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REVISED TABLE OF EARTH SATELLITES. VOLUME 2. 1969 TO 1973. (U)  
JAN 79 J A PILKINGTON, D G KING-HELE

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The microfiche card contains a grid of frames. The top row includes a title page, a table of contents, and 11 data frames. The remaining 54 frames (6 rows by 9 columns) contain individual data entries for various earth satellites, including their names, launch dates, and orbital parameters.

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ROYAL AIRCRAFT ESTABLISHMENT ✓

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Technical Report 79001

January 1979

**REVISED TABLE OF EARTH SATELLITES,  
VOLUME 2: 1969 TO 1973**

by

J.A. Pilkington, D.G. King-Hele,  
H. Hiller, Doreen M.C. Walker

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9 Technical Report 79001

Received for printing January 1979

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6 REVISED TABLE OF EARTH SATELLITES, VOLUME 2 • 1969 TO 1973

by

10 J. A./Pilkington\*  
D. G./King-Hele  
H./Hiller  
Doreen M. C./Walker

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SUMMARY

12 190p.

The RAE Table of satellites at present runs to more than 550 pages, and is divided into three volumes. Volume 1, with satellites launched in the years 1957-1968, was issued in revised form early in 1978. Volume 2, covering the years 1969-1973, was originally issued in 1974, and the present revised version incorporates more than a thousand amendments that have accumulated in the past five years. Volume 3 will cover the years 1974-1978, but so far only Parts 1-3 (1974-1976) have been issued.

The present volume lists 559 satellite launches, arranged chronologically. For each launch, the Table gives the name and international designation of each instrumented satellite and its associated rocket(s), with the date of launch, lifetime (actual or estimated), mass, shape, dimensions and at least one set of orbital parameters. Other fragments associated with a launch are listed without these details.

The main Table, which occupies 171 pages, is prefaced by six pages of introduction and explanation, and followed by a seven-page index.

Departmental Reference: Space 562

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*Jim*

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1 INTRODUCTION

A Table of artificial satellites, giving launch dates, lifetimes, weights, sizes and orbits, has been issued by the Royal Aircraft Establishment since 1958, with yearly revisions and monthly supplements. The launches are listed chronologically, with Volume 1 covering the years 1957-1968, Volume 2 the years 1969-1973, and Volume 3 the years 1974-1978. Volume 1 (originally issued in 1970) was reissued in revised form in 1978<sup>1</sup>. Volume 2 (originally issued<sup>2</sup> in 1974) now appears in the same format, updated to 1 January 1979, and incorporating more than a thousand amendments that have accumulated over the past five years. The most important changes are the insertion of decay dates for the years 1974-1978, revisions of the estimated mass and dimensions of many Russian rockets, and the identification of engines and capsules jettisoned from the recoverable Cosmos satellites. Volume 3 will be issued as soon as possible: so far only Parts 1-3 (1974-1976) have appeared.

The numbers of successful launches of satellites and space vehicles each year between 1969 and 1973 are tabulated below, with national sub-totals and the numbers of launches from which at least one component was still in orbit on 1 January 1979.

Census of satellites and space vehicles 1969-1973

| Country of origin \ Year of launch                 | 1957-1968  | 1969       | 1970       | 1971       | 1972       | 1973       | Total national launches 1957-1973 | Total launches in orbit 1 Jan 1979 |
|--|------------|------------|------------|------------|------------|------------|-----------------------------------|------------------------------------|
| USSR   | 314        | 68         | 79         | 81         | 70         | 83         | 695                               | 165                                |
| USA  | 432        | 33         | 23         | 25         | 24         | 21         | 558                               | 249                                |
| France   | 4          | 0          | 1          | 1          | 0          | 0          | 6                                 | 6                                  |
| Japan  | -          | -          | 1          | 2          | 1          | 0          | 4                                 | 4                                  |
| China  | -          | -          | 1          | 1          | 0          | 0          | 2                                 | 2                                  |
| UK   | -          | -          | -          | 1          | 0          | 0          | 1                                 | 1                                  |
| USA/Intelsat                                       | 6          | 3          | 3          | 2          | 2          | 1          | 17                                | 17                                 |
| USSR/Intercosmos                                   | -          | 2          | 2          | 1          | 3          | 2          | 10                                | 0                                  |
| USA/ESRO   | 3          | 1          | 0          | 0          | 3          | 0          | 7                                 | 1                                  |
| USA/Canada   | 2          | 1          | 0          | 1          | 1          | 1          | 6                                 | 6                                  |
| USA/UK   | 3          | 1          | 1          | 1          | 0          | 0          | 6                                 | 2                                  |
| USSR/France  | -          | -          | -          | 1          | 1          | 1          | 3                                 | 2                                  |
| USA/Italy  | 2          | 0          | 0          | 1          | 0          | 0          | 3                                 | 0                                  |
| USA/France   | 1          | 0          | 0          | 1          | 0          | 0          | 2                                 | 2                                  |
| USA/NATO   | -          | -          | 1          | 1          | 0          | 0          | 2                                 | 2                                  |
| USA/Australia                                      | 1          | 0          | 1          | 0          | 0          | 0          | 2                                 | 1                                  |
| USA/FRG  | -          | 1          | 0          | 0          | 1          | 0          | 2                                 | 1                                  |
| France/FRG   | -          | -          | 1          | 0          | 0          | 0          | 1                                 | 0                                  |
| <b>Total launches</b>                              | <b>768</b> | <b>110</b> | <b>114</b> | <b>120</b> | <b>106</b> | <b>109</b> | <b>1327</b>                       |                                    |
| <b>Total launches still in orbit on 1 Jan 1979</b> | <b>242</b> | <b>33</b>  | <b>40</b>  | <b>56</b>  | <b>46</b>  | <b>44</b>  |                                   | <b>461</b>                         |

Fig 1 below shows the number of launches each year between 1957 and 1978. The trend from 1957 to 1967 was a fairly steady increase, with the number of launches reaching 127 in 1967. Then the trend changed, and from 1968 to 1978 the yearly number of launches has remained much the same, between 106 and 128.

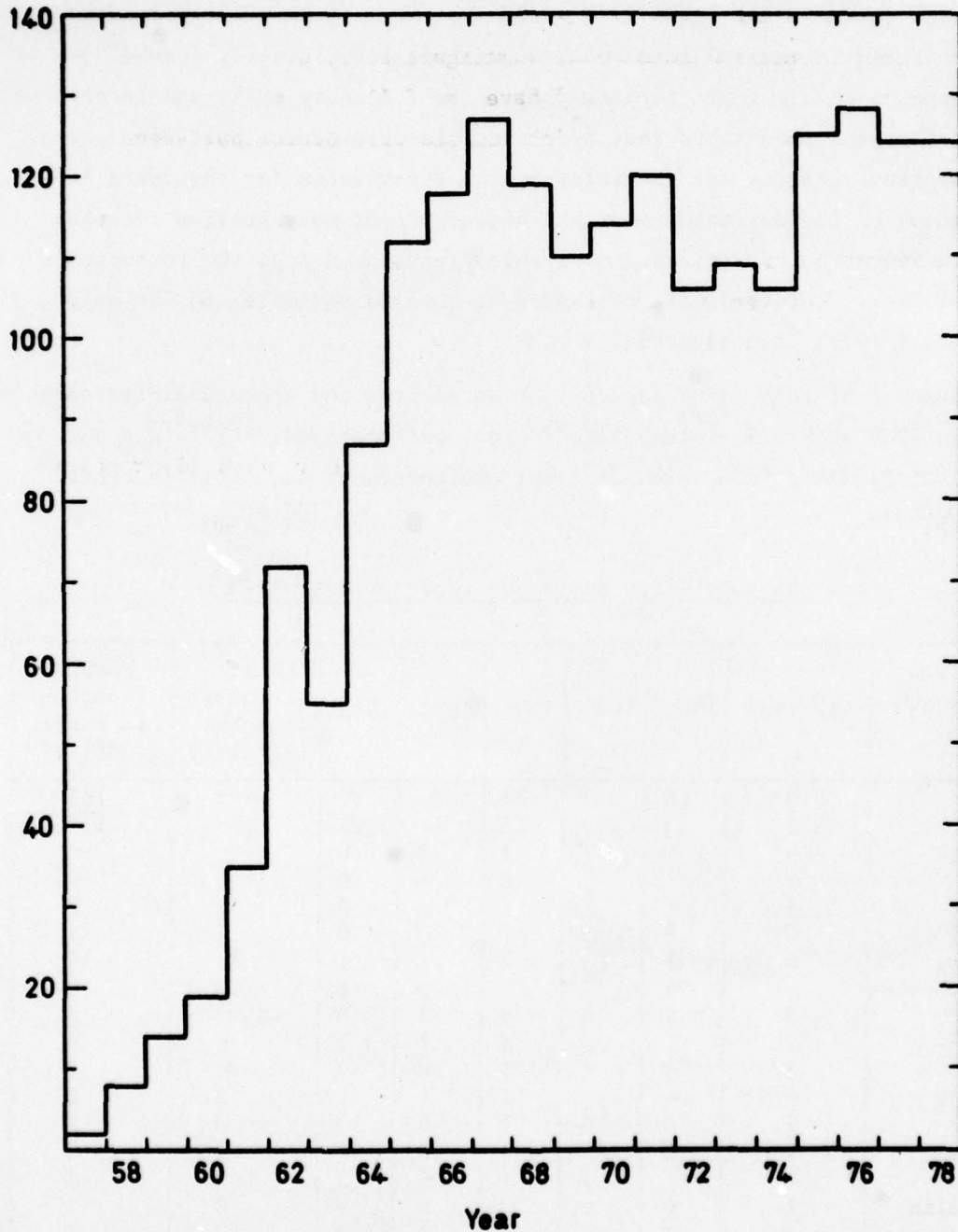


Fig 1 Yearly numbers of satellite launches, 1957 to 1978

## 2 GUIDE TO TABLE OF SATELLITES

The data given in the main Table, for all satellites other than fragments, are as follows.

Column 1 gives the name of the satellite and its international designation.

If the name is unknown, the launching vehicle is indicated in square brackets. Doubtful entries are distinguished by question marks.

Letters to the left of Column 1 have the following meanings:

B denotes unmanned satellites which carried live biological specimens.

D denotes satellites no longer in orbit on 1 January 1979. (For fragments, D indicates that all have decayed; 1d indicates that one has decayed; 2d indicates that two have decayed, and so on.)

L denotes satellites with retroreflectors for laser tracking.

M denotes manned satellites; 2M indicates a crew of two at launch; etc.

p indicates that pieces were picked up on Earth after re-entry.

R denotes satellites which returned to Earth and were recovered intact.

r denotes satellites carrying capsules which were successfully recovered.

T denotes satellites still transmitting radio signals on 1 January 1979.

Column 2 gives the launch date, lifetime (actual or estimated), and descent date (if appropriate). The dates are given in days and decimals of a day UT. Thus 1969 May 18.70 means "16h 48m UT (or GMT) on 18 May 1969".

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

Column 4 gives the basic dimensions of the satellite in metres. Aerials, paddles carrying solar cells, and other components projecting from the main body are not normally taken into account when giving the size and shape (1 m = 3.281 ft).

Column 5 gives the date for the orbital information in Columns 6-12.

Column 6 gives the inclination of the orbit to the equator, in degrees.

Column 7 gives the nodal period of revolution - the time interval, in minutes, between successive northward equatorial crossings by the satellite.

Columns 8-11 specify the size and shape of the orbit. The quantities tabulated are the semi major axis  $a$  ; the 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, 6378.1 km.

(1 km = 0.6214 statute miles = 3281 ft = 0.5396 nautical miles.)

Column 12 gives the argument of perigee - the angle, measured round the orbit, from the northward equatorial crossing to the perigee.

The names of space vehicles (which have escaped from the dominance of the Earth's gravitational field) are given below the table, on the appropriate pages. A separate Table of space vehicles is available<sup>3,4</sup>.

The index after the main Table gives the names of the satellites in alphabetical order, with the international designation of each and the page on which details may be found. Satellites which are not Russian or American may be found in the index by referring to the appropriate country.

### 3 METHODS USED

#### 3.1 Difficulties

The chief difficulty is lack of accurate information about the size, shape and weight of most of the satellites. The majority of launchings are military, and little information is released about these satellites or their final-stage rockets; we have to rely largely on deductions from their visual appearance in the night sky and on identifying previous launches of similar character. In contrast, we have full details of most international satellites and those launched by NASA.

#### 3.2 Names and designations of satellites

The names given by the launching authorities are indicated when known. For unnamed United States Air Force satellites, the launch vehicle is given in square brackets: the lists issued by the United Nations have been useful in identifying the launch vehicles and orbits for these satellites. Some of the names are given as initials only, and the meanings of these acronyms are given as footnotes.

The international designation of each satellite launching is 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 distinguish between the satellite and its rocket. Small pieces which are, as far as is known, not instrumented satellites, are called 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 orbital decay rates (unless the satellites are swept up as space-rubbish, or suffer other major perturbations). The decay rate depends on air density, and the density depends critically on solar activity, which cannot be accurately predicted. So most lifetime estimates are likely to be in error by 10% or more; if solar activity in future cycles should decline to the low levels prevalent in the late 17th century, lifetimes of 20-50 years given here would be seriously underestimated.

For some of the satellites in high-eccentricity orbits, such as the Molniya satellites and rockets, the lifetimes depend primarily on lunisolar perturbations rather than air drag, and have been estimated by numerical integration of these perturbations, as described in Ref 5.

### 3.4 Weights and dimensions

The weights and dimensions of the satellites come from Spacewarn launch telegrams, NASA Press Releases, and press and radio reports. Some indication of the accuracy is given by the number of significant figures. Often it is difficult to define the 'length' or 'diameter' when components of irregular size and shape are joined together, and dimensions are therefore sometimes approximate.

For satellites of unknown mass and size, the average cross-sectional area  $S$  can be approximately determined from the average brightness when observed visually; the mass/area ratio  $m/S$  can be obtained from the rate of change of orbital period and the known air density at heights near perigee, to give a value for the mass  $m$ . Many of our values for the dimensions of Russian rockets are based on the detailed studies by Sheldon<sup>6</sup>.

We hope that most of the weights and dimensions given with question marks are accurate to within a factor of 1.5, i.e. that the real values are between 2/3 and 3/2 times the value given. It seemed better to give some indication of the weights and sizes, even if approximate, rather than to leave blanks.

### 3.5 Orbital accuracy

Orbital information has come from many sources. Most of the orbits are based on the elements issued by the United States Air Force, and the remainder come mainly from NASA and RAE orbits.

The accuracy of the orbits varies greatly between one satellite and another, and no detailed guide can be given. Most orbits, however, are believed to have an error (sd) of about  $0.02^{\circ}$  in orbital inclination, 0.02 min in period, 2 km in semi major axis, 5 km in perigee and apogee heights (when the apogee height is less than 2000 km), 0.001 in eccentricity  $e$ , and perhaps  $3^{\circ}$  in argument of perigee (if  $e > 0.02$ ). Some orbits are much more accurate than this, and some, particularly those with eccentricity exceeding 0.3 or with very short lifetimes, may be much less accurate.

### 4 RADIO TRANSMISSIONS

The majority of satellites launched before 1972 are now silent, but a few are still transmitting. It is estimated that the average active life for radio transmission is about two years for Soviet satellites and seven years for US satellites. The most complete list of radio frequencies of satellites is in *Telecommunication Journal*, Vol 44, No.2 (1977).

### Acknowledgments

We are indebted to the various sources mentioned in the text for information about the satellites, and most of all to the North American Air Defense Command for having issued comprehensive orbital information for so many years. We thank G.E. Perry for providing the descent times of recoverable Cosmos satellites.

