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by

D. G. King-Hele

Eileen Quinn

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SUMMARY

All known artificial satellites launched before 1 January 1965 are listed chronologically. Lifetimes, weights, dimensions and orbital details are given for instrumented satellites and their final-stage rockets. Other fragments from satellites are listed without these details. The methods used in compiling the Table are described. Many improvements have been made since the previous issue.

1. Satellites, Earth, Artificial - Launching (1957-64).

Departmental Reference: Space 89

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1 INTRODUCTION

In 1958 the Royal Aircraft Establishment began issuing a Table of artificial satellites, giving lifetimes, weights, dimensions and orbits of all known satellites. Regular issues of this Table have continued, and an extensively revised version, incorporating about a thousand improvements and an index, was distributed in January 1965. This version, slightly amended, forms the basis of the present Report.

Table 1 below gives the number of successful satellite launchings each year and the number of resulting pieces in orbit - instrumented satellites (often with spent rockets attached), separated rockets, and other detectable fragments. Table 1 also gives a similar breakdown of the pieces still in orbit on 1 January 1965.

Table 1

Census of satellites

Year		1957	1958	1959	1960	1961	1962	1963	1964	Total
Launchings		2	6	11	18	35	68	55	87	282
Resulting pieces	Instrumented satellites	2	6	11	20	40	74	74	102	329
	Separated rockets	1	2	3	10	13	35	28	46	138
	Other fragments	2	3	1	20	236	81	65	80	488
	Total	5	11	15	50	289	190	167	228	955
Decayed		5	8	10	22	66	141	87	117	456
Still in orbit	Instrumented satellites	-	2	3	10	11	21	32	53	132
	Separated rockets	-	1	2	6	3	14	12	23	61
	Other fragments	-	-	-	12	209	14	36	35	306
	Total	0	3	5	28	223	49	80	111	499

Until 1962 the number of successful launchings in each year was approximately equal to the total number in all preceding years. The number N of launchings in year n of the Space Age, with 1957 as year 1, was given by

$$N \simeq 1{\cdot}1 \times 2^{n} \quad (1 \leqslant n \leqslant 6) \ ,$$

with a maximum error in N of 2. Since 1962 this agreeably simple law has failed, and for the past three years the number of launchings has varied between 55 and 87.

2 GUIDE TO TABLE 2

The detailed information about the individual satellites is collected in Table 2, which follows page 10 of this Report. The data given, if available, for all satellites other than fragments, are as follows.

Column 1 gives the name of the satellite and its astronomical designation. If the name of the satellite is unknown, its launching vehicle is indicated in square brackets. Doubtful entries are indicated by question marks, here and throughout the Table.

Letters to the left of the column have the following meanings:

D denotes satellites no longer in orbit on 1 January 1965.

M denotes manned satellites.

R denotes satellites which returned to earth and were successfully recovered.

r denotes satellites carrying capsules which returned to earth and were successfully recovered.

T denotes satellites still transmitting radio signals on 31 December 1964.

For the fragments, D indicates that all the fragments have decayed; 1d indicates that one has decayed; 2d indicates that two have decayed etc.

Column 2 gives the launch date, the lifetime (actual or estimated), and the descent date (if the satellite has decayed). Descent dates after the end of 1964 are in brackets. The dates are given in days and decimals of a day U.T. Thus "1958 Apr. 14.08" means "01 hr 55 min U.T. (or G.M.T.) on 14th of April 1958".

Column 3 gives the shape of the satellite and its mass in kilograms. Sometimes the shape defies description in a few words and the description given is only approximate (1 kg = 2.205 lb).

Column 4 gives the length and diameter of the satellite in metres (or just the diameter, for a spherical satellite). Since most satellites so far launched have been axially symmetric (or almost so), the length and diameter usually suffice to specify the size. Aerials, paddles carrying solar cells, and other components projecting from the main body are not taken into account when giving the size.
(1 metre = 3.281 feet.)

Column 5 gives the date to which the orbital information in columns 6-12 applies.

Column 6 gives the inclination i of the orbit to the equator (see Fig.1).

Column 7 gives the nodal period of revolution, the time interval between successive northward crossings of the equator by the satellite.

Columns 8-11 specify the size and shape of the orbit. The quantities tabulated are the semi major axis a and eccentricity e; and the perigee and apogee heights, $\{a(1-e) - R\}$ and $\{a(1+e) - R\}$ respectively, where R is the earth's equatorial radius, 6378.2 km.
(1 km = 0.6214 statute miles = 3281 ft = 0.5396 nautical miles.)

Column 12 gives the argument of perigee, ω, defined as the angle, measured round the orbit, from the northward equatorial crossing N to the perigee P, i.e. the angle NCP in Fig.1.

The names of space vehicles which have escaped from the earth's influence and do not appear in the Table are given at the ends of the appropriate pages of the Table. Fuller details of the space vehicles can be found in Ref.1.

It should be noted that the pages of the Table are numbered independently of this introductory text. The index at the end of the Table will be found useful for locating satellites known by name but not by their international designation.

3 METHODS USED

3.1 Difficulties

The chief difficulty in compiling Table 2 is the lack of information about the size, shape and weight of the majority of the satellites launched in the years 1962-4. Out of the 87 launchings in 1964, for example, 30 were of Cosmos,

Elektron or Polyot satellites, and (apart from the shape of the Cosmos and Elektron satellites[2]) no information about these satellites or their rockets seems to have been published. United States military satellites accounted for at least another 27 launchings during 1964, and no details of these satellites have been given, apart from the diameter of the Agena rockets. In contrast, full details are available of satellites launched by NASA. Our methods of combating these difficulties are outlined in section 3.4. Numerous uncertainties remain, however, and we regret the many blank entries in the Table.

3.2 Names and designations of satellites

The names given by the launching authorities are indicated whenever they are known. For unnamed United States Air Force satellites, the launching vehicle is given in square brackets. The name 'Midas' has been retained for all Agena-type satellites in near-polar, near-circular orbits at heights close to 3700 km, since observers find it useful to have a distinctive label for these satellites. The name 'Transit' has been given to those satellites in near-circular polar orbits at heights close to 1000 km which are believed to form a continuation of the navigation-satellite project formerly known as the Transit system.

Some of the names are given as initials only, and the meanings of these (for satellites launched in 1964) are as follows: GGSE = gravity gradient stabilization experiment; IMP = interplanetary monitoring platform; OGO = orbiting geophysical observatory; SECOR = sequential collation of range; SR = solar radiation; TRS = tetrahedron research satellite.

The international designation of each satellite launching is now satisfactorily allocated by the World Warning Agency on behalf of COSPAR. But the identification of particular pieces in a multiple launch has often depended on visual observations, since an experienced visual observer can often recognize the species of rocket or satellite he is looking at, and can usually distinguish easily between a satellite and its rocket. Small pieces which are, as far as is known, not instrumented satellites, are called fragments. The lists issued by the United Nations are helpful in identifying fragments.

3.3 Lifetimes

The orbits of most satellites contract slowly under the action of air drag, and the severity of the drag determines their lifetimes, which can be estimated from the rate of change of orbital period, using the theoretical formulae[3-5]. It is thus tacitly assumed that their orbits will suffer no major disturbances in the future - from the burning of residual propellants or impacts by meteors, etc. -

and that the satellites will not be swept up as space-rubbish. For most short-lived satellites (< 3 years life) the lifetime estimates are usually accurate to within 10%. For long-lived satellites (> 5 years life), the lifetimes are less certain, since they depend critically on solar activity, which controls the air density: it has been assumed that the average solar activity in future sunspot cycles will be the same as the average between 1959 and 1964, and that the dates of the next few sunspot maxima and minima are as predicted in Ref.6.

For some of the satellites in high-eccentricity orbits, such as Explorers 12, 14, 18, 21 and 26, OGO 1, and Elektrons 2 and 4, the lifetime depends primarily on luni-solar perturbations rather than air drag, and lifetime estimates are often rather uncertain for these satellites.

3.4 Weights and dimensions

The weights and dimensions of the satellites come from various sources - 'Spacewarn' telegrams, NASA Press Releases, Pravda, the satellite observing notes issued by the Radio Research Station, Slough, the International Geophysics Bulletins of the U.S. National Academy of Sciences, and other sources, including Press reports. Some indication of the accuracy of the individual weights and dimensions is given by the number of significant figures. Often it is difficult to define the 'length' of a satellite which bristles with aerials, etc, and lengths are therefore sometimes approximate.

For satellites whose weights and sizes have not been published, the following procedure can be adopted. First, the average cross-sectional area S can be approximately determined from the average brightness when observed visually; then, if the satellite is non-spherical, its length/diameter ratio can be estimated approximately from the variations in brightness. Finally the mass/area ratio m/s can be obtained from the rate of change of orbital period and the air density at perigee height. To apply this procedure to all relevant satellites would be a lengthy task, and we have used it only on small samples, assuming that all satellites of a particular type are similar.

The dimensions given in Table 2 were derived as follows. The sizes of the Cosmos and Elektron satellites and rockets have been based on the values given by Pilkington[7]. For the Vostok satellites the masses are known and mass/area ratios have been calculated from the rates of change of orbital period: this gives the effective cross-sectional area and hence the diameter if, as is probable, the Vostoks are stabilized with axis tangential to the orbit. For Agena rockets launched by the United States Air Force, the published diameter of 1·5 m has

been given; the length of the Agena rocket alone averages about 6m, but the satellites also carry payloads, which may presumably increase the length by up to about 4m. So the lengths are given as 8m? , implying 8 ± 2m.

Once the cross-sectional area is approximately known, mass/area ratio is determined from the rate of change of orbital period, and hence values are found for the masses of the satellites. The most careful estimates of m/S which we have made are for various Cosmos satellites (and two others) and are obtained from Ref.8.

They are as follows:

Satellite	m/S (kg/m^2)	Satellite	m/S (kg/m^2)
Cosmos 2	190	Cosmos 38	100
" 5	150	" 39	100
" 8	220	Star-rad (Agena)	140
" 11	170	1962 η1	290
" 25	170		
" 26	220		
" 31	170		

All the Cosmos satellites in the first column above were in orbits of 49° inclination, and since the values of m/S do not depart from 200 kg/m^2 by more than 25%, this value has been adopted for all 49° Cosmos satellites in Table 2. Several other values of m/S for Agena rockets have been calculated and generally lie fairly close to 140 kg/m^2. Similarly a number of values calculated for Cosmos rockets were close to 70 kg/m^2. The weights assigned to the various Agena and Cosmos rockets are derived from these values of m/S.

We hope that most of the weights and dimensions given with question marks are accurate to within a factor of 1·5. It seemed better to give some indication of the weights and sizes, even if approximate, than to leave blanks.

3.5 Orbital accuracy

Orbital information has come from many different sources. More than half of the orbits have been based on information issued in the United States Spadats/ Spacetrack Bulletins, while the remainder come mainly from three sources, the Smithsonian Astrophysical Observatory, NASA and R.A.E. It is impracticable to give full references, and indeed inappropriate, since many of the orbits have been smoothed and altered whenever they appeared inconsistent, following methods described previously[9].

The accuracy of the orbits varies greatly between one satellite and another, and no detailed guide can be given. Most orbits which are free of question marks, however, are believed to have an error (s.d.) of about 0.03° in orbital inclination, 0.02 min in period, 2 km in semi major axis, 4 km in perigee and apogee heights (for apogee heights less than 2000 km), 0.001 in eccentricity e, and perhaps 3° in argument of perigee (if e > 0.02). Some orbits are much more accurate than this, and some, particularly those with eccentricity exceeding 0.2 or with very short lifetimes, may be much less accurate.

4 RADIO TRANSMISSIONS

It is difficult to give precise information about radio transmissions from satellites for various reasons. Many satellites operate on command only, and the state of health of their transmitters is known only to those concerned with giving the commands. Other satellites transmit either sporadically or only when they have been in full sunlight for longer than a (variable) minimum time. Since there are so many uncertainties we have decided not to give a table of frequencies, but merely to indicate the frequencies used by various types of satellites. Details of the operating frequencies of United States non-military satellites can be found in the fortnightly NASA Satellite Situation Report.

Most scientific satellites launched by NASA operate on frequencies between 136 and 137 Mc/s: the outstanding exception is the veteran Vanguard 1, which is still transmitting while in sunlight, on 108.0 Mc/s. OGO 1 has additional frequencies near 400 Mc/s, and the Syncom communication satellites use further frequencies between 1814 and 1821 Mc/s. Satellites of the Transit and associated systems, operate either on 150 and 400 Mc/s or on the four linked frequencies 54, 162, 324 and 648 Mc/s. The Russian Cosmos satellites normally operate at frequencies near 20 Mc/s and sometimes also near 90 Mc/s.

ACKNOWLEDGMENTS

We are greatly indebted to the various sources mentioned in the text for making available information about the satellites. We also thank Mr. J.A. Pilkington of the London Planetarium for many helpful criticisms and suggestions on points of detail, and Mr. D. Gray of the Radio Research Station, Slough, for giving us much useful information. We have also benefited from the work of Mrs. Doreen Walker and Mrs. Janice Rees on earlier versions of the Table.

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TABLE 2

TABLE OF ARTIFICIAL EARTH SATELLITES

(Year of launch 1957)

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	Sputnik 1	1957α 2	1957 Oct. 4.8 92 days? 1958 Jan. 4?	Sphere 83.6	0.58 dia.	1957 Oct. 4.8 1957 Oct. 25.8 1957 Dec. 25.1	65.1 65.1 65.0	96.2 95.4 91.0	6955 6916 6702	215 213 190	939 863 458	0.052 0.047 0.020	58 49 23
D	Sputnik 1 rocket	1957α 1	1957 Oct. 4.8 57.6 days 1957 Dec. 1.4	Cylinder? 5000?	20 long?	1957 Oct. 4.8 1957 Nov. 4.0 1957 Nov. 24.3	65.1 65.1 65.0	96.2 94.0 91.0	6955 6849 6702	215 203 190	939 738 458	0.052 0.039 0.020	58 45 36
D	Fragment	1957α 3											
D	Sputnik 2	1957β 1	1957 Nov. 3.1 162.0 days 1958 Apr. 14.08	Cone-cylinder 5000? Payload 508.3	25 long?	1957 Nov. 3.1 1958 Jan. 4.0 1958 Feb. 21.0 1958 Mar. 25.0 1958 Apr. 9.0	65.33 65.29 65.26 65.23 65.21	103.750 100.505 97.105 93.785 90.780	7314 7161 6999 6838 6691	212 210 200 187 166	1660 1356 1040 733 460	0.099 0.080 0.060 0.040 0.022	59 35 14 359 352
D	Fragment	1957β 2											

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
	Explorer 1 1958α	1958 Feb. 1.16 10 years	Cylinder 13.97 Payload 4.8	2.03 long 0.15 dia.	1958 Feb. 1.2 1960 Dec. 5.3 1963 Nov. 9.3	33.24 33.21 33.19	114.8 107.2 104.89	7830 7481 7370	356 347 344	2548 1859 1641	0.140 0.101 0.088	121 10 102
T	Vanguard 1 1958β2	1958 Mar. 17.51 300 years	Sphere 1.47	0.16 dia.	1958 Mar. 17.5 1962 Nov. 14.5	34.25 34.25	134.18 133.80	8687 8671	650 648	3968 3938	0.191 0.190	129 85
	Vanguard 1 rocket 1958β1	1958 Mar. 17.51 300 years	Cylinder 23	1.2 long 0.51 dia.	1958 Mar. 17.5 1962 Dec. 5.6	34.25 34.26	138.50 138.3	8872 8864	649 642	4340 4330	0.208 0.208	129 -
D	Explorer 3 1958γ	1958 Mar. 26.73 93 days 1958 June 28	Cylinder 14 Payload 5	2.03 long 0.15 dia.	1958 Mar. 26.8 1958 May 15.0 1958 June 14.1	33.38 33.35 33.33	115.7 104.8 96.8	7871 7369 6990	186 180 171	2799 1802 1052	0.166 0.110 0.063	90 70 326
D	Sputnik 3 1958δ2	1958 May 15.3 692.0 days 1960 Apr. 6.3	Cone 1327	3.76 long 1.73 dia.	1958 May 15.3 1959 Jan. 1.3 1960 Jan. 3.8 1960 Mar. 24.5	65.18 65.15 65.11 65.06	105.97 102.000 94.000 90.000	7418 7232 6849 6653	217 210 190 162	1864 1497 751 388	0.111 0.089 0.041 0.017	58 331 182 146
D	Sputnik 3 rocket 1958δ1	1958 May 15.3 202.4 days 1958 Dec. 3.7	Cylinder? 5000?	20 long?	1958 May 15.3 1958 Aug. 15.1 1958 Oct. 11.2 1958 Nov. 30.6	65.18 65.14 65.10 65.00	105.9 102.000 98.000 90.000	7415 7232 7042 6653	214 210 199 162	1860 1497 1128 388	0.111 0.089 0.066 0.017	58 26 5 339
D	Fragments 1958δ3-5											
D	Explorer 4 1958ε	1958 July 26.63 454 days 1959 Oct. 23	Cylinder 17.5 Payload 8	2.03 long 0.15 dia.	1958 July 26.7 1959 Mar. 21.0 1959 Aug. 22.0 1959 Oct. 19.5	50.3 50.25 50.25 50.25	110.18 102.37 96.05 90.0	7616 7252 6950 6656	263 257 239 204	2213 1490 906 351	0.128 0.085 0.048 0.011	50 60 252 120
D	Atlas 1958ζ	1958 Dec. 18.96 33.6 days 1959 Jan. 21.6	Cylinder 3900 Payload 70	25 long 3.0 dia	1958 Dec. 19.0 1959 Jan. 1.8 1959 Jan. 17.0	32.3 32.3 32.3	101.47 98.12 92.7	7213 7053 6792	185 181 169	1484 1169 658	0.090 0.070 0.036	130 249 37

Space vehicles: Pioneer 1, 1958η; Pioneer 3, 1958 θ

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
	Vanguard 2 1959 α1	1959 Feb. 17.67 150 years	Sphere 9.8	0.51 dia.	1959 Feb. 17.7 1962 Nov. 13.0	32.88 32.87	125.7 125.25	8318 8298	559 559	3320 3281	0.166 0.164	135 143
	Vanguard 2 rocket 1959 α2	1959 Feb. 17.67 150 years	Cylinder 23	1.2 long 0.51 dia.	1959 Feb. 17.7 1962 Dec. 5.6	32.92 32.90	130.0 129.5	8506 8484	563 562	3693 3650	0.184 0.182	135 -
D	Discoverer 1 1959 β	1959 Feb. 28.91 5 days? 1959 Mar. 5?	Cone-cylinder 618	6 long 1.5 dia.	1959 Feb. 28	89.7?	96?	6943?	163?	968?	0.058?	-
D	Discoverer 2 1959 γ	1959 Apr. 13.89 13 days 1959 Apr. 26.6?	Cone-cylinder 1st day 743, then 650	6 long 1.5 dia.	1959 Apr. 13.9 1959 Apr. 24.6	89.9 89.9	90.4 88.9	6671 6597	239 199	346 238	0.008 0.003	160 96
D	Explorer 6 1959 δ1	1959 Aug. 7.60 23 months? 1961 July?	Spheroid + 4 vanes 64	Spheroid 0.66 dia. 0.74 long	1959 Aug. 7.6 1959 Oct. 26.0 1959 Dec. 19.2	47.0 47.0 47.0	765 760 754	27710 27590 27450	245 244 237	42400 42200 41900	0.761 0.760 0.759	35 53 65
D	Explorer 6 rocket 1959 δ2	1959 Aug. 7.60 23 months? 1961 July?	Cylinder 24	1.47 long 0.46 dia.	Orbit similar to 1959 δ1							
D	Discoverer 5 1959 ε1	1959 Aug. 13.79 46 days 1959 Sep. 28	Cone-cylinder 1st day 781, then 640	6 long 1.5 dia.	1959 Aug. 13.8 1959 Sep. 9.1 1959 Sep. 23.4	80.0 80.0 80.0	94.19 92.00 90.00	6856 6749 6651	217 209 193	739 533 353	0.038 0.024 0.012	157 70 22
D	Discoverer 5 capsule 1959 ε2	1959 Aug. 13.79 547 days 1961 Feb. 11	Paraboloid 140	0.6 long 0.9 dia.	1960 Feb. 15.1 1960 Dec. 2.3 1961 Jan. 31.3	78.94 78.94 78.94	104.27 94.45 90.68	7337 6869 6685	218 202 180	1700 779 434	0.101 0.042 0.019	47 320 124

