR	TAT-Agena D	125	181.4	2607	2662	87.1	In orbit: 100-ft balloon, photographed in geodetic study
Kosmos 122	1966 57A	USSR	June 25, 1966	Tyuratam	A-1/2	100	97.1	388	388	65	In orbit: metsat, launch witnessed by Gen. de Gaulle
Explorer 33	1966 58A	NASA	July 1, 1966	ETR	TAD	206	8540.0	9880	270,560	28.7	In orbit: IMP D, excessive velocity prevented lunar orbit, active
Apollo 2 (AS-20		NASA	July 1, 1966 July 5, 1966	ETR	Saturn I	58,500	88.5	114	132	32.0	Decayed 7-5-66: S-IVB blown up, not considered a spacecraft
Proton 3	1966 60A	USSR	July 6, 1966	Tyuratam	D	00,300	92.5	118	391	63.5	Decayed 9-16-66: heavyweight research satellite
Kosmos 123	1966 61A	USSR	July 8, 1966	Kap. Yar	B-1		92.2	163	329	48.8	Decayed 12-10-66: unannounced payload
None	1966 62A	USAF		WTR	The state of the s		88.7	93	162	95.5	Decayed 7-20-66: classified payload
MOUSE	1300 0ZA	USAF	July 12, 1966	WIN	Atlas-Agena D		-	3.11		2010	TOTAL CONTRACTOR STATE OF THE S

GGTS: Gravity Gradient Test Satellite

IDCSP: Initial Defense Communication Satellite Program

NAME	INT'L	PROJ.	_	LAUNCH D	WEIG		NITIAL OR	BITAL DAT	A	STATUS
IN INVIEW	DESIG.	DIR.	Date	Site	Vehicle	Period	Perigee	Apogee	Incl.	STATUS
0V1 7	None	USAF	July 13, 1966	WTR	Atlas D 26	0 -	-	210	-///	Failed to orbit: research satellite's injection motor failed
OV1 8	1966 63A				777	3 105.2	612	635	144.2	In orbit: 30-ft wire mesh sphere for passive comsat tests
Kosmos 124	1966 64A	USSR	July 14, 1966	Tyuratam	A-1/2	89.4	129	188	51.8	Re-entered or decayed 7-22-66: unannounced payload
Gemini 10 Target	1966 65A	NASA	July 18, 1966	ETR	Atlas-Agena D 718	90.4	183	188	28.9	Decayed 12-29-66: raised Gemini 10's apogee to 476 miles
Gemini 10	1966 66A	NASA	July 18, 1966	ETR	Titan II 829	88.8	100	168	28.9	Re-entered 7-21-66: rendezvoused with Gemini 8 & 10 targets; J. Young at M. Collins landed after 46 orbits, 70.8 hours
Kosmos 125	1966 67A	USSR	July 20, 1966	Tyuratam	A-x	89.5	155	155	65	Decayed 8-2-66: unannounced payload
Kosmos 126	1966 68A	USSR	July 28, 1966	Tyuratam	A-1/2	90	132	223	51.8	Re-entered or decayed 8-6-66: unannounced payload
None	1966 69A	USAF	July 29, 1966	WTR	Titan IIIB-Agena D	88.5	99	153	94.1	Decayed 8-6-66: classified payload, first Titan IIIB launch
0V3 3	1966 70A	USAF	Aug 4, 1966	WTR	Scout 1	_	220	2780	81.6	In orbit: radiation research satellite, active
Kosmos 127	1966 71A	USSR	Aug 8, 1966	Tyuratam	A-1/2	89.2	127	173	51.9	Re-entered or decayed 8-16-66: unannounced payload
None	1966 72A	USAF	Aug 9, 1966	WTR	Thorad-Agena D	89.4	120	149	100.1	Decayed 9-11-66: classified payload, first Thorad launch
Lunar Orbiter 1	1966 73A	NASA	Aug 10, 1966	ETR	Atlas-Agena D 8		117	1159	12.2	Impacted on moon 10-29-66: photographed moon until 8-29-66
None	1966 74A		1914 Hally Salaston	1000000		89.4	86	178	93.3	Decayed 8-24-66: classified payload
None	1966 74B	USAF	Aug 16, 1966	WTR	Atlas-Agena D	94.9	318	324	93.2	In orbit: classified payload
Pioneer 7	1966 75A	NASA	Aug 17, 1966	ETR	TAD 1	402.9 day		1.125AU	0.097	In solar orbit: six solar and interplanetary experiments, active
None	1966 76A	USN	Aug 17, 1966	WTR	Scout	106.8	654	687	88.9	In orbit: active classified payload, tx on 150 mc, 400 mc
None	1966 77A				10	167.6	2285	2302	90.1	In orbit: classified payload
Secor 7	1966 77B	USAF/	Aug 19, 1966	WTR	Atlas-Agena D	8 167.6	2287	2299	90.1	In orbit: first of new geodetic satellite series, active
ERS 15	1966 77C	USA			(POPE) E	167.5	2280	2300	90.1	In orbit: conducting five coldwelding experiments
Luna 11	1966 78A	USSR	Aug 24, 1966	Tyuratam	A-2-e 36	_	99	746	27	In lunar orbit: returned scientific data until 10-1-66
IDCSP	None	USAF	Aug 26, 1966	ETR	Titan IIIC 8		-	25	72	Failed to orbit: Titan IIIC malfunctioned, carried 8 comsats
Kosmos 128	1966 79A	USSR	Aug 27, 1966	Tyuratam	A-1/2	90	132	226	65	Re-entered or decayed 9-4-66: unannounced payload
Gemini 11 Target	1966 80A	NASA	Sept 12, 1966	ETR	Atlas-Agena D 71		180	191	28.8	Decayed 12-30-66: raised Gemini 11's apogee to 851 miles
Gemini 11	1966 81A	NASA	Sept 12, 1966	ETR	Titan II 83	89.0	100	174	28.8	Re-entered 9-15-66: C. Conrad and R. Gordon performed initial first orbit docking; landed after 47 orbits, 71.3 hours
None	1966 82A	USAF	Sept 15, 1966	WTR	Thor-Burner II	100.8	433	560	98.5	In orbit: classified payload, initial use of Burner II
None	1966 83A			1		89.1	89	178	93.9	Decayed 9-23-66: classified payload
None	1966 83B	USAF	Sept 16, 1966	WTR	Atlas-Agena D	94.2	291	306	94.0	Decayed 5-9-68: classified payload
None	1966 88A	USSR	Sept 17, 1966	Tyuratam	F-1-r	94.6	85	510	49.6	Decayed 11-11-66: unannounced launch, payload exploded
Surveyor 2	1966 84A	NASA	Sept 20, 1966	ETR	Atlas-Centaur 6	4		: 62.8 hour		Impacted on moon: vernier failed, crashed SE of Copernicus
None	1966 85A	USAF	Sept 20, 1966	WTR	TAT-Agena D	90.6	113	259	85.1	Decayed 10-12-66: classified payload
Lambda 4S 1	None	Japan	Sept 26, 1966	Kagoshima		88	-	200	-	Failed to orbit: first attempt to launch a Japnese satellite
None	1966 86A	USAF	Sept 28, 1966	WTR	Titan IIIB-Agena D	88.8	91	178	94.0	Decayed 10-7-66: classified payload
ESSA 3	1966 87A	ESSA	Oct 2, 1966	WTR	TAD 3	100000	860	923	101.0	In orbit: replaced ESSA 1 in TOS system, fully operational
None	1966 89A		7-12-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2	and the second		167.6	2285	2303	90.2	In orbit: classified payload
Secor 8	1966 89B	USAF	Oct 5, 1966	WTR	Atlas-Agena D	38 167.6	2287	2304	90.2	In orbit: active geodetic satellite
None	1966 90A	10 00 00 00 00 00 00 00 00 00 00 00 00 0	assume semants	1(32)		88.6	96	132	91.0	Decayed 10-20-66: classified payload
None	1966 90B	USAF	Oct 12, 1966	WTR	Atlas-Agena D	88.9	103			
			the state of the s	100	M	- 00.3	103	103	90.9	Decayed 10-21-66: classified payload