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REVISED TABLE OF EARTH SATELLITES

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| Year of launch 1969 | 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                   | Venus 5<br>launcher rocket | 1969 Jan 5.27<br>1.56 days<br>1969 Jan 6.83   | Cylinder<br>25007                        | 7.5 long<br>2.6 dia | 1969 Jan 5.3                   | 51.82                     | 88.65              | 6589                 | 203                 | 218                | 0.001                | 106                       |
| D                   | Venus 5<br>launcher        | 1969 Jan 5.27<br>1.96 days<br>1969 Jan 7.23   | Irregular                                | -                   | 1969 Jan 5.5                   | 51.80                     | 88.55              | 6584                 | 186                 | 225                | 0.003                | 133                       |
| D                   | Venus 6<br>launcher rocket | 1969 Jan 10.24<br>0.9 day<br>1969 Jan 11.14   | Cylinder<br>25007                        | 7.5 long<br>2.6 dia | 1969 Jan 10.5                  | 51.75                     | 88.20              | 6567                 | 184                 | 193                | 0.001                | 297                       |
| D                   | Venus 6<br>launcher        | 1969 Jan 10.24<br>3.07 days<br>1969 Jan 13.31 | Irregular                                | -                   | 1969 Jan 11.3                  | 51.66                     | 88.51              | 6582                 | 201                 | 207                | 0.0005               | 118                       |
| D<br>R              | Cosmos 263                 | 1969 Jan 12.51<br>7.72 days<br>1969 Jan 20.23 | Sphere-<br>cylinder<br>55307             | 5 long?<br>2.4 dia  | 1969 Jan 13.8                  | 65.43                     | 89.74              | 6641                 | 200                 | 325                | 0.009                | 54                        |
| D                   | Cosmos 263<br>rocket       | 1969 Jan 12.51<br>5.49 days<br>1969 Jan 18.00 | Cylinder<br>25007                        | 7.5 long<br>2.6 dia | 1969 Jan 14.4                  | 65.34                     | 89.40              | 6624                 | 174                 | 317                | 0.011                | 43                        |
| D                   | Fragment                   |   |  |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| D<br>1M<br>R        | Soyuz 4*                   | 1969 Jan 14.32<br>2.95 days<br>1969 Jan 17.27 | Sphere-<br>cylinder +<br>2 wings<br>6625 | 7.5 long<br>2.2 dia | 1969 Jan 14.5<br>1969 Jan 15.2 | 51.73<br>51.75            | 88.20<br>88.72     | 6566<br>6592         | 161<br>205          | 215<br>223         | 0.004<br>0.001       | 293<br>20                 |
| D                   | Soyuz 4<br>rocket          | 1969 Jan 14.32<br>0.78 day<br>1969 Jan 15.10  | Cylinder<br>25007                        | 7.5 long<br>2.6 dia | 1969 Jan 14.5                  | 51.70                     | 88.03              | 6558                 | 147                 | 212                | 0.005                | 276                       |

Space Vehicles: Venus 5, 1969-01A; Venus 6, 1969-02A.  
\* Two crew members from Soyuz 5 transferred to Soyuz 4 during docking from Jan 16.35 to Jan 16.54 (See page 186.)

Year of launch 1969 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<br>M<br>R<br>Soyuz 5<br>1969-05A     | 1969 Jan 15.30<br>3.03 days<br>1969 Jan 18.33  | Sphere-cylinder + 2 wings<br>6585 | 7.5 long<br>2.2 dia   | 1969 Jan 15.7                  | 51.69                     | 88.87              | 6600                 | 210                 | 233                | 0.002                | 66                        |
| D<br>Soyuz 5<br>rocket<br>1969-05B     | 1969 Jan 15.30<br>2.08 days<br>1969 Jan 17.38  | Cylinder<br>2500†                 | 7.5 long<br>2.6 dia   | 1969 Jan 15.5                  | 51.69                     | 88.50              | 6581                 | 194                 | 212                | 0.001                | 1                         |
| D<br>Fragment<br>1969-05C              |  |                                   |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D<br>OSO 5*<br>1969-06A                | 1969 Jan 22.70<br>20 years                     | Nonagonal box + vane<br>291       | 0.94 long<br>1.12 dia | 1969 Jan 22.9                  | 32.95                     | 95.48              | 6927                 | 536                 | 561                | 0.002                | 241                       |
| D<br>OSO 5 rocket<br>1969-06B          | 1969 Jan 22.70<br>12 years                     | Cylinder<br>24                    | 1.50 long<br>0.46 dia | 1969 Feb 10.4<br>1972 Sep 1.0  | 32.99<br>32.99            | 95.51<br>94.72     | 6928<br>6889         | 538<br>502          | 562<br>520         | 0.002<br>0.001       | 65<br>-                   |
| D<br>[Titan 3B<br>Agena D]<br>1969-07A | 1969 Jan 22.80<br>12 days<br>1969 Feb 3        | Cylinder<br>3000†                 | 8 long?<br>1.5 dia    | 1969 Jan 23.2<br>1969 Jan 30.3 | 106.15<br>106.12          | 97.04<br>96.78     | 6994<br>6981         | 142<br>140          | 1030<br>1066       | 0.068<br>0.066       | 154<br>151                |
| D<br>Fragment<br>1969-07B              |  |                                   |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D<br>Cosmos 264**<br>1969-08A          | 1969 Jan 23.39<br>12.88 days<br>1969 Feb 5.27  | Sphere-cylinder<br>6300†          | 6.5 long?<br>2.4 dia  | 1969 Jan 24.7<br>1969 Jan 29.7 | 69.94<br>69.92            | 89.57<br>89.73     | 6630<br>6639         | 209<br>213          | 295<br>308         | 0.006<br>0.007       | 47<br>53                  |
| D<br>Cosmos 264<br>rocket<br>1969-08B  | 1969 Jan 23.39<br>7.53 days<br>1969 Jan 30.92  | Cylinder<br>2500†                 | 7.5 long<br>2.6 dia   | 1969 Jan 25.2                  | 69.94                     | 89.41              | 6623                 | 207                 | 282                | 0.006                | 39                        |
| D<br>Cosmos 264<br>engine†<br>1969-08C | 1969 Jan 23.39<br>21.48 days<br>1969 Feb 13.87 | Cone<br>600† full                 | 1.5 long?<br>2 dia?   | 1969 Feb 5.2                   | 69.92                     | 89.61              | 6633                 | 207                 | 303                | 0.007                | 33                        |

\* Orbiting Solar Observatory.

\*\* Carried supplementary extragalactic gamma-ray experiment.

† 1969-08C ejected from O8A about Feb 4.4.

Year of launch 1969 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<br>Isis 1*              | 1969-09A<br>1969 Jan 30.28<br>250 years                   | Polyhedron<br>241                 | 1.07 long<br>1.27 dia | 1969 Feb 4.2                  | 88.42                     | 128.42             | 8130                 | 578                 | 3586               | 0.175                | 161                       |
| Isis 1<br>rocket          | 1969-09B<br>1969 Jan 30.28<br>150 years                   | Cylinder<br>24                    | 1.50 long<br>0.46 dia | 1969 Feb 1.7                  | 88.42                     | 128.30             | 8425                 | 579                 | 3515               | 0.174                | 165                       |
| D<br>[Thorad Agena D]**   | 1969-10A<br>1969 Feb 5.92<br>18.86 days<br>1969 Feb 24.78 | Cylinder<br>2000?                 | 8 long?<br>1.5 dia    | 1969 Feb 6.1                  | 81.54                     | 88.70              | 6587                 | 178                 | 239                | 0.005                | 161                       |
| Capsule                   | 1969-10B<br>1969 Feb 5.92<br>10000 years                  | Octagon?<br>60?                   | 0.3 long?<br>0.9 dia? | 1969 Feb 6.7                  | 80.41                     | 114.22             | 7796                 | 1396                | 1441               | 0.003                | 39                        |
| Fragment                  | 1969-10C  |                                   |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| Intelsat 3C (F-3)†        | 1969-11A<br>1969 Feb 6.03<br>> million years              | Cylinder<br>293 full<br>137 empty | 1.04 long<br>1.42 dia | 1969 Mar 17.0                 | 1.34                      | 1436.4             | 42173                | 35782               | 35808              | 0.0003               | 74                        |
| Intelsat 3C<br>rocket     | 1969-11B<br>1969 Feb 6.03<br>20 years                     | Cylinder<br>24                    | 1.50 long<br>0.46 dia | 1972 May 1.0                  | 29.5                      | 613.9              | 29226                | 343                 | 34753              | 0.719                | -                         |
| Cosmos 265                | 1969-12A<br>1969 Feb 7.59<br>82.50 days<br>1969 May 1.09  | Ellipsoid<br>400?                 | 1.8 long<br>1.2 dia   | 1969 Feb 9.2                  | 71.01                     | 91.89              | 6745                 | 275                 | 458                | 0.014                | 71                        |
| D<br>Cosmos 265<br>rocket | 1969-12B<br>1969 Feb 7.59<br>38.20 days<br>1969 Mar 17.79 | Cylinder<br>1500?                 | 8 long<br>1.65 dia    | 1969 Feb 9.2                  | 71.01                     | 91.67              | 6734                 | 274                 | 437                | 0.012                | 76                        |

\* International satellite for ionospheric studies (Canada).

\*\* Thorad: long-tank thrust-augmented Thor.

† International telecommunications satellite.

| 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) |
|----------------------------|--|-------------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Tactical Cosmosat 1        | 1969 Feb 9.88<br>> million years             | Cylinder<br>+5 aerials<br>730 | 6.1 long<br>2.4 dia   | 1969 Apr 16.0                 | 0.8                       | 1436.0             | 42164                | 35768               | 35903              | 0.0004               | -                         |
| Tecsat 1 rocket [Titan 3C] | 1969 Feb 9.88<br>> million years             | Cylinder<br>1500?             | 6 long?<br>3.0 dia    | 1969 Feb 10                   | 0.65                      | 1446.5             | 42370                | 35940               | 36044              | 0.001                | 159                       |
| D<br>R<br>Cosmos 266       | 1969 Feb 25.43<br>7.9 days<br>1969 Mar 5.3   | Sphere-<br>cylinder<br>5530?  | 5 long?<br>2.4 dia    | 1969 Feb 27.1                 | 72.90                     | 89.90              | 6647                 | 202                 | 336                | 0.010                | 48                        |
| D<br>Cosmos 266 rocket     | 1969 Feb 25.43<br>7.33 days<br>1969 Mar 4.76 | Cylinder<br>2500?             | 7.5 long<br>2.6 dia   | 1969 Feb 27.2                 | 72.89                     | 89.62              | 6633                 | 198                 | 312                | 0.009                | 43                        |
| D<br>Fragment              | 1969 Feb 26.32<br>10000 years                | Cylinder<br>145               | 0.56 long<br>1.07 dia | 1969 Mar 3.4                  | 101.79                    | 115.28             | 7846                 | 1427                | 1508               | 0.005                | 119                       |
| Essa 9 *                   | 1969 Feb 26.32<br>5000 years                 | Cylinder<br>24                | 1.50 long<br>0.46 dia | 1969 Mar 1.3                  | 101.79                    | 115.21             | 7842                 | 1423                | 1505               | 0.005                | 120                       |
| D<br>R<br>Cosmos 267       | 1969 Feb 26.35<br>7.93 days<br>1969 Mar 6.28 | Sphere-<br>cylinder<br>5530?  | 5 long?<br>2.4 dia    | 1969 Feb 27.2                 | 65.04                     | 89.82              | 6645                 | 205                 | 329                | 0.009                | 50                        |
| D<br>Cosmos 267 rocket     | 1969 Feb 26.35<br>7.12 days<br>1969 Mar 5.47 | Cylinder<br>2500?             | 7.5 long<br>2.6 dia   | 1969 Feb 27.2                 | 64.99                     | 89.63              | 6636                 | 204                 | 311                | 0.008                | 45                        |

Space Vehicles: Mariner 6, 1969-144; and Centaur rocket, 1969-148. • Environmental Science Services Administration.

| 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<br>Z<br>R<br>Apollo 9 (CM + SM)  | 1969 Mar 3.67<br>10.04 days<br>1969 Mar 13.71  | Cone-cylinder<br>22030 full<br>11205 empty        | 10.36 long<br>3.91 dia              | 1969 Mar 4.5<br>1969 Mar 4.9<br>1969 Mar 9.5   | 32.57<br>33.84<br>33.63   | 88.64<br>91.46<br>88.49    | 6594<br>6733<br>6587 | 203<br>198<br>194   | 229<br>511<br>223    | 0.002<br>0.023<br>0.002 | 67<br>70<br>94            |
| Saturn IV B [Saturn 504]           | 1969 Mar 3.67<br>Indefinite                    | Cylinder<br>13400                                 | 18.7 long<br>6.6 dia                | 1969 Mar 3.7<br>1969 Mar 3.9                   | 32.57<br>32.57            | 88.15<br>118.6             | 6569<br>7999         | 191<br>191          | 191<br>3050          | 0<br>0.179              | -<br>-                    |
| LEM 3 <sup>a</sup><br>Ascent stage | 1969 Mar 3.67<br>12 years                      | Box + 2 tanks<br>4450 full<br>2900 empty          | 2.52 high<br>3.76 wide<br>3.13 deep | 1969 Mar 8.6<br>1971 Feb 1.0<br>1974 Mar 1.0   | 28.91<br>28.91<br>28.90   | 164.70<br>154.61<br>142.2  | 9959<br>9546<br>9024 | 227<br>234<br>225   | 6995<br>6102<br>5067 | 0.337<br>0.307<br>0.268 | 130<br>-<br>-             |
| D<br>LEM 3<br>Descent stage        | 1969 Mar 3.67<br>18.49 days<br>1969 Mar 22.16  | Octagon + cone + legs<br>10075 full<br>1935 empty | 1.57 high<br>3.13 wide              | 1969 Mar 9.4                                   | 33.63                     | 89.25                      | 6622                 | 242                 | 246                  | 0.0004                  | 256                       |
| D<br>[Titan 3B Agena D]            | 1969 Mar 4.81<br>14 days<br>1969 Mar 18        | Cylinder<br>30007                                 | 8 long?<br>1.5 dia                  | 1969 Mar 5.2                                   | 92.00                     | 90.50                      | 6676                 | 134                 | 461                  | 0.024                   | 147                       |
| D<br>Cosmos 268                    | 1969 Mar 5.55<br>429.78 days<br>1970 May 9.33  | Ellipsoid<br>4007                                 | 1.8 long<br>1.2 dia                 | 1969 Mar 5.9<br>1969 Jul 16.3<br>1969 Dec 16.3 | 48.40<br>48.37<br>48.3    | 109.14<br>105.08<br>100.29 | 7569<br>7380<br>7153 | 209<br>209<br>202   | 2173<br>1795<br>1348 | 0.130<br>0.107<br>0.080 | 102<br>-<br>-             |
| D<br>Cosmos 268 rocket             | 1969 Mar 5.55<br>342.52 days<br>1970 Feb 11.07 | Cylinder<br>15007                                 | 8 long<br>1.65 dia                  | 1969 Mar 7.3<br>1969 Jun 16.0<br>1969 Oct 16.3 | 48.40<br>48.3<br>48.3     | 109.12<br>104.87<br>100.60 | 7568<br>7370<br>7169 | 221<br>219<br>212   | 2159<br>1764<br>1369 | 0.128<br>0.105<br>0.081 | 107<br>-<br>-             |

\* LEM attached to Apollo 9, separated from Saturn IV B on Mar 3.84. LEM is Lunar Excursion Module.

LEM with two crew members separated from Apollo 9 on Mar 7.53.