Continued on page 4

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	Discoverer 6	1959 ζ	1959 Aug. 19.81 62.0 days 1959 Oct. 20.8	Cone-cylinder 1st day 783, then 640	6 long 1.5 dia.	1959 Aug. 19.9 1959 Sep. 28.2 1959 Oct. 12.7	84.0 84.0 84.0	95.27 92.00 90.00	6908 6749 6651	212 196 186	848 547 359	0.046 0.026 0.013	143 360 297
	Vanguard 3	1959 η	1959 Sep. 18.22 300 years	Rocket-sphere-rod 45 Payload 23	2.5 long 0.51 dia.	1959 Sep. 18.3 1961 Apr. 26.0 1963 Dec. 10.0	33.35 33.34 33.34	130.0 129.75 129.74	8506 8495 8493	512 511 510	3744 3723 3720	0.190 0.189 0.189	133 112 119
D	Lunik 3	1959 θ1	1959 Oct. 4.1 177 days? 1960 Mar 29?.	Ellipsoid 278.5	1.32 long 1.19 dia.	1959 Oct. 18.7 1959 Dec. 22.5	73.8 82.9	22700 23300	264800 269900	40300 19700	476500 507400	0.824 0.903	182 186
	Explorer 7	1959 ι1	1959 Oct. 13.65 70 years	Double cone 41.5	0.76 long 0.76 dia.	1959 Oct. 13.7 1962 Jan. 14.0 1963 Oct. 20.3	50.31 50.31 50.30	101.28 101.12 101.12	7200 7193 7192	556 556 555	1088 1074 1073	0.037 0.036 0.036	55 337 10
	Explorer 7 rocket	1959 ι2	1959 Oct. 13.65 30 years	Cylinder 6	1.73 long 0.15 dia.	1959 Oct. 13.7 1962 Jan. 27.0 1964 Aug. 26.8	50.30 50.30 50.30	101.25 100.92 100.82	7199 7183 7180	554 553 551	1087 1057 1054	0.037 0.035 0.035	56 29 15
D	Discoverer 7	1959 κ	1959 Nov. 7.85 19.0 days 1959 Nov. 26.8	Cone-cylinder 1st day 794, then 660	6 long 1.5 dia.	1959 Nov. 7.9 1959 Nov. 15.6 1959 Nov. 20.8	81.64 81.6 81.6	94.70 92.9 91.5	6881 6793 6725	159 157 152	847 673 542	0.050 0.038 0.029	165 138 120
D	Discoverer 8	1959 λ	1959 Nov. 20.81 108.2 days 1960 Mar. 8.05	Cone cylinder 1st day 795, then 660	6 long 1.5 dia.	1959 Nov. 20.9 1960 Jan. 15.5 1960 Feb. 29.5	80.65 80.6 80.6	103.72 98.00 92.00	7311 7040 6749	187 176 162	1679 1147 580	0.102 0.069 0.031	156 356 206

Space vehicles: Lunik 1, 1959 μ; Pioneer 4, 1959 ν; Lunik 2, 1959 ξ

A rocket separated from Lunik 3, but its orbit is not known

Year of launch 1960

	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
	Tiros 1 1960 β2	1960 Apr. 1.49 60 years	Cylinder 120	0.48 long 1.07 dia.	1960 Apr. 1.5	48.4	99.16	7100	693	750	0.004	115
					1964 Apr. 14.3	48.37	99.11	7098	691	749	0.004	80
	Tiros 1 rocket 1960 β1	1960 Apr. 1.49 25 years	Cylinder 23	1.50 long 0.46 dia.	1960 Apr. 1.5	48.41	99.15	7099	693	750	0.004	115
					1962 Feb. 26.2	48.38	99.06	7095	689	745	0.004	113
	Fragments 1960 β3-4											
	Transit 1B 1960 γ2	1960 Apr. 13.50 7 years	Sphere 121	0.91 dia.	1960 Apr. 13.5	51.28	95.81	6939	373	748	0.027	261
					1961 June 23.7	51.28	94.94	6897	367	670	0.022	28
					1963 Nov. 20.6	51.25	94.10	6854	356	596	0.017	22
					1964 Aug. 17.8	51.23	93.85	6844	349	582	0.017	306
D	Transit 1B rocket 1960 γ1	1960 Apr. 13.50 491.7 days 1961 Aug. 18.19	Cylinder 600	5.3 long 1.40 dia.	1960 Apr. 13.5	51.25	95.25	6912	319	748	0.031	265
					1960 Dec. 8.6	51.25	93.21	6813	285	584	0.022	64
					1961 June 16.8	51.25	91.05	6707	255	403	0.011	83
1d	Fragments 1960 γ3-4											
D	Discoverer 11 1960 δ	1960 Apr. 15.85 10.88 days 1960 Apr. 26.73	Cone-cylinder 1st day 790, then 660	6 long 1.5 dia.	1960 Apr. 16.9	80.1	92.16	6757	170	589	0.031	150
					1960 Apr. 24.7	80.1	89.75	6639	161	360	0.015	121

Space vehicle: Pioneer 5, 1960 α

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	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	Sputnik 4 1960 ε1	1960 May 15.00 844.41 days 1962 Sep. 5.41	Cylinder? 2040? Payload 1477	6 long? 1.6 dia?	1960 May 19.0 1961 June 29.4 1962 Jan. 27.5 1962 Aug. 5.8	65.02 65.02 65.02 64.95	94.25 92.53 91.44 89.50	6861 6777 6724 6628	290 284 272 224	675 514 420 277	0.028 0.017 0.011 0.004	87 270 183 94
D	Sputnik 4 rocket 1960 ε2	1960 May 15.00 63.82 days 1960 July 17.82	Cylinder? 2000?	10 long? 2 dia?	1960 May 15.0 1960 June 6.8 1960 July 15.5	64.89 64.89 64.89	91.25 90.79 88.69	6714 6692 6588	318 299 206	355 329 215	0.002 0.002 0.0005	63 53 37
	Sputnik 4 cabin 1960 ε3	1960 May 15.00 5 years	Cylinder? 2500	5 long? 2 dia?	1960 May 19.0 1961 June 25.3 1962 Nov. 25.8 1964 Aug. 20.9	65.0 65.0 64.98 64.98	94.27 93.35 92.41 91.07	6862 6817 6771 6706	278 275 271 267	689 602 515 388	0.030 0.024 0.018 0.009	82 286 49 142
D	Fragments 1960 ε4-9											
	Midas 2 1960 ζ1	1960 May 24.73 20 years	Cylinder 2300	7 long 1.5 dia.	1960 May 24.8 1963 Dec. 9.0	33.0 33.0	94.44 94.15	6876 6867	484 474	511 504	0.002 0.002	136 110
D	Midas 2 nose-cap 1960 ζ2	1960 May 24.73 194.5 days 1960 Dec. 5.3	-	-	1960 May 24.8 1960 Oct. 9.5 1960 Dec. 2.6	33.00 33.00 33.00	94.44 93.02 89.79	6876 6807 6649	484 422 271	511 436 271	0.002 0.001 0	136 46

The designation of the nine pieces of Sputnik 4 is that adopted in the United States. Russian and British prediction centres referred to Sputnik 4 as ε2 and the rocket as ε1. Between 1960 May 15.0 and May 19.0 satellites 1960 ε1 and 1960 ε3 to 9 were one piece, whose orbit was similar to that of 1960 ε2.

Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km.)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
Transit 2A 1960η 1	1960 June 22.25 150 years	Sphere 101	0.91 dia.	1960 June 22.3 1962 Nov. 6.8	66.69 66.68	101.66 101.63	7216 7214	628 627	1047 1045	0.029 0.029	236 340
Greb 1 1960η 2	1960 June 22.25 80 years	Sphere 19	0.51 dia.	1960 June 22.3 1962 June 3.0	66.69 66.69	101.66 101.61	7216 7211	614 612	1061 1054	0.031 0.031	236 90
Transit 2A rocket 1960η 3	1960 June 22.25 80 years	Cylinder 450	5.3 long 1.40 dia.	1960 June 22.3 1961 June 27.6 1963 Mar. 25.2	66.7 66.66 66.66	101.37 101.42 101.41	7202 7203 7201	615 615 614	1032 1034 1031	0.029 0.029 0.029	235 333 243
Fragments 1960η4-5											
D r Discoverer 13 1960 θ	1960 Aug. 10.86 95.97 days 1960 Nov. 14.83	Cone-cylinder 1st day 850, then 700	6 long 1.5 dia	1960 Aug. 10.9 1960 Oct. 9.9 1960 Nov. 9.4	82.85 82.85 82.85	94.04 92.00 90.00	6849 6749 6651	258 250 226	683 493 319	0.031 0.018 0.007	154 295 178
Echo 1 1960ι 1	1960 Aug. 12.40 7 years?	Inflated sphere 75.9 initially; 62 after Jan.1961	30 dia.	1960 Aug. 12.4 1960 Dec. 16.0 1961 June 20.0 1961 Dec. 6.0 1962 May 8 1962 Nov. 20.0 1963 Sep. 4 1964 Aug. 9.3	47.22 47.27 47.20 47.30 47.20 47.30 47.29 47.27	118.22 117.28 117.03 116.18 116.17 115.35 114.82 114.05	7982 7940 7929 7890 7890 7854 7827 7794	1524 966 1550 904 1500 942 971 917	1684 2157 1550 2120 1524 2010 1926 1915	0.010 0.075 0 0.077 0.002 [illegible] 0.061 0.064	14 59 78 275 97 264 274
Echo 1 rocket 1960ι 2	1960 Aug. 12.40 20,000 years?	Cylinder 23	1.5 long 0.46 dia.	1960 Aug. 12.4 1963 Dec. 3.0	47.23 47.23	117.98 117.98	7972 7971	1502 1501	1685 1684	0.011 0.011	12 8
Fragments 1960ι3-5											

Continued on Page 8

	Name	Launch date, lifetime and discent date	Shape and weight (kg.)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D r	Discoverer 14 1960 κ	1960 Aug. 18.83 28.19 days 1960 Sep. 16.02	Cone-cylinder 1st day 850, then 700	6 long 1.5 dia.	1960 Aug. 18.9 1960 Aug. 30.8 1960 Sep. 10.1	79.65 79.65 79.65	94.55 93.00 91.00	6874 6798 6701	186 182 175	805 658 470	0.045 0.035 0.022	168 129 94
D R	Sputnik 5 1960 λ1	1960 Aug. 19.36 1.1 days 1960 Aug. 20.5	Cylinder 4600	6 long? 2 dia?	1960 Aug. 19.4	64.95	90.72	6688	297	324	0.002	60
D	Sputnik 5 1960 λ2 rocket	1960 Aug. 19.36 35.2 days 1960 Sep. 23.57	Cylinder? 2000?	10 long? 2 dia?	1960 Aug. 19.4 1960 Sep. 10.0 1960 Sep. 19.9	64.9 64.9 64.9	90.7 90.0 89.0	6687 6653 6604	296 268 225	323 282 226	0.002 0.001 0	81 72 67
D	Discoverer 15 1960 μ	1960 Sep. 13.93 34.2 days 1960 Oct. 18.1	Cone-cylinder 1st day 863, then 710	6 long 1.5 dia.	1960 Sep. 14.0 1960 Oct. 3.0 1960 Oct. 14.0	80.90 80.90 80.90	94.23 92.00 90.00	6858 6749 6651	199 196 180	761 547 366	0.041 0.026 0.014	162 96 55
	Courier 1B 1960 ν1	1960 Oct. 4.74 1000 years	Sphere 230	1.30 dia.	1960 Oct. 4.8	28.33	106.85	7465	938	1237	0.020	41
	Courier 1B 1960 ν2 rocket	1960 Oct. 4.74 500 years	Cylinder 450	5.3 long 1.40 dia.	1960 Oct. 4.8	28.30	106.38	7444	946	1184	0.016	41
	Explorer 8 1960 ξ1	1960 Nov. 3.22 60 years	Double cone 41	0.76 long 0.76 dia.	1960 Nov. 3.3 1964 Jun. 1.1	49.95 49.95	112.69 112.24	7731 7711	417 415	2288 2250	0.121 0.119	52 255
	Explorer 8 1960 ξ2 rocket	1960 Nov. 3.22 30 years	Cylinder 5	1.73 long 0.15 dia.	1960 Nov. 3.3 1964 Aug. 3.5	49.96 49.96	112.68 111.81	7731 7691	417 420	2288 2205	0.121 0.116	52 321
	Fragments 1960 ξ3-4											

	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
D	Discoverer 17 1960o	1960 Nov. 12.86	Cone-cylinder	8 long	1960 Nov. 12.9	81.70	96.45	6965	190	984	0.057	163
r		46.9 days	1st 2 days 1091	1.5 dia.	1960 Dec. 13.2	81.70	93.11	6804	184	668	0.036	59
		1960 Dec. 29.8	then 930		1960 Dec. 25.3	81.70	90.35	6668	170	410	0.018	15
T	Tiros 2 1960πi	1960 Nov. 23.47	Cylinder	0.48 long	1960 Nov. 23.5	48.5	98.20	7054	619	732	0.008	334
		60 years	130	1.07 dia.	1964 Aug. 1.2	48.52	98.15	7052	619	730	0.008	178
	Tiros 2 1960π2	1960 Nov. 23.47	Cylinder	1.50 long	1960 Nov. 23.5	48.57	98.14	7051	609	736	0.009	334
	rocket	30 years	23	0.46 dia.	1964 Sept. 8.8	48.51	98.02	7046	618	717	0.007	355
	Fragments 1960π3-4											
D	Sputnik 6 1960ρ1	1960 Dec. 1.31	Cylinder	6 long?	1960 Dec. 1.4	64.97	88.47	6577	166	232	0.005	60?
		1 day	4563	2 dia?								
		1960 Dec. 2										
D	Sputnik 6 1960ρ2	1960 Dec. 1.31	Cylinder?	10 long?	1960 Dec. 2.8	65.00	87.29	6518	140	140	0	-
	rocket	1.6 days	2000?	2 dia?								
		1960 Dec. 2.9										
D	Discoverer 18 1960σ	1960 Dec. 7.85	Cone-cylinder	8 long	1960 Dec. 7.9	81.50	93.66	6830	243	661	0.031	164
r		116 days	1st 3 days 1240	1.5 dia.	1961 Feb. 5.8	81.48	92.0	6749	233	510	0.021	312
		1961 Apr. 2			1961 Mar. 29.0	81.48	89.49	6626	205	291	0.006	121
D	Discoverer 19 1960τ	1960 Dec. 20.86	Cone-cylinder	8 long	1960 Dec. 20.9	83.40	93.00	6798	209	631	0.031	173
		33.2 days	1060	1.5 dia.	1961 Jan. 16.6	83.40	90.0	6651	186	359	0.013	75
		1961 Jan. 23.1			1961 Jan. 19.1	83.40	89.55	6629	178	324	0.011	62

	Name		Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
	Samos 2	1961 α 1	1961 Jan. 31.85 12 years	Cylinder 1900	7 long 1.5 dia.	1961 Jan. 31.9 1962 Dec. 3.7 1964 Jun. 20.8	97.40 97.40 97.40	94.97 94.84 94.77	6894 6883 6882	474 466 475	557 544 538	0.006 0.006 0.005	196 18 197
	Samos 2 nose-cap	1961 α 2	1961 Jan. 31.85 10 years	-	-	1961 Jan. 31.9 1962 May 17.5 1964 Jul. 23.5	97.40 97.36 97.40	94.97 94.84 94.70	6894 6882 6880	474 467 461	557 540 549	0.006 0.005 0.006	196 3 80
D	Sputnik 7	1961 β 1	1961 Feb. 4.1 22.7 days 1961 Feb. 26.8	- 6483	-	1961 Feb. 4.1	64.95	89.8	6643	212	318	0.008	59
D	Sputnik 7 rocket	1961 β 2	1961 Feb. 4.1 8.9 days 1961 Feb. 13.0	Cylinder? -	-	Initial orbit similar to 1961 β 1							
D	Fragment	1961 β 3											
	Venus probe	1961 γ 1	1961 Feb. 12.09	Cylinder 643.5	2.03 long 1.05 dia.	Initial earth-satellite orbit similar to 1961 γ 3							
D	Sputnik 8 rocket	1961 γ 2	1961 Feb. 12.09 6.5 days 1961 Feb. 18.6	Cylinder? -	-	1961 Feb. 13.9	65.0	89.2	6614	196	275	0.006	20
D	Sputnik 8	1961 γ 3	1961 Feb. 12.09 13.7 days 1961 Feb. 25.8	- 5839?	-	1961 Feb. 12.1	65.0	89.6	6633	229	282	0.004	23
D	Fragment	1961 γ 4											

	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
D	Explorer 9 1961 δ1	1961 Feb. 16.55 1148.2 days 1964 Apr. 9.8	Inflated sphere 6.63	3.66 dia.	1961 Feb. 16.6 1961 Dec. 19.0 1963 Jan. 1.0 1963 Dec. 7.9	38.86 38.82 38.86 38.95	118.28 118.04 117.36 112.11	7986 7976 7947 7704	634 752 632 394	2583 2443 2506 2258	0.122 0.106 0.118 0.121	100 118 134 26
	Explorer 9 1961 δ2 rocket	1961 Feb. 16.55 100 years	Cylinder 24	1.83 long 0.46 dia.	1961 Feb. 16.6	38.85	118.4	7992	639	2589	0.122	100
1d	Fragments 1961 δ3-4											
D	Discoverer 20 1961 ε1	1961 Feb. 17.85 525.9 days 1962 July 28.7	Cone-cylinder 1st 4 days 1110 then 980	8 long 1.5 dia.	1961 Feb. 17.9 1962 Jan. 27.2 1962 July 12.4	80.91 80.84 80.82	95.41 92.78 89.91	6915 6787 6641	288 267 223	786 552 303	0.036 0.021 0.006	125 36 158
D	Fragments 1961 ε 2-4											
D	Discoverer 21 1961 ζ	1961 Feb. 18.95 426.0 days 1962 Apr. 20.9	Cone-cylinder 1100?	8 long 1.5 dia.	1961 Feb. 19.0 1961 Dec. 17.5 1962 Apr. 9.8	80.74 80.68 80.64	97.85 93.49 90.19	7033 6822 6656	240 239 212	1069 649 344	0.059 0.030 0.010	141 244 198
D	Transit 3B- 1961 η Lofti 1	1961 Feb. 22.16 36.38 days 1961 Mar. 30.54	Cylinder 600	5.16 long 1.40 dia.	1961 Feb. 22.2 1961 Mar. 26.0	28.38 28.38	96.22 90.67	6963 6693	167 147	1002 482	0.060 0.025	29 29
D R	Sputnik 9 1961 θ1	1961 Mar. 9.27 0.1 day 1961 Mar. 9.4	Cone-cylinder 4700	9 long? 3 dia?	1961 Mar. 9.3	64.93	88.6	6584	173	239	0.005	-
D	Sputnik 9 1961 θ2 rocket	1961 Mar. 9.27 1.1 days 1961 Mar. 10.4	Cylinder? -	-	1961 Mar. 9.6	64.9	88.2	6564	173	199	0.002	25
D	Fragments 1961 θ 3-4											

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	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
D R	Sputnik 10 1961 ι 1	1961 Mar. 25.25 0.1 day 1961 Mar. 25.3	Cone-cylinder 4695	9 long? 3 dia?	1961 Mar. 25.3	64.9	88.42	6575	164	230	0.005	-
D	Sputnik 10 rocket 1961 ι 2	1961 Mar. 25.25 1.7 days 1961 Mar. 26.9	Cylinder? -	-	1961 Mar. 25.9	65.0	87.8	6544	140	192	0.004	42
D	Fragment 1961 ι 3											
D?	Explorer 10 1961 κ	1961 Mar. 25.64	Cylind.-sphere 35	2.72 long 0.48 dia.	1961 Mar. 25.7	33	5013	97050	221	181100	0.932	-
D	Discoverer 23 1961 λ 1	1961 Apr. 8.75 373.1 days 1962 Apr. 16.9	Cone-cylinder 950?	8 long 1.5 dia.	1961 Apr. 9.0 1961 July 2.4 1962 Jan. 18.6	82.31 82.31 82.26	94.09 93.52 91.68	6851 6823 6734	295 295 268	651 595 443	0.026 0.022 0.013	168 227 224
D	Discoverer 23 capsule 1961 λ 2	1961 Apr. 8.75 409.4 days 1962 May 23.2	Paraboloid -	0.6 long 0.9 dia.	1961 Apr. 24.9 1962 Feb. 2.5 1962 May 8.5	81.94 81.88 81.82	101.49 95.03 90.04	7206 6897 6648	208 194 180	1448 843 359	0.086 0.047 0.013	112 290 307
D	Discoverer 23 capsule rocket 1961 λ 3	1961 Apr. 8.75 154.8 days 1961 Sept. 10.6	Frustum -	0.6 long? 0.9 dia.?	1961 Apr. 24.9 1961 July 4.8 1961 Aug. 29.8	81.94 81.94 81.87	101.13 97.19 91.96	7189 7001 6747	200 196 187	1422 1050 551	0.085 0.061 0.027	111 249 53

A rocket is believed to have separated from Explorer 10.