F-1-r: Scrag or Scarp booster with orbital and re-entry stages

NAME	INT'L	PROJ.		LAUNCH D	ATA	No.		NITIAL OR	BITAL DAT	A	The state of the s
NAME	DESIG.	DIR.	Date	Site	Vehicle	WEIGHT	Period	Perigee	Apogee	Incl.	STATUS
Kosmos 129	1966 91A	USSR	Oct 14, 1966	Plesetsk	A-1/2		89.4	126	191	65	Re-entered or decayed 10-21-66: unannounced payload
Molniya 1D	1966 92A	USSR	Oct 20, 1966	Tyuratam	A-2-e	min and	713	301	24,668	64.9	Decayed 9-11-68: fourth Russian comsat
Kosmos 130	1966 93A	USSR	Oct 20, 1966	Tyuratam	A-1/2	SI U	89.8	131	211	65	Re-entered or decayed 10-28-66: unannounced payload
Luna 12	1966 94A	USSR	Oct 22, 1966	Tyuratam	A-2-e		205	62	1081		In lunar orbit: photographed moon, returned scientific data
Atlas-Centaur 9	1966 95A	NASA	Oct 25, 1966	ETR	Atlas-Centaur	2100 1		102	286,529	29.6	Decayed 11-6-66: Centaur test, not considered a spacecraft
Intelsat 2A	1966 96A	CSC	Oct 26, 1966	ETR	TAD	192	730.1	2088	23,014	17.2	In orbit: active comsat, 12-hr rather than planned 24-hr orbit
0V3 2	1966 97A	USAF	Oct 28, 1966	WTR	Scout	177	104.2	198	993	82.0	In orbit: active radiation satellite
None	1966 101A	USSR	Nov 2, 1966	Tyuratam	F-1-r		94.6	87	470	49.6	Decayed 11-29-66: unannounced launch, payload exploded
None	1966 98A	HOAF	N 0 1000	WITTE			88.9	99	174	91.0	Decayed 11-10-66: classified payload
None	1966 98B	USAF	Nov 2, 1966	WTR	Atlas-Agena D		89.6	126	185	91.0	Decayed 11-16-66: classified payload
0V43	1966 99A		TOTAL IN		L. Laren	21,300	90.6	187	188	32.8	Decayed 1-9-67: modified Titan II tank carrying 9 expm'ts.
0V4 1R	1966 99B	HOAF		FTD	T	300 8	90,4	181	181	32.8	Decayed 1-5-67: receiver for "whispering gallery" expm't.
OV1 6	1966 99C	USAF	Nov 3, 1966	ETR	Titan IIIC	445	90.4	180	180	32.8	Decayed 12-31-66: classified payload
0V4 1T	1966 99D					240	90.7	181	190	32.8	Decayed 1-11-67: transmitter for "whispering gallery" test
Lunar Orbiter 2	1966 100A	NASA	Nov 6, 1966	ETR	Atlas-Agena D	861	216.8	129	1147	11.8	Impacted moon 10-11-67: returned 205 lunar frames
None	1966 102A	USAF	Nov 8, 1966	WTR	TAT-Agena D	1000	89.4	107	188	100.1	Decayed 11-29-66: classified payload
Gemini 12 Target	1966-103A	NASA	Nov 11, 1966	ETR	Atlas-Agena D	7090	90.4	183	188	28.9	Decayed 12-23-66: positioned Gemini 12 for solar eclipse photo
Gemini 12	1966 104A	NASA	Nov 11, 1966	ETR	Titan II	8294	89.0	100	175	28.9	Re-entered 11-15-66: J. Lovell, E. Aldrin ended program with successfu EVA tests; landed after 63 orbits, 94.6 hrs.
Kosmos 131	1966 105A	USSR	Nov 12, 1966	Plesetsk	A-1/2		89.9	127	224	72.9	Re-entered or decayed 11-20-66: unannounced payload
Kosmos 132	1966 106A	USSR	Nov 19, 1966	Tyuratam	A-1/2		89.3	129	174	65	Re-entered or decayed 11-27-66: unannounced payload
Kosmos 133	1966 107A	USSR	Nov 28, 1966	Tyuratam	A-2		88.4	112	144	51.9	Re-entered or decayed 11-30-66: believed to be Soyuz precursor
Kosmos 134	1966 108A	USSR	Dec 3, 1966	Tyuratam	A-1/2		89.6	133	198	65	Re-entered or decayed 12-11-66: unannounced payload
None	1966 109A	USAF	Dec 6, 1966	WTR	Atlas-Agena D		89.7	86	226	104.6	Decayed 12-14-66: classified payload
ATS 1	1966 110A	NASA	Dec 6, 1966	ETR	Atlas-Agena D	775	660	22,277	22,920	0.2	In orbit: carrying out communication and meteorological tests
0V1 9	1966 111A	LICAE	De- 11 1000	MATE		230	142.3	297	3004	99.4	In orbit: radiation satellite to study bio-hazards, active
OV1 10	1966 111B	USAF	Dec 11, 1966	WTR	Atlas D	287	98.9	403	479	93.5	In orbit: gravity-stabilized radiation satellite, active
Kosmos 135	1966 112A	USSR	Dec 12, 1966	Kap. Yar	B-1		93.5	161	411	48.5	Decayed 4-12-67: unannounced payload
None	1966 113A	USAF	Dec 14, 1966	WTR	Titan IIIB-Agena	a D	89.5	86	229	109.5	Decayed 12-24-66: classified payload
Biosatellite 1	1966 114A	NASA	Dec 14, 1966	ETR	TAD	940	90.7	191	197	33.5	Decayed 2-15-67: failed to return biological capsule
Lambda 4S 2	None	Japan	Dec 20, 1966	Kagoshima	Lambda 4S	58	3	-	-	-	Failed to orbit: fourth stage failed to ignite
Kosmos 136	1966 115A	USSR	Dec 19, 1966	Plesetsk	A-1/2	10.1	89,4	123	190	64.6	Re-entered or decayed 12-27-66: unannounced payload
Luna 13	1966 116A	USSR	Dec 21, 1966	Tyuratam	А-2-е	10 111			e: 79.7 hour		Landed on moon: returned photos, soil density data
Kosmos 137	1966 117A	USSR	Dec 21, 1966	Kap. Yar	B-1	100	104.3	143	1069	48.8	Decayed 11-23-67: unannounced payload
None	1966 118A	USAF	Dec 28, 1966	WTR	TAT-Agena D		94.4	301	329	74.0	In orbit: classified payload

ATS: Applications Technology Satellite

NAME	INT'L	PROJ.		LAUNCH D	ATA	WEIGHT		INITIAL ORBITAL DATA			STATUS
WANT.	DESIG.	DIR.	Date	Site	Vehicle	WEIGHI	Period	Perigee	Apogee	Incl.	SIAIUS
Pacific 1 (Intelsat 2B)	1967 1A	CSC	Jan 11, 1967	ETR	TAD	192	436.1	22,244	22,257	1.3	In orbit: transpacific communication service initiated 1-11-67
None	1967 2A	USAF	Jan 14, 1967	WTR	TAT-Agena D		90.0	112	227	80.1	Decayed 2-2-67: classified payload
IDCSP 8	1967 3A	mor Time		116	1/1	100	1330	20,835	21,038	0.1	In orbit: initial defense communication satellite
IDCSP 9	1967 3B					100	1331	20,854	21,031	0.0	In orbit: initial defense communication satellite
IDCSP 10	1967 3C					100	1332	20,867	21,036	0.0	In orbit: initial defense communication satellite
IDCSP 11	1967 3D	USAF	l 10 1007	ETR	Titan IIIC	100	1333	20,875	21,063	0.0	In orbit: initial defense communication satellite
IDCSP 12	1967 3E	USAF	Jan 18, 1967	EIN	Titan Tito	100	1335	20,901	21,089	0.0	In orbit: initial defense communication satellite
IDCSP 13	1967 3F					100	1337	20,923	21,128	0.1	In orbit: initial defense communication satellite
IDCSP 14	1967 3G					100	1340	20,932	21,192	0.1	In orbit: initial defense communication satellite
IDCSP 15	1967 3H					100	1343	20,935	21,275	0.0	In orbit: initial defense communication satellite
Kosmos 138	1967 4A	USSR	Jan 19, 1967	Plesetsk	A-1/2		B9.2	120	182	65	Re-entered or decayed 1-27-67: unannounced payload
Kosmos 139	1967 5A	USSR	Jan 25, 1967	Tyuratam	F-1-r	100	87.5	89	130	50	Re-entered or decayed 1-25-67: FOBS flight test
ESSA 4	1967 6A	ESSA	Jan 26, 1967	WTR	TAD	290	113.4	822	894	102.0	In orbit: replaced ESSA 2, one of two APT cameras operational
0V35	None	USAF	Jan 31, 1967	WTR	Scout	208	2	-	2	-	Failed to orbit: atmospheric research satellite
None	1967 7A	USAF	Feb 2, 1967	WTR	Atlas-Agena D	167 7	88.8	96	183	102.4	Decayed 2-12-67: classified payload
Lunar Orbiter 3	1967 8A	NASA	Feb 4, 1967	ETR	Atlas-Agena D	850	218.6	124	1150	21	Impacted on moon 10-9-67: returned 182 lunar frames
Kosmos 140	1967 9A	USSR	Feb 7, 1967	Tyuratam	A-2		88.5	106	150	51.7	Re-entered or decayed 2-9-67: believed to be Soyuz precursor
None	1967 10A	USAF	Feb 8, 1967	WTR	Thor-Burner II	1	101.5	489	544	98.8	In orbit: classified payload
D 1C	1967 11A	France	Feb 8, 1967	Hammaguir	Diamant	50	104.3	360	833	40.0	In orbit: geodetic satellite, operational in spite of low apogee
Kosmos 141	1967 12A	USSR	Feb 8, 1967	Plesetsk	A-1/2		89.8	130	214	72.9	Re-entered or decayed 2-16-67: unannounced payload
Kosmos 142	1967 13A	USSR	Feb 14, 1967	Kap. Yar	B-1		100.3	133	846	48.4	Decayed 7-6-67: unannounced payload
D 1D	1967 14A	France	Feb 15, 1967	Hammaguir	Diamant	50	110.2	368	1172	39.4	In orbit: provided good laser, doppler data until 4-5-67
None	1967 15A	USAF	Feb 22, 1967	WTR	TAT-Agena D		90.1	111	235	80.0	Decayed 3-11-67: classified payload
None	1967 16A	USAF	Feb 24, 1967	WTR	Titan IIIB-Agen	a D	89.8	85	219	107.0	Decayed 3-6-67: classified payload
Kosmos 143	1967 17A	USSR	Feb 27, 1967	Tyuratam	A-1/2		89.5	127	188	65	Re-entered or decayed 3-7-67; unannounced payload
Kosmos 144	1967 18A	USSR	Feb 28, 1967	Plesetsk	A-1/2		96.9	388	388	81.2	In orbit: meteorological satellite, similar to Kosmos 122
Kosmos 145	1967 19A	USSR	Mar 3, 1967	Kap. Yar	B-1		108.6	137	1327	48.4	Decayed 3-8-68: unannounced payload
080 3	1967 20A	NASA	Mar 8, 1967	ETR	Delta	627	95.9	336	354	32.9	In orbit: solar observatory, nine experiments returning data
Kosmos 146	1967 21A	USSR	Mar 10, 1967	Tyuratam	D-1		89.2	118	193	51.5	Decayed 3-18-67: believed to be manned precursor
Kosmos 147	1967 22A	USSR	Mar 13, 1967	Plesetsk	A-1/2		89.5	123	197	65	Re-entered or decayed 3-21-67: unannounced payload
Kosmos 148	1967 23A	USSR	Mar 16, 1967	Plesetsk	B-1		91.3	171	271	71	Decayed 5-7-67: unannounced payload
Kosmos 149	1967 24A	USSR	Mar 21, 1967	Kap. Yar	B-1	1	89.8	154	185	48.4	Decayed 4-7-67: earth-oriented metsat
Kosmos 150	1967 25A	USSR	Mar 22, 1967	Plesetsk	A-1/2	1	90.1	128	232	65.7	Re-entered or decayed 3-30-67: unannounced payload
Atlantic 2 (Intelsat 2C)		CSC	Mar 22, 1967	ETR	TAD	192	1436.1	22,246	22,254	2.0	In orbit: third Intelsat II, stationed above Atlantic
Kosmos 151	1967 27A	USSR	Mar 24, 1967	Tyuratam	C-1	167.16	97.1	391	391	56	In orbit: unannounced payload
Kosmos 152	1967 28A	USSR	Mar 25, 1967	Plesetsk	B-1		92.2	176	318	71	Decayed 8-5-67: unannounced payload
None	1967 29A	USAF	Mar 30, 1967	WTR	TAT-Agena D	1	90.1	116	241	85.0	Decayed 4-17-67: classified payload
Kosmos 153	1967 30A	USSR	Apr 4, 1967	Plesetsk	A-1/2		89.3	126	181	64.6	Re-entered or decayed 4-12-67: unannounced payload
ATS 2	1967 31A	NASA	Apr 5, 1967	ETR	Atlas-Agena D	815	218.9	115	6947	28.4	In orbit: elliptical orbit prevented gravity gradient test
Kosmos 154	1967 32A	USSR	Apr 8, 1967	Tyuratam	D-1		88.5	116	144	51.6	Decayed 4-10-67: believed to be manned precursor
Kosmos 155	1967 33A	USSR	Apr 12, 1967	Tyuratam	A-1/2		B9.2	126	178	51.8	Re-entered or decayed 4-20-67: unannounced payload
None	1967 34A	USN	Apr 12, 1967	WTR	Scout		106.5	652	672	90.3	In orbit: classified payload