LEM ascent stage separated from descent stage on Mar 7.71; briefly re-docked with Apollo 9 on Mar 7.79.



| 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 OVI-17*                  | 1969 Mar 18.32<br>352.23 days<br>1970 Mar 5.55   | Cylinder +<br>2 hemi-<br>spheres<br>142 | 1.40 long<br>0.69 dia | 1969 Mar 28.7<br>1969 Jul 16.3<br>1969 Nov 16.0 | 99.18<br>99.1<br>99.1     | 99.21<br>92.99<br>91.83 | 6808<br>6778<br>6741 | 397<br>374<br>346   | 463<br>425<br>379  | 0.005<br>0.004<br>0.002 | 342<br>-<br>-             |
| D OVI-18                   | 1969 Mar 18.32<br>1258.68 days<br>1972 Aug 28.00 | Cylinder +<br>2 hemi-<br>spheres<br>125 | 1.40 long<br>0.69 dia | 1969 Mar 20.9<br>1970 May 1.0<br>1971 Nov 1.0   | 98.86<br>98.86<br>98.86   | 95.15<br>94.35<br>92.92 | 6903<br>6864<br>6794 | 466<br>443<br>395   | 583<br>528<br>436  | 0.008<br>0.006<br>0.003 | 157<br>-<br>-             |
| OVI-19                     | 1969 Mar 18.32<br>300 years                      | Cylinder +<br>2 hemi-<br>spheres<br>124 | 1.40 long<br>0.69 dia | 1969 Mar 20.8                                   | 104.77                    | 153.44                  | 9493                 | 466                 | 5764               | 0.279                   | 175                       |
| D OVI-17A<br>(Orbital 2)** | 1969 Mar 18.32<br>6.23 days<br>1969 Mar 24.55    | Cylinder<br>221                         | 2.05 long<br>0.72 dia | 1969 Mar 18.9                                   | 99.10                     | 89.37                   | 6620                 | 175                 | 309                | 0.010                   | 152                       |
| OVI-19<br>rocket           | 1969 Mar 18.32<br>150 years                      | Cylinder<br>707                         | 2.05 long<br>0.72 dia | 1969 Mar 28.2                                   | 104.78                    | 153.43                  | 9493                 | 463                 | 5767               | 0.279                   | 168                       |
| OVI-18<br>rocket           | 1969 Mar 18.32<br>10 years                       | Cylinder<br>707                         | 2.05 long<br>0.72 dia | 1969 Mar 23.3<br>1972 Jan 16.5                  | 98.85<br>98.85            | 95.15<br>94.35          | 6903<br>6864         | 465<br>441          | 584<br>530         | 0.009<br>0.006          | 149<br>-                  |
| D Fragment                 |  |   |                       |   |                           |                         |                      |                     |                    |                         |                           |

\* Orbiting Vehicle.

\*\* Orbiting radio beacon ionospheric satellite - calibration.

| 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<br>[Thorad Agena D] 1969-26A     | 1969 Mar 19, 90<br>4.35 days<br>1969 Mar 24, 25  | Cylinder<br>2000?              | 8 long?<br>1.5 dia    | 1969 Mar 21, 7                                    | 83.04                     | 88.75                   | 6588                 | 179                 | 241                | 0.005                      | 137                       |
| D<br>Capsule 1969-262              | 1969 Mar 19, 90<br>991.68 days<br>1971 Dec 6, 58 | Octagon?<br>607                | 0.3 long?<br>0.9 dia? | 1969 Mar 26, 2<br>1970 Oct 31, 7<br>1971 Jun 1, 0 | 83.08<br>83.0<br>83.0     | 94.82<br>93.34<br>92.19 | 6886<br>6815<br>6758 | 504<br>436<br>378   | 513<br>438<br>382  | 0.0006<br>0.0001<br>0.0003 | 25<br>-<br>-              |
| D<br>R<br>Cosmos 273 1969-27A      | 1969 Mar 22, 51<br>7.73 days<br>1969 Mar 30, 24  | Sphere-<br>cylinder<br>5530?   | 5 long?<br>2.4 dia    | 1969 Mar 26, 4                                    | 65.43                     | 89.78                   | 6642                 | 198                 | 329                | 0.010                      | 52                        |
| D<br>Cosmos 273 1969-27B<br>rocket | 1969 Mar 22, 51<br>6.40 days<br>1969 Mar 28, 91  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1969 Mar 26, 2                                    | 65.43                     | 89.06                   | 6606                 | 188                 | 267                | 0.006                      | 68                        |
| D<br>R<br>Cosmos 27A** 1969-28A    | 1969 Mar 24, 42<br>7.90 days<br>1969 Apr 1, 32   | Sphere-<br>cylinder<br>5530?   | 5 long?<br>2.4 dia    | 1969 Mar 26, 2                                    | 64.98                     | 89.56                   | 6631                 | 206                 | 300                | 0.007                      | 49                        |
| D<br>Cosmos 274 1969-28B<br>rocket | 1969 Mar 24, 42<br>5.26 days<br>1969 Mar 29, 68  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1969 Mar 26, 0                                    | 65.00                     | 89.26                   | 6616                 | 206                 | 270                | 0.005                      | 54                        |
| Meteor 1 1969-29A                  | 1969 Mar 26, 52<br>60 years                      | Cylinder +<br>2 vanes<br>2200? | 5 long?<br>1.5 dia?   | 1969 Mar 30, 0                                    | 81.20                     | 97.96                   | 7038                 | 633                 | 687                | 0.004                      | 80                        |
| Meteor 1 1969-29B<br>rocket        | 1969 Mar 26, 52<br>60 years                      | Cylinder<br>1440               | 3.8 long<br>2.6 dia   | 1969 Mar 31, 1                                    | 81.21                     | 98.14                   | 7046                 | 466                 | 870                | 0.029                      | 175                       |
| 294<br>Fragments 1969-29C-AP       |  |                                |                       |   |                           |                         |                      |                     |                    |                            |                           |

Space Vehicles: Mariner 7, 1969-30A; and Centaur rocket 1969-30B.

\*1969-268 ejected from 1969-26A about Mar 19, 97.

\*\* Carried supplementary atmospheric-composition experiment.

Year of launch 1969, 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 275           | 1969 Mar 28.67<br>315.61 days<br>1970 Feb 7.28  | Ellipsoid<br>4007            | 1.8 long<br>1.2 dia | 1969 Mar 30.0<br>1969 Sep 16.0 | 70.98<br>70.9             | 95.18<br>95.42     | 6905<br>6821         | 273<br>261          | 780<br>624         | 0.037<br>0.027       | 80<br>-                   |
| D      | Cosmos 275<br>rocket | 1969 Mar 28.67<br>17.76 days<br>1969 Sept 16.43 | Cylinder<br>15007            | 8 long<br>1.65 dia  | 1969 Mar 29.7<br>1969 Jun 16.0 | 70.96<br>70.9             | 95.07<br>95.30     | 6899<br>6815         | 274<br>260          | 768<br>613         | 0.036<br>0.026       | 82<br>-                   |
| D<br>R | Cosmos 276           | 1969 Apr 4.43<br>6.90 days<br>1969 Apr 11.33    | Sphere-<br>cylinder<br>55307 | 5 long?<br>2.4 dia  | 1969 Apr 6.2                   | 81.36                     | 90.25              | 6664                 | 200                 | 371                | 0.013                | 79                        |
| D      | Cosmos 276<br>rocket | 1969 Apr 4.43<br>10.07 days<br>1969 Apr 14.50   | Cylinder<br>25007            | 7.5 long<br>2.6 dia | 1969 Apr 7.1                   | 81.35                     | 89.94              | 6648                 | 203                 | 337                | 0.010                | 75                        |
| D      | Cosmos 277           | 1969 Apr 4.54<br>92.57 days<br>1969 Jul 6.11    | Ellipsoid<br>4007            | 1.8 long<br>1.2 dia | 1969 Apr 6.2                   | 70.95                     | 91.90              | 6745                 | 268                 | 466                | 0.015                | 87                        |
| D      | Cosmos 277<br>rocket | 1969 Apr 4.54<br>43.68 days<br>1969 May 18.22   | Cylinder<br>15007            | 8 long<br>1.65 dia  | 1969 Apr 6.8                   | 70.94                     | 91.77              | 6739                 | 266                 | 455                | 0.014                | 86                        |
| D<br>R | Cosmos 278           | 1969 Apr 9.54<br>7.78 days<br>1969 Apr 17.32    | Sphere-<br>cylinder<br>55307 | 5 long?<br>2.4 dia  | 1969 Apr 14.8                  | 65.42                     | 89.58              | 6632                 | 198                 | 310                | 0.008                | 144                       |
| D      | Cosmos 278<br>rocket | 1969 Apr 9.54<br>7 days<br>1969 Apr 16          | Cylinder<br>25007            | 7.5 long<br>2.6 dia | 1969 Apr 10.2                  | 65.40                     | 89.49              | 6628                 | 190                 | 309                | 0.009                | 36                        |

| 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    | Molniya IL<br>1969-35A                               | Windmill +<br>6 vanes<br>10007            | 3.4 long<br>1.6 dia      | 1969 Apr 22.1<br>1970 May 1.0<br>1971 May 16.5 | 64.94<br>65.07<br>65.15   | 713.50<br>717.67<br>717.44 | 26451<br>26554<br>26548 | 404<br>1060<br>1368 | 39741<br>39291<br>38972 | 0.744<br>0.720<br>0.708 | 285<br>-<br>-             |
| D    | Molniya IL<br>launcher rocket                        | Cylinder<br>25007                         | 7.5 long<br>2.6 dia      | 1969 Apr 12.8                                  | 65.02                     | 90.94                      | 6699                    | 234                 | 408                     | 0.013                   | 60                        |
| D    | Molniya IL<br>rocket                                 | Cylinder<br>440                           | 2.0 long<br>2.0 dia      | 1969 Apr 24.5<br>1970 May 1.0<br>1971 Jun 1.0  | 64.98<br>65.07<br>65.1    | 710.28<br>710.28<br>710.24 | 26371<br>26371<br>26370 | 461<br>1037<br>1350 | 39524<br>39848<br>38633 | 0.741<br>0.719<br>0.707 | 285<br>-<br>-             |
| D    | Molniya IL<br>launcher                               | Irregular                                 | -                        | 1969 Apr 13.4                                  | 65.00                     | 91.36                      | 6720                    | 222                 | 461                     | 0.018                   | 65                        |
|      | Secor 2 <sup>†</sup><br>[Atlas Agena D] <sup>•</sup> | Cylinder<br>700 full?<br>350 empty?       | 1.7 long?<br>1.4 dia?    | 1969 Apr 14                                    | 9.97                      | 1445                       | 42350                   | 32670               | 39270                   | 0.078                   | -                         |
|      | Nimbus 3   | Conical<br>skeleton<br>+ 2 paddles<br>575 | 3.00 long<br>1.45 dia    | 1969 Apr 25.5                                  | 99.91                     | 107.40                     | 7483                    | 1075                | 1135                    | 0.004                   | 215                       |
|      | Secor 13 <sup>**</sup><br>(Secor 13) <sup>††</sup>   | Rectangular<br>box<br>20                  | 0.33 x<br>0.28 x<br>0.23 | 1969 Apr 14.33<br>2000 years                   | 99.93                     | 107.36                     | 7481                    | 1075                | 1130                    | 0.004                   | 230                       |
|      | Nimbus 3<br>rocket                                   | Cylinder<br>700?                          | 6 long?<br>1.5 dia       | 1969 Apr 16.0                                  | 99.92                     | 107.50                     | 7488                    | 1078                | 1141                    | 0.004                   | -                         |

<sup>•</sup> The Agena D rocket (1969-368) is probably in an eccentric orbit like that of 1970-468.

<sup>†</sup> Ballistic Missile Early Warning Satellite.  
<sup>††</sup> Electronic Geodetic Ranging System.

<sup>\*\*</sup> Secor is Sequential collation of range.

|        | 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<br>R | Cosmos 279 <sup>†</sup><br>1969-38A  | 1969 Apr 15.35<br>7.98 days<br>1969 Apr 23.33  | Sphere-cylinder<br>5530? | 5 long?<br>2.4 dia    | 1969 Apr 18.4                                  | 51.74                     | 89.04                   | 6608                 | 192                 | 267                | 0.006                   | 25                        |
| D      | Cosmos 279<br>rocket                 | 1969 Apr 15.35<br>2.76 days<br>1969 Apr 18.11  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia   | 1969 Apr 16.7                                  | 51.74                     | 88.65                   | 6589                 | 169                 | 253                | 0.006                   | 9                         |
| D<br>R | [Titan 3B<br>Agena D]<br>1969-39A    | 1969 Apr 15.75<br>15 days<br>1969 Apr 30       | Cylinder<br>3000?        | 8 long?<br>1.5 dia    | 1969 Apr 20.1<br>1969 Apr 30.5                 | 108.76<br>108.76          | 89.96<br>89.03          | 6651<br>6605         | 135<br>1307         | 410<br>3237        | 0.021<br>0.0157         | 127<br>104                |
| D<br>R | Cosmos 280 <sup>††</sup><br>1969-40A | 1969 Apr 23.42<br>12.86 days<br>1969 May 6.28  | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia  | 1969 Apr 25.1<br>1969 Apr 28.7                 | 51.60<br>51.60            | 89.02<br>89.50          | 6607<br>6631         | 207<br>198          | 250<br>307         | 0.003<br>0.008          | 30<br>60                  |
| D      | Cosmos 280<br>rocket                 | 1969 Apr 23.42<br>3.38 days<br>1969 Apr 26.80  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia   | 1969 Apr 24.5                                  | 51.60                     | 88.83                   | 6598                 | 196                 | 243                | 0.003                   | 38                        |
| D      | Cosmos 280<br>engine*                | 1969 Apr 23.42<br>14.76 days<br>1969 May 8.18  | Cone<br>600? full        | 1.5 long?<br>2 dia?   | 1969 May 5                                     | 51.58                     | 89.06                   | 6610                 | 205                 | 258                | 0.004                   | -                         |
| D      | Fragment<br>1969-40D                 | 1969 May 2.08<br>21.35 days<br>1969 May 23.43  | Cylinder<br>2000?        | 8 long?<br>1.5 dia    | 1969 May 2.2                                   | 64.97                     | 89.54                   | 6631                 | 179                 | 326                | 0.011                   | 98                        |
| D      | [Thorad Agena D]<br>1969-41A         | 1969 May 2.08<br>290.78 days<br>1970 Feb 16.86 | Octagon?<br>60?          | 0.3 long?<br>0.9 dia? | 1969 May 2.3<br>1969 Aug 16.3<br>1969 Nov 16.0 | 65.71<br>65.71<br>65.71   | 93.37<br>92.96<br>92.28 | 6815<br>6796<br>6763 | 401<br>393<br>361   | 473<br>442<br>408  | 0.005<br>0.004<br>0.003 | 39<br>-<br>-              |
| D      | Capsule**<br>1969-41B                |  |                          |                       |  |                           |                         |                      |                     |                    |                         |                           |
| D      | Fragment<br>1969-41C                 |  |                          |                       |  |                           |                         |                      |                     |                    |                         |                           |

\* 1969-40C was ejected from 1969-40A about May 5 (approximate orbit).  
\*\* 1969-41B was ejected from 1969-41A about May 2.15.