	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
D R M	Vostok 1 1961 μ 1	1961 Apr. 12.25 108 min. 1961 Apr. 12.33	Cone-cylinder 4725	9 long? 3 dia?	1961 Apr. 12.3	64.95	89.34	6620	169	315	0.011	-
D	Vostok 1 1961 μ 2 rocket	1961 Apr. 12.25 4.2 days 1961 Apr. 16.5	Cylinder? -	-	1961 Apr. 12.6	65.07	89.3	6618	161	320	0.012	100
	Explorer 11 1961 ν	1961 Apr. 27.59 150 years	Cylinder 43	2.26 long 0.38 dia.	1961 Apr. 27.6	28.80	107.84	7512	487	1779	0.086	119
D r	Discoverer 25 1961 ξ1	1961 June 16.96 25 days? 1961 July 12?	Cone-cylinder 1000?	8 long 1.5 dia.	1961 June 17.1 1961 July 11.3	82.11 82.11	90.87 88.29	6694 6567	222 175	409 201	0.014 0.002	178 84
D	Fragment 1961 ξ 2											
T	Transit 4A 1961 o 1	1961 June 29.18 600 years	Cylinder 79	0.79 long 1.09 dia.	1961 June 29.2	66.81	103.82	7317	881	998	0.008	319
	Greb 3-Injun1 1961 o2	1961 June 29.18 900 years	Sphere-cylinder 25-16	0.51 dia. sphere	1961 June 29.2	66.82	103.85	7319	882	999	0.008	318
3d	Fragments 1961 03-206											
D r	Discoverer 26 1961 π	1961 July 7.98 150.4 days 1961 Dec. 5.4	Cone-cylinder 1000?	8 long 1.5 dia	1961 July 8.3 1961 Sept.18.4 1961 Nov. 21.3	82.94 82.94 82.94	95.02 93.14 90.39	6896 6805 6670	228 223 212	808 631 372	0.042 0.030 0.012	160 260 18

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	Name		Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
T	Tiros 3	1961 ρ 1	1961 July 12.43 100 years	Cylinder 129	0.48 long 1.07 dia.	1961 July 12.5	47.90	100.33	7156	735	820	0.006	42
	Tiros 3 rocket	1961 ρ 2	1961 July 12.43 50 years	Cylinder 23	1.50 long 0.46 dia.	1961 July 12.5	47.9	100.31	7154	740	812	0.005	42
	Fragments	1961 ρ 3-4											
	Midas 3	1961 σ 1	1961 July 12.68 100,000 years?	Cylinder 1600	9 long 1.5 dia.	1961 July 12.7 1962 Oct. 12.9	91.2 91.19	161.54 161.52	9824 9820	3358 3340	3534 3544	0.009 0.010	240 95
D	Midas 3 nose-cap	1961 σ 2	1961 July 12.68 13.20 days 1961 July 25.88	-	-	1961 July 15.4 1961 July 18.5	90.80 90.80	117.25 109.7	7934 7589	138 134	2974 2289	0.179 0.142	164 -
	Fragments	1961 σ 3-4											
D R M	Vostok 2	1961 τ 1	1961 Aug. 6.25 25.3 hours 1961 Aug. 7.30	Cone-cylinder 4730	9 long? 3 dia?	1961 Aug. 6.3	64.93	88.46	6577	166	232	0.005	-
D	Vostok 2 rocket	1961 τ 2	1961 Aug. 6.25 3 days 1961 Aug. 9	Cylinder?	-	Orbit similar to Vostok 2							
	Explorer 12	1961 υ	1961 Aug. 16.14 10 years?	Octagon + 4 vanes 38	0.15 long 0.66 dia.	1961 Sep. 22.5 1962 Jan. 30.5	33.1 33.43	1591 1587.3	45190 45086	314 790	77310 76620	0.852 0.841	- -
D	Ranger 1	1961 φ 1	1961 Aug. 23.46 6.89 days 1961 Aug. 30.35	Cylinder 306	3.5 long 1.5 dia.	1961 Aug. 24.1 1961 Aug. 29.5	32.9 32.9	90.64 88.9	6691 6605	179 174	446 280	0.020 0.008	206 -
D	Ranger 1 rocket	1961 φ 2	1961 Aug. 23.46 10.68 days 1961 Sep. 3.14	Cylinder 1000?	8 long? 1.5 dia	1961 Aug. 24.1 1961 Aug. 29.5	32.93 32.93	90.71 89.7	6694 6644	175 173	456 359	0.021 0.014	206 -

A rocket is believed to have separated from Explorer 12.

Year of launch 1961, continued

	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
D	Explorer 13 1961 χ	1961 Aug. 25.81 2.3 days 1961 Aug. 28.1	Cylinder 86	1.93 long 0.61 dia.	1961 Aug. 26.8	37.7	97.5	7023	125	1164	0.074	-
D r	Discoverer 29 1961 ψ	1961 Aug. 30.8 10.2 days 1961 Sep. 9.98	Cone-cylinder 1000?	8 long 1.5 dia.	1961 Aug. 31.3	82.14	91.51	6725	152	542	0.029	83
D r	Discoverer 30 1961 ω 1	1961 Sep.12.83 90.1 days 1961 Dec. 11.9	Cone-cylinder 1000?	8 long 1.5 dia.	1961 Sep. 13.6 1961 Nov. 21.5 1961 Dec. 5.5	82.66 82.66 82.66	92.40 90.4 89.4	6769 6671 6621	235 213 204	546 373 283	0.023 0.012 0.006	142 - -
D	Fragments 1961 ω 2-3											
D R	Mercury 4 1961$\alpha\alpha$1	1961 Sep. 13.59 109 min. 1961 Sep. 13.66	Cone-frustum 1200	2.90 long 1.83 dia.	1961 Sep. 13.6	32.8	88.4	6580	156	248	0.007	-
D	Mercury 4 1961$\alpha\alpha$2 rocket	1961 Sep. 13.59 5 hours 1961 Sep. 13.8	Cylinder 3400	20 long 3.0 dia	1961 Sep. 13.6	32.85	87.3	6526	147	147	0	
D	Discoverer 31 1961 $\alpha\beta$	1961 Sep. 17.88 38.57 days 1961 Oct. 26.45	Cone-cylinder 1100?	8 long 1.5 dia.	1961 Sep. 21.0 1961 Oct. 10.5	82.70 82.7	90.86 90.0	6693 6651	235 220	396 326	0.012 0.008	136 -
D r	Discoverer 32 1961$\alpha\gamma$1	1961 Oct. 13.81 30.6 days 1961 Nov. 13.4	Cone-cylinder 1000?	8 long 1.5 dia.	1961 Oct. 14.1 1961 Nov. 10.3	81.69 81.64	90.84 88.93	6692 6598	234 207	395 233	0.012 0.002	158 60
D	Fragments 1961$\alpha\gamma$ 2-3											

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	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
	Midas 4 1961αδ1	1961 Oct. 21.58 100,000 years?	Cylinder 1800?	9 long? 1.5 dia.	1961 Nov. 2.0	95.89	166.01	10004	3496	3756	0.013	18
1d	Fragments 1961αδ 2-4											
D	Discoverer 34 1961αε1	1961 Nov. 5.83 396.4 days 1962 Dec. 7.2	Cone-cylinder 1100?	8 long 1.5 dia.	1961 Nov. 6.1 1962 June 5.3 1962 Nov.24.7	82.52 82.46 82.46	97.12 94.40 89.91	6998 6863 6642	227 220 196	1011 750 332	0.056 0.039 0.010	152 149 246
D	Fragments 1961αε 2-5											
D r	Discoverer 35 1961αζ1	1961 Nov. 15.89 17.9 days 1961 Dec. 3.8	Cone-cylinder 1000?	8 long 1.5 dia.	1961 Nov. 21.5 1961 Dec. 2.5	81.63 81.63	89.7 88.2	6636 6562	238 177	278 190	0.003 0.001	- -
D	Fragment 1961αζ2											
	Transit 4B 1961αη1	1961 Nov. 15.93 1000 years	Cylinder 90	0.79 long 1.09 dia.	1961 Nov. 16.6	32.43	105.63	7408	956	1104	0.010	329
	Traac 1961αη2	1961 Nov. 15.93 800 years	"Door-knob" 90	1.3 long? 1.09 dia.	1961 Nov. 21.5	32.43	105.64	7409	941	1119	0.012	-
	Transit 4B rocket 1961αη3	1961 Nov. 15.93 500 years?	Cylinder 450?	5.3 long 1.4 dia.	1961 Nov. 21.5	32.41	105.49	7402	942	1105	0.011	-

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	Ranger 2 1961 αθ	1961 Nov. 18.34 2 days 1961 Nov. 20	Cylinder 1300?	11 long? 1.5 dia.	1961 Nov. 18.4 1961 Nov. 19.3	33.34 33.34	88.28 87.51	6574 6536	150 145	242 171	0.007 0.002	49 59
D R	Mercury 5 1961αι 1	1961 Nov. 29.63 3.3 hours 1961 Nov. 29.77	Cone-frustum 1300	2.90 long 1.83 dia.	1961 Nov. 29.7	32.6	88.3	6575	158	237	0.006	127
D	Mercury 5 rocket 1961αι 2	1961 Nov. 29.63 1 day 1961 Nov. 30	Cylinder 3400	20 long 3.0 dia.	Orbit similar to 1961αι1							
D r	Discoverer 36 1961ακ 1	1961 Dec. 12.86 85.3 days 1962 Mar. 8.2	Cone-cylinder 1000?	8 long 1.5 dia.	1961 Dec. 14.7 1962 Jan. 30.5 1962 Feb. 27.5	81.21 81.21 81.15	91.82 90.85 89.60	6741 6691 6636	241 229 218	484 396 298	0.018 0.012 0.006	134 - -
D	Oscar 1 1961ακ2	1961 Dec. 12.86 49.4 days 1962 Jan. 31.3	Rectangular box 5	0.30 long 0.25 wide	1961 Dec. 14.0 1962 Jan. 16.5 1962 Jan. 30.5	81.21 81.21 81.21	91.76 90.4 88.2	6738 6671 6562	245 226 164	474 359 204	0.017 0.010 0.003	137 - -
D	Fragment 1961ακ3											
D	[Atlas Agena B] 1961αλ1	1961 Dec. 22.80 235 days 1962 Aug. 14	Cylinder 1800?	8 long? 1.5 dia.	1962 Mar. 13.5 1962 June 5.6 1962 Aug. 3.6	89.6 89.6 89.6	94.1 92.1 89.6	6851 6754 6628	244 228 201	702 524 299	0.033 0.022 0.007	- - -
D	Fragments 1961αλ2-3											

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
T	Tiros 4 1962 β 1	1962 Feb. 8.52 100 years	Cylinder 129	0.48 long 1.07 dia.	1962 Feb. 13.5	48.30	100.31	7154	712	840	0.009	-
	Tiros 4 rocket 1962 β 2	1962 Feb. 8.52 50 years	Cylinder 23	1.50 long 0.46 dia.	1962 Feb. 13.5 1963 Dec. 15.5	48.13 48.13	101.4 101.3	7206 7201	706 703	951 943	0.017 0.017	- -
	Fragments 1962 β 3-4											
D R M	Mercury 6 (Friendship 7) 1962 γ 1	1962 Feb. 20.62 296 min. 1962 Feb. 20.82	Cone-frustum 1352	2.90 long 1.83 dia.	1962 Feb. 20.7	32.54	88.6	6590	159	265	0.008	80
D	Mercury 6 rocket 1962 γ 2	1962 Feb. 20.62 1 day 1962 Feb. 21	Cylinder 3400	20 long 3.0 dia.	1962 Feb. 20.8	32.57	88.0	6560	156	208	0.004	84
D r?	Discoverer 37? 1962 δ	1962 Feb. 21 16 days 1962 Mar. 9	Cylinder 1000?	8 long? 1.5 dia.	1962 Feb. 21	81.97	90.0	6649	167	374	0.016	-
D r	Discoverer 38 1962 ε 1	1962 Feb. 27.91 21 days 1962 Mar. 21	Cone-cylinder 1000?	8 long 1.5 dia.	1962 Mar. 9.8 1962 Mar. 13.5	82.23 82.23	90.04 89.7	6653 6636	208 208	341 308	0.010 0.008	98 -
D	Fragments 1962 ε 2-4											
T?	Oso 1 1962 ζ 1	1962 Mar. 7.67 30 years	Nonagonal box 200	0.94 long 1.12 dia.	1962 Mar. 13.5	32.85	95.89	6942	556	570	0.001	-
	Oso 1 rocket 1962 ζ 2	1962 Mar. 7.67 15 years	Cylinder 24	1.8 long 0.46 dia.	1962 Mar. 18.3	32.83	95.98	6950	544	600	0.004	203

Space vehicle: Ranger 3, 1962 α

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Atlas Agena B] 1962 η 1	1962 Mar. 7.8 457.1 days 1963 Jun. 7.9	- 500?	1.5 dia?	1962 Mar. 13.5 1963 Jan. 5.7 1963 May 28.7	90.89 90.87 90.86	93.9 91.57 88.85	6842 6723 6600	251 223 189	676 467 255	0.031 0.018 0.005	- 2 104
D	Agena rocket 1962 η 3	1962 Mar. 7.8 240.6 days 1962 Nov. 3.4	Cylinder 1000?	6 long? 1.5 dia.	1962 May 1.6 1962 July 6.6 1962 Oct. 24.6	90.87 90.87 90.87	93.3 92.4 89.6	6813 6769 6630	250 228 209	618 553 294	0.027 0.024 0.006	- - -
D	Fragment 1962 η 2											
D	Cosmos 1 (Sputnik 11) 1962 θ 1	1962 Mar.16.50 70 days 1962 May 25	Ellipsoid 400?	1.8 long? 1.2 dia?	1962 Mar. 16.6 1962 May 1.6 1962 May 25	49.00 48.99 48.99	96.35 92.7 87.9	6964 6788 6552	204 194 173	967 626 175	0.055 0.032 0	104 309 -
D	Cosmos 1 rocket 1962 θ 2	1962 Mar.16.50 94 days 1962 June 18	Cylinder ? 1500?	10 long? 2 dia?	1962 Mar. 19.8 1962 May 17.5 1962 June 5.6	49.0 49.0 49.0	96.10 92.6 91.0	6953 6783 6705	206 202 186	943 609 468	0.053 0.030 0.021	118 - 108
D	Cosmos 2 (Sputnik 12) 1962 ι 1	1962 Apr. 6.72 499.3 days 1963 Aug.20.0	Ellipsoid 400?	1.8 long? 1.2 dia?	1962 Apr. 7 1962 Dec. 22.0 1963 Jul. 28.3	48.97 48.94 48.90	102.25 97.17 90.39	7246 7006 6686	202 195 187	1535 1060 428	0.092 0.062 0.018	- 49 306
D	Cosmos 2 rocket 1962 ι 2	1962 Apr. 6.72 182.7 days 1962 Oct. 6.4	Cylinder? 1500?	10 long? 2 dia?	1962 Apr. 10.1 1962 July 16.4 1962 Oct. 3.1	48.94 48.91 48.85	101.90 96.69 90.02	7230 6982 6652	215 191 169	1488 1015 379	0.088 0.059 0.016	119 147 141
	Midas 5? 1962 κ 1	1962 Apr. 9.66 100,000 years?	Cylinder 2000?	9 long? 1.5 dia.	1962 May 1.6	86.68	153.03	9476	2814	3382	0.030	-
1d	Fragments 1962 κ 2-4											
D	[Thor Agena B] 1962 λ 1	1962 Apr. 18 40 days 1962 May 28	Cylinder 1500?	8 long? 1.5 dia.	1962 May 1.6 1962 May 17.5	73.48 73.45	90.9 89.5	6699 6626	200 198	441 297	0.018 0.007	- -
D	Fragments 1962 λ 2-4											

Space vehicle: Ranger 4, 1962 μ

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	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	Cosmos 3 (Sputnik 13)	1962 ν 1	1962 Apr. 24.17 176 days 1962 Oct. 17	Ellipsoid 400?	1.8 long? 1.2 dia?	1962 Apr. 24.2 1962 July 18.3 1962 Oct. 10.3	48.99 48.97 48.95	93.8 92.43 89.37	6840 6775 6625	216 214 193	707 580 301	0.036 0.027 0.008	- 126 170
D	Cosmos 3 rocket	1962 ν 2	1962 Apr. 24.17 103.6 days 1962 Aug. 5.8	Cylinder? 1500?	10 long? 2 dia?	1962 Apr. 26.4 1962 July 11.9 1962 July 29.0	49.00 48.98 48.96	93.71 90.98 89.79	6837 6704 6644	220 212 209	699 440 323	0.035 0.017 0.009	109 101 183
D R	Cosmos 4 (Sputnik 14)	1962 ξ 1	1962 Apr. 26.42 3 days 1962 Apr. 29	-	-	1962 Apr. 26.5	65.00	90.6	6679	285	317	0.002	-
D	Cosmos 4 rocket	1962 ξ 2	1962 Apr. 26.42 52.5 days 1962 June 17.9	Cylinder? 1500?	10 long? 2 dia	1962 Apr. 30.4 1962 June 8.9 1962 June 15.6	64.95 64.94 64.92	90.52 89.28 88.6	6679 6615 6584	287 233 205	314 240 207	0.002 0.001 0	174 146
D	Fragment	1962 ξ 3											
T	Ariel 1	1962 ο 1	1962 Apr. 26.75 20 years	Cylinder + 4 paddles 60	0.53 long 0.58 dia.	1962 Apr. 28.5 1962 Aug. 18.6 1964 Aug. 12.5	53.85 53.84 53.86	100.86 100.81 100.50	7180 7177 7162	389 382 383	1214 1216 1185	0.057 0.058 0.056	173 89 71
	Ariel 1 rocket	1962 ο 2	1962 Apr. 26.75 15 years	Cylinder 24	1.8 long 0.46 dia.	1962 May 17.5 1964 Aug. 23.6	53.84 53.84	100.9 100.44	7182 7157	394 385	1213 1172	0.057 0.055	- 103
D	[Atlas Agena B]	1962 π	1962 Apr. 26.9 2 days 1962 Apr. 28	Cylinder 2000?	8 long? 1.5 dia.	Orbit unknown							
D	[Thor Agena B]	1962 ρ 1	1962 Apr. 28.95 28 days 1962 May 26	Cylinder 1500?	8 long? 1.5 dia.	1962 May 1.6 1962 May 17.6 1962 May 25.6	73.11 73.07 73.07	91.1 89.90 88.7	6706 6647 6588	180 176 166	475 362 253	0.022 0.014 0.007	- 94 -
D	Fragment	1962 ρ 2											