D-1: Proton booster plus upper stage

NAME	INT'L	PROJ.		LAUNCH D	WE	IGHT		INITIAL OR	BITAL DATA	1	074710
The state of the	DESIG.	DIR.	Date	Site	Vehicle		Period	Perigee	Apogee	Incl.	STATUS
Lambda 4S 3	None	Japan	Apr 13, 1967	Kagoshima	Lambda 4S	58	-	-1	-	-///	Failed to orbit: Japan's third attempt to orbit test satellite
Surveyor 3	1967 35A	NASA	Apr 17, 1967	ETR	Atlas-Centaur	625		Flight time	: 65.0 hours	10	Landed on moon: soil sampler, photo experiments until 5-3-67
ESSA 5	1967 36A	ESSA	Apr 20, 1967	WTR	TAD	320	113.5	840	883	101.9	In orbit: replaced ESSA 3, two AVCS cameras operational
Soyuz 1	1967 37A	USSR	Apr 23, 1967	Tyuratam	A-2		88.6	125	139	51.7	Re-entered 4-24-67: recovery attempt after 18 orbits, 26.8 hrs; failed due to fouled parachutes; V. Komarov killed
San Marco 2	1967 38A	Italy	Apr 26, 1967	10	Scout	285	94.9	135	498	2.9	Decayed 10-14-67: equatorial launch, returned air density data
None	None	USAF	Apr 26, 1967	WTR	Titan IIIB-Agena D		-	-	-	-	Failed to orbit: classified payload
Kosmos 156	1967 39A	USSR	Apr 27, 1967	Plesetsk	A-1/2	-	97	391	391	81.2	In orbit: metsat, forms operational system with Kosmos 144
Vela 7	1967 40A					509 6		67,804	69,991	32.2	In orbit: earth-oriented advanced nuclear detection satellite
Vela 8	1967 40B					509 6	734	67,238	71,674	32.1	In orbit: lags Vela 7 by 180°, both continue to transmit
ERS 18	1967 40C	USAF	Apr 28, 1967	ETR	Titan IIIC	20 2		5357	69,316	32.9	In orbit: radiation research sub-satellite, active
0V5 3	1967 40D					19 21		5357	69,316	32.9	In orbit: radiation research sub-satellite, active
0V5 1	1967 40E	2 000				14 2		5357	69,316	32.9	In orbit: materials research sub-satellite, active
Lunar Orbiter 4	1967 41A	NASA	May 4, 1967	ETR	Atlas-Agena D		721	1681	3750	85.5	Impacted on moon 10-6-67: returned 163 frames
Ariel 3	1967 42A	UK	May 5, 1967	WTR	Scout	Child State	95.6	306	373	80.2	In orbit: first all-British research satellite, active
None	1967 43A	HOAF	eur la secula	MED	12. 30 .		94.3	114	488	85.1	Decayed 7-13-67: classified payload
None	1967 43B	USAF	May 9, 1967	WTR	LTTAT-Agena D		98.3	345	500	85.0	In orbit: classified payload
Kosmos 157	1967 44A	USSR	May 12, 1967	Tyuratam	A-1/2		89.4	126	184	51.3	Re-entered or decayed 5-20-67: unannounced payload
Kosmos 158	1967 45A	USSR	May 15, 1967	Plesetsk	C-1		100.7	528	528	74.0	In orbit: unannounced payload
Kosmos 159	1967 46A	USSR	May 17, 1967	Tyuratam	A-2-e	1	173	236	37,655	51.8	In orbit: unannounced payload
Kosmos 160	1967 47A	USSR	May 17, 1967	Tyuratam	F-1-r		88.4	88	127	49.6	Re-entered or decayed 5-18-67: FOBS flight test
None //	1967 48A	USN	May 18, 1967	WTR	Scout		107.0	667	685	89.6	In orbit: classified payload
Kosmos 161	1967 49A	USSR	May 22, 1967	Plesetsk	A-1/2		89.8	127	213	65.7	Re-entered or decayed 5-30-67: unannounced payload
None	1967 50A	USAF	May 22, 1967	WTR	Atlas Assas D		89.1	88	194	91.5	Decayed 5-30-67: classified payload
None	1967 50B	USAL	Mdy 22, 1307	WIN	Atlas-Agena D		88.3	99	121	91.4	Decayed 5-27-67: classified payload
Explorer 34	1967 51A	NASA	May 24, 1967	WTR	TAD	163 6	231	154	131,187	67.1	In orbit: IMP F, returning radiation, magnetic fields data
Molniya 1E	1967 52A	USSR	May 25, 1967	Tyuratam	A-2-e		715	286	24,737	64.8	In orbit: fifth Soviet comsat, in 12-hour orbit
ESRO 2A	None	ESRO	May 29, 1967	WTR	Scout	163	-	-	=		Failed to orbit: third stage failure foiled first ESRO launch
Surcal	1967 53B						103.5	570	582	70.0	In orbit: 20-in surveillance calibration sphere
GGSE 4	1967 53C						103.4	569	577	70.0	In orbit: gravity gradient stabilization experiment satellite
GGSE 5	1967 53D						103.4	570	575	70.0	In orbit: gravity gradient stabilization experiment satellite
None	1967 53E	USAF/USN	May 31, 1967	WTR	Thor-Agena D		103.4	569	572	69.9	In orbit: classified payload
Surcal	1967 53F					84	103.4	569	575	69.9	In orbit: navigation experiment satellite
Vone	1967 53G					N	103.4	574	575	69.9	In orbit: classified payload
None	1967 53H				100	1	103.4	573	575	69.9	In orbit: classified payload
Surcal	1967 53J						103.4	569	577	70.0	In orbit: 16-in surveillance calibration sphere
Kosmos 162	1967 54A	USSR	June 1, 1967	Tyuratam	A-1/2		89.2	125	174	51.8	Re-entered or decayed 6-9-67: unannounced payload
None	1967 55A	USAF	June 4, 1967	WTR	Atlas-Agena D		B9.3	148	157	104.8	Decayed 6-12-67: classified payload
Kosmos 163	1967 56A	USSR	June 5, 1967	Kap. Yar	B-1	- 170	93.1	162	383	48.4	Decayed 10-11-67: unannounced payload

ESRO: European Space Research Organization
GGSE: Gravity Gradient Stabilization Experiment

10: Indian Ocean

LTTAT: Long Tank Thrust Augmented Thor

NAME	INT'L	PROJ.	4	LAUNCH	DATA		INITIAL O	RBITAL DAT	A	The state of the s
NAME	DESIG.	DIR.	Date	Site	Vehicle WE	IGHT Period	Perigee	Apogee	Incl.	STATUS
Kosmos 164	1967 57A	USSR	June 8, 1967	Plesetsk	A-1/2	89.5	126	199	65.7	Re-entered or decayed 6-14-67: unannounced payload
Venera 4	1967 58A	USSR	June 12, 1967	Tyuratam	A-2-e	2438	Flight tin	ne: 128.4 day	s O	Landed on Venus 10-18-67: tx during 94-min descent
Kosmos 165	1967 59A	USSR	June 12, 1967	Plesetsk	B-1	102.1	131	958	81.9	Decayed 1-15-68: unannounced payload
Mariner 5	1967 60A	NASA	June 14, 1967	ETR	Atlas-Agena D	540	Helioc	entric Orbit		In solar orbit: 2480-mi Venus flyby 10-19-67; continues to tx
Kosmos 166	1967 61A	USSR	June 16, 1967	Kap. Yar	B-1	92.9	176	359	48.4	Decayed 10-25-67: performed solar radiation experiments
None	1967 62A	USAF	lune 16 1067	WTR	LTTAT-Agena D	89.9	112	222	80.1	Decayed 7-20-67: classified payload
None	1967 62B	USAF	June 16, 1967	WIN	LITAT-Agena D	94.8	313	321	80.2	Decayed 10-22-68: classified payload
Kosmos 167	1967 63A	USSR	June 17, 1967	Tyuratam	A-2-e	89.2	125	178	51.8	Re-entered or decayed 6-25-67: unannounced payload
None	1967 64A	USAF	June 20, 1967	WTR	Titan IIIB-Agena D	89.8	88	175	111.5	Decayed 6-30-67: classified payload
Secor 9	1967 65A	USA/	June 29, 1967	WTR	Thor-Burner II	45 172.1	2362	2451	89.8	In orbit: geodetic satellite, continues location survey
Aurora 1	1967 65B	USN	Julie 23, 1307	WIN	Thur-burner II	47 172.1	2370	2458	89.8	In orbit: investigating formation of Aurora Borealis
IDCSP 16	1967 66B	USAF	and harden mi	3.0	THE PERSON	100 - 1309.8	20,509	20,846	7.2	In orbit: initial defense communication satellite
IDCSP 17	1967 66C	USAF				100 1311.6	20,542	20,857	7.2	In orbit: initial defense communication satellite
IDCSP 18	1967 66D	USAF	Lub. 1 1007	ETR	The III	100 1313.5	20,582	20,866	7.2	In orbit: completes global IDCSP system
DATS 1	1967 66E	USAF	July 1, 1967	EIN	Titan IIIC	150 1315	20,620	20,875	7.2	In orbit: electronically despun antenna test satellite
DODGE	1967 66F	USN			10.1	430 1317	20,661	20,884	7.2	In orbit: DOD gravity-gradient experiment satellite
LES 5	1967 66G	USAF				225 1319	20,692	20,894	7.2	In orbit: conducting tactical military communication tests
Kosmos 168	1967 67A	USSR	July 4, 1967	Tyuratam	A-1/2	89.1	124	167	51.8	Re-entered or decayed 7-12-67: unannounced payload
Surveyor 4	1967 68A	NASA	July 14, 1967	ETR	Atlas-Centaur	625	Flight time	: 63.0 hours		Impacted on moon 7-16-67: Signal lost 2.5 min before landing
Kosmos 169	1967 69A	USSR	July 17, 1967	Tyuratam	F-1-r	87.6	89	129	50	Re-entered or decayed 7-17-67: FOBS flight test
Explorer 35	1967 70A	NASA	July 19, 1967	ETR	TAD	230 692.3	464	4812	146.3	In lunar orbit: measures earth's magnetic tail every 29.5 days
None	1967 71A	USAF	July 24, 1967	WTR	TAT-Agena D	94.3	296	428	75.0	In orbit: classified payload
OV1 11	None					297 -	-	2	-	Failed to orbit: propulsion system malfunctioned
OV1 86	1967 72A	USAF	July 27, 1967	WTR	Atlas D	231 95.5	346	431	101.6	In orbit: four experiments including cosmic ray telescope
OV1 12	1967 72D					310 95.4	309	428	101.7	In orbit: flare activated radiological observatory
0G0 4	1967 73A	NASA	July 28, 1967	WTR	TAT-Agena D	1216 98.1	256	564	86.0	In orbit: tape recorder failed 1-19-69; spacecraft exceeded expected lifeting
Kosmos 170	1967 74A	USSR	July 31, 1967	Tyuratam	F-1-r		90	129	50	Re-entered or decayed 7-31-67: FOBS flight test
Lunar Orbiter 5	1967 75A	NASA	Aug 1, 1967	ETR	Atlas-Agena D	860 495	122	3738	85	Impacted moon 1-31-68: completed Lunar Orbiter photographic mapping
None	1967 76A	USAF	Aug 7, 1967	WTR	LTTAT-Agena D	89.9	116	220	80.0	Decayed 9-1-67: classified payload
Kosmos 171	1967 77A	USSR	Aug 8, 1967	Tyuratam	F-1-r		90	137	50	Re-entered or decayed 8-8-67: FOBS flight test
Kosmos 172	1967 78A	USSR	Aug 9, 1967	Tyuratam	A-1/2	89.4	126	187	51.8	Re-entered or decayed 8-17-67: unannounced payload
None	1967 79A	USAF	Aug 16, 1967	WTR	Titan IIIB-Agena D	89.4	77	201	111.6	Decayed 8-29-67: classified payload
None	1967 80A	USAF	Aug 22, 1967	WTR	Thor-Burner II	102.2	516	557	99.0	In orbit: classified payload
Kosmos 173	1967 81A	USSR	Aug 24, 1967	Plesetsk	B-1	92.3	174	328	71	Decayed 12-17-67: unannounced payload
Kosmos 174	1967 82A	USSR	Aug 31, 1967	Tyuratam	А-2-е	715	311	24,699	64.5	In orbit: believed to be comsat failure
Biosatellite 2	1967 83A	NASA	Sept 7, 1967	ETR	TAD	1120 90.8	188	203	33.5	Re-entered 9-9-67: biological capsule recovered after 44.9 hrs
Surveyor 5	1967 84A	NASA	Sept 8, 1967	ETR	Atlas-Centaur	616	Flight tin	ne: 64.8 hours	S	Landed on moon: returned 19,000 photos, soil analysis data
Kosmos 175	1967 85A	USSR	Sept 11, 1967	Plesetsk	A-1/2	92.2	130	240	72.9	Re-entered or decayed 9-19-67: unannounced payload
Kosmos 176	1967 86A	USSR	Sept 12, 1967	Plesetsk	B-1	102.5	128	982	81.9	Decayed 3-3-68: unannounced payload
None	1967 87A	USAF	Sept 15, 1967	WTR	LTTAT-Agena D	89.8	102	195	80.1	Decayed 10-4-67: classified payload
Kosmos 177	1967 88A	USSR	Sept 16, 1967	Tyuratam	A-1/2	89.3	126	181	51.8	Re-entered or decayed 9-24-67: unannounced payload
Kosmos 178	1967 89A	USSR	Sept 19, 1967	Tyuratam	F-1-r		90	127	50	Re-entered or decayed 9-19-67: FOBS flight test
None	1967 90A	USAF	Sept 19, 1967	WTR	Titan IIIB-Agena D	89.9	78	222	106.1	Decayed 9-30-67: classified payload
Kosmos 179	1967 91A	USSR	Sept 22, 1967	Tyuratam	F-1-r		90	129	50	Re-entered or decayed 9-22-67: FOBS flight test
	Tast Catall		John EE, 1007							The strategy of a settly of or 2.2-07. I obt ingit test
ATC. Dannin Anto	Tour Const	(Zam)				_				