<sup>†</sup> Carried supplementary ion orientation system.  
<sup>††</sup> Carried supplementary charged-particles experiment.

| 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<br>R<br>Cosmos 281        | 1969-42A<br>1969 May 13.39<br>7.74 days<br>1969 May 21.13 | Sphere-cylinder<br>55307                   | 5 long?<br>2.4 dia                 | 1969 May 14.1                                 | 65.42                     | 89.43                       | 6625                    | 191                     | 303                     | 0.008                    | 33                        |
| D<br>Cosmos 281<br>rocket   | 1969-42B<br>1969 May 13.39<br>3.65 days<br>1969 May 17.04 | Cylinder<br>25007                          | 7.5 long<br>2.6 dia                | 1969 May 14.1                                 | 65.40                     | 89.28                       | 6617                    | 181                     | 297                     | 0.009                    | 23                        |
| D<br>R<br>3H<br>Apollo 10** | 1969-43A<br>1969 May 18.70<br>8.00 days<br>1969 May 26.70 | Cone-cylinder<br>28870 full<br>12460 empty | 11.15 long<br>3.91 dia             | 1969 May 18.7<br>1969 May 18.9                | 32.56<br>33.2             | 88.03<br>24400              | 6562<br>273000          | 183<br>174              | 184<br>533000           | 0<br>0.976               | 107<br>30*                |
| Saturn IVB<br>[Saturn 505]  | 1969-43B<br>Indefinite                                    | Cylinder<br>13600                          | 18.7 long<br>6.6 dia               | 1969 May 18.7                                 | 32.56                     | 88.03                       | 6562                    | 183                     | 184                     | 0                        | 107                       |
| LEM 4 †                     | 1969-43C<br>1969 May 18.70<br>Indefinite                  | Box + Octagon + legs<br>13993 full         | 4.1 high<br>3.76 wide<br>3.13 deep | 1969 May 18.9                                 | 33.2                      | 24400                       | 273000                  | 174                     | 533000                  | 0.976                    | 30*                       |
| D<br>R<br>Cosmos 282        | 1969-44A<br>1969 May 20.36<br>7.7 days<br>1969 May 28.1   | Sphere-cylinder<br>55307                   | 5 long?<br>2.4 dia                 | 1969 May 21.8                                 | 65.40                     | 89.73                       | 6640                    | 202                     | 321                     | 0.009                    | 52                        |
| D<br>Cosmos 282<br>rocket   | 1969-44B<br>1969 May 20.36<br>8.32 days<br>1969 May 28.68 | Cylinder<br>25007                          | 7.5 long<br>2.6 dia                | 1969 May 22.5                                 | 65.40                     | 89.45                       | 6626                    | 206                     | 290                     | 0.006                    | 41                        |
| Intelsat 3D (P-4)           | 1969-45A<br>1969 May 22.08<br>7 million years             | Cylinder<br>293 full<br>137 empty          | 1.04 long<br>1.42 dia              | 1969 Jun 1.0<br>1969 Jul 1.0<br>1977 May 13.0 | 0.5<br>0.5<br>6.09        | 1418.9<br>1436.5<br>1636.33 | 41827<br>42172<br>45998 | 35226<br>35787<br>39487 | 35671<br>35801<br>36093 | 0.005<br>0.0002<br>0.003 | -<br>-<br>199             |
| D<br>Intelsat 3D<br>rocket  | 1969-45B<br>1969 May 22.08<br>2846 days<br>1977 Mar 7     | Cylinder<br>24                             | 1.50 long<br>0.46 dia              | 1972 May 1.0                                  | 28.5                      | 640.9                       | 24623                   | 396                     | 36093                   | 0.725                    | -                         |

\* Approximate orbits. \*\* Apollo attached to LEM, separated from Saturn IVB on May 18.89.  
 † LEM with 2 crew members, separated from Apollo on May 22.80. LEM ascent stage jettisoned descent stage May 22.98; re-joined Apollo May 23.13; now in solar 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) |
|-----------------------------|---|------------------------------------|---------------------|--------------------------------|---------------------------|--------------------|---------------------------|---------------------|--------------------|----------------------|---------------------------|
| OV5-5<br>(ERS 29)*          | 1969 May 23.33<br>million years                 | Octa-<br>hedron<br>11              | 0.31 side           | 1969 May 24.3                  | 33.03                     | 3120.3             | 70736                     | 17069               | 111647             | 0.668                | 184                       |
| OV5-6<br>(ERS 26)           | 1969 May 23.33<br>million years                 | Tetra-<br>hedron<br>10             | 0.28 side           | 1969 May 24.3                  | 32.86                     | 3115.2             | 70658                     | 16923               | 111636             | 0.670                | 184                       |
| OV5-9                       | 1969 May 23.33<br>million years                 | Modified<br>Tetra-<br>hedron<br>13 | 0.28 side           | 1969 May 24.3                  | 32.7                      | 3115.4             | 70661                     | 17046               | 111519             | 0.668                | 184                       |
| Vela 9                      | 1969 May 23.33<br>> million years               | Icosa-<br>hedron<br>259            | 1.27 dia            | 1969 May 24.5                  | 32.8                      | 6703               | 117933                    | 110900              | 112210             | 0.006                | -                         |
| Vela 10                     | 1969 May 23.33<br>> million years               | Icosa-<br>hedron<br>259            | 1.27 dia            | 1969 May 25.5                  | 32.8                      | 6709               | 117980                    | 110920              | 112283             | 0.006                | -                         |
| Vela 9 rocket<br>[Titan 3C] | 1969 May 23.33<br>> million years               | Cylinder<br>15007                  | 6 long?<br>3.0 dia  |                                |                           |                    | Orbit similar to 1969-46A |                     |                    |                      |                           |
| Coenos 283                  | 1969 May 27.54<br>197.25 days<br>1969 Dec 10.79 | Ellipsoid<br>4007                  | 1.8 long<br>1.2 dia | 1969 May 31.0<br>1969 Aug 31.7 | 81.94<br>81.9             | 101.95<br>98.48    | 7228<br>7065              | 199<br>195          | 1501<br>1178       | 0.090<br>0.070       | 64<br>-                   |
| Coenos 283<br>rocket        | 1969 May 27.54<br>126.48 days<br>1969 Oct 1.02  | Cylinder<br>15007                  | 8 long<br>1.65 dia  | 1969 May 30.5<br>1969 Aug 1.0  | 81.94<br>81.9             | 101.80<br>98.35    | 7221<br>7058              | 199<br>199          | 1486<br>1161       | 0.089<br>0.068       | 66<br>-                   |

|        | 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<br>R | Cosmos 284            | 1969 May 29.29<br>7.95 days<br>1969 Jun 6.24  | Sphere-cylinder<br>55307 | 5 long?<br>2.4 dia                  | 1969 May 31.5                 | 51.76                     | 89.45              | 6628                 | 205                 | 294                | 0.007                | 46                        |
| D      | Cosmos 284<br>rocket  | 1969 May 29.29<br>6.02 days<br>1969 Jun 4.31  | Cylinder<br>25007        | 7.5 long<br>2.6 dia                 | 1969 May 30.5                 | 51.75                     | 89.28              | 6620                 | 197                 | 286                | 0.007                | 30                        |
| D      | Fragment              | 1969-4.8C                                     |                          |                                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D      | Cosmos 285            | 1969 Jun 3.54<br>126.09 days<br>1969 Oct 7.63 | Ellipsoid<br>4007        | 1.8 long<br>1.2 dia                 | 1969 Jun 4.8<br>1969 Aug 16.3 | 71.03<br>70.98            | 92.16<br>91.11     | 6758<br>6707         | 267<br>249          | 495<br>409         | 0.017<br>0.012       | 85<br>-                   |
| D      | Cosmos 285<br>rocket  | 1969 Jun 3.54<br>62.89 days<br>1969 Aug 5.43  | Cylinder<br>15007        | 8 long<br>1.65 dia                  | 1969 Jun 3.9                  | 71.03                     | 92.06              | 6753                 | 266                 | 484                | 0.016                | 95                        |
| D<br>R | [Titan 3B<br>Agena D] | 1969 Jun 3.70<br>11.2 days<br>1969 Jun 14.9   | Cylinder<br>30007        | 8 long?<br>1.5 dia                  | 1969 Jun 4.1                  | 110.00                    | 90.04              | 6654                 | 137                 | 414                | 0.021                | 131                       |
|        | 000 6*                | 1969 Jun 5.61<br>10 years                     | Box + booms<br>620       | 1.75 long<br>0.84 high<br>0.84 wide | 1969 Jun 17.2<br>1971 Nov 1.0 | 82.00<br>82.00            | 99.71<br>98.46     | 7121<br>7062         | 397<br>391          | 1089<br>977        | 0.049<br>0.042       | 123<br>-                  |
| D<br>R | 000 6<br>rocket       | 1969 Jun 5.61<br>11 years                     | Cylinder<br>7007         | 6.5 long<br>1.5 dia                 | 1969 Jun 17.2<br>1972 Feb 1.0 | 82.00<br>82.00            | 99.66<br>98.43     | 7118<br>7061         | 396<br>402          | 1084<br>963        | 0.049<br>0.040       | 113<br>-                  |
| D<br>R | Cosmos 286            | 1969 Jun 15.38<br>7.78 days<br>1969 Jun 23.16 | Sphere-cylinder<br>55307 | 5 long?<br>2.4 dia                  | 1969 Jun 17.0                 | 65.41                     | 89.78              | 6642                 | 200                 | 327                | 0.010                | 51                        |
| D      | Cosmos 286<br>rocket  | 1969 Jun 15.38<br>7.95 days<br>1969 Jun 23.31 | Cylinder<br>25007        | 7.5 long<br>2.6 dia                 | 1969 Jun 17.2                 | 65.40                     | 89.43              | 6625                 | 188                 | 305                | 0.009                | 40                        |

\* Orbiting Geophysical Observatory.

|   | 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 41 (Imp 7)* | 1969 Jun 21.37<br>1281 days<br>1972 Dec 23                 | Octagon +<br>4 vanes. 79     | 0.25 long<br>0.71 dia | 1969 Jun 21.9<br>1970 Feb 15.3<br>1971 Jun 16.0 | 86.78<br>86.65<br>85.06   | 4843.5<br>4836.9<br>4840.9 | 94784<br>94743<br>94754 | 378<br>2083<br>3980 | 176,434<br>174,646<br>172,512 | 0.929<br>0.911<br>0.891 | 200<br>-<br>-             |
| D | Explorer 41 rocket   | 1969 Jun 21.37<br>months?                                  | Cylinder<br>24               | 1.57 long<br>0.50 dia | Orbit similar to 1969-53A                       |                           |                            |                         |                     |                               |                         |                           |
| D | Cosmos 287           | 1972 Dec 7<br>1969 Jun 24.29<br>7.96 days<br>1969 Jul 2.25 | Sphere-<br>cylinder<br>5530? | 5 long?<br>2.4 dia    | 1969 Jun 25.1                                   | 51.77                     | 88.95                      | 6604                    | 188                 | 264                           | 0.006                   | 3                         |
| D | Cosmos 287 rocket    | 1969 Jun 24.29<br>2.83 days<br>1969 Jun 27.12              | Cylinder<br>2500?            | 7.5 long<br>2.6 dia   | 1969 Jun 25.3                                   | 51.76                     | 88.62                      | 6588                    | 171                 | 249                           | 0.006                   | 351                       |
| D | Cosmos 288           | 1969 Jun 27.30<br>7.98 days<br>1969 Jul 5.28               | Sphere-<br>cylinder<br>5530? | 5 long?<br>2.4 dia    | 1969 Jun 28.0                                   | 51.76                     | 89.17                      | 6614                    | 199                 | 273                           | 0.006                   | 24                        |
| D | Cosmos 288 rocket    | 1969 Jun 27.30<br>5.29 days<br>1969 Jul 2.59               | Cylinder<br>2500?            | 7.5 long<br>2.6 dia   | 1969 Jun 28.9                                   | 51.75                     | 88.94                      | 6604                    | 195                 | 258                           | 0.005                   | 29                        |
| D | Bios 3 capsule**     | 1969 Jun 29.14<br>8.85 days<br>1969 Jul 7.99               | Blunt cone<br>259            | 1.2 long<br>1.02 dia  | 1969 Jul 1.1                                    | 33.56                     | 91.86                      | 6750                    | 356                 | 388                           | 0.002                   | 244                       |
| B | Bios 3 adapter       | 1969 Jun 29.14<br>205.43 days<br>1970 Jan 20.57            | Cone-<br>cylinder<br>440     | 1.8 long<br>1.45 dia  | 1969 Jul 1.1<br>1969 Oct 16.3                   | 33.56<br>33.5             | 91.86<br>91.29             | 6750<br>6723            | 356<br>333          | 388<br>357                    | 0.002<br>0.002          | 244<br>-                  |
| D | Bios 3 rocket        | 1969 Jun 29.14<br>155.82 days<br>1969 Dec 1.96             | Cylinder<br>350?             | 4.9 long<br>1.43 dia  | 1969 Jul 1.0<br>1969 Sep 16.0                   | 33.56<br>33.5             | 91.74<br>91.25             | 6745<br>6721            | 351<br>334          | 382<br>352                    | 0.002<br>0.001          | 260<br>-                  |
| D | Fragment             | 1969-56C   |                              |                       |   |                           |                            |                         |                     |                               |                         |                           |

\* Interplanetary monitoring platform.

\*\* Before 1969 Jul 7.99, Bios capsule, which carried a monkey, was attached to Bios 3 adapter.

|  | 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<br>R   | Cosmos 209<br>1969-57A                  | 1969 Jul 10.38<br>4.90 days<br>1969 Jul 15.18 | Sphere-cylinder<br>5530?                        | 5 long?<br>2.4 dia                  | 1969 Jul 14.1                  | 65.40  | 89.69              | 6638                 | 194                 | 325                | 0.010                | 41                        |
| D  | Cosmos 289<br>rocket<br>1969-57E        | 1969 Jul 10.38<br>5.69 days<br>1969 Jul 16.07 | Cylinder<br>2500?                               | 7.5 long<br>2.6 dia                 | 1969 Jul 11.1                  | 66.39  | 89.55              | 6631                 | 191                 | 314                | 0.009                | 36                        |
| C  | Luna 15<br>launcher rocket<br>1969-58E  | 1969 Jul 13.13<br>3.70 days<br>1969 Jul 16.83 | Cylinder<br>4000?                               | 12 long?<br>4 dia                   | 1969 Jul 13.4                  | 51.55  | 88.72              | 6593                 | 182                 | 247                | 0.005                | 352                       |
| D  | Luna 15<br>launcher<br>1969-58C         | 1969 Jul 13.13<br>3.60 days<br>1969 Jul 16.73 | -   | -                                   | 1969 Jul 13.3                  | 51.50  | 88.71              | 6592                 | 190                 | 238                | 0.004                | 320                       |
| D<br>M<br>R  | Apollo 11**<br>1969-59A                 | 1969 Jul 16.56<br>8.14 days<br>1969 Jul 24.70 | Cone-cylinder<br>28800 full<br>12050 empty      | 11.15 long<br>3.91 dia              | 1969 Jul 16.6<br>1969 Jul 16.8 | 32.51<br>33.3  | 88.03<br>24400     | 6562<br>273 000      | 183<br>174          | 184<br>533 000     | 0<br>0.976           | 182<br>30*                |
| In selenocentric orbit 1969 Jul 19.73 to Jul 22.21 |   |   |   |                                     |                                |  |                    |                      |                     |                    |                      |                           |
|  | Saturn IV B<br>[Saturn 50G]<br>1969-59B | 1969 Jul 16.56<br>Indefinite                  | Cylinder<br>13300                               | 18.7 long<br>6.6 dia                | 1969 Jul 16.6                  | 32.51<br>Entered heliocentric orbit 1969 Jul 16.76                                   | 88.03              | 6562                 | 183                 | 184                | 0                    | 183                       |
| D  | LEM 5†<br>Descent stage<br>1969-59D     | 1969 Jul 16.56<br>4.29 days<br>1969 Jul 20.85 | Octagon +<br>4 legs<br>10243 full<br>2033 empty | 1.57 high<br>3.13 wide              | 1969 Jul 16.8                  | 33.3<br>Entered selenocentric orbit 1969 Jul 19.73<br>Landed on Moon 1969 July 20.85 | 24400              | 273 000              | 174                 | 533 000            | 0.976                | 30*                       |
|  | LEM 5<br>Ascent stage<br>1969-59C       | 1969 Jul 16.56<br>Indefinite                  | Box + 2<br>tanks<br>4818 full<br>2179 empty     | 2.52 high<br>3.76 wide<br>3.13 deep | 1969 Jul 16.8                  | 33.3<br>On Moon's surface 1969 Jul 20.85 to Jul 21.75<br>Now in selenocentric orbit  | 24400              | 273 000              | 174                 | 533 000            | 0.976                | 30*                       |

\*\* Apollo attached to LEM, separated from Saturn IV B on Jul 16.76, First manned landing on Moon.  
† LEM with 2 crew members, separated from Apollo on Jul 20.74

LEM ascent stage launched from Moon Jul 21.75; re-joined Apollo Jul 21.90.