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	[Thor Agena B] 1962σ1	1962 May 15.82 560.0 days 1963 Nov. 26.8	Cylinder 1500?	8 long? 1.5 dia	1962 May 20.6 1962 Dec. 11.7 1963 Oct. 17.5	82.33 82.33 82.32	94.02 93.03 90.55	6848 6795 6680	305 287 248	634 546 355	0.024 0.019 0.008	148 131 56
D	Fragments 1962σ2-3											
D R M	Mercury 7 (Aurora 7) 1962τ1	1962 May 24.53 296 min. 1962 May 24.74	Cone-frustum 1349	2.90 long 1.85 dia.	1962 May 24.6	32.5	88.5	6585	154	260	0.008	-
D	Mercury 7 rocket 1962τ2	1962 May 24.53 1 day 1962 May 25	Cylinder 3400	20 long 3.0 dia	Orbit similar to 1962τ1							
D	Cosmos 5 (Sputnik 15) 1962 [illegible]1	1962 May 28.13 339.6 days 1963 May 2.7	Ellipsoid 400?	1.8 long? 1.2 dia?	1962 May 28.2 1962 Nov. 28.8 1963 Mar. 15.1	49.06 49.00 48.96	102.75 97.41 92.89	7267 7019 6808	190 187 184	1587 1095 712	0.096 0.065 0.039	112 104 205
D	Cosmos 5 rocket 1962 [illegible]2	1962 May 28.13 201 days 1962 Dec. 15	Cylinder? 1500?	10 long? 2 dia?	1962 May 29.5 1962 Sept 4.3 1962 Nov. 24.5	49.1 49.01 48.98	102.67 99.06 92.69	7266 7096 6792	205 194 181	1571 1242 647	0.094 0.074 0.034	116 129 113
D	[Thor Agena B] 1962φ1	1962 May 30.02 12 days 1962 June 11	Cylinder 1500?	8 long? 1.5 dia.	1962 June 5.5 1962 June 8.3	74.10 74.10	89.7 88.96	6637 6599	199 193	319 248	0.009 0.004	- 1
D	Fragment 1962φ2											

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	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Thor Agena B] 1962 χ 1	1962 June 2.03 26.9 days 1962 June 28.9	Cylinder 1500?	8 long? 1.5 dia.	1962 June 5.5 1962 June 19.5 1962 June 25.4	74.26 74.25 74.25	90.5 89.60 88.87	6676 6632 6596	211 193 188	385 315 247	0.013 0.009 0.004	- 91 75
D	Oscar 2 1962 χ 2	1962 June 2.03 19 days 1962 June 21	Rectangular box? 5	0.30 long? 0.25 wide?	1962 June 2.9 1962 June 15.6	74.27 74.27	90.55 89.3	6679 6617	207 193	394 285	0.014 0.007	133 -
D	Fragment 1962 χ 3											
D	[Atlas Agena B] 1962 ψ	1962 June 17 1 day 1962 June 18	Cylinder 2000?	8 long? 1.5 dia.	Orbit unknown							
D	[Thor Agena B] 1962 ω 1	1962 June 18.85 498.1 days 1963 Oct. 30.0	Cylinder 1500?	8 long? 1.5 dia.	1962 June 22.6 1962 Dec. 17.7 1963 Oct. 26.8	82.14 82.12 82.10	92.4 91.86 88.69	6769 6738 6583	370 344 198	411 375 211	0.003 0.002 0.001	- 50 336
D	Fragments 1962 ω 2-3											
T	Tiros 5 1962 α α 1	1962 June 19.51 100 years	Cylinder 129	0.56 long 1.07 dia.	1962 July 13.4	58.08	100.44	7159	588	974	0.027	121
	Tiros 5 rocket 1962 α α 2	1962 June 19.51 50 years	Cylinder 23	1.50 long 0.46 dia.	1962 July 17.5	58.08	100.4	7157	586	972	0.027	-
	Fragments 1962 α α 3-4											
D	[Thor Agena B] 1962 α β	1962 June 23.02 14.7 days 1962 July 7.7	Cylinder 1500?	8 long? 1.5 dia.	1962 June 27.5 1962 July 3.9	75.09 75.09	89.58 88.82	6631 6593	213 209	293 222	0.006 0.001	140 121

Year of launch 1962, continued

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Thor Agena D] 1962αγ	1962 June 28.05 78 days 1962 Sept 14	Cylinder 1500?	8 long? 1.5 dia.	1962 July 3.5 1962 Aug. 20.4 1962 Sept 8.4	76.04 76.04 76.01	93.6 91.24 89.48	6828 6713 6619	211 187 176	689 482 305	0.035 0.022 0.010	- 358 297
D	Cosmos 6 (Sputnik 16) 1962α δ1	1962 June 30.67 70 days 1962 Sept 8	Ellipsoid 400?	1.8 long? 1.2 dia?	1962 July 1.0 1962 Aug. 9.5 1962 Aug. 26.1	48.96 48.96 48.95	90.54 89.91 89.46	6683 6652 6628	264 247 241	344 300 258	0.006 0.004 0.001	72 258 358
D	Cosmos 6 rocket 1962α δ2	1962 June 30.67 38.5 days 1962 Aug. 8.2	Cylinder? 1500?	10 long? 2 dia?	1962 July 1.0 1962 July 21.5 1962 Aug. 1.6	48.97 48.97 48.95	90.49 89.86 89.22	6680 6649 6617	262 244 226	342 297 253	0.006 0.004 0.002	72 150 -
	Telstar 1 1962 αε 1	1962 July 10.36 10,000 years	Sphere 77	0.86 dia.	1962 July 10.4	44.79	157.65	9670	952	5632	0.242	165
	Telstar 1 rocket 1962 αε 2	1962 July 10.36 3000 years	Cylinder 23	1.5 long 0.46 dia.	1962 July 17.5	44.78	157.53	9664	947	5625	0.242	176
D	[Atlas Agena B] 1962αζ1	1962 July 18.87 9 days 1962 July 27	Cylinder 2000?	8 long? 1.5 dia.	1962 July 22.2 1962 July 24.6	96.12 96.12	88.73 88.5	6588 6577	184 179	236 218	0.004 0.003	217 -
D	Fragment 1962αζ 2											
D	[Thor Agena B] 1962 αη	1962 July 21.04 24 days 1962 Aug. 14	Cylinder 1500?	8 long? 1.5 dia.	1962 July 21.2 1962 Aug. 4.1 1962 Aug. 12.8	70.29 70.29 70.29	90.42 89.69 88.42	6673 6637 6574	208 192 176	381 325 216	0.013 0.010 0.003	155 139 122
D	[Thor Agena B] 1962 αθ	1962 July 28.02 27 days 1962 Aug. 24	Cylinder 1500?	8 long? 1.5 dia.	1962 July 28.2 1962 Aug. 16.6 1962 Aug. 21.7	71.09 71.09 71.09	90.64 89.69 88.93	6684 6637 6599	225 192 188	386 325 254	0.012 0.010 0.005	155 119 109

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	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D R?	Cosmos 7 1962 αι1 (Sputnik 17)	1962 July 28.39 4 days 1962 Aug. 1	-	-	1962 July 30.3	64.95	90.08	6655	197	356	0.012	48
D	Cosmos 7 rocket 1962 αι2	1962 July 28.39 24 days 1962 Aug. 21	Cylinder? 1500?	10 long? 2 dia?	1962 July 30.3 1962 Aug. 12.1 1962 Aug. 18.8	64.96 64.92 64.91	90.00 89.38 88.56	6653 6622 6582	208 198 171	341 291 237	0.010 0.007 0.005	67 58 52
D	Fragments 1962 αι3-4											
D	[Thor Agena D] 1962 α κ1	1962 Aug. 2.02 24 days 1962 Aug. 26	Cylinder 1500?	8 long? 1.5 dia.	1962 Aug. 3.2 1962 Aug. 17.7 1962 Aug. 24.8	82.25 82.25 82.25	90.77 89.85 88.64	6689 6644 6584	204 199 179	418 332 232	0.016 0.010 0.004	149 99 71
D	Fragment 1962 αK2											
D	[Atlas Agena B] 1962 α λ	1962 Aug. 5.75 1 day 1962 Aug. 6	Cylinder 2000?	8 long? 1.5 dia.	1962 Aug. 6.0	96.30	88.62	6583	205	205	0	
D R M	Vostok 3 1962 αμ1	1962 Aug. 11.35 3.94 days 1962 Aug. 15.29	Cone-cylinder 4730	9 long? 3 dia.?	1962 Aug. 11.5 1962 Aug. 12.8 1962 Aug. 13.8 1962 Aug. 15.2	64.98 64.98 64.98 64.98	88.33 88.24 88.13 87.97	6570 6566 6561 6553	166 162 158 155	218 214 207 194	0.004 0.004 0.004 0.003	- - - -
D	Vostok 3 rocket 1962 αμ2	1962 Aug. 11.35 2.7 days 1962 Aug. 14.1	Cylinder? -	-	1962 Aug. 13.0	64.82	87.5	6529	151	151	0	
D R M	Vostok 4 1962 αν1	1962 Aug. 12.33 2.96 days 1962 Aug. 15.29	Cone-cylinder 4730	9 long? 3 dia.?	1962 Aug. 12.4 1962 Aug. 13.8 1962 Aug. 14.8	64.95 64.95 64.95	88.39 88.26 88.18	6573 6567 6563	169 163 159	222 215 211	0.004 0.004 0.004	- - -
D	Vostok 4 rocket 1962 αν2	1962 Aug. 12.33 2.4 days 1962 Aug. 14.7	Cylinder?	-	1962 Aug. 13.0	64.80	88.38	6573	169	221	0.004	141

	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	Cosmos 8 1962αξ1	1962 Aug. 18.21 364.7 days 1963 Aug. 17.92	Ellipsoid? 400?	1.8 long? 1.2 dia?	1962 Aug. 18.3 1963 Jan. 14.1 1963 Aug. 14.9	48.97 48.96 48.93	92.93 91.94 88.26	6799 6751 6571	244 238 173	598 508 213	0.026 0.020 0.003	121 92 45
D	Cosmos 8 rocket 1962αξ2	1962 Aug. 18.21 123.3 days 1962 Dec. 19.5	Cylinder? 1500?	10 long? 2 dia?	1962 Aug. 19.7 1962 Oct. 14.7 1962 Nov. 29.0	48.98 48.98 48.96	92.92 91.95 90.50	6799 6752 6681	251 245 232	591 502 373	0.025 0.019 0.011	132 31 246
	[Blue Scout] 1962 αο1	1962 Aug. 23.49 20 years	- 60?	-	1962 Aug. 23.5 1963 Dec. 31.4	98.66 98.66	99.62 99.58	7117 7111	620 613	858 852	0.017 0.017	240 183
	Altair rocket 1962α ο4	1962 Aug. 23.49 20 years	Cylinder 24	1.5 long 0.46 dia	1962 Oct. 10.5	98.68	99.6	7115	615	858	0.017	-
	Fragments 1962α ο 2-3											
D	Sputnik 19? 1962απ1	1962 Aug. 25.12 3 days 1962 Aug. 28	-	-	1962 Aug. 25.9 1962 Aug. 27.0	64.88 64.88	88.73 88.37	6590 6572	173 168	252 221	0.006 0.004	90 -
D	Sputnik 19 rocket? 1962απ2	1962 Aug. 25.12 8 days 1962 Sep. 2	-	-	1962 Aug. 25.9 1962 Aug. 31.0	64.89 64.89	89.38 88.63	6623 6585	178 161	311 253	0.010 0.007	90 -
D	Fragments 1962απ3-8											
D	[Thor Agena D] 1962 ασ	1962 Aug. 29.05 12 days 1962 Sep. 10	Cylinder 1500?	8 long? 1.5 dia.	1962 Aug. 30.1 1962 Sep. 7.4	65.21 65.21	90.38 89.09	6672 6608	187 170	400 289	0.016 0.009	182 -
D	Sputnik 20? 1962ατ1	1962 Sep. 1 5 days 1962 Sep. 6	-	-	1962 Sep. 1	65?	90?					
D	Fragments 1962ατ2-4											

Space Vehicle: Mariner 2, 1962 αρ

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	Name	Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m.)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Thor Agena B] 1962α ♑	1962 Sep. 1.86 785.54 days 1964 Oct. 26.40	Cylinder 1500?	8 long? 1.5 dia.	1962 Sep. 9.2 1963 Dec. 29.4 1964 Aug. 22.5	82.82 82.80 82.79	94.42 92.39 90.65	6863 6764 6684	300 279 266	669 492 346	0.027 0.016 0.006	139 207 35
D	Sputnik 21? 1962αφ1	1962 Sep. 12.07 2 days 1962 Sep. 14	-	-	1962 Sep. 13	64.8?	88?	6554?	176?	176?	0?	
D	Fragments 1962αφ2-7											
D	[Thor Agena B] 1962αχ (contained TRS)	1962 Sep. 17.99 62.2 days 1962 Nov. 19.2	Cylinder 1500?	8 long? 1.5 dia.	1962 Sep. 19.5 1962 Oct. 17.6 1962 Nov. 7.6	81.84 81.84 81.84	93.33 91.87 90.1	6814 6743 6655	204 196 191	668 533 363	0.034 0.025 0.013	154 51 -
	Tiros 6 1962αψ1	1962 Sep. 18.37 50 years	Cylinder 127	0.56 long 1.07 dia.	1962 Sep. 19.4	58.32	98.73	7076	684	711	0.002	102
	Tiros 6 1962αψ2 rocket	1962 Sep. 18.37 25 years	Cylinder 23	1.50 long 0.46 dia.	1962 Oct. 10.6	58.29	98.7	7076	684	712	0.002	-
	Fragments 1962αψ3-4											
D R?	Cosmos 9 1962αω1	1962 Sep. 27.40 4.0 days 1962 Oct. 1.4	-	-	1962 Sep. 28	65.0	90.9	6697	292	346	0.004	-
D	Cosmos 9 1962αω2 rocket	1962 Sep. 27.40 86 days 1962 Dec. 22	Cylinder? 1500?	10 long? 2 dia?	Initial orbit similar to 1962 α ω 1							
D	Fragments 1962αω3-8											

	Name		Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
T	Alouette	1962 βα 1	1962 Sep. 29.25 2,000 years	Oblate spheroid 144.7	0.86 long 1.07 dia	1962 Sep. 29.7	80.46	105.52	7392	996	1032	0.002	8
	Alouette rocket	1962 βα 2	1962 Sep. 29.25 2,000 years	Cylinder 1000?	6 long 1.5 dia	1962 Sep. 29.7	80.47	105.47	7393	1008	1023	0.001	336
	Fragments	1962βα3-4											
D	[Thor Agena D]	1962 ββ	1962 Sep. 29.99 14 days 1962 Oct. 14	Cylinder 1500?	8 long? 1.5 dia	1962 Oct. 1.5 1962 Oct. 10.7	65.40 65.40	90.30 89.08	6668 6607	203 196	376 262	0.013 0.005	172 166
	Explorer 14	1962 βγ 1	1962 Oct. 2.92 10 years?	Octagon + 4 vanes 40	1.30 long 0.74 dia	1962 Oct. 10.6 1963 Dec. 27.5	32.95 42.31	2185 2184.6	55784 55772	281 2558	98530 96229	0.881 0.840	150 191
	Explorer 14 rocket	1962 βγ 2	1962 Oct. 2.92 10 years?	Cylinder 24	1.5 long 0.46 dia	Orbit similar to 1962 βγ 1							
D R M	Mercury 8 (Sigma 7)	1962 βδ 1	1962 Oct. 3.51 9.22 hours 1962 Oct. 3.89	Cone-frustum 1370	2.90 long 1.83 dia	1962 Oct. 3.6	32.55	88.75	6597	153	285	0.010	74
D	Mercury 8 rocket	1962 βδ 2	1962 Oct. 3.51 1 day 1962 Oct. 4	Cylinder 3400	20 long 3 dia	1962 Oct. 3.6	32.55	88.67	6594	156	275	0.009	74
D	[Thor Agena B]	1962 βε	1962 Oct. 9.79 37.3 days 1962 Nov. 16.1	Cylinder 1500?	8 long? 1.5 dia	1962 Oct. 10.8 1962 Oct. 20.7 1962 Nov. 14.6	81.96 81.96 81.96	90.96 90.71 88.37	6698 6680 6569	213 209 170	427 395 212	0.016 0.014 0.003	58 20 286
D R?	Cosmos 10	1962 βζ 1	1962 Oct. 17.39 4 days 1962 Oct. 21	-	-	1962 Oct. 17.4	65.00	90.2	6660	197	367	0.013	-
D	Cosmos 10 rocket	1962 βζ 2	1962 Oct. 17.39 19 days 1962 Nov. 5	Cylinder? 1500?	10 long? 2 dia?	1962 Oct. 31.7	64.90	89.06	6606	196	260	0.005	61

Space vehicle: Ranger 5, 1962 βη

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	Name		Launch date, lifetime and descent date	Shape and weight (kg.)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km.)	Perigee height (km.)	Apogee height (km.)	Orbital eccentricity	Argument of perigee (deg.)
D	Cosmos 11	1962 βθ 1	1962 Oct. 20.16 575.9 days 1964 May 18.1	Ellipsoid 400?	1.8 long? 1.2 dia?	1962 Oct. 28.2 1963 Dec. 30.4	48.97 48.95	95.95 92.03	6946 6762	234 234	901 533	0.048 0.022	148 249
D	Cosmos 11 rocket	1962 βθ 2	1962 Oct. 20.16 228.8 days 1963 June 6.0	Cylinder? 1500?	10 long? 2 dia?	1962 Oct. 29.2 1962 Dec. 27.6 1963 May 21.3	48.95 48.93 48.93	95.77 94.63 90.22	6937 6883 6679	233 226 221	885 784 381	0.047 0.041 0.012	154 50 351
D	Sputnik 22?	1962 βι 1	1962 Oct. 24 5 days 1962 Oct. 29	-	-	1962 Oct. 25	65?	90?					
D	Fragments	1962β ι2-24											
	Star-rad	1962 βκ	1962 Oct. 26.68 4½ years	Cylinder 1500?	9 long? 1.5 dia	1962 Oct. 29.5 1964 Aug. 19.5	71.41 71.27	147.87 132.72	9262 8619	198 201	5570 4275	0.290 0.236	156 303
	Explorer 15	1962 βλ 1	1962 Oct. 27.97 100 years	Octagon+ 4 vanes 45.2	1.30 long 0.74 dia	1962 Oct. 28.0 1964 Aug. 9.7	18.02 18.02	315.20 311.44	15353 15247	313 300	17640 17438	0.564 0.562	137 196
	Explorer 15 rocket	1962 βλ 2	1962 Oct. 27.97 100 years?	Cylinder 24	1.5 long 0.46 dia	Initial orbit similar to 1962β λ1							
	Anna 1B	1962 βμ 1	1962 Oct. 31.34 5000 years	Spheroid 161	0.91 long 1.22 dia	1962 Oct. 31.8	50.14	107.84	7508	1077	1182	0.007	202
	Anna 1B rocket	1962 βμ 2	1962 Oct. 31.34 2000 years	Cylinder 450?	5.3 long 1.4 dia	1962 Nov. 7.6	50.13	107.53	7492	1069	1159	0.006	-
	Mars 1	1962 βν 1	1962 Nov. 1	Cylinder 893.5	3.3 long 1.1 dia	Initial earth-satellite orbit similar to 1962β ν 3							
D	Sputnik 23?	1962 βν3	1962 Nov. 1 1 day 1962 Nov. 2.3	-	-	1962 Nov. 1	65	90?		200?	300?		-
D	Sputnik 23 rocket?	1962β ν2	1962 Nov. 1 2 days 1962 Nov. 3	-	-	Initial earth-satellite orbit similar to 1962 β ν3							

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	Sputnik 24? 1962 βξ 1	1962 Nov. 4.65 1 day 1962 Nov. 5	-	-	Initial orbit similar to 1962 βξ 3							
D	Sputnik 24 rocket? 1962 βξ 3	1962 Nov. 4.65 76 days 1963 Jan. 19	Cylinder? 1500?	10 long? 2 dia?	1962 Nov. 5.4 1962 Dec. 1.3	64.7 64.7	92.42 91.49	6772 6726	197 193	590 503	0.029 0.023	353 355
D	Fragments 1962 βξ 2,4,5											
D	[Thor Agena B] 1962 β o	1962 Nov. 5.93 27 days 1962 Dec. 3	Cylinder 1500?	8 long? 1.5 dia	1962 Nov. 7.7 1962 Nov. 29.2	74.98 74.97	90.71 89.02	6687 6603	208 185	409 265	0.015 0.006	150 106
D	[Atlas Agena B] 1962 βπ	1962 Nov. 11.85 1 day 1962 Nov. 12	Cylinder 2000?	8 long? 1.5 dia	1962 Nov. 12.0	96.00	88.65	6584	206	206	0	-
D	[Thor Agena B] 1962 βρ	1962 Nov. 24.92 18 days 1962 Dec. 13	Cylinder 1500?	8 long? 1.5 dia	1962 Nov. 27.0 1962 Dec. 4.3	65.14 65.13	89.92 89.63	6649 6635	204 204	337 310	0.010 0.008	145 150
D	[Thor Agena D] 1962 βσ	1962 Dec. 4.90 3 days 1962 Dec. 8	Cylinder 1500?	8 long? 1.5 dia	1962 Dec. 5.1 1962 Dec. 7.0	65.1 65.1	89.16 88.40	6612 6574	194 169	273 222	0.006 0.004	154 223