DATS: Despun Antenna Test Satellite

DODGE: DOD Gravity Experiment

NAME	INT'L	PROJ.		LAUNCH	DATA		INITIAL OF	RBITAL DAT	Α	CTATHO	
WAWE	DESIG.	DIR.	Date	Site	Vehicle WEI	Period	Perigee	Apogee	Incl.	STATUS	
None	1967 92A	USAF/ USN	Sept 25, 1967	WTR	Scout	106.8	647	693	89.3	In orbit: classified payload	
Kosmos 180	1967 93A	USSR	Sept 26, 1967	Plesetsk	A-1/2	90.1	132	230	72.9	Re-entered or decayed 10-4-67: unannounced payload	
Pacific 2 (Intelsat 2D)	1967 94A	CSC	Sept 27, 1967	ETR	TAD 1	92 1439.5	22,220	22,245	0.9	In orbit: transpacific communication service initiated 11-4-67	
Molniya 1F	1967 95A	USSR	Oct 3, 1967	Tyuratam	A-2-e	712	289	24,606	65	In orbit: sixth Soviet comsat, in 12-hour orbit	
None	1967 96A	USAF	Oct 11, 1967	WTR	Thor-Burner II	101.1	415	536	99.2	In orbit: classified payload	
Kosmos 181	1967 97A	USSR	Oct 11, 1967	Plesetsk	A-1/2	89.7	124	214	65.6	Re-entered or decayed 10-18-67: unannounced payload	
Kosmos 182	1967 98A	USSR	Oct 16, 1967	Tyuratam	A-1/2	89.9	130	221	65	Re-entered or decayed 10-24-67: unannounced payload	
Kosmos 183	1967 99A	USSR	Oct 18, 1967	Tyuratam	F-1-r	87.4	90	132	50	Re-entered or decayed 10-18-67: FOBS flight test	
OSO 4	1967 100A	NASA	Oct 18, 1967	ETR	Delta 5	95.7	334	354	32.9	In orbit: returned 1st pictures of sun in extreme ultraviolet	
Molniya 1G	1967 101A	USSR	Oct 22, 1967	Tyuratam	A-2-e	714	283	24,693	64.7	In orbit: seventh Soviet comsat	
Kosmos 184	1967 102A	USSR	Oct 25, 1967	Plesetsk	A-1/2	97.1	395	395	81.2	In orbit: fourth Soviet weather satellite	
None	1967 103A	USAF	Oct 25, 1967	WTR	Titan IIIB-Agena D	89.5	78	235	111.4	Decayed 11-5-67: classified payload	
Kosmos 185	1967 104A	USSR	Oct 27, 1967	Tyuratam	X-1-m	98.7	324	552	64.1	In orbit: unannounced payload, probable metsat	
Kosmos 186	1967 105A	USSR	Oct 27, 1967	Tyuratam	A-2	88.7	130	146	51.7	Re-entered 10-31-67: docked with Kosmos 188; 1st automatic docking	
Kosmos 187	1967 106A	USSR	Oct 28, 1967	Tyuratam	F-1-r	87.4	90	130	50	Re-entered or decayed 10-28-67: FOBS flight test	
Kosmos 188	1967 107A	USSR	Oct 30, 1967	Tyuratam	A-2	89.0	124	171	51.7	Re-entered 11-2-67: target vehicle for docking with Kosmos 186	
Kosmos 189	1967 108A	USSR	Oct 30, 1967	Plesetsk	C-1	95.7	332	373	74	In orbit: unannounced payload	
None	1967 109A	HEAF	N 2 1007	WITD	ATTAT A D	90.7	116	272	81.5	Decayed 12-2-67: classified payload	
None	1967 109B	USAF	Nov 2, 1967	WTR	LTTAT-Agena D	94.3	281	327	81.6	In orbit: classified payload	
Kosmos 190	1967 110A	USSR	Nov 3, 1967	Plesetsk	A-1/2	89.8	125	216	65.7	Re-entered or decayed 11-11-67: unannounced payload	
ATS 3	1967 111A	NASA	Nov 5, 1967	ETR	Atlas-Agena D 8	05 1436.4	22,228	22,254	0.4	In orbit: tx color, b&w photos of entire earth's disc	
Surveyor 6	1967 112A	NASA	Nov 7, 1967	ETR	Atlas-Centaur 6	17	Flight time	: 65.4 hours		Landed on moon: performed 1st rocket takeoff from moon	
Apollo 4	1967 113A	NASA	Nov 9, 1967	ETR	Saturn V 278,6	99 88.3	114	119	32.6	Re-entered 11-9-67: successful 1st flight of Apollo/Saturn V	
ESSA 6	1967 114A	ESSA	Nov 10, 1967	WTR	TAD 2	90 114.8	876	925	102.1	In orbit: returning photos of cloud cover every 6 min	
Kosmos 191	1967 115A	USSR	Nov 21, 1967	Plesetsk	B-1	92.2	175	322	71	Decayed 3-2-68: unannounced payload	
Kosmos 192	1967 116A	USSR	Nov 23, 1967	Plesetsk	C-1	99.9	472	472	74	In orbit: unannounced payload	
Kosmos 193	1967 117A	USSR	Nov 25, 1967	Plesetsk	A-1/2	89.9	126	220	65.7	Re-entered or decayed 12-3-67: unannounced payload	
Wresat 1	1967 118A	Austr.	Nov 29, 1967	Woomera	Sparta 1	00 95.7	106	777	83.2	Decayed 1-10-68: returned solar radiation and upper atmospheric data	
Kosmos 194	1967 119A	USSR	Dec 3, 1967	Plesetsk	A-1/2	89.7	127	207	65.7	Re-entered or decayed 12-11-67: unannounced payload	
0 V 3 6	1967 120A	USAF	Dec 4, 1967	WTR	Scout 2	22 92.9	252	271	90.6	In orbit: conducted ionospheric studies; tx ended 5th day	
None	1967 121A	USAF	Dec 5, 1967	WTR	Titan IIIB-Agena D	90.2	88	266	109.5	Decayed 12-16-67: classified payload	
None	1967 122A	USAF	Dec 9, 1967	WTR	LTTAT-Agena D	88.4	94	154	81.6	Decayed 12-25-67: classified payload	
Pioneer 8	1967 123A	NAGE	D 40 4000		1	45	1.0 AU	1.1AU		In solar orbit: studying solar radiation, earth's magnetosphere	
TTS 1	1967 123B	NASA	Dec 13, 1967	ETR	TAD	44 92.3	182	300	32.9	Decayed 4-28-68: tested Apollo tracking network	
Kosmos 195	1967 124A	USSR	Dec 16, 1967	Plesetsk	A-1/2	90,1	131	233	65.7	Re-entered or decayed 12-23-67: unannounced payload	
Kosmos 196	1967 125A	USSR	Dec 19, 1967	Kap. Yar	B-1	95.5	140	551	49	Decayed 7-7-68: unannounced payload	
Kosmos 197	1967 126A	USSR	Dec 27, 1967	Kap. Yar	B-1	91.5	137	314	48.5	Decayed 1-30-68: unannounced payload	
Kosmos 198	1967 127A	USSR	Dec 28, 1967	Tyuratam	X-1-m	89.8	165	175	65.1	In orbit: maneuvered unannounced payload	