\* Approximate orbits.  
Space Vehicle: Luna 15, 1969-58A

| Name                               | Launch date, lifetime and descent date         | Shape and weight (kg)          | Size (m)  | Date of orbital determination                   | Orbital inclination (deg) | Nodes period (min)         | Semi major axis (km)    | Perigee height (km) | Apogee height (km)      | Orbital eccentricity    | Argument of perigee (deg) |
|------------------------------------|--|--------------------------------|---|---|---------------------------|----------------------------|-------------------------|---------------------|-------------------------|-------------------------|---------------------------|
| D<br>R<br>Cosmos 290               | 1969 Jul 22.52<br>7.79 days<br>1969 Jul 30.31  | Sphere-cylinder<br>5530?       | 5 long?<br>2.4 dia  | 1969 Jul 24.1                                   | 65.40                     | 89.75                      | 6641                    | 194                 | 332                     | 0.010                   | 44                        |
| D<br>Cosmos 290<br>rocket          | 1969 Jul 22.52<br>6.75 days<br>1969 Jul 29.27  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia                                       | 1969 Jul 24.1                                   | 65.41                     | 89.52                      | 6650                    | 183                 | 320                     | 0.010                   | 39                        |
| D<br>Molniya 1M                    | 1969 Jul 22.54<br>696 days<br>1971 Jun 18      | Windmill<br>+ 6 vanes<br>1000? | 3.4 long<br>1.6 dia                                       | 1969 Jul 31.5<br>1969 Sep 16.0<br>1970 Oct 31.7 | 64.90<br>64.90<br>64.90   | 710.94<br>717.65<br>717.46 | 26387<br>26553<br>26549 | 499<br>525<br>316   | 39519<br>39825<br>40025 | 0.740<br>0.740<br>0.746 | 285<br>-<br>-             |
| D<br>Molniya 1M<br>launcher rocket | 1969 Jul 22.54<br>36.89 days<br>1969 Aug 28.43 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia                                       | 1969 Jul 23.9                                   | 64.93                     | 91.73                      | 6738                    | 228                 | 492                     | 0.020                   | 72                        |
| D<br>Molniya 1M<br>launcher        | 1969 Jul 22.54<br>32.32 days<br>1969 Aug 23.86 | Irregular                      | -   | 1969 Jul 23.9                                   | 64.93                     | 91.90                      | 6747                    | 213                 | 524                     | 0.023                   | 69                        |
| D<br>Molniya 1M<br>rocket          | 1969 Jul 22.54<br>688 days<br>1971 Jun 10      | Cylinder<br>440                | 2.0 long<br>2.0 dia                                       | 1969 Jul 29.5<br>1969 Dec 1.0<br>1970 Oct 31.7  | 64.89<br>64.88<br>64.88   | 707.80<br>707.84<br>707.58 | 26309<br>26311<br>26304 | 486<br>548<br>307   | 39876<br>39318<br>39545 | 0.739<br>0.737<br>0.746 | 285<br>-<br>-             |
| D<br>Fragments<br>[Thor Burner 2]  | 1969 Jul 23.19<br>80 years                     | 12-faced<br>frustum<br>195     | 1.64 long<br>1.31 to<br>1.10 dia<br>1.32 long<br>0.94 dia | 1969 Jul 25.1                                   | 98.80                     | 101.36                     | 7200                    | 788                 | 856                     | 0.005                   | 2                         |
| D<br>Burner 2<br>rocket            | 1969 Jul 23.19<br>60 years                     | Sphere-cone<br>66              |   | 1969 Jul 23.6                                   | 98.78                     | 01.36                      | 7200                    | 787                 | 857                     | 0.005                   | 1                         |

|     | 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   | [Thorad Agena D] 1969-63A  | 1969 Jul 24.06<br>30.44 days<br>1969 Aug 23.50  | Cylinder<br>2000?     | 8 long?<br>1.5 dia    | 1969 Jul 27.9                                 | 74.98                     | 88.49                   | 6577                 | 178                 | 220                | 0.003                   | 123                       |
|     | Intelsat 3E (F-5) 1969-64A | 1969 Jul 26.09<br>20 years                      | Cylinder<br>292 full  | 1.04 long<br>1.42 dia | 1969 Jul 30.7<br>1973 Jan 1.0                 | 30.33<br>30.33            | 146.42<br>138.4         | 9212<br>8863         | 271<br>268          | 5397<br>4701       | 0.278<br>0.250          | 204<br>-                  |
| D   | Intelsat 3E rocket         | 1969 Jul 26.09<br>355.67 days<br>1970 Jul 16.76 | Sphere-cone<br>66     | 1.32 long<br>0.94 dia | 1969 Aug 4.9<br>1970 Apr 14.4                 | 30.37<br>30.26            | 146.17<br>111.65        | 9201<br>7689         | 271<br>261          | 5375<br>2360       | 0.277<br>0.137          | 227<br>140                |
| 19d | Fragments 1969-64C-I       |   |                       |                       |   |                           |                         |                      |                     |                    |                         |                           |
| D   | [Thorad Agena D] 1969-65A  | 1969 Jul 31.44<br>1253.28 days<br>1973 Jan 4.72 | Cylinder<br>2000?     | 8 long?<br>1.5 dia    | 1969 Aug 1.5<br>1970 Oct 1.3<br>1971 Nov 16.0 | 75.02<br>74.97<br>75.00   | 94.67<br>93.98<br>93.25 | 6880<br>6847<br>6812 | 462<br>439<br>410   | 541<br>498<br>457  | 0.006<br>0.004<br>0.003 | 238<br>-<br>-<br>63       |
| D   | Cosmos 291                 | 1969 Aug 6.24<br>33.70 days<br>1969 Sep 8.94    | Cylinder?<br>2 dia?   | 4 long?<br>2 dia?     | 1969 Aug 7.2                                  | 62.24                     | 91.46                   | 6726                 | 147                 | 548                | 0.030                   | 63                        |
| D   | Cosmos 291 rocket          | 1969 Aug 6.24<br>5.11 days<br>1969 Aug 11.35    | Cylinder<br>1500?     | 8 long?<br>2.5 dia?   | 1969 Aug 8.0                                  | 62.23                     | 90.71                   | 6690                 | 143                 | 481                | 0.025                   | 63                        |
| D   | Zond 7 launcher            | 1969 Aug 8.00<br>2.17 days<br>1969 Aug 10.17    | -                     | -                     | 1969 Aug 8.7                                  | 51.51                     | 88.17                   | 6565                 | 183                 | 191                | 0.001                   | 139                       |
| D   | Zond 7 launcher rocket     | 1969 Aug 8.00<br>4.37 days<br>1969 Aug 12.37    | Cylinder<br>4000?     | 12 long?<br>4 dia     | 1969 Aug 10.1                                 | 51.52                     | 88.46                   | 6580                 | 190                 | 214                | 0.002                   | 330                       |
| D   | Fragment 1969-67D          |   |                       |                       |   |                           |                         |                      |                     |                    |                         |                           |

Space vehicle: Zond 7, 1969-67A, passed around the Moon Aug 11.18; was recovered on Earth at Aug 14.76

Year of launch 1969 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) |
|--------------------------|---|-----------------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| OSD 6                    | 1969 Aug 9.33<br>20 years                 | None<br>box + vane<br>290         | 0.91 long<br>1.12 dia | 1969 Aug 10.8                 | 32.96                     | 94.95              | 6901                 | 491                 | 554                | 0.005                | 282                       |
| PAC 1*<br>(OSD 6 rocket) | 1969 Aug 9.33<br>2819 days<br>1977 Apr 28 | Cylinder<br>470?<br>payload 120   | 4.9 long<br>1.43 dia  | 1969 Aug 13.8<br>1971 Feb 1.0 | 32.95<br>32.95            | 94.89<br>94.23     | 6898<br>6865         | 485<br>460          | 554<br>514         | 0.005<br>0.004       | 311                       |
| ATS 5 †                  | 1969 Aug 12.46<br>> million<br>years      | Cylinder<br>821 full<br>433 empty | 1.83 long<br>1.52 dia | 1969 Aug 23.2<br>1969 Nov 1.0 | 2.6<br>2.5                | 1463.8<br>1435.9   | 42705<br>42162       | 35760<br>35777      | 36894<br>35790     | 0.013<br>0.0002      | 291                       |
| ATS 5<br>rocket          | 1969 Aug 12.46<br>200 000 years           | Cylinder<br>1815                  | 8.6 long<br>3.0 dia   | 1969 Sep 16.0                 | 17.55                     | 703.1              | 26192                | 2209                | 37419              | 0.672                | 185                       |
| ATS 5**<br>apogee motor  | 1969 Aug 12.46<br>> million<br>years      | Cone<br>3887 full<br>397 empty    | 1.3 long?<br>0.5 dia? | 1969 Sep 5                    | 2.6                       | 1463.8             | 42705                | 35760               | 36894              | 0.013                | 291                       |
| Fragment<br>Cosmos 292   | 1969 Aug 13.92<br>100 years               | Cylinder<br>+ paddles?<br>750?    | 2 long?<br>1 dia?     | 1969 Aug 28.8                 | 74.06                     | 99.96              | 7134                 | 746                 | 765                | 0.001                | 71                        |
| Cosmos 292<br>rocket     | 1969 Aug 13.92<br>80 years                | Cylinder<br>2200?                 | 7.4 long<br>2.4 dia   | 1969 Aug 22.6                 | 74.06                     | 99.85              | 7129                 | 738                 | 763                | 0.002                | 58                        |
| Fragment                 | 1969-70C                                  |                                   |                       |                               |                           |                    |                      |                     |                    |                      |                           |

\* Package Attitude Control.

\*\* Separated from ATS 5 on 1969 Sep 5.

† Applications Technology Satellite.

|        | 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<br>R | Cosmos 293*           | 1969 Aug 16.50<br>11.95 days<br>1969 Aug 28.43 | Sphere-cylinder<br>59007 | 5.9 long?<br>2.4 dia | 1969 Aug 16.8  | 51.77                                | 89.08                            | 6610                         | 208                      | 256                      | 0.004                            | 44                        |
| D      | Cosmos 293<br>rocket  | 1969 Aug 16.50<br>3.93 days<br>1969 Aug 20.43  | Cylinder<br>25007        | 7.5 long<br>2.6 dia  | 1969 Aug 16.8  | 51.77                                | 88.94                            | 6603                         | 202                      | 248                      | 0.003                            | 31                        |
| D<br>R | Cosmos 294            | 1969 Aug 19.54<br>7.79 days<br>1969 Aug 27.33  | Sphere-cylinder<br>55307 | 5 long?<br>2.4 dia   | 1969 Aug 20.3  | 65.40                                | 89.79                            | 6643                         | 200                      | 329                      | 0.010                            | 48                        |
| D      | Cosmos 294<br>rocket  | 1969 Aug 19.54<br>7.62 days<br>1969 Aug 27.16  | Cylinder<br>25007        | 7.5 long<br>2.6 dia  | 1969 Aug 20.3  | 65.40                                | 89.65                            | 6636                         | 195                      | 320                      | 0.009                            | 43                        |
| D      | Cosmos 295            | 1969 Aug 22.60<br>101.15 days<br>1969 Dec 1.75 | Ellipsoid<br>4007        | 1.8 long<br>1.2 dia  | 1969 Aug 28.1  | 71.01                                | 91.95                            | 6748                         | 270                      | 469                      | 0.015                            | 77                        |
| D      | Cosmos 295<br>rocket  | 1969 Aug 22.60<br>43.56 days<br>1969 Oct 11.16 | Cylinder<br>15007        | 8 long<br>1.65 dia   | 1969 Aug 27.4  | 71.01                                | 91.80                            | 6741                         | 272                      | 453                      | 0.013                            | 79                        |
| D<br>R | [Titan 3B<br>Agena D] | 1969 Aug 22.67<br>16 days<br>1969 Sep 7        | Cylinder<br>30007        | 8 long?<br>1.5 dia   | 1969 Aug 24.7<br>1969 Aug 25.0<br>1969 Sep 1.1<br>1969 Sep 2.1 | 108.00<br>107.99<br>107.99<br>107.96 | 89.51<br>89.74<br>89.29<br>89.84 | 6628<br>6639<br>6618<br>6644 | 133<br>136<br>130<br>130 | 366<br>386<br>349<br>402 | 0.018<br>0.019<br>0.017<br>0.021 | 130<br>131<br>119<br>122  |

\* Telemetry suggests Cosmos 293 carried a pickaback capsule, but none was apparently tracked or designated



|        | 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<br>R | Cosmos 299<br>1969-78A           | 1969 Sep 18.36<br>3.98 days<br>1969 Sep 22.34   | Sphere-cylinder<br>55307 | 5 long?<br>2.4 dia    | 1969 Sep 19.4                                 | 64.97                     | 89.41                   | 6624                 | 207                 | 284                | 0.006                      | 62                        |
| D      | Cosmos 299<br>rocket<br>1969-78B | 1969 Sep 18.36<br>5.69 days<br>1969 Sep 24.05   | Cylinder<br>25007        | 7.5 long<br>2.6 dia   | 1969 Sep 19.5                                 | 64.98                     | 89.16                   | 6612                 | 206                 | 261                | 0.004                      | 54                        |
| D      | [Thorad<br>Agena D]<br>1969-79A  | 1969 Sep 22.88<br>19.74 days<br>1969 Oct 12.62  | Cylinder<br>20007        | 8 long?<br>1.5 dia    | 1969 Sep 24.3                                 | 85.03                     | 88.85                   | 6594                 | 178                 | 253                | 0.006                      | 134                       |
| D      | Capsule<br>1969-79B              | 1969 Sep 22.88<br>600.84 days<br>1971 May 16.72 | Octagon?<br>607          | 0.3 long?<br>0.9 dia? | 1969 Sep 29.7<br>1970 Oct 1.3<br>1971 Feb 1.0 | 85.16<br>85.16<br>85.16   | 94.51<br>93.23<br>92.22 | 6871<br>6808<br>6760 | 490<br>427<br>380   | 496<br>434<br>383  | 0.0005<br>0.0005<br>0.0002 | 305<br>-<br>-             |
| D      | Cosmos 300**<br>1969-80A         | 1969 Sep 23.59<br>4 days<br>1969 Sep 27         | Cylinder<br>134007 full  | 7 long<br>3.9 dia     | 1969 Sep 24.3<br>1969 Sep 27.4                | 51.52<br>51.52            | 88.16<br>87.54          | 6565<br>6533         | 184<br>148          | 189<br>162         | 0.0004<br>0.0011           | 193<br>317                |
| D      | Cosmos 300<br>rocket<br>1969-80B | 1969 Sep 23.59<br>3.44 days<br>1969 Sep 27.05   | Cylinder<br>40007        | 12 long?<br>4 dia     | 1969 Sep 24.9                                 | 51.54                     | 88.03                   | 6558                 | 179                 | 181                | 0.0002                     | 203                       |
| D<br>R | Cosmos 301<br>1969-81A           | 1969 Sep 24.51<br>7.76 days<br>1969 Oct 2.27    | Sphere-cylinder<br>55307 | 5 long?<br>2.4 dia    | 1969 Sep 25.4                                 | 65.41                     | 89.34                   | 6620                 | 195                 | 289                | 0.007                      | 34                        |
| D      | Cosmos 301<br>rocket<br>1969-81B | 1969 Sep 24.51<br>5.00 days<br>1969 Sep 29.51   | Cylinder<br>25007        | 7.5 long<br>2.6 dia   | 1969 Sep 25.6                                 | 65.40                     | 89.13                   | 6610                 | 198                 | 266                | 0.005                      | 19                        |

\* 1969-79B ejected from 1969-79A on 1969 Sep 22.95.