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	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
	[Thor Agena D]	1962 βτ 1	1962 Dec. 13.17 4 years	-	-	1962 Dec. 17.0 1964 Aug. 21.3	70.36 70.36	116.26 109.75	7887 7593	231 228	2786 2202	0.162 0.130	145 157
	Injun 3	1962 βτ 2	1962 Dec. 13.17 7 years	Sphere 48	0.61 dia	1962 Dec. 13.7 1964 Jul. 3.2	70.38 70.34	116.32 112.95	7888 7740	235 236	2785 2484	0.162 0.145	149 233
D	[Thor Agena D]	1962 βτ 3	1962 Dec. 13.17 200.8 days 1963 July 2.0	-	-	1962 Dec. 16.5 1963 Mar. 9.7 1963 Apr. 21.1	70.33 70.32 70.28	115.89 108.94 101.83	7871 7564 7222	226 225 223	2763 2147 1465	0.161 0.127 0.086	146 53 353
	[Thor Agena D]	1962 βτ 4	1962 Dec. 13.17 3½ years	-	-	1962 Dec. 16.5 1964 Aug. 18.8	70.34 70.31	116.24 106.25	7886 7431	231 227	2784 1878	0.162 0.111	146 136
	[Thor Agena D]	1962 βτ 5	1962 Dec. 13.17 4 years	-	-	1962 Dec. 19.5 1964 Aug. 9.5	70.34 70.31	116.22 109.73	7885 7592	229 226	2785 2200	0.162 0.130	143 170
	Agena rocket	1962 βτ 6	1962 Dec. 13.17 6 years	Cylinder 1200?	6 long? 1.5 dia	1962 Dec. 28.6 1964 Aug. 6.9	70.36 70.37	116.3 112.13	7889 7704	248 238	2774 2412	0.160 0.141	- 189
T	Relay 1	1962 β υ 1	1962 Dec. 13.98 100,000 years?	Octagonal prism 78	0.81 long 0.74 dia	1962 Dec. 14.0	47.49	185.01	10759	1322	7439	0.284	178
	Relay 1 rocket	1962 β υ 2	1962 Dec. 13.98 50,000 years?	Cylinder 23	1.8 long 0.46 dia	1962 Dec. 20.0	47.45	184.71	10750	1345	7398	0.282	184
D	[Thor Agena D]	1962 βφ	1962 Dec. 14.89 25.0 days 1963 Jan. 8.9	Cylinder 1500?	8 long? 1.5 dia	1962 Dec. 15.8 1962 Dec. 27.8 1963 Jan. 4.5	70.97 70.95 70.95	90.46 89.85 89.08	6674 6643 6604	199 193 178	392 336 274	0.014 0.011 0.007	163 150 122

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
	Explorer 16	1962 βχ	1962 Dec. 16.61 1000 years	Cylinder 100.8	1.93 long 0.61 dia	1962 Dec. 16.6	52.01	104.32	7344	750	1181	0.029	142
	Transit 5A	1962 βψ1	1962 Dec. 19.06 60 years	Octagon+4 vanes + boom 61	0.50 long 0.30 dia	1962 Dec. 20.0	90.62	99.12	7090	698	725	0.002	353
	Transit 5A rocket	1962 βψ3	1962 Dec. 19.06 60 years	Cylinder 23	1.8 long 0.46 dia	1962 Dec. 20.7	90.74	99.11	7089	698	723	0.002	-
	Fragments	1962 βψ2,4											
D R?	Cosmos 12	1962 βω1	1962 Dec. 22.39 8 days 1962 Dec. 30	-	-	1962 Dec. 22.4	65.0	90.45	6673	198	392	0.015	-
D	Cosmos 12 rocket	1962 βω2	1962 Dec. 22.39 31 days 1963 Jan. 22	Cylinder? 1500?	10 long? 2 dia?	1963 Jan. 2.6	64.94	90.17	6662	197	370	0.013	-

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	Sputnik 25?	1963-01A	1963 Jan. 4.3 1 day 1963 Jan. 5	-	-	Orbit unknown							
D	Fragments	1963-01B-C											
D	[Thor Agena D]	1963-02A	1963 Jan. 7.88 16.3 days 1963 Jan. 24.2	Cylinder 1500?	8 long? 1.5 dia.	1963 Jan. 7.9 1963 Jan. 13.8 1963 Jan. 21.4	82.23 82.23 82.19	90.54 90.13 88.92	6680 6651 6589	205 193 168	399 353 254	0.015 0.012 0.006	178 156 126
D	Fragment	1963-02B		-	-								
	[Thor Agena D]	1963-03A	1963 Jan. 16.92 7 years	Cylinder 1500?	8 long? 1.5 dia.	1963 Jan. 16.9 1964 Nov. 21.2	81.89 81.88	94.66 94.52	6874 6872	459 459	533 528	0.005 0.005	40 224
D	Fragments	1963-03B-C											
	Syncom 1	1963-04A	1963 Feb. 14.22 > million years	Cylinder 39	0.39 long 0.71 dia.	1963 Feb. 14.2	33.30	1425.5	41944	34392	36739	0.028	276
	Syncom 1 rocket	1963-04B	1963 Feb. 14.22 100 years?	Cylinder 24	1.5 long 0.46 dia.	1963 Apr. 4.9 1963 Dec. 15.5	33.12 33.12	606.0 604.4	23753 23691	252 252	34498 34374	0.721 0.720	165 -
	[Blue Scout]	1963-05A	1963 Feb. 19.69 20 years	- 60?	-	1963 Mar. 9.7	100.48	97.79	7026	505	791	0.020	289
	Altair rocket	1963-05B	1963 Feb. 19.69 25 years	Cylinder 24	1.5 long 0.46 dia.	1963 Feb. 19.7	100.49	97.79	7028	510	789	0.020	340
	Fragments	1963-05C-D											
D R?	Cosmos 13	1963-06A	1963 Mar. 21.35 8 days 1963 Mar. 29	-	-	1963 Mar. 21.4	64.97	89.77	6636	192	324	0.010	65?
D	Cosmos 13 rocket	1963-06B	1963 Mar. 21.35 19 days 1963 Apr. 9	Cylinder? 1500?	10 long? 2 dia?	Initial orbit similar to 1963-06A							

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Thor Agena D]	1963-07A	1963 Apr. 1.92 25.0 days 1963 Apr. 26.9	Cylinder 1500?	8 long? 1.5 dia.	1963 Apr. 2.0 1963 Apr. 10.4	75.40 75.38	90.66 90.28	6683 6661	201 198	408 367	0.015 0.013	158 134
	Luna 4*	1963-08A	1963 Apr. 2	-	-	Initial earth-satellite orbit similar to 1963-08C							
				1422		1963 Apr.	-	42,000?	400,000?	90,000?	700,000?	0.8?	-
D	Sputnik 26?	1963-08C	1963 Apr. 2 1 day 1963 Apr. 3	-	-	1963 Apr. 2	65?	88?					
	Explorer 17	1963-09A	1963 Apr. 3.08 4 years	Sphere 185	0.89 dia.	1963 Apr. 3.1 1964 Oct. 24.6	57.63 57.63	96.40 94.72	6964 6885	255 252	917 762	0.048 0.037	49 58
D	Explorer 17 rocket	1963-09B	1963 Apr. 3.08 235.6 days 1963 Nov. 24.7	Cylinder 24	1.5 long 0.46 dia.	1963 Apr. 3.6 1963 May 31.6	57.59 57.59	96.32 95.12	6962 6904	247 245	920 807	0.048 0.041	51 -
D	Cosmos 14	1963-10A	1963 Apr. 13.46 137.6 days 1963 Aug. 29.1	Ellipsoid 400?	1.8 long? 1.2 dia?	1963 Apr. 13.5 1963 June 2.4	48.95 48.88	92.1 91.29	6754 6722	252 253	499 435	0.018 0.013	- -
D	Cosmos 14 rocket	1963-10B	1963 Apr. 13.46 84.2 days 1963 Jul. 6.7	Cylinder? 1500?	10 long? 2 dia?	1963 May 1.0 1963 June 9.0	48.90 48.90	91.59 90.64	6735 6689	249 237	465 384	0.016 0.011	205 42
D R?	Cosmos 15	1963-11A	1963 Apr. 22.35 5 days 1963 Apr. 27	-	-	1963 Apr. 22.4	65.00	89.77	6637	160	358	0.015	-
D	Cosmos 15 rocket	1963-11B	1963 Apr. 22.35 9.5 days 1963 May 1.8	Cylinder? 1500?	10 long? 2 dia?	1963 Apr. 27.3	64.95	89.19	6614	170	302	0.010	58

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*In the United States, Luna 4 has been designated as 1963-08B and Sputnik 26 as 1963-08A. There is also believed to be a rocket in the Luna 4 orbit.

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D R?	Cosmos 16 1963-12A	1963 Apr. 28.40 10 days 1963 May 8	-	-	1963 Apr. 28.4	65.02	90.4	6669	194	388	0.015	57
D	Cosmos 16 rocket 1963-12B	1963 Apr. 28.40 22.3 days 1963 May 20.7	Cylinder? 1500?	10 long? 2 dia?	1963 Apr. 30.3	65.02	90.48	6674	196	396	0.015	73
T	Telstar 2 1963-13A	1963 May 7.48 600,000 years?	Spheroid 79.4	0.94 long 0.86 dia.	1963 May 7.5	42.73	225.05	12267	974	10803	0.401	172
	Telstar 2 rocket 1963-13B	1963 May 7.48 200,000 years?	Cylinder 24	1.52 long 0.45 dia.	1963 May 13.3	42.76	224.81	12258	989	10770	0.399	178
	Midas 6? 1963-14A	1963 May 9.84 100,000 years?	Cylinder 2000?	9 long? 1.5 dia.	1963 May 12.2	87.42	166.48	10020	3604	3680	0.004	69
	TRS 1A 1963-14B	1963 May 9.84 50,000 years?	Tetrahedron 0.8	0.17 side	1963 May 15.2	87.35	166.51	10021	3604	3683	0.004	69
	TRS 1B 1963-14C	1963 May 9.84 50,000 years?	Tetrahedron 0.8	0.17 side	1963 May 29.2	87.42	166.47	10020	3606	3678	0.004	54
	Fragments 1963-14D-H											
	Needles 1963-14J	1963 May 9.84 2 to 5 years	Annulus 23	20,000 km dia.	1963 Aug 7 1964 Jan 29	87.35 87.22	166.46 166.0	10025 10007	3379 2760	3915 4497	0.027 0.087	180 349

Year of launch 1963, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D R M	Mercury 9 (Faith 7)	1963-15A	1963 May 15.54 1.44 days 1963 May 16.98	Cone frustum 1370	2.90 long 1.83 dia	1963 May 15.6	32.54	88.74	6592	161	267	0.008	-
D	Mercury 9 rocket	1963-15B	1963 May 15.54 0.6 days 1963 May 16.2	Cylinder 3400	20 long 3.0 dia	1963 May 15.7	32.54	88.10	6571	167	219	0.004	72
D	[Thor Agena D]	1963-16A	1963 May 18.94 8 days 1963 May 27	Cylinder 1500?	8 long? 1.5 dia	1963 May 20.4	74.54	91.12	6703	153	497	0.025	142
	Cosmos 17	1963-17A	1963 May 22.13 2 years	Ellipsoid 400?	1.8 long? 1.2 dia?	1963 May 22.2 1964 Jan. 1.9	49.0 49.0	94.82 93.69	6902 6839	260 256	788 666	0.037 0.030	107 354
D	Cosmos 17 rocket	1963-17C	1963 May 22.13 316.7 days 1964 April 2.8	Cylinder? 1500?	10 long? 2 dia?	1963 May 30.6 1964 Jan. 7.4	49.0 49.0	94.74 91.80	6891 6745	265 238	761 495	0.036 0.019	139 66
4d	Fragments	1963-17B-F											
D R?	Cosmos 18	1963-18A	1963 May 24.45 9.0 days 1963 June 2.4	-	-	1963 May 24.5	65.0	89.44	6620	196	288	0.007	-
D	Cosmos 18 rocket	1963-18B	1963 May 24.45 14.6 days 1963 June 8.0	Cylinder? 1500?	10 long? 2 dia?	1963 May 26.9 1963 June 3.4	65.0 64.95	89.47 88.74	6629 6593	198 195	304 235	0.008 0.003	96 92
D	[Thor Agena D]	1963-19A	1963 Jun 13.00 29.1 days 1963 Jul 12.1	Cylinder 1500?	8 long? 1.5 dia	1963 Jun 14.4 1963 Jul 10.0	81.87 81.82	90.67 88.48	6684 6577	192 173	419 225	0.017 0.004	135 36

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	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D R M	Vostok 5 1963-20A	1963 June 14.50 4.96 days 1963 June 19.46	Cone-cylinder 4730	9 long? 3 dia?	1963 June 14.8 1963 June 15.5 1963 June 17.5	64.97 64.97 64.97	88.27 88.2 88.00	6564 6559 6539	162 160 152	209 206 189	0.004 0.004 0.003	- - -
D	Vostok 5 rocket 1963-20B	1963 June 14.50 2.0 days 1963 June 16.5	Cylinder? -	-	1963 June 15.9	64.86	87.88	6547	150	187	0.003	110
D	[Thor Agena D] 1963-21A	1963 June 15.61 53.4 days 1963 Aug. 8.0	Cylinder 1500?	8 long? 1.5 dia	1963 June 16.1 1963 July 13.2	69.87 69.87	95.65 93.47	6924 6811	172 160	919 706	0.054 0.040	152 109
D	Lofti 2 1963-21B	1963 June 15.61 32.8 days 1963 July 18.4	Spheroid	0.61 long 0.51 dia	1963 June 15.6 1963 July 11.0	69.87 69.84	95.71 91.53	6926 6713	171 161	925 501	0.054 0.026	152 110
D	SR 4 1963-21C	1963 June 15.61 46.7 days 1963 Aug. 1.3	Sphere 39	0.61 dia	1963 July 18.3 1963 July 31.3	69.88 69.85	93.00 88.92	6751 6590	155 146	590 278	0.032 0.010	100 74
D	Radose 1963-21D	1963 June 15.61 44.9 days 1963 July 30.5	-	-	1963 June 28.9 1963 July 26.7	69.88 69.82	94.37 90.14	6884 6644	175 152	837 379	0.048 0.017	139 85
D	[Thor Agena D] 1963-21E	1963 June 15.61 42.1 days 1963 July 27.7	-	-	1963 June 26.4 1963 July 26.5	69.91 69.87	94.45 88.89	6880 6585	181 154	829 260	0.048 0.008	139 87
D	Surcal 1963-21F	1963 June 15.61 19.7 days 1963 July 5.3	-	-	1963 June 17.4 1963 July 2.5	69.86 69.81	95.26 90.34	6906 6680	169 168	887 435	0.052 0.020	150 123
D	Fragment 1963-21G											
T	Transit [Blue Scout] 1963-22A	1963 June 16.08 50 years?	'Mushroom' + 30 m.bogm 60?	-	1963 June 16.5	89.97	99.76	7119	724	757	0.002	64
	Altair rocket 1963-22B	1963 June 16.08 30 years	Cylinder 24	1.5 long 0.46 dia	1963 June 16.2	90.02	99.75	7119	720	759	0.002	-
	Fragments 1963-22C-D											

Year of launch 1963, continued

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	Vostok 6 1963-23A	1963 June 16.40	Cone-cylinder	9 long?	1963 June 16.4	65.09	88.34	6571	168	218	0.004	80
R		2.95 days	4713	3 dia?	1963 June 17.5	65.09	88.2	6566	164	212	0.004	-
M		1963 June 19.35										
D	Vostok 6 1963-23B	1963 June 16.40	Cylinder?	-	1963 June 16.8	65.08	88.38	6571	163	223	0.005	76
	rocket	1.7 days?	-									
		1963 June 18.1?										
T	Tiros 7 1963-24A	1963 June 19.41	Cylinder	0.56 long	1963 June 19.5	58.23	97.40	7013	621	649	0.002	17
		50 years	133	1.07 dia								
	Tiros 7 1963-24B	1963 June 19.41	Cylinder	1.50 long	1963 July 23.14	58.21	97.35	7011	612	650	0.003	56
	rocket	20 years	23	0.46 dia								
	Fragments 1963-24C-D											
D	[Thor Agena D] 1963-25A	1963 June 27.03	Cylinder	8 long?	1963 June 29.5	81.6	90.5	6674	196	396	0.015	147
		29.7 days	1500?	1.5 dia	1963 July 23.8	81.6	88.8	6583	168	243	0.006	36
		1963 July 26.7										
	Hitch-hiker 1 1963-25B	1963 June 27.03	Octagon	0.3 long	1963 July 20.1	82.1	132.55	8607	333	4132	0.221	350
		100 years	79.8	0.9 dia	1963 Dec. 22.9	82.1	132.48	8604	333	4119	0.220	78
			23 payload									
	GRS 1963-26A	1963 June 28.83	Cylinder	2.54 long	1963 June 29.6	49.74	102.1	7239	411	1311	0.062	136
		15 years	99.3	0.592 dia	1963 Oct. 21.4	49.72	102.04	7238	414	1305	0.061	174
	[Thor Agena B] 1963-27A	1963 June 29.94	Cylinder	8 long?	1963 July 10.0	82.3	94.84	6888	484	536	0.004	336
		7 years	1500?	1.5 dia	1964 Oct. 12.6	82.32	94.74	6884	483	528	0.003	164
D	Fragments 1963-27B-C											

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	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Oribtal eccentricity	Argument of perigee (deg.)
D	[Atlas Agena D]	1963-28A	1963 Jul 12.86 5.? days 1963 Jul 18.0	Cylinder 2000?	8 long? 1.5 dia	1963 Jul 17.1	95.37	88.2	6542	164	164	0	136
D	Fragments	1963-28B-C											
D	[Thor Agena D]	1963-29A	1963 Jul 19.00 25.8 days 1963 Aug 13.8	Cylinder 1500?	8 long? 1.5 dia	1963 Jul 20.7 1963 Jul 26.8 1963 Aug 11.6	82.86 82.86 82.86	90.44 90.37 88.65	6669 6656 6573	194 189 178	387 367 215	0.014 0.013 0.003	142 118 43
D	Fragment	1963-29B											
	Midas 7?	1963-30A	1963 Jul 19.16 100,000 years?	Cylinder 2000?	8 long? 1.5 dia	1963 Jul 23.5	88.41	168.0	10077	3670	3727	0.003	16
	TRS 1C	1963-30B	1963 Jul 19.16 50,000 years?	Tetrahedron 0.8	0.17 side	1963 Jul 20.9	88.36	168.0	10076	3662	3734	0.003	-
	[Atlas Agena B]	1963-30D	1963 Jul 19.16 6 years	Inflated sphere 1.25?	2.4 dia?	1963 Aug 6.1 1963 Dec 31.2 1964 Nov 19.4	88.42 88.59 88.25	168.04 168.03 167.89	10083 10082 10077	3665 3482 3114	3745 3926 4283	0.004 0.022 0.058	45 227 260
	Fragments	1963-30C,E											
T	Syncom 2	1963-31A	1963 Jul 26.61 > million yrs	Cylinder 39	0.39 long 0.79 dia	1963 Jul 27.8 1964 Oct 9.6	33.05 32.36	1454.0 1437.9	42512 42201	35584 35780	36693 35865	0.013 0.001	62 221
	Syncom 2 rocket	1963-31B	1963 Jul 26.61 15 years?	Cylinder 24	1.5 long 0.46 dia	1963 Aug 15.0 1963 Oct 15.5	33.14 33.14	636.5 630.3	24505 24361	255 255	36029 35711	0.730 0.728	- -
D	[Thor Agena D]	1963-32A	1963 Jul 31.00 12.0 days 1963 Aug 12.0	Cylinder 1500?	8 long? 1.5 dia	1963 Aug 5.7	74.95	90.4	6663	157	411	0.019	110
D	Fragment	1963-32B											