X-1-m: Unidentified booster with orbital and maneuverable stages

Wresat: Weapons Research Establishment Satellite

TTS: Test and Training Satellite

Austr: Australia

200	INT'L	PROJ.		LAUNCH DA	TA O	1	INITIAI	/CURRENT	T* ORBITAL	DATA	30.3
NAME	DESIG.	DIR.	Date	Site	Vehicle	- WEIGHT -	Period	Perigee	Apogee	Incl.	STATUS
Surveyor 7	1968 1A	NASA	Jan 7, 1968	ETR	Atlas-Centaur	2288	77	Flight time	66.5 hours	- 100	Landed on moon 1-10-68: Surveyor program ends with 5th success in 7 tries
Explorer 36	1968 2A	NASA	Jan 11, 1968	WTR	TAID	460	112.2	671	976	105.8	In orbit: GEOS 2 returning geodetic data
Kosmos 199	1968 3A	USSR	Jan 16, 1968	Plesetsk	A-1/2	700	90.2	127	240	65.7	Decayed 2-1-68: unannounced payload; probable recovery attempt failed
None	1968 4A	USAF	Jan 17, 1968		TAT - Agena D		94.5	284	335	75.1	In orbit: classified payload
None	1968 5A	USAF	Jan 18, 1968	WTR	Titan IIIB-Agena D		90,1	84	265	111.5	Decayed 2-4-68; classified payload
Kosmos 200	1968 6A	USSR	Jan 20, 1968	Plesetsk	C-1		95.2	333	333	74	In orbit: unannounced payload
Apollo 5	1968 7A	NASA	Jan 22, 1968	ETR	Uprated Saturn I	31,700	89.5	101	138	31.6	Ascent stage decayed 1-24-68, descent stage 2-12-68: successful LM 1st flight to
None	1968 8A	7002002	7 12 10 10 10 10	MARK!	Table 1		90.6	109	270	81.4	Decayed 2-27-68: classified payload
None	1968 8B	USAF	Jan 24, 1968	WTR	LTTAT-Agena D		94.7	291	338	81.6	In orbit: classified payload
Kosmos 201	1968 9A	USSR	Feb 6, 1968	Tyuratam	A-1/2	17770	89.9	130	221	65	Re-entered or decayed 2-14-68: unannounced payload
Kosmos 202	1968 10A	USSR	Feb 20, 1968	Kap. Yar	B-1		91.5	137	312	48.4	Re-entered or decayed 3-24-68: unannounced payload
Kosmos 203	1968 11A	USSR	Feb 20, 1968	Plesetsk	C-1		101.4	746	746	74.08	In orbit: unannounced payload
None	1968 12A	USAF	Mar 1, 1968	WTR	Scout	3/7	106.9	640	711	89.9	In orbit: classified payload
Zond 4	1968 13A	USSR	Mar 2, 1968	Tyuratam	D-1-e	110	89.5	131	180	51.6	Launched into undisclosed trajectory from initial parking orbit: probable precursor to manned lunar mission
0G0 5	1968 14A	NASA	Mar 4, 1968	ETR	Atlas-Agena D	1347	3795.9	180	91,260	31	In orbit: 23 of 24 experiments returning data
Kosmos 204	1968 15A	USSR	Mar 5, 1968	Plesetsk	B-1	111	95.9	175	542	71	In orbit: unannounced payload
Kosmos 205	1968 16A	USSR	Mar 5, 1968	* Plesetsk	A-1/2	7	89.4	125	193	65.7	Re-entered or decayed 3-13-68: unannounced payload
Explorer 37	1968 17A	USN/NASA	Mar 5, 1968	WI	Scout	198	98.7	324	545	59.4	In orbit: Solar Explorer B returning radiation data despite off-nominal orbit
None	1968 18A	USAF	Mar 13, 1968	WTR	Titan IIIB-Agena D		89.9	82	260	99.9	Decayed 3-24-68: classified payload
Kosmos 206	1968 19A	USSR	Mar 14, 1968	Plesetsk	A-1/2		97	391	391	81	In orbit: metsat; returning weather and infrared photos, thermal data
None	1968 20A	110.5	10. 11.124	100	A		90.2	114	242	83.0	Decayed 4-10-68: classified payload
None	1968 20B	USAF	Mar 14, 1968	WTR	LTTAT-Agena D		94.6	299	326	83.1	In orbit: classified payload
Kosmos 207	1968 21A	USSR	Mar 16, 1968	Plesetsk	A-1/2		89,8	130	213	65.6	Re-entered or decayed 3-24-68: unannounced payload
Kosmos 208	1968 22A	USSR	Mar 21, 1968	Tyuratam	A-1/2		89.4	129	190	65.0	Re-entered or decayed 4-2-68: unannounced payload
Kosmos 209	1968 23A	USSR	Mar 22, 1968	Tyuratam	X-1-m		89.6	155	175	65.1	In orbit: unannounced payload; maneuvered to 556/590-mile orbit
Kosmos 210	1968 24A	USSR	Apr 3, 1968	Plesetsk	A-1/2		90,3	135	245	81.2	Re-entered or decayed 4-11-68: unannounced payload
Apollo 6	1968 25A	NASA	Apr 4, 1968	ETR	Saturn V	84,900	88,2	111	226	32.5	CM re-entered 4-4-68: spacecraft performed well despite Saturn V 1st stage "pogo" effect, 2nd stage engine malfunction, 3rd stage failure to restart
OV1 13	1968 26A	unte		146000	28 27	235	199.5	341	5792	100	In orbit: measuring radiation below 5000 mi; conducting engr'g experiments
0V1 14	1968 26B	USAF	Apr 6, 1968	WTR	Atlas F	222	207.8	343	6193	100	In orbit: measured radiation; power system failed after 1 week
Luna 14	1968 27A	USSR	Apr 7, 1968	Tyuratam	A-2-e	1.0	160	99	541	42.0	In lunar orbit: studying earth-moon mass relationship, moon's gravitational field
Kosmos 211	1968 28A	USSR	Apr 9, 1968	Plesetsk	B-1	(1)	102.5	130	978	81.9	Decayed 11-10-68: unannounced payload
Kosmos 212	1968 29A	USSR	Apr 14, 1968	Tyuratam	A-2	13-16,000	88,75	130	149	51.7	Soft-landed 4-19-68: docked with Cosmos 213, 2nd Soviet docking
Kosmos 213	1968 30A	USSR	Apr 15, 1968	Tyuratam	A-2	13-16,000	89.16	127	181	51.4	Soft-landed 4-20-68: passive target for Cosmos 212; orbited together 3 hrs 50 mi
None	1968 31A	USAF	Apr 17, 1968	WTR	Titan IIIB-Agena D	111	90,1	83	265	111.5	Decayed 4-29-68: classified payload
Kosmos 214	1968 32A	USSR	Apr 18, 1968	Plesetsk	A-1/2	2	90.3	131	250	81.4	Re-entered or decayed 4-26-68: unannounced payload
Kosmos 215	1968 33A	USSR	Apr 19, 1968	Kap. Yar	B-1		91,1	162	265	48.5	Decayed 6-30-68: spin-stabilized radiation observatory carried 8 small telescopes
Kosmos 216	1968 34A	USSR	Apr 20, 1968	Tyuratam	A-1/2		89.1	124	172	51.8	Re-entered or decayed 4-28-68: unannounced payload
A Linear Sun				7,0,0,0			1339			FF1133	(mil)

D-1-e: Proton booster plus upper and escape stages

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NAME	INT'L	PROJ.		LAUNCH D	ATA WEIGHT	INITIAL	INITIAL/CURRENT* ORBITAL DATA		. DATA	CTATUS
IVAIVIL	DESIG.	DIR.	Date	Site	Vehicle	Period	Perigee	Apogee	Incl.	STATUS
Molniya 1H	1968 35A	USSR	Apr 21, 1968	Tyuratam	A-2-e	713	286	24,668	65	In orbit: 8th Molniya comsat in Orbita network
Kosmos 217	1968 36A	USSR	Apr 24, 1968	Tyuratam	X-1-m	93,4	246	323	62.2	Re-entered or decayed 4-26-68: unannounced payload
Kosmos 218	1968 37A	USSR	Apr 25, 1968	Tyuratam	F-1-r		89	130	50	Re-entered or decayed 4-25-68: possible FOBS re-entry test
Kosmos 219	1968 38A	USSR	Apr 26, 1968	Kap. Yar	B-1	104.7	138	1100	48.4	In orbit: unannounced payload
None	1968 39A	USAF	May 1, 1968	WTR	LTTAT-Agena D	88.6	97	161	83	Decayed 5-15-68: classified payload
Kosmos 220	1968 40A	USSR	May 7, 1968	Plesetsk	C-1	99.2	416	472	74	In orbit: unannounced payload
Nimbus B/Secor 10	None	NASA/USA	May 18, 1968	WTR	Thorad-Agena D 1260/49	19	12	12	-	Failed to orbit: booster guidance malfunction forced payload destruc
ESRO 2B	1968 41A	ESRO	May 17, 1968	WTR	Scout 164	98.9	205	677	97.2	In orbit: returning solar and cosmic radiation data
None	1968 42A	USAF	May 22, 1968	WTR	Thor-Burner II	102.1	509	560	98.9	In orbit: classified payload
Kosmos 221	1968 43A	USSR	May 24, 1968	Kap. Yar	B-1	108.3	137	1310	48.4	In orbit: unannounced payload
Kosmos 222	1968 44A	USSR	May 30, 1968	Plesetsk	B-1	92.3	172	328	71	Decayed 10-11-68: unannounced payload
Kosmos 223	1968 45A	USSR	June 1, 1968	Plesetsk	A-1/2	90.1	132	232	72.9	Re-entered or decayed 6-9-68: unannounced payload
Kosmos 224	1968 46A	USSR	June 4, 1968	Tyuratam	A-1/2	89	124	168	51.8	Re-entered or decayed 6-12-68: unannounced payload
None	1968 47A	USAF	June 5, 1968	WTR	Titan IIIB-Agena D	90.1	93	261	110.5	Decayed 6-17-68: classified payload
Kosmos 225	1968 48A	USSR	June 12, 1968	Kap, Yar	B-1	92,2	160	329	48.4	Decayed 11-2-68: unannounced payload
Cosmos 226	1968 49A	USSR	June 12, 1968	Plesetsk	A-1/2	96.9	375	404	81,2	In orbit: 13th metsat; returning cloud cover photos & weather data
DSCS 19	1968 50A		ALL PROPERTY.		100	1335.7	20,976	21,027	0.1	In orbit: IDSCS now operational over Pacific
DSCS 20	1968 50B				100	1335,5	20,955	21,041	0.1	In orbit: supplements 18 defense comsats previously launched
DSCS 21	1968 50C				100	1335.9	20,940	21,068	0.1	In orbit: supplements 18 defense comsats previously launched
DSCS 22	1968 50D				100	1338.0	20,963	21,097	0.1	In orbit: supplements 18 defense comsats previously launched
DSCS 23	1968 50E	USAF	June 13, 1968	ETR	Titan IIIC 100	1339.6	20,953	21,148	0.1	In orbit: supplements 18 defense comsats previously launched
DSCS 24	1968 50F				100	1269.0	19,121	21,205	0.1	In orbit: supplements 18 defense comsats previously launched
DSCS 25	1968 50G				100	1345.2	20,953	21,286	0.1	In orbit: supplements 18 defense comsats previously launched
DSCS 26	1968 50H				100	1350.6	20,972	21,401	0.1	In orbit: supplements 18 defense comsats previously launched
Cosmos 227	1968 51A	USSR	June 18, 1968	Tyuratam	A-1/2	89.1	121	175	51.8	Re-entered or decayed 6-26-68: unannounced payload
lone	1968 52A					90.3	113	250	85.0	Decayed 7-16-68: classified payload
Vone	1968 52B	USAF	June 20, 1968	WTR	LTTAT-Agena D	94.1	272	321	85.1	In orbit: classified payload
Cosmos 228	1968 53A	USSR	June 21, 1968	Tyuratam	A-1/2	89.0	128	161	51.6	Re-entered or decayed 7-3-68: unannounced payload
Cosmos 229	1968 54A	USSR	June 26, 1968	Plesetsk	A-1/2	89.9	130	220	72.8	Re-entered or decayed 7-4-68: unannounced payload
Explorer 38	1968 55A	NASA	July 4, 1968	WTR	TAID 417	224	3636	3641	120.8	In orbit: Radio Astronomer Explorer 1 monitoring radio emissions from cosmic, solar, & earth sources
Cosmos 230	1968 56A	USSR	July 5, 1968	Kap. Yar	B-1	93	180	360	48.5	Decayed 11-2-68: unannounced payload
Molniya 1J	1968 57A	USSR	July 5, 1968	Tyuratam	A-2-e	715	292	24,712	65	In orbit: Ninth Molniya 1
Cosmos 231	1968 58A	USSR	July 10, 1968	Tyuratam	A-1/2	89.7	131	205	65	Re-entered or decayed 7-18-68: unannounced payload
OV1 15	1968 59A	HOAF	1.1.11.1000	wrn	411	103.8	94	1074	89.8	Decayed 11-6-68: air density-solar radiation correlation expm't.
OV1 16	1968 59B	USAF	July 11, 1968	WTR	Atlas F 601	91.0	88	316	89.7	Decayed 8-19-68: ionospheric drag expm't.
Kosmos 232	1968 60A	USSR	July 16, 1968	Plesetsk	A-1/2	89.8	126	219	65	Re-entered or decayed 7-24-68: unannounced payload
Cosmos 233	1968 61A	USSR	July 18, 1968	Plesetsk	B-1	102.1	130	960	82	In orbit: unannounced payload
Cosmos 234	1968 62A	USSR	July 30, 1968	Tyuratam	A-1/2	89.5	130	193	51.8	Re-entered or decayed 8-5-68: unannounced payload
Vone	1968 63A	USAF	Aug 6, 1968	ETR	Atlas-Agena	1436	19,686	24,769	9.9	In orbit: classified payload
A MARKET PROPERTY.				1 177		-	The Comments	- CONTRACTOR		- Parison Parison