\*\*Probably an attempted lunar probe. (Payload 5600 kg)

| 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) |
|--------------------|---|---------------------------|-----------------------|--|---------------------------|-------------------------|----------------------|---------------------|--------------------|-------------------------|---------------------------|
| Capsule            | 1969 Sep 30.57<br>394.65 days<br>1970 Oct 30.22 | Octagon?<br>607           | 0.3 long?<br>0.9 dia? | 1969 Oct 7.1<br>1970 Mar 9.9<br>1970 Jul 1.3 | 69.64<br>69.64<br>69.64   | 99.91<br>99.28<br>92.38 | 6843<br>6813<br>6768 | 446<br>419<br>381   | 484<br>450<br>399  | 0.003<br>0.002<br>0.001 | 58<br>189<br>-            |
| Flotation 2*       | 1969 Sep 30.57<br>900 years                     | Cylinder<br>+ boom?<br>57 | 1.1 long<br>0.4 dia   | 1970 Mar 3.1                                 | 70.02                     | 103.48                  | 7301                 | 906                 | 940                | 0.002                   | 217                       |
| [ Thorad Agena D ] | 1969 Sep 30.57<br>600 years                     | -                         | -                     | 1970 Feb 27.2                                | 70.02                     | 103.49                  | 7302                 | 906                 | 941                | 0.002                   | 222                       |
| [ Thorad Agena D ] | 1969 Sep 30.57<br>600 years                     | -                         | -                     | 1970 Jan 3.2                                 | 70.02                     | 103.49                  | 7302                 | 907                 | 940                | 0.002                   | 284                       |
| [ Thorad Agena D ] | 1969 Sep 30.57<br>600 years                     | -                         | -                     | 1970 Feb 28.2                                | 70.02                     | 103.49                  | 7302                 | 906                 | 941                | 0.002                   | 221                       |
| [ Thorad Agena D ] | 1969 Sep 30.57<br>600 years                     | -                         | -                     | 1970 Feb 3.4                                 | 70.03                     | 103.49                  | 7302                 | 906                 | 941                | 0.002                   | 251                       |
| [ Thorad Agena D ] | 1969 Sep 30.57<br>600 years                     | -                         | -                     | 1970 Feb 2.4                                 | 70.01                     | 103.48                  | 7301                 | 906                 | 940                | 0.002                   | 254                       |
| Tempsat 2          | 1969 Sep 30.57<br>750 years                     | Sphere<br>(black)<br>14.5 | 0.41 dia              | 1970 Mar 2.2                                 | 70.02                     | 103.48                  | 7301                 | 906                 | 940                | 0.002                   | 219                       |

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) |
|-----------------------|---|--------------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| SOICAL*<br>cylinder   | 1969 Sep 30.57<br>80 years                    | Cylinder<br>2.4                | 1.02 long<br>0.25 dia | 1970 Feb 23.8                 | 70.02                     | 103.46             | 7300                 | 904                 | 940                | 0.002                | 232                       |
| SOICAL<br>cone        | 1969 Sep 30.57<br>150 years                   | Cone<br>3.4                    | 0.66 long<br>0.51 dia | 1970 Feb 22.8                 | 70.01                     | 103.50             | 7302                 | 903                 | 945                | 0.003                | 228                       |
| Agna D<br>rocket      | 1969 Sep 30.57<br>600 years                   | Cylinder<br>700?               | 6 long?<br>1.5 dia    | 1969 Oct 22.5                 | 69.96                     | 105.22             | 7383                 | 918                 | 1092               | 0.012                | 87                        |
| Fragments             | 1969-82L-KL                                   |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| Boreas<br>(ESRO 1B)** | 1969 Oct 1.94<br>52.47 days<br>1969 Nov 23.41 | Cone-<br>cylinder<br>80        | 1.52 long<br>0.76 dia | 1969 Oct 3.1                  | 85.11                     | 91.39              | 6718                 | 291                 | 389                | 0.007                | 313                       |
| Boreas<br>rocket      | 1969 Oct 1.94<br>32.36 days<br>1969 Nov 3.30  | Cylinder<br>24                 | 1.50 long<br>0.46 dia | 1969 Oct 5.9                  | 85.13                     | 91.36              | 6717                 | 296                 | 381                | 0.006                | 309                       |
| Fragments             | 1969-83C,D                                    |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| Meteor 2              | 1969 Oct 6.07<br>60 years                     | Cylinder +<br>2 vanes<br>2200? | 5 long?<br>1.5 dia?   | 1969 Oct 6.7                  | 81.26                     | 97.70              | 7025                 | 613                 | 681                | 0.005                | 131                       |
| Meteor 2<br>rocket    | 1969 Oct 6.07<br>60 years                     | Cylinder<br>1440               | 3.8 long<br>2.6 dia   | 1969 Oct 8.4                  | 81.24                     | 97.86              | 7033                 | 550                 | 760                | 0.015                | 163                       |

\* Space object identification calibration.

\*\* European Space Research Organization.

Year of launch 1969 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<br>21<br>R | Soyuz 6*<br>1969-85A                | 1969 Oct 11.47<br>4.94 days<br>1969 Oct 16.41  | Sphere-cylinder +<br>2 wings<br>6577 | 7.5 long<br>2.2 dia | 1969 Oct 11.9                 | 51.68                     | 88.67              | 6590                 | 192                 | 231                | 0.003                | 3                         |
| D            | Soyuz 6<br>rocket<br>1969-85B       | 1969 Oct 11.47<br>1.08 days<br>1969 Oct 12.55  | Cylinder<br>25007                    | 7.5 long<br>2.6 dia | 1969 Oct 11.8                 | 51.67                     | 88.15              | 6564                 | 156                 | 215                | 0.004                | 303                       |
| D<br>21<br>R | Soyuz 7<br>1969-86A                 | 1969 Oct 12.45<br>4.94 days<br>1969 Oct 17.39  | Sphere-cylinder +<br>2 wings<br>6570 | 7.5 long<br>2.2 dia | 1969 Oct 14.5                 | 51.65                     | 88.77              | 6595                 | 210                 | 223                | 0.001                | 338                       |
| D            | Soyuz 7<br>rocket<br>1969-86B       | 1969 Oct 12.45<br>2.09 days<br>1969 Oct 14.54  | Cylinder<br>25007                    | 7.5 long<br>2.6 dia | 1969 Oct 13.2                 | 51.65                     | 88.37              | 6575                 | 191                 | 202                | 0.001                | 348                       |
| D<br>21<br>R | Soyuz 8<br>1969-87A                 | 1969 Oct 13.43<br>4.95 days<br>1969 Oct 18.38  | Sphere-cylinder +<br>2 wings<br>6646 | 7.5 long<br>2.2 dia | 1969 Oct 16.0                 | 51.65                     | 88.72              | 6592                 | 201                 | 227                | 0.002                | 40                        |
| D            | Soyuz 8<br>rocket<br>1969-87B       | 1969 Oct 13.43<br>1.97 days<br>1969 Oct 15.40  | Cylinder<br>25007                    | 7.5 long<br>2.6 dia | 1969 Oct 14.6                 | 51.66                     | 88.13              | 6563                 | 177                 | 192                | 0.001                | 52                        |
| D            | Intercosmos 1<br>1969-88A           | 1969 Oct 14.57<br>79.98 days<br>1970 Jan 2.55  | Ellipsoid +<br>6 panels<br>4007      | 1.8 long<br>1.2 dia | 1969 Oct 15.1                 | 48.38                     | 95.31              | 6818                 | 254                 | 626                | 0.027                | 112                       |
| D            | Intercosmos 1<br>rocket<br>1969-88B | 1969 Oct 14.57<br>65.06 days<br>1969 Dec 16.63 | Cylinder<br>15007                    | 8 long<br>1.65 dia  | 1969 Oct 15.1                 | 48.37                     | 95.24              | 6815                 | 249                 | 624                | 0.027                | 111                       |

\* Soyuz 6, 7 and 8 closed to within a few hundred metres of each other in pairs at various times.

|        | 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<br>R | Cosmos 302           | 1969 Oct 17.49<br>7.78 days<br>1969 Oct 25.27  | Sphere-cylinder<br>55307       | 5 long?<br>2.4 dia  | 1969 Oct 18.8                 | 65.41                     | 89.69              | 6638                 | 198                 | 321                | 0.009                | 48                        |
| D      | Cosmos 302<br>rocket | 1969 Oct 17.49<br>7.11 days<br>1969 Oct 24.60  | Cylinder<br>25007              | 7.5 long<br>2.6 dia | 1969 Oct 18.2                 | 65.40                     | 89.55              | 6631                 | 196                 | 310                | 0.009                | 44                        |
| D      | Cosmos 303           | 1969 Oct 18.42<br>97.41 days<br>1970 Jan 23.83 | Ellipsoid<br>4007              | 1.8 long<br>1.2 dia | 1969 Oct 20.6                 | 70.99                     | 91.91              | 6746                 | 270                 | 466                | 0.015                | 80                        |
| D      | Cosmos 303<br>rocket | 1969 Oct 18.42<br>50.02 days<br>1969 Dec 7.44  | Cylinder<br>15007              | 8 long<br>1.65 dia  | 1969 Oct 20.1                 | 71.00                     | 91.80              | 6741                 | 269                 | 456                | 0.014                | 82                        |
|        | Cosmos 304           | 1969 Oct 21.54<br>100 years                    | Cylinder +<br>paddles?<br>7507 | 2 long?<br>1 dia?   | 1969 Oct 24.8                 | 74.04                     | 99.87              | 7130                 | 742                 | 761                | 0.001                | 320                       |
|        | Cosmos 304<br>rocket | 1969 Oct 21.54<br>80 years                     | Cylinder<br>22007              | 7.4 long<br>2.4 dia | 1969 Oct 24.5                 | 74.05                     | 99.74              | 7124                 | 734                 | 757                | 0.002                | 344                       |
| D      | Cosmos 305*          | 1969 Oct 22.59<br>2.08 days<br>1969 Oct 24.67  | Cylinder<br>194007<br>full     | 7 long<br>3.9 dia   | 1969 Oct 23.3                 | 51.52                     | 88.23              | 6569                 | 175                 | 206                | 0.002                | 299                       |
| D      | Cosmos 305<br>rocket | 1969 Oct 22.59<br>2.2 days<br>1969 Oct 24.8    | Cylinder<br>40007              | 12 long?<br>4 dia   | 1969 Oct 23.6                 | 51.51                     | 88.17              | 6565                 | 171                 | 203                | 0.002                | 285                       |

\* Possibly an attempted lunar probe. (Payload 5600 kg?)

|        | Name                              | Launch date,<br>lifetime and<br>descent date      | Shape and<br>weight (kg)     | Size<br>(m)         | Date of<br>orbital<br>determination             | Orbital<br>inclina-<br>tion<br>(deg) | Nodal<br>period<br>(min)  | Semi<br>major<br>axis<br>(km) | Perigee<br>height<br>(km) | Apogee<br>height<br>(km) | Orbital<br>eccen-<br>tricity | Argument<br>of<br>perigee<br>(deg) |
|--------|-----------------------------------|---|------------------------------|---------------------|---|--------------------------------------|---------------------------|-------------------------------|---------------------------|--------------------------|------------------------------|------------------------------------|
| D<br>R | Cosmos 306<br>1969-92A            | 1969 Oct 24, 41<br>11.87 days<br>1969 Nov 5, 28   | Sphere-<br>cylinder<br>5700? | 5.0 long<br>2.4 dia | 1969 Oct 25.1                                   | 64.97                                | 89.64                     | 6635                          | 215                       | 299                      | 0.006                        | 54                                 |
| D      | Cosmos 306<br>rocket<br>1969-92B  | 1969 Oct 24, 41<br>5.49 days                      | Cylinder<br>2500?            | 7.5 long<br>2.6 dia | 1969 Oct 25.1                                   | 64.96                                | 89.45                     | 6626                          | 203                       | 293                      | 0.007                        | 45                                 |
| D      | Cosmos 307<br>1969-94A            | 1969 Oct 24, 55<br>431.86 days<br>1970 Dec 30, 41 | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia | 1969 Oct 26.7<br>1970 Mar 31.9<br>1970 Aug 31.7 | 48.39<br>48.35<br>48.3               | 109.04<br>104.66<br>98.81 | 7564<br>7359<br>7083          | 214<br>210<br>201         | 2157<br>1752<br>1208     | 0.128<br>0.105<br>0.071      | 107<br>-<br>-                      |
| D      | Cosmos 307<br>rocket<br>1969-94B  | 1969 Oct 24, 55<br>268.49 days<br>1970 Jul 20, 04 | Cylinder<br>1500?            | 8 long<br>1.65 dia  | 1969 Oct 26.6<br>1970 Jan 31.7<br>1970 May 1.0  | 48.41<br>48.3<br>48.3                | 108.78<br>104.18<br>98.82 | 7552<br>7337<br>7083          | 210<br>205<br>199         | 2138<br>1712<br>1211     | 0.128<br>0.103<br>0.071      | 107<br>-<br>-                      |
| D      | [Titan 3B<br>Agena D]<br>1969-95A | 1969 Oct 24, 76<br>15 days<br>1969 Nov 8          | Cylinder<br>3000?            | 8 long?<br>1.5 dia  | 1969 Oct 25.5                                   | 108.04                               | 93.39                     | 6816                          | 136                       | 740                      | 0.044                        | 144                                |
| D      | Cosmos 308<br>1969-96A            | 1969 Nov 4, 50<br>60.99 days<br>1970 Jan 4, 49    | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia | 1969 Nov 5, 2                                   | 71.02                                | 91.34                     | 6718                          | 271                       | 408                      | 0.010                        | 68                                 |
| D      | Cosmos 308<br>rocket<br>1969-96B  | 1969 Nov 4, 50<br>32.35 days<br>1969 Dec 6, 85    | Cylinder<br>1500?            | 8 long<br>1.65 dia  | 1969 Nov 5, 5                                   | 71.02                                | 91.20                     | 6711                          | 271                       | 395                      | 0.009                        | 66                                 |

| 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) |
|--------------------------|--|---|-------------------------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Azur (ORIS A) ††         | 1969 Nov 8.08<br>100 years                             | Cone-cylinder<br>7                                | 1.13 long<br>0.76 dia               | 1969 Nov 10.5                  | 102.96                    | 122.00             | 8147                 | 387                 | 3150               | 0.170                | 158                       |
| Azur rocket              | 1969 Nov 8.08<br>40 years                              | Cylinder<br>24                                    | 1.50 long<br>0.46 dia               | 1969 Nov 8.6                   | 102.97                    | 122.02             | 8148                 | 390                 | 3149               | 0.169                | 161                       |
| Fragments                | 1969-97C-F   |   |                                     |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 309               | 1969 Nov 12.48<br>7.75 days<br>1969 Nov 20.23<br>5900? | Sphere-cylinder<br>5900?                          | 5.9 long<br>2.4 dia                 | 1969 Nov 14.2                  | 65.40                     | 89.99              | 6653                 | 185                 | 364                | 0.014                | 89                        |
| Cosmos 309 rocket        | 1969 Nov 12.48<br>10.31 days<br>1969 Nov 22.79         | Cylinder<br>2500?                                 | 7.5 long<br>2.6 dia                 | 1969 Nov 13.1                  | 65.41                     | 89.95              | 6651                 | 192                 | 353                | 0.012                | 97                        |
| Fragments                | 1969-98E-E†  |   |                                     |                                |                           |                    |                      |                     |                    |                      |                           |
| Apollo 12**              | 1969 Nov 14.68<br>10.19 days<br>1969 Nov 24.87         | Cone-cylinder<br>28790, then<br>11250             | 11.15 long<br>3.91 dia              | 1969 Nov 14.7<br>1969 Nov 14.9 | 32.56<br>33.2             | 88.15<br>18150     | 6569<br>226087       | 183<br>207          | 199<br>439 210     | 0.001<br>0.971       | →<br>30*                  |
| Saturn IV B [Saturn 507] | 1969 Nov 14.68<br>Indefinite                           | Cylinder<br>13300                                 | 18.7 long<br>6.6 dia                | 1969 Nov 14.7<br>1969 Nov 14.9 | 32.56<br>31.6             | 88.15<br>60480     | 6569<br>518 800      | 183<br>163 100      | 199<br>861 800     | 0.001<br>0.673       | →<br>30*                  |
| LEM 6***<br>Ascent stage | 1969 Nov 14.68<br>6.25 days<br>1969 Nov 20.93          | Box + tanks<br>4774 full<br>2159 empty            | 2.52 high<br>3.76 wide<br>3.13 deep | 1969 Nov 14.9                  | 33.2                      | 18150              | 226 087              | 207                 | 439 210            | 0.971                | 30*                       |
| LEM 6<br>Descent stage   | 1969 Nov 14.68<br>4.61 days<br>1969 Nov 19.29          | Octagon + cone + legs<br>10342 full<br>2211 empty | 1.57 high<br>3.13 wide              | 1969 Nov 14.9                  | 33.2                      | 18150              | 226 087              | 207                 | 439 210            | 0.971                | 30*                       |

\*\* Apollo attached to LEM, separated from Saturn IV B on Nov 14.87.