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	Cosmos 19 1963-33A	1963 Aug 6.25 237.07 days 1964 Mar 30.32	Ellipsoid 400?	1.8 long? 1.2 dia?	1963 Aug 15.6 1963 Oct 10.7 1964 Jan 7.0	49.01 49.01 49.00	92.11 91.71 90.89	6760 6740 6704	267 261 252	497 463 400	0.017 0.015 0.011	153 99 98
D	Cosmos 19 rocket 1963-33B	1963 Aug 6.25 124.8 days 1963 Dec 9.0	Cylinder? 1500?	10 long? 2 dia?	1963 Aug 15.5 1963 Oct 21.1 1963 Dec 3.7	49.00 49.00 48.94	92.00 91.07 89.58	6756 6712 6626	267 253 235	489 415 261	0.016 0.012 0.002	- 109 299
D	[Thor Agena D] 1963-34A	1963 Aug 25.02 18.6 days 1963 Sep 12.6	Cylinder 1500?	8 long? 1.5 dia	1963 Sep 7.3	75.01	89.4	6618	161	320	0.012	104
D	Fragment 1963-34B											
D	[Thor Agena D] 1963-35A	1963 Aug 29.80 69.7 days 1963 Nov 7.5	Cylinder	8 long? 1.5 dia	1963 Sep 3.0 1963 Oct 22.1	81.89 81.86	90.80 90.00	6686 6652	292 261	324 287	0.002 0.002	151 32
D	[Thor Agena D] 1963-35B	1963 Aug 29.80 24-30 days 1963 Sep 23-29	-	-	1963 Sep 2.7	81.89	92.07	6749	310	431	0.009	261
D	Fragments 1963-35C-D											
D	[Atlas Agena D] 1963-36A	1963 Sep 6.81 7.05 days 1963 Sep 13.86	Cylinder 2000?	8 long? 1.5 dia	1963 Sep 10.8	94.37	89.06	6594	168	263	0.007	103
D	Fragments 1963-36B-F											
D	[Thor Agena D] 1963-37A	1963 Sep 23.95 18.2 days 1963 Oct 12.14	Cylinder 1500?	8 long? 1.5 dia	1963 Sep 24.1 1963 Oct 10.8	74.90 74.89	90.63 88.64	6679 6594	161 150	441 282	0.021 0.010	158 101

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	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
	Ablestar rocket	1963-38A	1963 Sep 28.84 1000 years	Cylinder 450?	5.3 long 1.4 dia	1963 Sep 29.7	89.80	107.13	7466	1069	1107	0.003	240
T?	Transit?	1963-38B	1963 Sep 28.84 1000 years?	73	-	1963 Oct 11.1	89.90	107.42	7479	1075	1127	0.003	232
T	Radiation satellite	1963-38C	1963 Sep 28.84 1000 years?	- 61	-	1963 Oct 11.2	89.89	107.40	7479	1075	1126	0.003	234
	Fragments	1963-38D-E											
	[Atlas Agena D] (Vela 1?)	1963-39A	1963 Oct 17.10 >million yrs	Cylinder?	8 long? 1.5 dia?	1963 Oct 17.1	38.3	6270	113,000	102,098	111,137	0.040	-
	TRS 2	1963-39B	1963 Oct 17.10 10 years?	Tetrahedron 2.0	0.2 side	1963 Oct 17.1	36.77	2329	58,240	220	103,500	0.887	153
	Vela 2?	1963-39C	1963 Oct 17.10 > million yrs	Icosahedron 220	1.0 dia?	1963 Oct 19	37.8	6370	113,900	99,300	115,800	0.072	-
D	Cosmos 20	1963-40A	1963 Oct 18.40 10 days	-	-	1963 Oct 18.7	64.90	89.53	6632	205	302	0.007	32
R?			1963 Oct 28-29			1963 Oct 20.7	64.90	89.51	6628	204	296	0.007	32
D	Cosmos 20 rocket	1963-40B	1963 Oct 18.40 12 days	Cylinder? 1500?	10 long? 2 dia?	1963 Oct 18.4	64.91	89.68	6635	204	310	0.008	43
			1963 Oct 30-31			1963 Oct 28.0	64.87	88.12	6586	185	231	0.004	91

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Atlas Agena D] 1963-41A	1963 Oct 25.79 4.0 days 1963 Oct 29.8	Cylinder? 1500?	8 long? 1.5 dia.	1963 Oct 26.0 1963 Oct 27.8	99.05 99.05	88.99 88.70	6616 6584	144 140	332 272	0.014 0.010	97 78
D	[Atlas Agena D] 1963-41B	1963 Oct 25.79 3-4 days 1963 Oct 28-29	-	-	1963 Oct 27.9	99.05	88.55	6575	136	297	0.012	78
D	Fragments 1963-41C-D											
D	[Thor Agena D] 1963-42A	1963 Oct 29.88 83.51 days 1964 Jan 21.39	Cylinder 1500?	8 long? 1.5 dia.	1963 Nov 2.1 1963 Nov 29.4 1964 Jan 6.4	89.90 89.90 89.89	90.84 90.42 89.53	6690 6670 6623	279 275 232	345 308 258	0.005 0.002 0.002	- 250 84
	[Thor Agena D] 1963-42B	1963 Oct 29.88 18 months	-	-	1963 Oct 31.7 1964 Nov 18.5	89.99 89.97	93.35 91.83	6813 6741	285 282	585 444	0.022 0.012	32 284
D	Fragment 1963-42C											
	Polyot 1 1963-43A	1963 Nov 1.37 10 years	-	-	1963 Nov 1.4 1963 Nov 2.0 1964 Nov 21.5	- 58.92 58.92	94.0 102.46 102.30	6843 7268 7248	339 343 347	592 1437 1392	0.018 0.075 0.072	- 114 154
	Polyot 1 rocket 1963-43B	1963 Nov 1.37 3 years	Cylinder?	-	1963 Nov 5.6 1964 Nov 13.5	58.58 58.61	102.51 100.61	7257 7168	324 330	1434 1249	0.076 0.064	116 192
	Fragments 1963-43C-D											
D	Cosmos 21 1963-44A	1963 Nov 11.27 2.86 days 1963 Nov 14.13	-	-	1963 Nov 11.4	64.83	88.5	6577	182	216	0.003	-
D	Cosmos 21 rocket 1963-44B	1963 Nov 11.27 1.69 days 1963 Nov 12.96			Orbit similar to 1963-44A							

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	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D R?	Cosmos 22	1963-45A	1963 Nov 16.45 6 days 1963 Nov 22	-	-	1963 Nov 16.5	64.93	90.3	6665	192	381	0.014	-
D	Cosmos 22 rocket	1963-45B	1963 Nov 16.45 16.7 days 1963 Dec 3.2	Cylinder? 1500?	10 long? 2 dia?	1963 Nov 18.4 1963 Dec 1.1	64.86 64.84	90.14 88.06	6658 6573	189 166	369 223	0.013 0.004	33 40
T	Explorer 18 (IMP 1)	1963-46A	1963 Nov 27.10 2 years?	Octagon + 4 vanes 62	0.34 long 0.74 dia.	1963 Nov 28.5 1964 Nov 9.4	33.34 36.39	5666 5600	105,282 104,488	192 3862	197,616 192,358	0.938 0.902	- 152
	Explorer 18 rocket	1963-46B	1963 Nov 27.10 2 years?	Cylinder 24	1.8 long 0.46 dia.	Orbit similar to Explorer 18							
	Centaur 2	1963-47A	1963 Nov 27.79 500 years	Cylinder 4620	8.6 long 3 dia.	1963 Nov 30.8	30.34	107.46	7500	544	1699	0.077	137
	Fragments	1963-47B-H											
D	[Thor Agena D]	1963-48A	1963 Nov 27.88 17.3 days 1963 Dec 15.2	Cylinder 1500?	8 long? 1.5 dia.	1963 Nov 30	69.99	90.2	6658	175	386	0.016	-

Year of launch 1963, continued

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
	Ablestar rocket 1963-49A	1963 Dec 5.91 1000 years	Cylinder 450?	5.3 long 1.4 dia	1963 Dec 6.1	89.97	106.86	7458	1065	1095	0.002	308
T	[Thor Ablestar] 1963-49B	1963 Dec 5.91 1000 years?	- 70?	-	1963 Dec 12.4	89.98	107.18	7468	1067	1112	0.003	327
T	Transit? 1963-49C	1963 Dec 5.91 1000 years?	- 60?	-	1963 Dec 8.8	89.95	107.16	7468	1069	1111	0.003	303
	Fragments 1963-49D-F											
D	Cosmos 23 1963-50A	1963 Dec 13.58 104.48 days 1964 March 27.06	Ellipsoid 400?	1.8 long? 1.2 dia?	1963 Dec 13.7 1964 Jan 9.3	49.0 48.98	92.90 92.27	6805 6769	240 241	613 540	0.027 0.022	126 255
D	Cosmos 23 rocket 1963-50B	1963 Dec 13.58 84.37 days 1964 March 6.95	Cylinder? 1500?	10 long? 2 dia	1963 Dec 13.6 1964 Jan 12.0	49.12 48.99	92.84 92.04	6799 6757	230 230	611 527	0.028 0.022	136 268
D	Fragments 1963-50C-D											
D	[Atlas Agena D] 1963-51A	1963 Dec 18.91 1.28 days 1963 Dec 20.17	Cylinder 2000?	8 long? 1.5 dia	1963 Dec 19.1	97.89	88.48	6572	122	266	0.011	94
D R?	Cosmos 24 1963-52A	1963 Dec 19.39 9 days 1963 Dec 28	-	-	1963 Dec 19.8	65.03	90.51	6676	204	391	0.014	49
D	Cosmos 24 rocket 1963-52B	1963 Dec 19.39 36.1 days 1964 Jan 24.5	Cylinder? 1500?	10 long? 2 dia?	1963 Dec 21.1 1964 Jan 13.0	65.00 65.00	90.58 89.61	6679 6630	207 192	394 312	0.014 0.009	62 46

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	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
	Explorer 19 1963-53A	1963 Dec 19.78 4 years	Inflated sphere 7	3.65 dia	1963 Dec 19.8 1964 Oct 15.5	78.62 78.63	115.93 115.5	7870 7858	590 600	2394 2359	0.115 0.112	- 227
	Explorer 19 rocket 1963-53F	1963 Dec 19.78 200 years	Cylinder 24	1.5 long 0.46 dia	1963 Dec 23.0	78.62	115.85	7867	594	2383	0.114	154
	Fragments 1963-53B-E,G,H											
T	Tiros 8 1963-54A	1963 Dec 21.39 60 years	Cylinder 119	0.55 long 1.05 dia	1963 Dec 21.5	58.48	99.33	7105	691	765	0.005	123
	Tiros 8 rocket 1963-54B	1963 Dec 21.39 30 years	Cylinder 23	1.50 long 0.46 dia	1963 Dec 29.9	58.47	99.27	7103	696	753	0.004	117
	Fragments 1963-54C-D											
D	[Thor Agena D] 1963-55A	1963 Dec 21.91 18.0 days 1964 Jan 8.9	Cylinder 1500?	8 long? 1.5 dia	1963 Dec 22.3	64.94	89.96	6644	176	355	0.0135	149
D	[Thor Agena D] 1963-55B	1963 Dec 21.91 326.89 days 1964 Nov 7.80	-	-	1963 Dec 23.8 1964 Jul 26.1 1964 Nov 4.1	64.52 64.52 64.52	91.68 90.73 88.72	6733 6689 6588	321 291 203	388 331 216	0.005 0.003 0.001	89 348 307

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
	Agena D rocket	1964-01A	1964 Jan 11.84 800 years	Cylinder 1000?	6 long? 1.5 dia	1964 Jan 16.3	69.91	103.47	7298	905	934	0.002	84
T	GGSE	1964-01B	1964 Jan 11.84 1000 years?	-	-	1964 Jan 16.8	69.94	103.47	7298	898	942	0.003	92
T	SECOR (EGRS)	1964-01C	1964 Jan 11.84 1500 years	Rectangular box 18	0.4 x 0.3 x 0.2	1964 Jan 16.8	69.89	103.46	7297	904	933	0.002	84
T	SR 5	1964-01D	1964 Jan 11.84 1000 years	Sphere 45	0.6 dia	1964 Jan 16.8	69.90	103.47	7298	905	934	0.002	74
T	[Thor Agena D]	1964-01E	1964 Jan 11.84 1000 years?	-	-	1964 Jan 21.3	69.90	103.48	7298	905	934	0.002	96
	[Thor Agena D]	1964-02A	1964 Jan 19.45 300 years	Cylinder 1500?	8 long? 1.5 dia	1964 Nov 9.5	99.07	101.33	7199	792	850	0.004	169
	Fragments	1964-02B-C											
T	Relay 2	1964-03A	1964 Jan 21.88 1 million years	Octagonal prism 78	0.81 long 0.74 dia	1964 Jan 22.9	46.32	194.60	11129	2091	7411	0.239	184
	Relay 2 rocket	1964-03B	1964 Jan 21.88 1 million years	Cylinder 23	1.5 long 0.46 dia	1964 Jan 22.8	46.32	194.61	11132	2071	7437	0.241	186

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	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
T	Echo 2 1964-04A	1964 Jan 25.58 20 years?	Sphere 256	41 dia	1964 Jan 27.1 1964 Mar 4.9 1964 Nov 3.0	81.50 81.46 81.55	108.95 108.88 108.66	7551 7548 7541	1029 989 1148	1316 1351 1178	0.019 0.024 0.002	104 19 330
	Echo 2 rocket 1964-04B	1964 Jan 25.58 5000 years	Cylinder 1000?	6 long 1.5 dia	1964 Jan 27.1	81.50	108.96	7552	1030	1317	0.019	103
	Fragments 1964-04C-E											
	Saturn SA5 1964-05A	1964 Jan 29.68 20 months	Cylinder 17100	25.6 long 6.5 dia	1964 Jan 30.6 1964 Mar 3.1 1964 Nov 24.8	31.43 31.43 31.45	94.60 94.41 93.49	6890 6883 6830	264 264 254	760 756 650	0.036 0.035 0.029	135 105 317
T	Elektron 1 1964-06A	1964 Jan 30.40 200 years	Cylinder and 6 paddles	3 long? 2 dia?	1964 Jan 31.5	60.83	169.32	10138	394	7126	0.332	61
T	Elektron 2 1964-06B	1964 Jan 30.40 10 years?	Cone-cylinder and spire	5 long? 2 dia?	1964 Feb 5.0 1964 Nov 21.2	60.87 59.25	1356.40 1356.35	40593 40589	441 806	67988 67616	0.832 0.823	70 78
	Elektron 2 rocket 1964-06D	1964 Jan 30.40 10 years?	Cylinder 1500?	10 long? 2 dia?	1964 Feb 6.1 1964 Nov 24.3	60.87 59.34	1384.11 1384.00	41145 41140	411 821	69123 68702	0.835 0.825	70 77
	Fragment 1964-06C											

Space Vehicle: Ranger 6, 1964-07

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Thor Agena D] 1964-08A	1964 Feb 15.90 23.0 days 1964 Mar 9.9	Cylinder 1500?	8 long? 1.5 dia	1964 Feb 17.7 1964 Mar 5.5	74.95 74.95	90.86 89.5	6690 6623	179 165	444 324	0.020 0.012	147 96
D	Fragment 1964-08B											
D	[Atlas Agena D] 1964-09A	1964 Feb 25.79 4 days 1964 Mar 1	Cylinder 2000?	8 long? 1.5 dia	1964 Feb 26.4	95.66	88.24	6560	173	190	0.001	103
D	Fragment 1964-09B											
D	Cosmos 25 1964-10A	1964 Feb 27.56 267.05 days 1964 Nov 21.61	Ellipsoid 400?	1.8 long? 1.2 dia?	1964 Feb 27.7 1964 Jun 10.5 1964 Nov 7.3	49.01 48.97 49.0	92.27 91.40 89.61	6769 6725 6636	255 253 225	526 441 301	0.020 0.014 0.005	121 248 236
D	Cosmos 25 rocket 1964-10B	1964 Feb 27.56 111.7 days 1964 June 18.3	Cylinder? 1500?	10 long? 2 dia?	1964 Feb 28.4 1964 Jun 3.1	49.07 49.04	92.25 89.64	6768 6639	234 227	545 294	0.023 0.005	127 220
D	Fragments 1964-10C-D											
	[Thor Agena D] 1964-11A	1964 Feb 28.14 7 years	Cylinder 1500?	8 long? 1.5 dia	1964 Feb 29.1	82.03	94.74	6878	479	520	0.003	58
	Fragments 1964-11B-C											

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	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Atlas Agena D] 1964-12A	1964 Mar 11.84 4.3 days 1964 Mar 16.1	Cylinder 2000?	8 long? 1.5 dia	1964 Mar 12.9	95.73	88.2	6561	163	203	0.003	123
D	Fragment 1964-12B											
D	Cosmos 26 1964-13A	1964 Mar 18.63 193.87 days 1964 Sept 28.50	Ellipsoid 400?	1.8 long? 1.2 dia?	1964 Mar 19.3 1964 Jun 20.4 1964 Sept 21.4	48.96 48.95 48.95	91.00 90.23 88.79	6705 6668 6598	266 250 207	387 330 233	0.009 0.006 0.002	122 212 304
D	Cosmos 26 rocket 1964-13B	1964 Mar 18.63 59.5 days 1964 May 17.1	Cylinder? 1500?	10 long? 2 dia?	1964 Mar 22.8 1964 Apr 30.4	48.99 48.96	90.91 89.92	6702 6649	270 251	377 291	0.008 0.003	132 331
D	Fragments 1964-13C-D											
D	Cosmos 27 1964-14A	1964 Mar 27.14 1.2 days 1964 Mar 28.3	-	-	1964 Mar 27.6	64.80	88.16	6561	167	198	0.002	323
D	Cosmos 27 rocket 1964-14B	1964 Mar 27.14 2.6 days 1964 Mar 29.7	-	-	1964 Mar 28.5	64.80	88.22	6566	181	194	0.001	18
D	Fragments 1964-14C-D											

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
T	Ariel 2	1964-15A	1964 Mar 27.73 4 years	Cylinder + 4 paddles 68	0.9 long 0.58 dia	1964 Mar 28.4 1964 Jul 30.4 1964 Nov 18.0	51.64 51.65 51.66	101.29 101.00 100.68	7201 7188 7172	285 285 285	1362 1335 1303	0.075 0.073 0.071	140 158 138
	Ariel 2 rocket	1964-15B	1964 Mar 27.73 3 years	Cylinder 24	1.8 long 0.46 dia	1964 Mar 29.2 1964 Nov 15.5	51.67 51.64	101.27 100.4	7200 7157	282 282	1362 1275	0.075 0.069	142 -
	Fragment	1964-15C											
D	Zond 1 launcher	1964-16A	1964 Apr 2.12 1.5 days 1964 Apr 3.6	-	-	1964 Apr 2.5	64.83	88.47	6578	187	213	0.002	345
D	Zond 1 rocket?	1964-16B	1964 Apr 2.12 0.6 days 1964 Apr 2.7	-	-	1964 Apr 2.5	65.22	88.10	6559	122	240	0.009	139
D	Fragment	1964-16C											
D R?	Cosmos 28	1964-17A	1964 Apr 4.40 7.9 days 1964 Apr 12.3	-	-	1964 Apr 4.8	65.04	90.37	6671	213	373	0.012	45
D	Cosmos 28 rocket	1964-17B	1964 Apr 4.40 28.7 days 1964 May 3.1	Cylinder? 1500?	10 long? 2 dia?	1964 Apr 4.9	65.01	90.48	6676	224	371	0.011	63
D	Fragment	1964-17C											