IDSCS: Initial Defense Satellite Communication System

NAME	INT'L	PROJ.		LAUNCH	DATA TO C	*********	INITIA	2015			
NAME	DESIG.	DIR.	Date	Site	Vehicle	- WEIGHT	Period	Perigee	T* ORBITAL Apogee	Incl.	STATUS
None	1968 64A	USAF	Aug 6, 1968	WTR	Titan IIIB-Agena D		90.1	68	281	110.0	Decayed 8-16-68: classified payload
None	1968 65A	USAF	Aug 7, 1968	WTR	LTTAT	THE REAL PROPERTY.	88.4	93	157	82.0	Decayed 8-27-68: classified payload
Explorer 39	1968 66A	NASA		1/2	111	20.8	118.2	418	1574	80.6	In orbit: Air Density Explorer studying density & temperature variations at
Explorer 40	1968 66B		Aug 8, 1968	WTR	Scout	157	110.0	422	4574	00.0	intermediate latitudes
Kosmos 235	1968 67A	USSR	Aug 9, 1968	Tyuratam	A-1/2	100000	118.3	423	1574	80.6	In orbit: Injun Explorer returning radiation data
ATS 4	1968 68A	NASA	Aug 10, 1968	ETR	Atlas-Centaur	864	89.4	129	188	51.8	Re-entered or decayed 8-17-68: unannounced payload
ESSA 7	1000.004	FCCA	4 40 4000	WITTE		2000	94.5	135	480	29.0	Decayed 10-17-68: 2nd stage failure to re-start prevented reaching synchronous or
0V5 8	1968 69A	ESSA	Aug 16, 1968	WTR	Long-Tank Delta	320	114.9	889	913	101.7	In orbit: replaced ESSA 5 as primary stored data satellite in TOS System; one camera returning cloud cover photos
	None	USAF				20					Failed to orbit: materials friction experiment
Radcat	None	ARPA				396					Failed to orbit: radar calibration target
LCS	None	USAF				75					Failed to orbit: Lincoln Calibration Sphere for radar calibration experiment
Grid Sphere Drag	None	USAF	VIII - VI			10					Failed to orbit: 4 spheres for drag coefficient experiment
Orbis-Cal	None	USN/USAF	Aug 16, 1968	WTR	Atlas-Burner 2	-019	1				Failed to orbit: intended to measure effect of ionosphere on communication
Secor	None	USA				11/1/2	10.				Failed to orbit: geodetic satellite
Secor	None	USA			1	- 0					Failed to orbit: geodetic satellite
Lidos	None	USN				117					Failed to orbit: to investigate earth's sphericity and gravitational fields
RM 18	None	USAF				5					Failed to orbit: IR & TV measurements of earth's IR background
UV Radiometer	None	USAF			1.6						Failed to orbit: short wave radiation experiment
Kosmos 236	1968 70A	USSR	Aug 27, 1968	Tyuratam	C-1		96.9	373	407	56	In orbit: unannounced payload; probable navsat
Kosmos 237	1968 71A	USSR	Aug 27, 1968	Plesetsk	A-1/2		89.7	125	213	65.4	Re-entered or decayed 9-4-68: unannounced payload
Kosmos 238	1968 72A	USSR	Aug 28, 1968	Tyuratam	A-2		88.5	124	136	51.7	Decayed 9-1-68: unannounced payload; probable Soyuz precursor
Kosmos 239	1968 73A	USSR	Sept 5, 1968	Tyuratam	A-1/2		89.2	126	175	51.8	Re-entered or decayed 9-13-68: unannounced payload
None	1968 74A	USAF	Sept 10, 1968	WTR	Titan IIIB-Agena D		89,1	89	199	106.0	In orbit: classified payload
Kosmos 240	1968 75A	USSR	Sept 14, 1968	Tyuratam	A-1/2		89.3	122	182	51.8	Re-entered or decayed 9-21-68: unannounced payload
Zond 5	1968 76A	USSR	Sept 15, 1968	Tyuratam	D-1-e			116	136	51.5	Re-entered 9-21-68: first lunar flyaround, recovered from Indian Ocean
Kosmos 241	1968 77A	USSR	Sept 16, 1968	Plesetsk	A-1/2		89.7	125	213	65.4	Re-entered or decayed 9-24-68: unannounced payload
Intelsat 3	None	US	Sept 18, 1968	ETR	Long-Tank Delta	644	1000	120	210	00.4	Failed to orbit: pitch rate system malfunction forced payload destruct
None	1968 78A	USAF	C+ 10 1000	WED	TATA		90.1	111	243	83.0	In orbit: classified payload
None	1968 78B	USAF	Sept 18, 1968	WTR	TAT-Agena D		94.7	312	318	83.2	
Kosmos 242	1968 79A	USSR	Sept 20, 1968	Plesetsk	B-1		91.3	174	273	71	In orbit: classified payload
Kosmos 243	1968 80A	USSR	Sept 23, 1968	Tyuratam	A-1/2		89.6	130	198		Decayed 11-13-68: unannounced payload, probable scientific satellite
0V2 5	1968 81A	100		Printer to	The second second	450	1418	21,820	22,255	71.3	Re-entered or decayed 10-4-68: unannounced payload
0V5 2	1968 81B	UGA E	0 .00 40-5		Table Social	21.5	629.5	109		2.9	In orbit: comprehensive environmental research satellite carrying 11 expm'ts.
0V54	1968 81C	USAF	Sept 26, 1968	ETR	Titan IIIC	27.9	1435.8		22,203	26.3	In orbit: ERS 28 monitoring particle radiation
LES 6	1968 81D					360	1431.2	22,230	22,236	3.0	In orbit: ERS 21 obtaining data on heat transfer to a liquid under zero-g condition
	Tolking Co.					Chi Wall	131.2	22,119	22,236	3	In orbit: solid-state experimental military comsat