\*\*\* LEM with 2 crew members, separated from Apollo on Nov 19.18.

Ascent stage relaunched from Moon Nov 20.60; briefly docked with Apollo Nov 20.75.

† 1969-98E was a capsule, 0.9 m long, 1.9 m dia. Lifetime 18.09 days.

\* Approximate orbits  
†† German Research Satellite

In selenocentric orbit 1969 Nov 18.16 to Nov 21.87

On Moon's surface 1969 Nov 19.29 to Nov 20.60  
Finally crashed on Moon 1969 Nov 20.93

Landed on Moon 1969 Nov 19.29

| 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<br>R<br>Cosmos 310      | 1969 Nov 15.36<br>7.92 days<br>1969 Nov 23.28   | Sphere-cylinder<br>55307          | 5 long?<br>2.4 dia    | 1969 Nov 16.2  | 65.00                       | 89.91                                | 6648                             | 204                              | 336                              | 0.010                               | 59                        |
| D<br>Cosmos 310<br>rocket | 1969 Nov 15.36<br>7.91 days<br>1969 Nov 23.27   | Cylinder<br>25007                 | 7.5 long<br>2.6 dia   | 1969 Nov 16.1  | 65.02                       | 89.74                                | 6640                             | 204                              | 319                              | 0.009                               | 52                        |
| Skyenet 1A                | 1969 Nov 22.03<br>> million<br>years            | Cylinder<br>243 full<br>126 empty | 0.81 long<br>1.37 dia | 1969 Dec 9.8<br>1970 Feb 16.0<br>1970 Jul 7.0<br>1970 Nov 25.6 | 2.40<br>2.2<br>1.88<br>1.56 | 1407.8<br>1436.0<br>1436.4<br>1436.4 | 41598<br>42162<br>42173<br>42172 | 34702<br>35779<br>35790<br>35794 | 35838<br>35788<br>35800<br>35794 | 0.012<br>0.0001<br>0.0001<br>0.0000 | 165<br>-<br>289<br>142    |
| Skyenet 1A<br>rocket      | 1969 Nov 22.03<br>10 years?                     | Sphere-cone<br>66                 | 1.32 long<br>0.94 dia | 1969 Nov 22.1<br>1970 Oct 1.0                                  | 27.73<br>27.19              | 656.9<br>632.6                       | 25043<br>24411                   | 245<br>215                       | 37084<br>35850                   | 0.735<br>0.750                      | 181<br>-                  |
| D<br>Cosmos 311           | 1969 Nov 24.46<br>105.80 days<br>1970 Mar 10.26 | Ellipsoid<br>4007                 | 1.8 long<br>1.2 dia   | 1969 Nov 25.9  | 71.04                       | 91.99                                | 6749                             | 273                              | 469                              | 0.014                               | 79                        |
| D<br>Cosmos 311<br>rocket | 1969 Nov 24.46<br>56.33 days<br>1970 Jan 19.79  | Cylinder<br>15007                 | 8 long<br>1.65 dia    | 1969 Nov 25.2  | 71.03                       | 91.88                                | 6744                             | 274                              | 458                              | 0.014                               | 82                        |
| Cosmos 312                | 1969 Nov 24.70<br>2500 years                    | Spheroid +<br>paddles?<br>6507    | 1.6 dia?              | 1969 Dec 1.5   | 74.03                       | 108.60                               | 7540                             | 1144                             | 1179                             | 0.002                               | 339                       |
| D<br>Cosmos 312<br>rocket | 1969 Nov 24.70<br>1500 years                    | Cylinder<br>22007                 | 7.4 long<br>2.4 dia   | 1969 Nov 28.9  | 74.01                       | 108.44                               | 7532                             | 1140                             | 1168                             | 0.002                               | 6                         |



Year of launch 1969 concluded

|        | 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<br>P | Cosmos 316 †<br>1969-108A            | 1969 Dec 23.39<br>248.46 days<br>1970 Aug 28.85 | Cylinder?<br>5000?           | 4 long?<br>1.5 dia   | 1969 Dec 24.5<br>1970 June 20.0<br>1970 Aug 28.0 | 49.50<br>49.48<br>49.45   | 102.82<br>95.20<br>87.90 | 7273<br>6910<br>6552 | 152<br>138<br>119   | 1638<br>926<br>226 | 0.102<br>0.057<br>0.008 | 83<br>43<br>354           |
| D      | Cosmos 316<br>rocket<br>1969-108C    | 1969 Dec 23.39<br>35.84 days<br>1970 Jan 28.23  | Cylinder<br>1500?            | 8 long?<br>2.5 dia?  | 1969 Dec 26.0                                    | 49.49                     | 102.15                   | 7242                 | 147                 | 1581               | 0.099                   | 88                        |
| D      | Fragment<br>1969-103B                |   |                              |                      |  |                           |                          |                      |                     |                    |                         |                           |
| D<br>R | Cosmos 317<br>1969-109A              | 1969 Dec 23.58<br>12.72 days<br>1970 Jan 5.30   | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1969 Dec 24.4<br>1969 Dec 24.9                   | 65.41<br>65.50            | 89.34<br>89.65           | 6621<br>6636         | 205<br>211          | 280<br>304         | 0.006<br>0.007          | 55<br>52                  |
| D      | Cosmos 317<br>rocket<br>1969-109B    | 1969 Dec 23.58<br>5 days<br>1969 Dec 28         | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1969 Dec 24.3                                    | 65.42                     | 89.15                    | 6611                 | 201                 | 265                | 0.005                   | 45                        |
| D      | Cosmos 317<br>engine*<br>1969-109C   | 1969 Dec 23.58<br>16 days<br>1970 Jan 8         | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1970 Jan 3.7                                     | 65.40                     | 89.08                    | 6608                 | 190                 | 269                | 0.006                   | 46                        |
| D      | Fragment<br>1969-109D                |   |                              |                      |  |                           |                          |                      |                     |                    |                         |                           |
| D      | Intercosmos 2<br>1969-110A           | 1969 Dec 25.42<br>164.52 days<br>1970 Jun 7.54  | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia  | 1969 Dec 27.0<br>1970 Mar 31.9                   | 48.40<br>48.38            | 98.48<br>95.08           | 7067<br>6904         | 200<br>193          | 1178<br>858        | 0.069<br>0.048          | 108<br>-                  |
| D      | Intercosmos 2<br>rocket<br>1969-110B | 1969 Dec 25.42<br>86.33 days<br>1970 Mar 21.75  | Cylinder<br>1500?            | 8 long<br>1.65 dia   | 1969 Dec 27.9                                    | 48.40                     | 98.14                    | 7051                 | 207                 | 1139               | 0.066                   | 112                       |

† Pieces recovered in Oklahoma, Kansas and Texas.

\* 1969-109C ejected from 1969-109A about 1970 Jan 3.4. (Cosmos 317 carried supplementary charged-particles experiment.)

| 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<br>R<br>Cosmos 318       | 1970-01A<br>1970 Jan 9.39<br>11.90 days<br>1970 Jan 21.29  | Sphere-cylinder<br>5700?          | 5.0 long<br>2.4 dia   | 1970 Jan 10.8                                   | 64.97                     | 39.29                       | 6618                    | 203                   | 277                     | 0.006                    | 31                        |
| D<br>Cosmos 318<br>rocket  | 1970-01B<br>1970 Jan 9.39<br>6.21 days<br>1970 Jan 15.60   | Cylinder<br>2500?                 | 7.5 long<br>2.6 dia   | 1970 Jan 10.7                                   | 64.37                     | 89.11                       | 6610                    | 200                   | 263                     | 0.005                    | 29                        |
| D<br>[Titan 3B<br>Agena D] | 1970-03A<br>1970 Jan 14.78<br>18 days<br>1970 Feb 1        | Cylinder<br>3000?                 | 8 long?<br>1.5 dia    | 1970 Jan 15.3                                   | 109.56                    | 89.59                       | 6637                    | 134                   | 363                     | 0.019                    | 133                       |
| Intelsat 3F (F-6)          | 1970-03A<br>1970 Jan 15.01<br>> million years              | Cylinder<br>293 full<br>137 empty | 1.04 long<br>1.42 dia | 1970 Jan 15.7<br>1970 Feb 16.0<br>1977 May 13.0 | 28.04<br>0.9<br>5.16      | 629.71<br>1436.1<br>1465.69 | 24386<br>42165<br>42742 | 267<br>35773<br>36185 | 35748<br>35801<br>36542 | 0.727<br>0.0003<br>0.004 | 181<br>-<br>10*           |
| Intelsat 3F<br>rocket      | 1970-03B<br>1970 Jan 15.01<br>20 years                     | Sphere-cone<br>66                 | 1.32 long<br>0.94 dia | 1970 Jan 15.7                                   | 28.04                     | 629.70                      | 24385                   | 267                   | 35747                   | 0.727                    | 181                       |
| D<br>Cosmos 319            | 1970-04A<br>1970 Jan 15.57<br>167.13 days<br>1970 Jul 1.70 | Ellipsoid<br>400?                 | 1.8 long<br>1.2 dia   | 1970 Jan 16.2<br>1970 Apr 1.0                   | 81.96<br>81.96            | 102.03<br>98.97             | 7232<br>7088            | 200<br>195            | 1508<br>1224            | 0.090<br>0.073           | 74<br>-                   |
| D<br>Cosmos 319<br>rocket  | 1970-04B<br>1970 Jan 15.57<br>106.42 days<br>1970 May 1.99 | Cylinder<br>1500?                 | 8 long<br>1.65 dia    | 1970 Jan 16.2                                   | 81.96                     | 101.85                      | 7224                    | 199                   | 1493                    | 0.090                    | 74                        |

\* Transmissions terminated after orbit change

Year of launch 1970 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 320           | 1970-05A<br>1970 Jan 16.46<br>24.67 days<br>1970 Feb 10.13 | Ellipsoid + annular tail? 400? | 6.5 long?<br>1.2 dia? | 1970 Jan 17.6                 | 48.40                     | 90.18              | 6665                 | 247                 | 326                | 0.006                | 139                       |
| D | Cosmos 320<br>rocket | 1970-05B<br>1970 Jan 16.46<br>11.56 days<br>1970 Jan 28.02 | Cylinder 1500?                 | 8 long<br>1.65 dia    | 1970 Jan 18.5                 | 48.41                     | 90.19              | 6665                 | 255                 | 319                | 0.005                | 175                       |
| D | Fragments            | 1970-05C-G   |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 321*          | 1970-06A<br>1970 Jan 20.85<br>61.39 days<br>1970 Mar 23.24 | Ellipsoid 400?                 | 1.8 long<br>1.2 dia   | 1970 Jan 23.9                 | 70.95                     | 92.07              | 6754                 | 272                 | 479                | 0.015                | 73                        |
| D | Cosmos 321<br>rocket | 1970-06B<br>1970 Jan 20.85<br>45.56 days<br>1970 Mar 7.41  | Cylinder 1500?                 | 8 long<br>1.65 dia    | 1970 Jan 24.1                 | 70.95                     | 91.84              | 6742                 | 270                 | 458                | 0.014                | 72                        |
| D | Fragments            | 1970-06C-D   |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 322           | 1970-07A<br>1970 Jan 21.50<br>7.78 days<br>1970 Jan 29.28  | Sphere-cylinder 5530?          | 5 long?<br>2.4 dia    | 1970 Jan 22.2                 | 65.41                     | 89.65              | 6635                 | 195                 | 319                | 0.009                | 41                        |
| R |                      |  |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 322<br>rocket | 1970-07B<br>1970 Jan 21.50<br>4.33 days<br>1970 Jan 25.83  | Cylinder 5500?                 | 7.5 long<br>2.6 dia   | 1970 Jan 22.2                 | 65.40                     | 89.46              | 6626                 | 190                 | 306                | 0.005                | 38                        |

\* Ionospheric and geoelectric studies

| Name                    | Launch date, lifetime and descent date        | Shape and weight (kg)          | Size (m)                          | Date of orbital determination                  | Orbital inclination (deg) | Modal period (min)         | Semi major axis (km) | Perigee height (km) | Apogee height (km)   | Orbital eccentricity       | Argument of perigee (deg) |
|-------------------------|---|--------------------------------|-----------------------------------|--|---------------------------|----------------------------|----------------------|---------------------|----------------------|----------------------------|---------------------------|
| ITOS 1*                 | 1970 Jan 23.48<br>10000 years                 | Box + 3 panels<br>309          | 1.02 square<br>1.22 long          | 1970 Feb 14.3                                  | 102.00                    | 115.10                     | 7837                 | 1436                | 1482                 | 0.003                      | 219                       |
| Oscar 5 †               | 1970 Jan 23.48<br>10000 years                 | Rectangular<br>box<br>18       | 0.43 x 0.30<br>x 0.15             | 1970 Jan 25.4                                  | 101.96                    | 115.08                     | 7836                 | 1435                | 1481                 | 0.003                      | 263                       |
| ITOS 1<br>second stage  | 1970 Jan 23.48<br>5000 years                  | Cylinder<br>3507               | 4.9 long<br>1.43 dia              | 1970 Jan 25.4                                  | 101.95                    | 115.11                     | 7838                 | 1441                | 1478                 | 0.002                      | 262                       |
| BERT 2**<br>(Agena D)   | 1970 Feb 4.12<br>800 years                    | Cylinder +<br>2 wings<br>1500  | 7.6 long<br>1.52 dia<br>12.2 span | 1970 Feb 11.8<br>1970 JUL 23.0<br>1970 Nov 1.0 | 99.13<br>99.13<br>99.13   | 105.15<br>106.94<br>106.23 | 7378<br>7458<br>7427 | 997<br>1079<br>1045 | 1003<br>1081<br>1092 | 0.0004<br>0.0001<br>0.0005 | 328<br>-<br>-             |
| Cosmos 323              | 1970 Feb 10.50<br>7.78 days<br>1970 Feb 18.28 | Sphere-<br>cylinder<br>55307   | 5 long?<br>2.4 dia                | 1970 Feb 11.2                                  | 65.43                     | 89.65                      | 6636                 | 201                 | 314                  | 0.009                      | 49                        |
| Cosmos 323<br>rocket    | 1970 Feb 10.50<br>5.08 days<br>1970 Feb 15.58 | Cylinder<br>25007              | 7.5 long<br>2.6 dia               | 1970 Feb 12.2                                  | 65.41                     | 89.27                      | 6617                 | 189                 | 288                  | 0.008                      | 35                        |
| Ohsumi<br>[ Lambda 4g ] | 1970 Feb 11.18<br>80 years                    | Cylinder<br>38<br>(payload 12) | 1.00 long<br>0.48 dia             | 1970 Feb 14.7                                  | 31.07                     | 144.20                     | 9117                 | 339                 | 5138                 | 0.263                      | 131                       |

\* Improved TIROS Operational Satellite.

\*\* Space Electric Rocket Test.

Oscar 5 is Australian; Ohsumi is Japanese.