Space Vehicle: Zond 1, 1964-16D

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	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	Gemini 1	1964-18A	1964 Apr 8.67 4.2 days 1964 Apr 12.9	Cone-cylinder 5170 payload 3000	11.6 long 3.0 dia	1964 Apr 9.5	32.56	89.00	6605	154	299	0.011	82
	Polyot 2	1964-19B	1964 Apr 12.39 3 years	-	-	1964 Apr 14.1 1964 May 10.8 1964 Nov 10.2	59.92 58.06 58.07	91.86 92.31 92.05	6742 6769 6755	242 303 289	485 479 465	0.018 0.013 0.013	57 98 34
D	Polyot 2 rocket	1964-19A	1964 Apr 12.39 18.4 days 1964 Apr 30.8	-	-	1964 Apr 17.2	59.92	91.54	6729	236	465	0.017	63
D	[Atlas Agena D]	1964-20A	1964 Apr 23.78 5.2 days 1964 Apr 29.0	Cylinder 2000?	8 long? 1.5 dia	1964 Apr 25.5	103.56	89.40	6621	150	336	0.014	128
D	Fragments	1964-20B-E											
D R?	Cosmos 29	1964-21A	1964 Apr 25.43 7 days 1964 May 2	-	-	1964 Apr 28.2	65.01	89.50	6628	203	296	0.007	22
D	Cosmos 29 rocket	1964-21B	1964 Apr 25.43 15.9 days 1964 May 11.3	Cylinder? 1500?	10 long? 2 dia?	1964 Apr 28.3	65.04	89.56	6631	220	286	0.005	69
D	Fragments	1964-21C-E											

	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	[Thor Agena D] 1964-22A	1964 Apr 27.98 28.19 days 1964 May 26.17	Cylinder 1500?	8 long? 1.5 dia	1964 May 1.1	79.93	90.77	6690	178	446	0.020	130
D R?	Cosmos 30 1964-23A	1964 May 18.41 7.90 days 1964 May 26.31	-	-	1964 May 20.3	64.87	90.25	6664	206	366	0.012	38
D	Cosmos 30 1964-23B rocket	1964 May 18.41 20.3 days 1964 June 7.7	Cylinder? 1500?	10 long? 2 dia?	1964 May 24.2	64.84	89.94	6650	205	338	0.010	24
D	[Atlas Agena D] 1964-24A	1964 May 19.81 2.9 days 1964 May 22.7	Cylinder 2000?	8 long? 1.5 dia	1964 May 20.7	101.12	89.69	6639	141	380	0.018	120
D	Saturn SA6 1964-25A	1964 May 28.71 3.31 days 1964 June 1.02	Cone-cylinder 16900	24 long 5.7 dia	1964 May 29.7	31.74	88.22	6570	179	204	0.002	122
T	Transit? 1964-26A [Blue Scout]	1964 June 4.16 200 years	- 60?	-	1964 June 5.2	90.42	103.12	7283	854	956	0.007	99
	Altair rocket 1964-26D	1964 June 4.16 200 years	Cylinder 24	1.5 long 0.46 dia	1964 June 19.2	90.45	103.13	7283	854	956	0.007	-
	Fragments 1964-26B-C											
D	[Thor Agena D] 1964-27A	1964 June 4.96 13.94 days 1964 June 18.90	Cylinder 1500?	8 long? 1.5 dia	1964 June 7.1 1964 June 17.0	79.96 79.95	90.27 89.15	6667 6610	149 139	429 324	0.021 0.014	107 74

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	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	Cosmos 31	1964-28A	1964 June 6.25 135.97 days 1964 Oct 20.22	Ellipsoid? 400?	1.8 long? 1.2 dia?	1964 June 6.7 1964 Oct 8.5	48.93 48.97	91.61 89.40	6735 6626	222 195	492 301	0.020 0.008	112 353
D	Cosmos 31 rocket	1964-28B	1964 June 6.25 71.35 days 1964 Aug 16.60	Cylinder? 1500?	10 long? 2 dia?	1964 June 8.2 1964 Aug 8.3	48.97 48.94	91.60 89.51	6733 6633	220 208	490 301	0.020 0.007	118 61
D R?	Cosmos 32	1964-29A	1964 June 10.45 8.0 days 1964 June 18.5	-	-	1964 June 10.9	51.24	89.76	6644	213	319	0.008	35
D	Cosmos 32 rocket	1964-29B	1964 June 10.45 34.43 days 1964 Jul 14.88	Cylinder? 1500?	10 long? 2 dia?	1964 June 12.4	51.30	89.93	6650	232	312	0.006	82
D	Fragment	1964-29C											
	Starflash 1A [Agena D]	1964-30A	1964 June 13.66 1 year	Cylinder 2500?	8 long? 1.5 dia	1964 June 14.6 1964 Sept 11.3 1964 Nov 2.5	114.98 114.98 115.00	91.67 91.53 91.34	6735 6728 6719	350 343 334	364 357 348	0.001 0.001 0.001	216 341 329
D	Fragment	1964-30B											
	[Thor Agena D]	1964-31A	1964 June 18.20 400 years	Cylinder	8 long? 1.5 dia	1964 June 18.4	99.84	101.64	7213	828	842	0.001	334
	Capsule	1964-31B	1964 June 18.20 500 years?	-	-	1964 June 24.2	99.83	101.64	7213	828	842	0.001	147
	Fragment	1964-31C											

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
D	[Thor Agena D]	1964-32A	1964 June 19.97 26.81 days 1964 July 16.78	Cylinder 1500?	8 long? 1.5 dia	1964 June 21.1 1964 Jul 10.5	85.0 84.99	90.95 89.60	6697 6631	176 173	462 332	0.021 0.012	- 56
D	Fragment	1964-32B											
D R?	Cosmos 33	1964-33A	1964 June 23.43 7.93 days 1964 July 1.36	-	-	1964 June 23.6	65.0	89.50	6629	209	293	0.006	-
D	Cosmos 33 rocket	1964-33B	1964 June 23.43 17.37 days 1964 July 10.80	Cylinder? 1500?	10 long? 2 dia?	1964 June 23.8	65.08	89.54	6630	219	285	0.005	42
D	Fragments	1964-33C-D											
D R?	Cosmos 34	1964-34A	1964 July 1.47 7.93 days 1964 July 9.40	-	-	1964 July 3.4	64.89	89.98	6653	202	348	0.011	37
D	Cosmos 34 rocket	1964-34B	1964 July 1.47 13.89 days 1964 July 15.36	Cylinder? 1500?	10 long? 2 dia?	1964 July 5.4	64.89	89.80	6644	193	339	0.011	24

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	Name	Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg.)	Nodal period (min.)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg.)
	[Thor Agena D] 1964-35A	1964 Jul 3.06 7 years	Cylinder 1500?	8 long? 1.5 dia	1964 Jul 5.5 1964 Nov 25.3	82.09 82.08	94.94 94.92	6893 6892	501 495	529 532	0.002 0.003	228 111
D	[Atlas Agena D] 1964-36A	1964 Jul 6.91 2.0 days 1964 Jul 8.9	Cylinder 2000?	8 long? 1.5 dia	1964 Jul 7.4	92.89	89.20	6612	121	346	0.017	145
	Capsule 1964-36B	1964 Jul 6.91 180.21 days (1965 Jan 3.12)	-	-	1964 Jul 8.5 1964 Nov 26.2	92.97 92.93	91.2 90.31	6715 6666	297 261	377 314	0.006 0.004	253 42
D	Fragment 1964-36C											
D	[Thor Agena D] 1964-37A	1964 Jul 10.97 26.52 days 1964 Aug 6.49	Cylinder 1500?	8 long? 1.5 dia	1964 Jul 13.4	84.98	91.00	6699	180	461	0.021	133
T	Elektron 3 1964-38A	1964 Jul 10.91 200 years?	Cylinder and 6 paddles 400?	3 long? 2 dia?	1964 Jul 14.3	60.79	168.17	10093	404	7025	0.328	61
T	Elektron 4 1964-38B	1964 Jul 10.91 10 years?	Cone-cylinder 550?	5 long? 2 dia?	1964 Jul 14.5	60.80	1313.63	39737	457	66261	0.828	70
	Elektron 4 rocket 1964-38D	1964 Jul 10.91 10 years?	Cylinder? 1500?	10 long? 2 dia?	1964 Jul 15.9	60.96	1341.37	40289	471	67350	0.830	71
	Fragment 1964-38C											

Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D R?	Cosmos 35	1964-39A	1964 Jul 15.48 7.92 days 1964 Jul 23.40	-	-	1964 Jul 16.2	51.24	89.2	6616	218	258	0.003	23
D	Cosmos 35 rocket	1964-39B	1964 Jul 15.48 17.32 days 1964 Aug 1.80	Cylinder? 1500?	10 long? 2 dia?	1964 Jul 16.3	51.32	89.40	6627	216	282	0.005	130
	Fragments	1964-39C-D											
	[Atlas Agena] (Vela 3?)	1964-40A	1964 Jul 17.35 >million years	Cylinder?	9 long? 1.5 dia?	1964 Jul 17.4 1964 Dec 15.5	39.58 39.13	6022.6 6091.5	109653 110487	101959 103048	104591 105169	0.012 0.010	149 -
	Vela 4?	1964-40B	1964 Jul 17.35 >million years	Icosahedron 234	1.0 dia	1964 Jul 17.4 1964 Dec 15.5	40.88 40.90	6007.0 6070.5	109462 110233	94436 94584	111775 113125	0.079 0.084	74 -
T	TRS	1964-40C	1964 Jul 17.35 10 years?	Tetrahedron 2.0	0.2 side	1964 Jul 17.4 1964 Oct 24.9	36.7 38.6	2364 2350	58988 58555	220 590	105000 103764	0.888 0.881	147 159
	Cosmos 36	1964-42A	1964 Jul 30.15 7 months	Ellipsoid 400?	1.8 long? 1.2 dia?	1964 Aug 2.4 1964 Dec 8.9	49.00 48.99	91.85 90.86	6747 6698	261 239	477 400	0.016 0.012	127 22
D	Cosmos 36 rocket	1964-42B	1964 Jul 30.15 121.98 days 1964 Nov 29.13	Cylinder? 1500?	10 long? 2 dia?	1964 Aug 4.7 1964 Oct 7.4 1964 Nov 24.0	49.02 49.00 48.99	91.83 91.12 89.22	6746 6710 6617	254 245 212	482 419 265	0.017 0.013 0.004	143 85 328

Space vehicle: Ranger 7, 1964-41

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	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	[Thor Agena]	1964-43A	1964 Aug 5.97 26.0 days 1964 Sept 1.0	Cylinder 1500?	8 long? 1.5 dia	1964 Aug 6.9 1964 Aug 24.8	79.96 79.99	90.71 89.35	6687 6619	182 175	436 307	0.019 0.010	138 68
D R?	Cosmos 37	1964-44A	1964 Aug 14.40 8 days? 1964 Aug 22?	-	-	1964 Aug 15.8	64.92	89.41	6625	207	287	0.006	22
D	Cosmos 37 rocket	1964-44B	1964 Aug 14.40 19.64 days 1964 Sept 3.04	Cylinder? 1500?	10 long? 2 dia?	1964 Aug 15.8	65.01	89.54	6633	215	295	0.006	36
D	[Atlas Agena]	1964-45A	1964 Aug 14.92 8.8 days 1964 Aug 23.7	Cylinder 2000?	8 long? 1.5 dia	1964 Aug 17.6	95.52	89.0	6606	149	307	0.012	135
	Capsule (Hitch-hiker?)	1964-45B	1964 Aug 14.92 30 years	-	-	1964 Aug 18.3 1964 Dec 10.0	95.67 95.68	127.40 127.24	8390 8378	275 274	3748 3726	0.207 0.206	11 145
D	Fragment	1964-45C											

Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	Cosmos 38	1964-46A	1964 Aug 18.39 82.4 days 1964 Nov 8.8	-	-	1964 Aug 18.8 1964 Oct 3.5 1964 Nov 1.4	56.12 56.13 56.09	94.31 92.17 89.70	6866 6760 6641	206 193 190	769 571 336	0.041 0.028 0.011	60 157 233
D	Cosmos 39	1964-46B	1964 Aug 18.39 91.14 days 1964 Nov 17.53	-	-	1964 Aug 18.8 1964 Oct 12.4 1964 Nov 11.4	56.10 56.10 56.10	94.59 91.93 89.52	6880 6751 6631	206 197 186	798 548 319	0.043 0.026 0.010	61 177 254
D	Cosmos 40	1964-46C	1964 Aug 18.39 92.50 days 1964 Nov 18.89	-	-	1964 Aug 19.7 1964 Oct 5.6 1964 Nov 9.5	56.12 56.10 56.10	93.95 92.07 89.74	6851 6757 6643	206 196 185	740 561 345	0.039 0.027 0.012	61 162 247
	Cosmos 38 rocket	1964-46D	1964 Aug 18.39 6 months	-	-	1964 Aug 19.8 1964 Dec 11.5	56.12 56.15	95.13 92.51	6908 6778	212 210	848 590	0.046 0.028	64 304
D	Fragments	1964-46E-G											
T	Syncom 3	1964-47A	1964 Aug 19.51 >million years	Cylinder about 30	0.39 long 0.71 dia	1964 Aug 22.2 1964 Dec 15.5	0.10 0.07	1407.8 1436.5	41609 42177	34191 35790	36271 35799	0.025 0	117 -
	Syncom 3 rocket	1964-47B	1964 Aug 19.51 100 000 years	Cylinder 24	1.5 long 0.46 dia	1964 Aug 20.2	16.70	698.83	25914	1137	37935	0.710	181
	Starflash 1B [Agena]	1964-48A	1964 Aug 21.66 6 months	Cylinder 1500?	8 long? 1.5 dia	1964 Aug 25.6 1964 Dec 5.5	115.0 115.0	91.60 90.90	6734 6697	349 305	363 332	0.001 0.002	108 50

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Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
T?	Cosmos 41	1964-49D	1964 Aug 22.30 100 years?	-	-	1964 Sept 10.7	64.88	714.58	26477	426	39771	0.743	326
D	Cosmos 41 rocket	1964-49A	1964 Aug 22.30 24.24 days 1964 Sept 15.54	Cylinder? 1500?	10 long? 2 dia?	1964 Aug 23.7	64.74	91.06	6706	200	455	0.019	66
2d	Fragments	1964-49B,C,E											
T?	Cosmos 42	1964-50A	1964 Aug 22.46 18 months	-	-	1964 Aug 23.2 1964 Dec 8.9	48.96 48.96	98.05 96.84	7047 6989	230 226	1113 995	0.062 0.055	110 196
	Cosmos 42 rocket	1964-50B	1964 Aug 22.46 1 year	Cylinder? 1500?	10 long? 2 dia?	1964 Aug 23.4 1964 Dec 12.2	48.97 48.97	97.91 96.14	7040 6955	224 222	1098 931	0.062 0.051	112 215
T?	Cosmos 43	1964-50C	1964 Aug 22.46 16 months	-	-	1964 Aug 23.3 1964 Dec 6.3	48.96 48.97	98.00 96.82	7042 6988	227 225	1100 994	0.062 0.055	111 186
T	Explorer 20	1964-51A	1964 Aug 25.57 800 years	Double cone 44	0.83 long 0.66 dia	1964 Aug 25.9	79.77	104.09	7329	878	1024	0.010	304
	Explorer 20 rocket	1964-51B	1964 Aug 25.57 500 years	Cylinder 24	1.5 long 0.46 dia	1964 Aug 26.6	79.93	103.92	7321	877	1009	0.009	300
	Fragments	1964-51C-E											

Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
T	Nimbus 1	1964-52A	1964 Aug 28.39 20 years	Conical skeleton + 2 paddles 376	2.85 long 1.45 dia	1964 Aug 28.8	98.66	98.42	7061	429	937	0.036	158
	Nimbus 1 rocket	1964-52B	1964 Aug 28.39 10 years	Cylinder 1000?	6 long 1.5 dia	1964 Sept 15.5	98.68	98.40	7060	429	934	0.036	-
T	Cosmos 44	1964-53A	1964 Aug 28.68 100 years?	-	-	1964 Aug 29.3	65.04	99.48	7114	615	857	0.017	23
	Cosmos 44 rocket	1964-53B	1964 Aug 28.68 50 years	Cylinder? 1500?	10 long? 2 dia?	1964 Aug 30.1	65.05	99.54	7117	682	796	0.008	45
T	OGO 1	1964-54A	1964 Sept 5.92 2 years?	Box + booms 487	1.82 long 0.91 wide 0.91 high	1964 Sept 7.8 1964 Nov 13.4	31.15 33.02	3838.8 3841.4	81211 81251	281 1503	155763 148242	0.918 0.903	313 319
	OGO 1 rocket	1964-54B	1964 Sept 5.92 2 years?	Cylinder 1000?	6 long 1.5 dia			Orbit similar to 1964-54A					
D R?	Cosmos 45	1964-55A	1964 Sept 13.41 4.9 days 1964 Sept 18.3	-	-	1964 Sept 14.6	64.89	89.68	6638	207	313	0.008	36
D	Cosmos 45 rocket	1964-55B	1964 Sept 13.41 14.45 days 1964 Sept 27.86	Cylinder? 1500?	10 long? 2 dia?	1964 Sept 14.5	64.88	89.60	6634	203	309	0.008	36
D	[Thor Agena]	1964-56A	1964 Sept 14.95 21.7 days 1964 Oct 6.7	Cylinder 1500?	8 long? 1.5 dia	1964 Sept 16.1	84.96	90.88	6697	238	466	0.022	135
D	Fragment	1964-56B											

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Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D	Saturn SA7	1964-57A	1964 Sept 18.68 3.86 days 1964 Sept 22.54	Cylinder 16700	24.4 long 5.5 dia	1964 Sept 20.3	31.72	88.30	6568	178	203	0.002	142
D	[Atlas Agena]	1964-58A	1964 Sept 23.84 4.78 days 1964 Sept 28.62	Cylinder 2000?	8 long? 1.5 dia	1964 Sept 25.2	92.91	89.00	6602	145	303	0.012	173
D	Fragment	1964-58B											
D R?	Cosmos 46	1964-59A	1964 Sept 24.50 8.02 days 1964 Oct 2.52	-	-	1964 Sept 25.5	51.25	89.22	6616	211	264	0.004	16
D	Cosmos 46 rocket	1964-59B	1964 Sept 24.50 13.22 days 1964 Oct 7.72	Cylinder? 1500?	10 long? 2 dia?	1964 Sept 25.5	51.27	89.40	6624	234	259	0.002	125
T	Explorer 21 (IMP 2)	1964-60A	1964 Oct 4.16 10 years?	Octagon + 4 vanes 62	0.20 long 0.71 dia	1964 Oct 4.2 1964 Dec 15.5	33.53 33.77	2097 2080	54271 53971	190 362	95595 94825	0.879 0.875	133 -
	Explorer 21 rocket	1964-60B	1964 Oct 4.16 10 years?	Cylinder 24	1.5 long 0.46 dia	Orbit similar to Explorer 21							
D	[Thor Agena]	1964-61A	1964 Oct 5.91 20.50 days 1964 Oct 26.41	Cylinder 1500?	8 long? 1.5 dia	1964 Oct 7.3	79.97	90.75	6689	182	440	0.019	158

Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D R?	Cosmos 47	1964-62A	1964 Oct 6.30 1.0 days 1964 Oct 7.3	-	-	1964 Oct 6.7	64.62	90.07	6657	174	383	0.016	72
D	Cosmos 47 rocket	1964-62B	1964 Oct 6.30 7.9 days 1964 Oct 14.2	Cylinder? 1500?	10 long? 2 dia?	1964 Oct 7.2	64.71	89.92	6649	168	373	0.015	67
D	Fragments	1964-62C-E											
	Ablestar rocket	1964-63A	1964 Oct 6.70 1500 years	Cylinder 450?	5.3 long 1.4 dia	1964 Oct 12.1	89.91	106.65	7448	1055	1085	0.002	35
T?	[Thor Ablestar]	1964-63B	1964 Oct 6.70 1000 years	-	-	1964 Dec 21.2	89.92	106.65	7448	1055	1085	0.002	156
T	[Thor Ablestar]	1964-63C	1964 Oct 6.70 1000 years	-	-	1964 Oct 13.0	89.93	106.63	7447	1054	1084	0.002	29
T	[Thor Ablestar]	1964-63E	1964 Oct 6.70 1000 years	-	-	1964 Oct 14.5	89.97	106.66	7449	1056	1086	0.002	32
	Fragments	1964-63D,F											
T	Explorer 22 (Beacon)	1964-64A	1964 Oct 10.13 2000 years	Octagon 52	0.30 long 0.46 dia	1964 Oct 10.1	79.69	104.70	7359	885	1077	0.013	146
	Explorer 22 rocket	1964-64B	1964 Oct 10.13 300 years	Cylinder 24	1.5 long 0.46 dia	1964 Oct 20.9	79.69	104.75	7362	888	1079	0.013	119