NAME	INT'L	PROJ.		LAUNCH D.	WEIGHT	INITIAL ORBITAL DATA		RBITAL DA	TA	CYATHO
The state of the s	DESIG.	DIR.	Date	Site	Vehicle	Period	Perigee	Apogee	Incl.	STATUS
Kosmos 244	1968 82A	USSR	Oct 2, 1968	Tyuratam	F-1-r		87	132	50	Re-entered or decayed 10-2-68: unannounced payload; possible FOBS re-entry test
Kosmos 245	1968 83A	USSR	Oct 3, 1968	Plesetsk	B-1	92.1	175	316	71	In orbit: unannounced payload
ESRO 1	1968 84A	ESRO	Oct 3, 1968	WTR	Scout 185	102.8	161	949	93.7	In orbit: investigating auroral phenomena & polar ionosphere
Molniya 1K	1968 85A	USSR	Oct 5, 1968	Tyuratam	A-2-e	712	304	24,606	65	In orbit: 10th Molniya 1
None	1968 86A	USAF	Oct 5, 1968	WTR	LTTAT-Agena D	94.5	301	316	75.0	In orbit: classified payload
Kosmos 246	1968 87A	USSR	Oct 7, 1968	Plesetsk	A-1/2	89.4	91	216	65.4	Re-entered or decayed 10-12-68: unannounced payload
Kosmos 247	1968 88A	USSR	Oct 11, 1968	Plesetsk	A-1/2	89.9	127	225	65.4	Re-entered or decayed 10-19-68: unannounced payload
Apollo 7	1968 89A	NASA	Oct 11, 1968	ETR	Saturn 1B 45,089	89.7	142	177	31.64	Re-entered 10-22-68: astronauts Schirra, Cunningham, & Eisele complete near-flaw 1st manned flight of Apollo spacecraft; recovered after 163 orbits, 260-2hrs
Kosmos 248	1968 90A	USSR	Oct 19, 1968	Tyuratam	X-1-m	94.8	304	342	62.3	In orbit: unannounced payload; maneuverable
Kosmos 249	1968 91A	USSR	Oct 20, 1968	Tyuratam	X-1-m	112.2	319	1353	62.4	In orbit: unannounced payload; maneuverable
None	1968 92A	USAF	Oct 22, 1968	WTR	Thor-Burner II	101.3	497	529	99.0	In orbit: classified payload
Soyuz 2	1968 93A	USSR	Oct 25, 1968	Tyuratam	A-2	88.5	115	139	51.7	Re-entered 10-28-68: rendezvous target for Soyuz 3
Soyuz 3	1968 94A	USSR	Oct 26, 1968	Tyuratam	A-2	88.6	127	140	51.4	Re-entered 10-30-68: Cosmonaut Beregovoy maneuvered to 650 ft. from Soyuz 2, landed after 64 orbits, 94.9 hrs.
Kosmos 250	1968 95A	USSR	Oct 31, 1968	Plesetsk	C-1	95.3	325	345	74	In orbit: unannounced payload; possible navsat
Kosmos 251	1968 96A	USSR	Oct 31, 1968	Tyuratam	A-1/2	89.1	123	168	65	Re-entered or decayed 11-18-68: unannounced payload
Kosmos 252	1968 97A	USSR	Nov 1, 1968	Tyuratam	X-1-m	112.5	334	1350	61.9	In orbit: unannounced payload; maneuverable
None	1968 98A	USAF	Nov 3, 1968	WTR	TAT-Agena D	88.7	92	176	82.1	Decayed 11-23-68: classified payload
None	1968 99A	USAF	Nov 6, 1968	WTR	Titan III B-Agena D	88.6	80	242	106.0	Decayed 11-20-68: classified payload
Pioneer 9	1968 100A		The second	[[1][333]	148	297.5 days		1.0 AU	100.0	In solar orbit: 8 expmts, providing data on solar radiation
TETR 2	1968 100B	NASA	Nov 8, 1968	ETR	TAID 40	97.9	232	587	32.8	
					V	01.0	202	307	32.0	In orbit: 2nd orbiting target for NASA's Manned Space flight network.
Zond 6	1968 101A	USSR	Nov 10, 1968	Tyuratam	D-1-e	100	115	130	51.4	Re-entered 11-17-68: 2nd unmanned circumlunar flight, landed in USSR after
Kosmos 253	1968 102A	USSR	Nov 13, 1968	Plesetsk	A-1/2	89.9	128	221	65.4	double-dip glide re-entry, aerodynamic lift for deceleration
Proton 4	1968 103A	USSR	Nov 16, 1968	Tyuratam	D 37,500	91.75	158	308	31.5	Re-entered or decayed 11-18-68: unannounced payload
Kosmos 254	1968 104A	USSR	Nov 21, 1968	Plesetsk	A-1/2	89.8	126	217	65.4	In orbit: performing cosmic ray measurements
Kosmos 255	1968 105A	USSR	Nov 29, 1968	Plesetsk	A-1/2	89.7	125	209	65.4	Re-entered or decayed 11-29-68: unannounced payload
Kosmos 256	1968 106A	USSR	Nov 30, 1968	Plesetsk	C-1	109.3	726	767	74.06	Re-entered or decayed 12-8-68: unannounced payload
Kosmos 257	1968 107A	USSR	Dec 3, 1968	Plesetsk	B-1	91.7	175	292	74.06	In orbit: unannounced payload
None	1968 108A	USAF	Dec 4, 1968	WTR	Titan III B-Agena D	91.9	83	375	106.1	In orbit: unannounced payload
HEOS 1	1968 109A	ESRO	Dec 5, 1968	ETR	TAID 238	6792.7	2696	The second	0.000000	Decayed 12-12-68: classified payload
0A0 2	1968 110A	NASA	Dec 7, 1968	ETR	Atlas Centaur 4446	100	479	139,453	28.2 34.99	In orbit: studying magnetic fields outside earth's magnetosphere
Kosmos 258	1968 111A	USSR	Dec 10, 1968	Tyuratam	A-1/2	89.6	130	202		In orbit: 11 telescopes studying stars in ultraviolet, infrared, X, & gamma rays
None	1968 112A	00011	Dec 10, 1300	Tyuratani	N-1/2	88.6	109		65	Re-entered or decayed 12-18-68: unannounced payload
None	1968 112B	USAF	Dec 12, 1968	WTR	LTTAT-Agena D	114.4	862	148	81.0	Decayed 12-28-68: classified payload
Kosmos 259	1968 113A	USSR	Dec 14, 1968	Kap. Yar	B-1	100.3	136	916	80.3	In orbit: classified payload
ESSA 8	1968 114A	ESSA	Dec 14, 1968	WTR	785	114.6	880	841	48.5	In orbit: unannounced payload
Kosmos 260	1968 115A	USSR	Dec 15, 1968	Tyuratam	Long-Tank Delta 290 A-1/2	712	311	910	101.8	In orbit: 2 APT cameras sending cloud cover photos every 6 min.
Intelsat 3A	1968 116A	CSC		7177 114 1	APPLY 1	1436		24,606	65	In orbit: unannounced payload; possible Molniya failure
Kosmos 261	Committee (Inchies his	1 Comment	Dec 18, 1968	ETR	THE PARTY OF THE P	93.1	22,244	22,257	0.71	In orbit: first global commercial comsat, stationed off coast of Brazil
Rushius 201	1968 117A	USSR	Dec 20, 1968	Plesetsk	B-1	33,1	135	416	71	In orbit: Soviet bloc joint expmts. in air density, polar auroras
Apollo 8	1968 118A	NASA	Dec 21, 1968	ETR	Saturn V 63,650	88.15	114	118	32.6	Re-entered 12-27-68: 1st manned circumlunar flight; astronauts Borman, Lovell, & Anders recovered in mid Pacific after 10 lunar orbits, 147 hrs.
Kosmos 262	1968 119A	USSR	Dec 26, 1968	Kap. Yar	B-1	95.2	163	508	48.5	In orbit: unannounced payload

BOX SCORE OF U.S. SPACECRAFT LAUNCHES



NASA's new Long-Tank Delta, shown here launching ESSA 8 from WTR, also launched ESSA 7 and Intelsat 3A during the latter half of 1968.

LAUNCH RATING: 847 As of 31 December 1968

Classified payloads listed by launch vehicle

*Payload(s) injected into orbit

Atlas-Agena B Discoverer 36 Mercury-Atlas 5 Ranger 2 Transit 48 Discoverer 35 Discoverer 34 Midas 4 Discoverer 32 Discoverer 31 Mercury-Atlas 4 Discoverer 30 Discoverer 29 Explorer 13 Ranger 1 Explorer 12 Midas 3 Tiros 3 Discoverer 25 Transit 4A Discoverer 25 Explorer 11 Discoverer 23 Explorer 10 Transit 3B Discoverer 21 Discoverer 20 Explorer 9 Samos 2 Atlas-Agena B Mercury-Scout 1 Discoverer 33 Samos 3 Discoverer 28 Discoverer 27 Explorer 5-55 Discoverer 24 Scout Explorer S-45A Mercury-Atlas 3 Discoverer 22 Explorer S-45 SUCCESSES: 8 "SUCCESSES: 7 "SUCCESSES: 11 "SUCCESSES: 16 "SUCCESSES: 25 SUCCESSES: 52 *SUCCESSES: 37 *SUCCESSES: 54 *SUCCESSES: 62 FAILURES: 12 FAILURES: 7 TOTAL: 41

Discoverer 19

Discoverer 18

Discoverer 17

Discoverer 15

Discoverer 14

Discoverer 13

Discoverer 11

Atlas-Able 58

Explorer S-56

Discoverer 16

Atlas-Able 5A

Discoverer 12

Explorer S-48

Discoverer 18

FAILURES: 13

1960

TOTAL . 20

1961

Courier 1A

Echo A-10

Midas 1

Transit 3A

Samos 1

Transit 1B

Transit 24

Midas 2

Tiros 1

Pioneer 5

Explorer 8

Courier 18

Echo 1

Discoverer 8

Discoverer 7

Explorer 7

Vanguard 3

Discoverer 6

Discoverer 5

Discoverer 2

Discoverer 1

Vanguard 2

Atlas-Able 4

Transit 1A

Beacon 2

Explorer S-1

Vanguard SLV 6

FAILURES: 8

1959

TOTAL - 19

Discoverer 3

Explorer 6

Pioneer 4

Score

Pioneer 1

Explorer 4

Explorer 3

Vanguard 1

Explorer 1

Pioneer 2

Beacon 1

Explorer 5

Explorer 2

FAILURES: 1

1957

TOTAL 1

Able 1

Vanguard SLV 3

Vanguard SLV 2

Vanguard TV 5

FAILURES: 10

1958

TOTAL: 17

Vanguard SLV 1 Discoverer 4

Vanguard TV 3 Vanguard TV 3a Vanguard SLV 5 Discoverer 9

Tiros 2

Pioneer 6 Gemini 6 TAT-Agena D FR 1 Transit 5A TAT-Agena D Gemini 7 Explorer 15 Explorer 26 Alouette 2 et al Thor-Agena D TAT-Agena D Explorer 30 Relay 1 San Marco 1 Atlas-Agena D Thor-Agena D Thor-Able Star Explorer 29 Thor-Avena D Atlas-Agena D TAT-Agena D Thor-Agena B Mariner 4 OV2 1/LCS 2 Atlas-Agena B Explorer 24 & 25 060 2 Thor-Agena B TAT-Agena B TAT-Agena D Anna 18 Explorer 23 0V1 2 Explorer 15 Mariner 3 Atlas-Agena D Starad TAT-Agens D TAT-Agena D Ranger 5 TAT-Agena D Thor-Altair Thor-Agena B Atlas-Agena D Mercury-Atlas 8 TAT-Agena D Gemini 5 TAT-Agena D TAT-Agena D Explorer 14 Explorer 22 Tires 8 Surcal et al Thor-Agena D Thor-Able Star Explorer 19 Atlas-Centaur 6 TAT-Agena D Alouette 1 Atlas-Agena D Secor 5 Tiras 6 Explorer 21 Thor-Able Star Atlas-Agena D Thor-Agena B Atlas-Agena D Thor-Agena D Pagasus 3 Thor-Agena B Saturn SA-7 Explorer 18 Vela 5 & 6 Thor-Agena D TAT-Agena D TAT-Agena D TAT-Agena D 0G0 1 Mariner 2 Atlas-Agena D TAT-Agena D Nimbus T Scout Vela 1 & 2 Tiros 10 Atlas-Agena B Explorer 20 Thor-Able Star TAT-Agena D Atlas-Agena D Thor-Agena D TAT-Avena D Thor-Able Star Thor-Agena B Syncom 3 Atlas-Agena D TAT-Agena D Thor-Agena B Atlas-Agena D Thor-Agena D Gemini 4 TAT-Agena D Atlas-Agena B TAT-Agena D Teistar 1 Ranger 7 Explorer 28 TAT-Agena D Vels 3 2 4 Atlas-Agena D Thor-Agena D Syncom 2 Pegasus 2 TAT-Agena D Thor-Agena B Atlas-Agena B Thor-Altair Atlas-Agena D Tiros 5 Thor-Agena D. TAT-Agena D TAT-Agens D Thor-Agena B Atlas-Agena D TAT-Agena D LES 2, LCS 1 Atlas-Agena B TAT-Agena B Thor-Agena D TAT-Agena D Thor-Agena B Geophysical Thor-Agena B TAT-Agena D Explorer 27 Research TAT-Agena D Atlas-Agena D Mercury-Atlas 7 Satellite Scout Early Bird Thor-Agena B TAT-Agena D Saturn SA-6 Snapshot Thor-Agena B Tiros 7 Atlas-Agena D TAT-Agena D Atias-Agena B Scout Ariel 1 TAT-Agena D Gemini 3 Thor-Agena D Atlas-Agena B Ranger 4 Ranger 9 TAT-Agena D Ther-Agena B Gemini-Titan 1 Ther-Altair TAT-Agena D Atlas-Agena B Ariel 2 Atlas-Agena D Mercury-Atlas 9 Atlas-Agena D Atlas-Agena B Thor-Able Star Atlas-Agena B TAT-Agena D 050 1 GGSE 2 & 3 et al Telstar 2 Atlas-Agena D Discoverer 38 TAT-Agena D Explorer 17 Thor-Agena R TAT-Agenz D Ranger 8 Thor-Agena D Mercury-Atlas 6 Ranger 6 Pegasus 1 Scout Echo 2 Tiros 4 LES 1 Syncom 1 Ranger 3 Relay 2 0S0 2 Thor-Agena D Thor-Agena D Atlas-Agena D Thor-Agena D TAT-Agena B Tires 9 Thor-Aitair Thor-Agena D Atlas-Agena D TAT-Agena D Atlas-Agena B Scout Environmental Mariner 1 Atlas-Agena B Sciences Gemini 6 Target Thor-Agena D Research TAT-Agena D Anna 1A Scout Satellite OSO C Solrad 4B Scout Thor-Able Star Atlas-Agena D Composite 1 Thor-Agena D TAT-Agena D 0V1 3 Discoverer 37 Thor-Agena D Beacon Explorer A OV1 1

FAILURES: 8

1963

TOTAL: 45

TOTAL: 59

1962

FAILURES: 5

1964

TOTAL: 59

FAILURES: 6

1965

TOTAL: 68

TAT-Agena D LES 3 & 4 et al Lunar Orbiter 2 OV4 3 et al Atlas-Agena D DV3 2 Intelsat 24 Atlas-Agena D Secor 8 ESSA 3 LTTAT-Agena D Titan IIIB-Agena D Surveyor 2 Atlas-Agena D Thor-Burner II Gemini 11 Gemini 11 Target Secor 7, ERS 15 Scout Pioneer 7 Atlas-Agena B Lunar Orbiter 1 Thorad-Agena D 0V3 3 Titan IIIB-Agena D Gemini 10 Gemini 10 Target 0V1 8 Atlas-Agena D Explorer 33 Pageos TAT-Agena D IDSCS 1-7, GGTS1 0V3 4 Secor 6, ERS 16 060 3 Atlas-Agena D Gemini 9 Gemini 9 Target B Surveyor 1 Explorer 32 TAT-Agena D Nimbus 2 Atlas-Agena D 0V3 1 Atlas-Agena D 0A0 1 TAT-Agens D Thor-Altair 0V148 5 Scout Atlas-Agena D Gemini 8 Gemini 8 Target TAT-Agena D ESSA 2 Atlas-Agena D TAT-Agena D ESSA 1 TAT-Agena D Scout Atlas-Agena D IDCSP

Gemini 9 Target A

DV3 5

"SUCCESSES: 59

1967

FAILURES: 3

TOTALS: 62

TAT-Agena D

SUCCESSES: 70

1966

FAILURES: 4

TOTALS: 74

Thor-Altair

TAT-Agena D Biosatellite 1 Titan IIIB-Agena D 0V1 9 & 10

ATS 1 Atlas-Agena D

TAT-Agena D

Gamini 12

Gemini 12 Target

Pioneer 8/TTS 1 LTTAT-Agena D Titan IIIB-Agena D 0V3 B WRESAT 1 ESSA E Apollo 4 Surveyor 6 ATS 3 LTTAT-Agena D Titan IIIB-Agena D 050 4 Thor-Burner II Intelsat 20 (Pacific 2) Scout Titan IIIB-Agena D LTTAT-Agena D Surveyor 5 Biosatellite 2 Thor-Burner II Titan IIIB-Agena D LTTAT-Agena D Lunar Orbiter 5 060 4 OV1 11, 12 & 86 TAT-Agena D Explorer 35 Surveyor 4 IDSCS 16-18 et al Secor 9 & Aurora 1 Titan IIIB-Agena D LTTAT-Agena D Mariner 5 Atlas-Agena D GGSE 4 & 5 et al Explorer 34 Atlas-Agena D Scout LTTAT-Agena D Ariel 3 Lunar Orbiter 4 Vela 7 & 8 et al San Marco 2 ESSA 5 Surveyor 3 Scout ATS 2 TAT-Agena D Intelsat 2C (Atlantic 2) 050 3 Titan IIIB-Agena D TAT-Agena D Thor-Burner II Lunar Orbiter 3 Atlas-Agena D ESSA 4 IDSCS 8-15 TAT-Agena D Intelsat 2B (Pacific 1) ESRO 2A Titan IIIB-Agena D

Annile 8 Intelsat 3A FSSS R LTTAT-Agena D DAD 2 Titan IIIB-Agena D Pionner 9/TETR 2 Titan IIIB-Agena D TAT-Agena D Thor Burner II Apoilo 7 LTTAT-Agena D DV2 5 et al TAT-Agena D Titan IIIB-Agena D ESSA 7 ATS 4 Explorer 39 & 40 LTFAT Titan IIIB-Agena D Atlas-Agena OV1 15 & 18 Explorer 38 LTTAT-Agena D IDSCS 19-26 Titan IIIB-Agena D Thor-Burner II ESRO 28 LTTAT-Agena D Titan IIIB-Agena D OV1 13 & 14 Apollo 5 LTTAT-Agena D LTTAT-Agena D Titan IIIB-Agena D Explorer 37 060 5 Scout LTTAT-Agena D LTTAT-Agena D Apollo 5 Titan IIIB-Agena D TAT-Agena D Explorer 36 (GEOS 2) Surveyor 7 Intelsat 3 0V5 8 et al Nimbus B/Secor 10

SUCCESSES: 45

1968

FAILURES: 3

TOTALS: 48



SPACECRAFT TOTALS

(as of 31 December, 1968)

TOTAL SPACECRAFT ORBITED

	EARTH	LUNAR	LUNAR	LUNAR	VENUS	SOLAR	
	ORBIT	IMPACT	ORBIT	RETURN	IMPACT	ORBIT	TOTALS
UNITED STATES1	544	12	6	1		12	575
AUSTRALIA	1			-	77		1
CANADA	2	-	#	# 4	-	4	2
ESRO	3	110 11 12 11		-	-		3
FRANCE	5	***	- 4	-	140	***	5
ITALY	2			05	100	44.	2
RUSSIA ²	314	7	4	2	2	8	337
UNITED KINGDOM ³	. 3	-		- D-	**	+	3
TOTALS	874	19	10	3	2	20	928

1U. S. totals include unidentified U. S. spacecraft; do not include Atlas-Centaur, Saturn, or Titan III non-functional payloads. ²USSR totals include unidentified Russian spacecraft; do not include parking-orbit launch platforms. ³U. K. totals include Ariel, joint U. S./U. K. satellites.

SPACECRAFT CURRENTLY IN ORBIT

	EARTH ORBIT	LUNAR	SOLAR ORBIT	TOTALS
UNITED STATES	275	2	12	289
CANADA	2		*	2
ESRO	3			3
FRANCE	5			5
RUSSIA	69	4	8	81
UNITED KINGDOM	3		4	3
TOTALS	357	6	20	383

MANNED FLIGHT RECORDS

	FLIGHTS	EARTH ORBITS	LUNAR ORBITS	MAN-FLIGHTS	MAN-HOURS
UNITED STATES	16	840	10	30	3214.7
RUSSIA	10	374		13	627.4
TOTALS	26	1214	10	43	3842.1

FIRST FLIGHT: Vostok 1
FIRST EVA: Voskhod 2

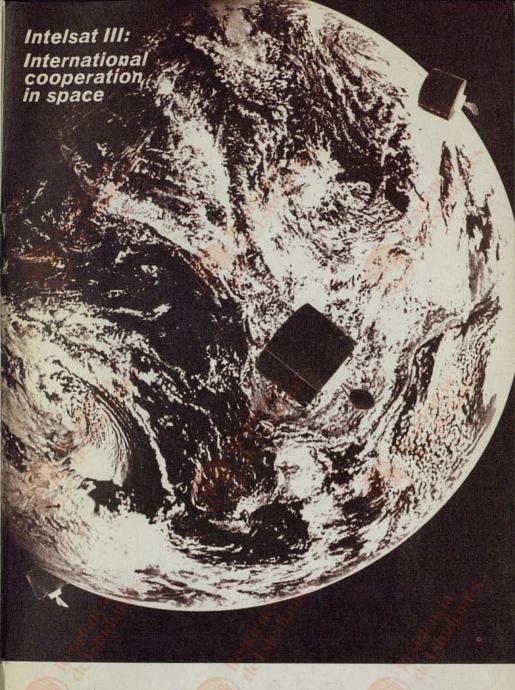
LONGEST FLIGHT: Gemini 7 (220 orbits, 330.6 hrs.)

FIRST RENDEZVOUS FLIGHT: Gemini 7/6

FIRST DOCKING FLIGHT: Gemini 8

HEAVIEST SPACECRAFT: Apollo 8 (63,650 lbs)

FIRST LUNAR FLIGHT: Apollo 8



Designed to strengthen communications between nations, Intelsat III was built by an industrial team from many countries. The team drew heavily on the experience gained by TRW's participation in 9 out of 10 U.S. space programs.

TRW's participation in 9 out of 10 U.S. space programs. Through such programs as Intelsat III, TRW has helped to establish the basis for an international exchange of advanced technologies. New international satellites...for scientific exploration, communications, education, meteorology, navigation and earth resources...will develop out

of a dialogue among people who will share the benefits of space around the world.

TRW Systems Group is a major operating unit of TRW Inc., where more than 80,000 people at over 300 locations around the world are applying advanced technology to products, systems, and

services for commercial, industrial, and government markets. TRW.