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Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
D M R	Voskhod 1	1964-65A	1964 Oct 12.31 1.01 days 1964 Oct 13.32	-	-	1964 Oct 12.7	64.90	90.04	6655	177	377	0.015	65
D	Voskhod 1 rocket	1964-65B	1964 Oct 12.31 8.1 days 1964 Oct 20.4	Cylinder?	-	1964 Oct 15.7	64.77	89.39	6627	169	328	0.012	57
D	Fragment	1964-65C											
D R?	Cosmos 48	1964-66A	1964 Oct 14.41 5.96 days 1964 Oct 20.37	-	-	1964 Oct 15.8	65.08	89.32	6622	204	284	0.006	21
D	Cosmos 48 rocket	1964-66B	1964 Oct 14.41 13.84 days 1964 Oct 28.25	Cylinder? 1500?	10 long? 2 dia?	1964 Oct 15.5	65.06	89.53	6629	211	291	0.006	23
D	Fragment	1964-66C											
D	[Thor Agena]	1964-67A	1964 Oct 17.91 17.28 days 1964 Nov 4.19	Cylinder 1500?	8 long? 1.5 dia	1964 Oct 19.1	74.99	90.59	6681	189	416	0.017	147
D	[Atlas Agena]	1964-68A	1964 Oct 23.76 5.07 days 1964 Oct 28.83	Cylinder 2000?	8 long? 1.5 dia	1964 Oct 24.6	95.55	88.6	6583	139	271	0.010	169
	Capsule	1964-68B	1964 Oct 23.76 4 months	-	-	1964 Oct 27.9	95.84	91.14	6708	323	336	0.001	330
D	Fragments	1964-68C-D											

Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
T	Cosmos 49	1964-69A	1964 Oct 24.22 14 months	Ellipsoid 400?	1.8 long? 1.2 dia?	1964 Oct 24.7 1964 Dec 16.4	48.99 48.94	91.78 91.60	6743 6734	264 255	466 457	0.015 0.015	117 7
	Cosmos 49 rocket	1964-69B	1964 Oct 24.22 109.46 days (1965 Feb.10.68)	Cylinder? 1500?	10 long? 2 dia?	1964 Oct 24.7 1964 Dec 3.4	48.94 48.93	91.81 91.26	6746 6717	260 251	477 426	0.016 0.013	117 306
D	Fragment	1964-69C											
D	Cosmos 50	1964-70A	1964 Oct 28.45 8.0 days 1964 Nov 5.5	-	-	1964 Oct 29.7	51.23	88.67	6588	190	230	0.003	312
D	Cosmos 50 rocket	1964-70B	1964 Oct 28.45 4.7 days 1964 Nov 2.2	Cylinder? 1500?	10 long? 2 dia?	1964 Oct 29.7	51.24	88.86	6592	187	240	0.004	192
D	Fragments	1964-70C-D											
D	[Thor Agena]	1964-71A	1964 Nov 2.89 25.34 days 1964 Nov 28.23	Cylinder 1500?	8 long? 1.5 dia	1964 Nov 3.6	79.95	90.70	6692	180	448	0.020	155
T?	[Thor Agena]	1964-72A	1964 Nov 4.09 7 years	Cylinder 1500?	8 long? 1.5 dia	1964 Nov 5.1	82.00	95.05	6897	512	526	0.001	303
	Fragments	1964-72B-D											

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Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-Major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
T	Explorer 23	1964-74A	1964 Nov 6.50 50 years	Cylinder 134	2.3 long 0.62 dia	1964 Nov 6.51	51.95	99.17	7100	466	977	0.036	138
D	[Thor Agena]	1964-75A	1964 Nov 18.90 17.41 days 1964 Dec 6.31	Cylinder 1500?	8 long? 1.5 dia	1964 Nov 21.70	70.02	89.71	6638	180	339	0.012	100
T	Explorer 24	1964-76A	1964 Nov 21.71 5 years?	Inflated sphere 8.6	3.65 dia	1964 Nov 21.79	81.36	116.30	7889	525	2498	0.125	166
T	Explorer 25 (Injun 4)	1964-76B	1964 Nov 21.71 200 years	Sphere 40	0.61 dia	1964 Nov 21.79	81.36	116.27	7886	522	2494	0.125	166
	Explorer 24 rocket	1964-76C	1964 Nov 21.71 100 years	Cylinder 23	1.5 long 0.46 dia	1964 Dec 15.5	81.36	116.2	7891	531	2495	0.124	-
	Fragments	1964-76D-J											
D	Zond 2 launcher	1964-78A	1964 Nov 30.55 1.23 days 1964 Dec 1.78	-	-	1964 Nov 30.9	64.72	88.16	6564	153	219	0.005	313
D	Zond 2 rocket	1964-78B	1964 Nov 30.55 2.10 days 1964 Dec 2.65	-	-	1964 Dec 1.5	64.73	88.15	6562	177	190	0.001	317
D	[Atlas Agena]	1964-79A	1964 Dec 4.79 1.2 days 1964 Dec 6.0	Cylinder 2000?	8 long? 1.5 dia	1964 Dec 5.2	97.02	89.69	6636	158	357	0.015	-

Space Vehicles: Mariner 3, 1964-73; Mariner 4, 1964-77; Zond 2,1964-78C.

Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
T	Cosmos 51	1964-80A	1964 Dec 9.96 1 year	Ellipsoid 400?	1.8 long? 1.2 dia?	1964 Dec 11.9	48.78	92.44	6776	262	533	0.020	130
	Cosmos 51 rocket	1964-80B	1964 Dec 9.96 5 months	Cylinder? 1500?	10 long? 2 dia?	1964 Dec 11.9	48.78	92.46	6778	257	542	0.021	129
	Fragments	1964-80C-F											
D	[Titan 3A]	1964-81A	1964 Dec 10.70 2.95 days 1964 Dec 13.65	Cylinder 1500	5 long? 3 dia	1964 Dec 12.3	32.15	87.60	6542	157	170	0.001	280
D	Centaur 4	1964-82A	1964 Dec 11.60 0.63 days 1964 Dec 12.23	Cylinder 2950	14 long 3 dia	1964 Dec 11.7	30.71	87.81	6550	165	178	0.001	183
	Ablestar rocket	1964-83A	1964 Dec 13.00 1000 years	Cylinder 450?	5.3 long 1.4 dia	1964 Dec 16.1	89.99	106.06	7420	1012	1071	0.004	352
T?	[Thor Ablestar]	1964-83B	1964 Dec 13.00 1000 years?	-	-	1964 Dec 15.5	89.97	106.26	7430	1031	1074	0.003	-
T	Radiation satellite	1964-83C	1964 Dec 13.00 1000 years?	- 60?	-	1964 Dec 24.5	88.99	106.36	7435	1027	1086	0.004	286
T?	Transit?	1964-83D	1964 Dec 13.00 1000 years?	- 60?	-	1964 Dec 24.8	89.86	106.33	7433	1025	1084	0.004	13
	Fragments	1964-83E-F											

Year of launch 1964, continued

	Name		Launch date, lifetime and descent date	Shape and weight (kg)	Size (m)	Date of orbital determination	Orbital inclination (deg)	Nodal period (min)	Semi-major axis (km)	Perigee height (km)	Apogee height (km)	Orbital eccentricity	Argument of perigee (deg)
T	San Marco 1	1964-84A	1964 Dec 15.85 8 months	Sphere 115	0.66 dia	1964 Dec 16.9	37.77	94.94	6900	198	846	0.047	113
	San Marco rocket	1964-84B	1964 Dec 15.85 53.2 days (1965 Feb 7.1)	Cylinder 24	1.5 long 0.46 dia	1964 Dec 31.5	37.80	93.5	6824	194	697	0.037	-
	Fragment	1964-84C											
	[Thor Agena]	1964-85A	1964 Dec 19.88 26.06 days (1965 Jan 14.94)	Cylinder 1500?	8 long? 1.5 dia	1964 Dec 22.9	74.97	90.46	6675	183	410	0.017	153
T	Explorer 26	1964-86A	1964 Dec 21.38 10 years?	Octagon + 4 vanes 46	0.43 long 0.71 dia	1964 Dec 21.4	20.14	456.26	19632	316	26191	0.659	121
	Explorer 26 rocket	1964-86B	1964 Dec 21.38 10 years?	Cylinder 23	1.5 long 0.46 dia			orbit similar to 1964-86A					
	[Thor Agena]	1964-87A	1964 Dec 21.80 21.64 days (1965 Jan 11.44)	Cylinder 1500?	8 long? 1.5 dia	1964 Dec 25.1	70.08	89.5	6629	238	264	0.002	111

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Name	Designation	Page
Alouette	1962 βα1	27
Anna 1B	1962 βμ1	28
Ariel 1	1962 ο1	20
Ariel 2	1964-15A	49
Atlas	1958 ζ	2
Aurora 7	1962 τ1	21
Beacon	1964-64A	61
Centaur 2	1963-47A	42
Centaur 4	1964-82A	65
Cosmos 1	1962 θ1	19
" 2	1962 ι1	19
" 3	1962 ν1	20
" 4	1962 ξ1	20
" 5	1962 ϑ1	21
" 6	1962 αδ1	23
" 7	1962 αι1	24
" 8	1962 αξ1	25
" 9	1962 αω1	26
" 10	1962 βζ1	27
" 11	1962 βθ1	28
" 12	1962 βω1	31
" 13	1963-6A	32
" 14	1963-10A	33
" 15	1963-11A	33
" 16	1963-12A	34
" 17	1963-17A	35
" 18	1963-18A	35
" 19	1963-33A	39
" 20	1963-40A	40
" 21	1963-44A	41
" 22	1963-45A	42
" 23	1963-50A	43
" 24	1963-52A	43
" 25	1964-10A	47
" 26	1964-13A	48
" 27	1964-14A	48
" 28	1964-17A	49
" 29	1964-21A	50
" 30	1964-23A	51
" 31	1964-28A	52
" 32	1964-29A	52
" 33	1964-33A	53
" 34	1964-34A	53
" 35	1964-39A	55
" 36	1964-42A	55
" 37	1964-44A	56
" 38	1964-46A	57
" 39	1964-46B	57
" 40	1964-46C	57
" 41	1964-49D	58
" 42	1964-50A	58
" 43	1964-50C	58
Cosmos 44	1964-53A	59
" 45	1964-55A	59
" 46	1964-59A	60
" 47	1964-62A	61
" 48	1964-66A	62
" 49	1964-69A	63
" 50	1964-70A	63
" 51	1964-80A	65
Courier 1B	1960 ν1	8
Discoverer 1	1959 β	3
" 2	1959 γ	3
" 5	1959 ε1	3
" 6	1959 ζ	4
" 7	1959 κ	4
" 8	1959 λ	4
" 11	1960 δ	5
" 13	1960 θ	7
" 14	1960 κ	8
" 15	1960 μ	8
" 17	1960 ο	9
" 18	1960 σ	9
" 19	1960 τ	9
" 20	1961 ε1	11
" 21	1961 ζ	11
" 23	1961 λ1	12
" 25	1961 ξ1	13
" 26	1961 π	13
" 29	1961 ψ	15
" 30	1961 ω	15
" 31	1961 αβ	15
" 32	1961 αγ1	15
" 34	1961 αε1	16
" 35	1961 αζ1	16
" 36	1961 ακ1	17
" 37	1962 δ	18
" 38	1962 ε	18
Echo 1	1960 ι1	7
" 2	1964-4A	46
Electron 1	1964-6A	46
" 2	1964-6B	46
" 3	1964-38A	54
" 4	1964-38B	54
Explorer 1	1958 α	2
" 3	1958 γ	2
" 4	1958 ε	2
" 6	1959 δ1	3
" 7	1959 ι1	4
" 8	1960 ξ1	8
" 9	1961 δ1	11
" 10	1961 κ1	12
" 11	1961 ν	13
" 12	1961 υ	14

Name	Designation	Page
Explorer 13	1961 χ	15
" 14	1962 βγ1	27
" 15	1962 βλ1	28
" 16	1962 βχ	31
" 17	1963-9A	33
" 18	1963-46A	42
" 19	1963-53A	44
" 20	1964-51A	58
" 21	1964-60A	60
" 22	1964-64A	61
" 23	1964-74A	64
" 24	1964-76A	64
" 25	1964-76B	64
" 26	1964-86A	66
Faith 7	1963-15A	35
Friendship 7	1962 γ1	18
Gemini 1	1964-18A	50
GGSE	1964-1B	45
Greb 1	1960 η2	7
Greb 3	1961 ο2	13
GRS	1963-26A	37
Hitchhiker	1963-25B	37
Imp 1	1963-46A	42
Imp 2	1964-60A	60
Injun 1	1961 ο2	13
Injun 3	1962 βτ2	30
Injun 4	1964-76B	64
Lofti 1	1961 η	11
Lofti 2A	1963-21B	36
Luna 4	1963-8A	33
Lunik 3	1959 θ	4
Mars 1	1962 βν1	28
Mercury 4	1961 αα1	15
" 5	1961 αι1	17
" 6	1962 γ1	18
" 7	1962 τ1	21
" 8	1962 βδ1	27
" 9	1963-15A	35
Midas 2	1960 ζ1	6
" 3	1961 σ1	14
" 4	1961 αδ1	16
" 5	1962 κ1	19
" 6	1963-14A	34
" 7	1963-30A	38
Needles	1963-14J	34
Nimbus 1	1964-52A	59
Ogo	1964-54A	59
Oscar 1	1961 ακ2	17
Oscar 2	1962 χ2	22
Oso 1	1962 ζ1	18
Polyot 1	1963-43A	41
Polyot 2	1964-19B	50
Radiation Sat.	1963-38C	40
" "	1964-83C	65
Radose	1963-21D	36
Ranger 1	1961 φ1	14
" 2	1961 αϑ	17
Relay 1	1962 βυ1	30
" 2	1964-3A	45
Samos 2	1961 α1	10
San Marco 1	1964-84A	66
Saturn SA5	1964-5A	46
" SA6	1964-25A	51
" SA7	1964-57A	60
Secor	1964-1C	45
Sigma 7	1962 βδ1	27
Sputnik 1	1957 α2	1
" 2	1957 β1	1
" 3	1958 δ2	2
" 4	1960 ε1	6
" 5	1960 λ1	8
" 6	1960 ρ1	9
" 7	1961 β1	10
" 8	1961 γ1	10
" 9	1961 θ1	11
" 10	1961 ι1	12
" 19	1962 απ1	25
" 20	1962 ατ1	25
" 21	1962 αφ1	26
" 22	1962 βι1	28
" 23	1962 βν1	28
" 24	1962 βξ1	29
" 25	1963-1A	32
" 26	1963-8C	33
SR 4	1963-21C	36
SR 5	1964-1D	45
Starflash 1A	1964-30A	52
Starflash 1B	1964-48A	57
Star-rad	1962 βκ	28
Surcal	1963-21F	36
Syncom 1	1963-4A	32
" 2	1963-31A	38
" 3	1964-47A	57

Name	Designation	Page
Telstar 1	1962 αε1	23
" 2	1963-13A	34
Tiros 1	1960-β2	5
" 2	1960 π1	9
" 3	1961 ρ1	14
" 4	1962 β1	18
" 5	1962 αα1	22
" 6	1962 αψ1	26
" 7	1963-24A	37
" 8	1963-54A	44
Titan 3A	1964-81A	65
Traac	1961 αη2	16
Transit 1B	1960 γ2	5
" 2A	1960 η1	7
" 3B	1961 η	11
" 4A	1961 ο1	13
" 4B	1961 αη1	16
" 5A	1962 βψ1	31
"	1963-22A	36
"	1963-49C	43
"	1964-83D	66
TRS 1A	1963-14B	34
" 1B	1963-14C	34
" 1C	1963-30B	38
" 2	1963-39B	40
"	1964-40C	55
Vanguard 1	1958 β2	2
" 2	1959 α1	3
" 3	1959 η1	4
Vela 1	1963-39A	40
" 2	1963-39C	40
" 3	1964-40A	55
" 4	1964-40B	55
Venus Probe	1961 γ1	10
Voskhod 1	1964-65A	62
Vostok 1	1961 μ1	13
" 2	1961 τ1	14
" 3	1962 αμ1	24
" 4	1962 αν1	24
" 5	1963-20A	36
" 6	1963-23A	37
Zond 1	1964-16	49
Zond 2	1964-78	64

Fig.1

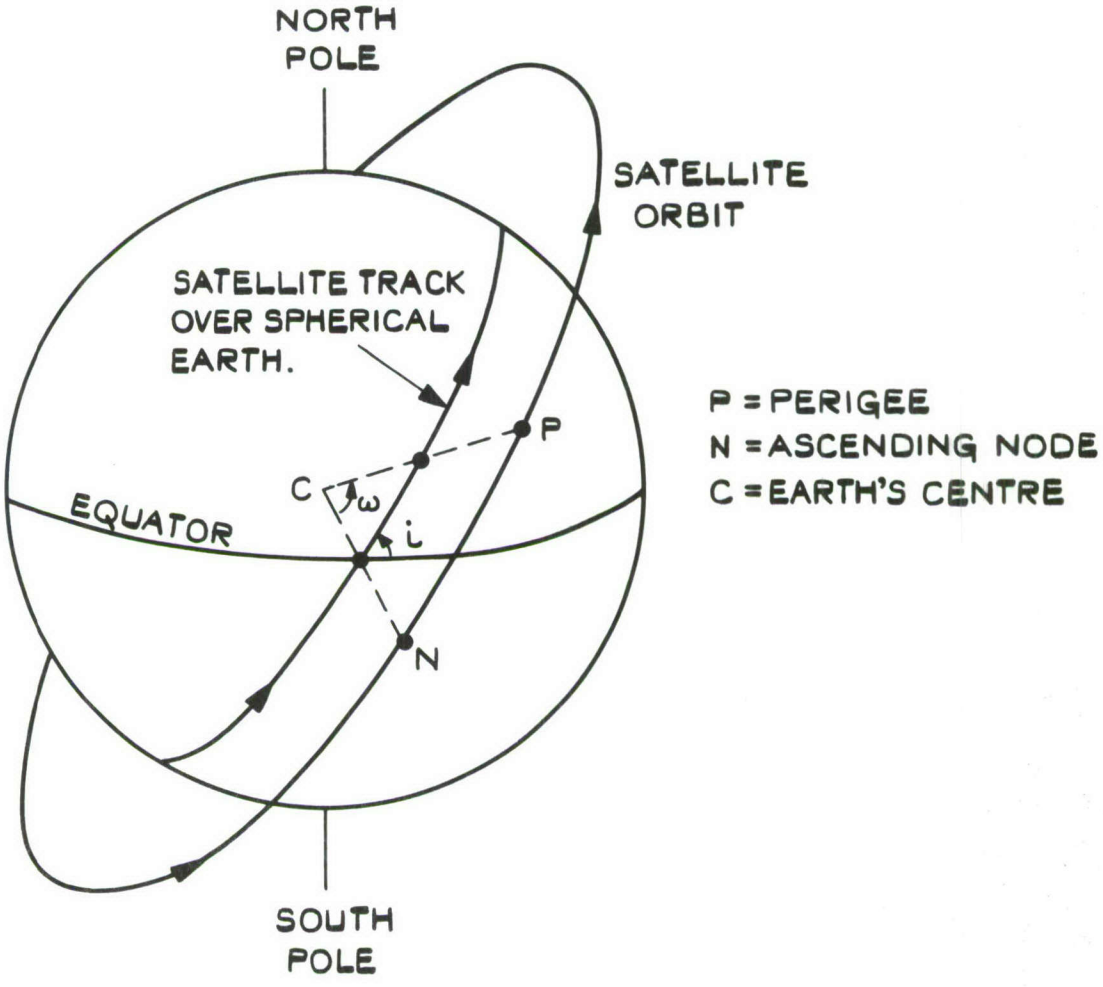

FIG. 1 DIAGRAM SHOWING DEFINITION OF INCLINATION i AND ARGUMENT OF PERIGEE ω.