† Orbiting satellite carrying amateur radio

D R D

| Name                       | Launch date, lifetime and descent date                     | Shape and weight (kg)          | Size (m)                         | Date of orbital determination                   | Orbital inclination (deg) | Modal period (min)         | Semi major axis (km)    | Perigee height (km) | Apogee height (km)      | Orbital eccentricity    | Argument of perigee (deg) |
|----------------------------|--|--------------------------------|----------------------------------|---|---------------------------|----------------------------|-------------------------|---------------------|-------------------------|-------------------------|---------------------------|
| [Thor Burner 2]            | 1970-12A<br>1970 Feb 11.36<br>80 years                     | 12-faced frustum<br>195        | 1.64 long<br>1.31 to<br>1.10 dia | 1970 Feb 16.7                                   | 98.71                     | 101.39                     | 7201                    | 775                 | 874                     | 0.007                   | 12                        |
| Burner 2 rocket            | 1970-12B<br>1970 Feb 11.36<br>60 years                     | Sphere-cone<br>66              | 1.32 long<br>0.94 dia            | 1970 Feb 18.4                                   | 98.74                     | 101.38                     | 7201                    | 772                 | 874                     | 0.007                   | 7                         |
| Molniya 1N                 | 1970-13A<br>1970 Feb 19.79<br>2048 days<br>1975 Sep 29     | Windmill +<br>6 vanes<br>1000? | 3.4 long<br>1.6 dia              | 1970 Feb 26.2<br>1970 May 16.5<br>1975 Oct 16.5 | 65.44<br>65.57<br>65.1    | 703.13<br>717.73<br>717.95 | 26194<br>26556<br>26564 | 461<br>470<br>940   | 39170<br>39885<br>39426 | 0.799<br>0.742<br>0.724 | 285<br>-<br>-             |
| Molniya 1N launcher        | 1970-13B<br>1970 Feb 19.79<br>17.42 days<br>1970 Mar 9.21  | Irregular                      | -                                | 1970 Feb 20.6                                   | 65.42                     | 91.43                      | 6723                    | 205                 | 485                     | 0.021                   | 72                        |
| Molniya 1N launcher rocket | 1970-13C<br>1970 Feb 19.79<br>20.07 days<br>1970 Mar 11.86 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia              | 1970 Feb 20.6                                   | 65.43                     | 91.21                      | 6713                    | 220                 | 449                     | 0.017                   | 70                        |
| Molniya 1N rocket          | 1970-13D<br>1970 Feb 19.79<br>2150 days<br>1976 Jan 9      | Cylinder<br>440                | 2.0 long<br>2.0 dia              | 1970 Mar 2.0<br>1975 Oct 1.0                    | 65.46<br>65.25            | 699.06<br>698.70           | 26093<br>26084          | 465<br>925          | 38964<br>38486          | 0.738<br>0.720          | 285<br>-                  |
| Cosmos 324                 | 1970-14A<br>1970 Feb 27.73<br>84.53 days<br>1970 May 23.26 | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia              | 1970 Feb 28.4                                   | 71.03                     | 91.97                      | 6749                    | 275                 | 466                     | 0.014                   | 75                        |
| Cosmos 324 rocket          | 1970-14B<br>1970 Feb 27.73<br>42.75 days<br>1970 Apr 11.48 | Cylinder<br>1500?              | 8 long<br>1.65 dia               | 1970 Mar 1.1                                    | 71.04                     | 91.74                      | 6757                    | 277                 | 441                     | 0.012                   | 75                        |

|        | 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<br>R | Comos 325<br>1970-15A              | 1970 Mar 4, 51<br>7.73 days<br>1970 Mar 12, 30   | Sphere-cylinder<br>55307                   | 5 long<br>2.4 dia     | 1970 Mar 6.2                                  | 65.39                     | 89.77                     | 6642                 | 200                 | 327                  | 0.010                   | 49                        |
| D      | Comos 325<br>rocket<br>1970-15B    | 1970 Mar 4, 51<br>5.60 days<br>1970 Mar 10, 11   | Cylinder<br>25007                          | 7.5 long<br>2.6 dia   | 1970 Mar 6.2                                  | 65.40                     | 89.50                     | 6628                 | 194                 | 306                  | 0.008                   | 39                        |
| D      | [Thorad<br>Agena D.]<br>1970-16A   | 1970 Mar 4, 93<br>21.98 days<br>1970 Mar 26, 91  | Cylinder<br>20007                          | 8 long<br>1.5 dia     | 1970 Mar 5.6                                  | 88.02                     | 88.76                     | 6990                 | 167                 | 257                  | 0.007                   | 121                       |
| D      | Capsule<br>1970-16B                | 1970 Mar 4, 93<br>815.19 days<br>1971 Nov 10, 12 | Octagon<br>607                             | 0.3 long<br>0.9 dia   | 1970 Mar 7.2<br>1970 Aug 31.7<br>1971 Apr 1.0 | 88.14<br>88.14<br>88.14   | 94.16<br>93.58<br>92.49   | 6856<br>6828<br>6775 | 442<br>420<br>376   | 514<br>479<br>414    | 0.005<br>0.004<br>0.003 | 10<br>-<br>-              |
| D      | DIAL/MIK <sup>oo</sup><br>1970-17A | 1970 Mar 10, 51<br>3131 days<br>1978 Oct 5       | Octagonal<br>door-hatch<br>63              | 1.01 long<br>0.63 dia | 1970 Mar 12.4<br>1971 Aug 1.0                 | 5.44<br>5.44              | 104.20<br>102.14          | 7944<br>7247         | 301<br>304          | 1631<br>1434         | 0.091<br>0.078          | 112<br>-                  |
| D      | DIAL rocket/<br>MIKA<br>1970-17B   | 1970 Mar 10, 51<br>1644 days<br>1974 Sep 9       | Cylinder +<br>inertial 120<br>(payload 52) | 2.60 long<br>0.80 dia | 1970 Mar 11.7<br>1971 Feb 1.0<br>1972 Oct 1.0 | 5.42<br>5.42<br>5.42      | 104.67<br>102.49<br>99.20 | 7967<br>7264<br>7108 | 313<br>303<br>293   | 1665<br>1468<br>1166 | 0.092<br>0.080<br>0.061 | 105<br>-<br>-             |
| D<br>R | Comos 326<br>1970-18A              | 1970 Mar 13, 34<br>7.88 days<br>1970 Mar 21, 22  | Sphere-cylinder<br>55307                   | 5 long<br>2.4 dia     | 1970 Mar 13.8                                 | 81.35                     | 90.20                     | 6661                 | 203                 | 363                  | 0.012                   | 85                        |
| D      | Comos 326<br>rocket<br>1970-18B    | 1970 Mar 13, 34<br>9.98 days<br>1970 Mar 23, 32  | Cylinder<br>25007                          | 7.5 long<br>2.6 dia   | 1970 Mar 14.3                                 | 81.36                     | 90.00                     | 6651                 | 202                 | 346                  | 0.011                   | 83                        |

\* 1970-16B ejected from 1970-16A on 1970 Mar 5.00.  
oo D'Amont B - Allmand (French-German satellite).

| 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) |
|--|---|-----------------------------------|-----------------------|---|---------------------------|---------------------------|--------------------------|-----------------------|-------------------------|-------------------------|---------------------------|
| Meteor 3<br>1970-19A                             | 1970 Mar 17.47<br>50 years                      | Cylinder +<br>2 vanes<br>2200?    | 5 long?<br>1.5 dia?   | 1970 Mar 18.2                                 | 81.18                     | 96.42                     | 6984                     | 537                   | 635                     | 0.007                   | 236                       |
| Meteor 3<br>rocket<br>1970-19B                   | 1970 Mar 17.47<br>50 years                      | Cylinder<br>1440                  | 3.8 long<br>2.6 dia   | 1970 Mar 18.8                                 | 81.17                     | 96.55                     | 6971                     | 467                   | 718                     | 0.018                   | 205                       |
| Fragment<br>Cosmos 327<br>1970-19C<br>1970-20A   | 1970 Mar 18.61<br>306.41 days<br>1971 Jan 19.02 | Ellipsoid<br>400?                 | 1.8 long<br>1.2 dia   | 1970 Mar 19.6<br>1970 Aug 31.7                | 70.95<br>70.95            | 95.65<br>93.64            | 6928<br>6832             | 280<br>255            | 819<br>652              | 0.099<br>0.029          | 87<br>-                   |
| Cosmos 327<br>rocket<br>1970-20B                 | 1970 Mar 18.61<br>192.44 days<br>1970 Sep 27.05 | Cylinder<br>1500?                 | 8 long<br>1.65 dia    | 1970 Mar 19.6<br>1970 Jul 1.3                 | 70.94<br>70.94            | 95.57<br>93.39            | 6924<br>6819             | 272<br>254            | 819<br>628              | 0.099<br>0.027          | 85<br>-                   |
| NATO 1*<br>1970-21A                              | 1970 Mar 20.99<br>> million<br>years            | Cylinder<br>243 full<br>117 empty | 0.81 long<br>1.37 dia | 1970 Mar 21.0<br>1970 May 1.0<br>1975 May 1.0 | 25.81<br>2.8<br>1.7       | 656.9<br>1403.4<br>1436.3 | 2504.3<br>41523<br>42168 | 281<br>34429<br>35745 | 37048<br>35860<br>35834 | 0.734<br>0.017<br>0.001 | 179<br>-<br>-             |
| NATO 1<br>rocket<br>1970-21B                     | 1970 Mar 20.99<br>20 years                      | Sphere-cone<br>66                 | 1.32 long<br>0.94 dia | 1970 Mar 21.3                                 | 25.67                     | 655.4                     | 24995                    | 295                   | 36934                   | 0.733                   | 179                       |
| Fragment<br>Cosmos 328**<br>1970-21C<br>1970-22A | 1970 Mar 27.49<br>12.77 days<br>1970 Apr 9.26   | Sphere-<br>cylinder<br>6300?      | 6.5 long?<br>2.4 dia  | 1970 Mar 28.6<br>1970 Mar 29.8                | 72.86<br>72.86            | 89.54<br>89.75            | 6629<br>6639             | 203<br>206            | 299<br>316              | 0.007<br>0.008          | 56<br>59                  |
| Cosmos 328<br>rocket<br>1970-22B                 | 1970 Mar 27.49<br>4.69 days<br>1970 Apr 1.18    | Cylinder<br>2500?                 | 7.5 long<br>2.6 dia   | 1970 Mar 28.4                                 | 72.87                     | 89.39                     | 6622                     | 204                   | 284                     | 0.006                   | 53                        |

\* North Atlantic Treaty Organisation

\*\* Cosmos 328 manoeuvred, but the jettisoned engine was apparently not tracked or designated

| 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<br>R<br>Cosmos 329           | 1970-23A<br>1970 Apr 3.36<br>11.87 days<br>1970 Apr 15.23               | Sphere-cylinder<br>5700?            | 5.0 long<br>2.4 dia   | 1970 Apr 4.1                  | 81.33                     | 88.79              | 6591                 | 198                 | 228                | 0.002                | 319                       |
| D<br>Cosmos 329<br>rocket      | 1970-23B<br>1970 Apr 3.36<br>2.44 days<br>1970 Apr 5.80                 | Cylinder<br>2500?                   | 7.5 long<br>2.6 dia   | 1970 Apr 4.3                  | 81.32                     | 88.52              | 6578                 | 185                 | 214                | 0.002                | 316                       |
| Cosmos 330                     | 1970-24A<br>1970 Apr 7.47<br>9 1/2 years                                | Cylinder + paddles?<br>900?         | 2 long?<br>1 dia?     | 1970 Apr 8.6<br>1972 Sep 16.0 | 74.06<br>74.06            | 95.22<br>94.63     | 6907<br>6878         | 514<br>492          | 543<br>508         | 0.002<br>0.001       | 334<br>-                  |
| Cosmos 330<br>rocket           | 1970-24B<br>1970 Apr 7.47<br>9 1/2 years                                | Cylinder<br>2200?                   | 7.4 long<br>2.4 dia   | 1970 Apr 10.2<br>1973 Feb 1.0 | 74.06<br>74.06            | 95.12<br>94.56     | 6902<br>6875         | 507<br>480          | 541<br>513         | 0.002<br>0.002       | 336<br>-                  |
| Nimbus 4                       | 1970-25A<br>1970 Apr 8.35<br>1200 years                                 | Conical skeleton + 2 paddles<br>620 | 3.00 long<br>1.45 dia | 1970 Apr 10.2                 | 99.89                     | 107.29             | 7476                 | 1095                | 1100               | 0.0003               | 8                         |
| TOPO 1                         | 1970-25B<br>1970 Apr 8.35<br>2000 years                                 | Rectangular box<br>18               | 0.36 x 0.30<br>x 0.23 | 1970 Apr 9.5                  | 99.76                     | 107.09             | 7466                 | 1064                | 1111               | 0.003                | 193                       |
| Nimbus 4<br>rocket             | 1970-25C<br>1970 Apr 8.35<br>1000 years                                 | Cylinder*<br>700?                   | 6 long?<br>1.5 dia    | 1970 Apr 10.2                 | 99.89                     | 106.86             | 7454                 | 1066                | 1086               | 0.001                | 331                       |
| Fragments<br>Cosmos 331        | 1970-25D-HQ<br>1970-26A<br>1970 Apr 8.43<br>7.92 days<br>1970 Apr 16.35 | Sphere-cylinder<br>5530?            | 5 long?<br>2.4 dia    | 1970 Apr 10.2                 | 65.02                     | 89.77              | 6641                 | 206                 | 320                | 0.009                | 45                        |
| D<br>R<br>Cosmos 331<br>rocket | 1970-26B<br>1970 Apr 8.43<br>7.80 days<br>1970 Apr 16.23                | Cylinder<br>2500?                   | 7.5 long<br>2.6 dia   | 1970 Apr 10.1                 | 65.01                     | 89.60              | 6633                 | 205                 | 305                | 0.007                | 43                        |

\* Before explosion about 1970 Nov 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) |
|------------------------------|---|--|------------------------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Vela 11                      | 1970 Apr 8.46<br>> million years              | Icosahedron<br>259                                 | 1.27 dia                           | 1970 Apr 9.4                   | 32.41                     | 6729               | 118060               | 111210              | 112160             | 0.005                | 280                       |
| Vela 12                      | 1970 Apr 8.46<br>> million years              | Icosahedron<br>259                                 | 1.27 dia                           | 1970 Apr 11.6                  | 32.52                     | 6745               | 118230               | 111500              | 112210             | 0.003                | 47                        |
| Vela 11 rocket<br>[Titan 3C] | 1970 Apr 8.46<br>> million years              | Cylinder<br>15007                                  | 6 long?<br>3.0 dia                 | 1970 Apr 10.4                  | 32.36                     | 3005               | 68980                | 15040               | 110170             | 0.690                | 178*                      |
| Cosmos 332                   | 1970 Apr 11.7<br>100 years                    | Cylinder +<br>paddles<br>7507                      | 2 long?<br>1 dia?                  | 1970 Apr 12.4                  | 74.05                     | 100.01             | 7136                 | 755                 | 761                | 0.0004               | 110                       |
| Cosmos 332<br>rocket         | 1970 Apr 11.7<br>80 years                     | Cylinder<br>22007                                  | 7.4 long<br>2.4 dia                | 1970 Apr 12.4                  | 74.05                     | 99.90              | 7131                 | 744                 | 762                | 0.001                | 34                        |
| Apollo 13**                  | 1970 Apr 11.80<br>5.95 days<br>1970 Apr 17.75 | Cone-<br>cylinder<br>28890                         | 11.15 long<br>3.91 dia             | 1970 Apr 11.8<br>1970 Apr 12.0 | 32.56<br>33.2             | 88.07<br>26320     | 6564<br>292320       | 186<br>200          | 186<br>572080      | 0<br>0.977           | --<br>30*                 |
| Saturn IVB<br>[Saturn 508]   | 1970 Apr 11.80<br>5.25 days<br>1970 Apr 15.05 | Cylinder<br>13930                                  | 18.7 long<br>6.6 dia               | 1970 Apr 11.8<br>1970 Apr 12.0 | 32.56<br>33.2             | 88.07<br>26320     | 6564<br>292320       | 186<br>200          | 186<br>572080      | 0<br>0.977           | --<br>30*                 |
| LEM 7†                       | 1970 Apr 11.80<br>5.95 days<br>1970 Apr 17.75 | Box + octa-<br>gon + 4 legs<br>15190, then<br>7890 | 4.1 high<br>3.76 wide<br>3.13 deep | 1970 Apr 12.0                  | 33.2                      | 26320              | 292320               | 200                 | 572080             | 0.977                | 30*                       |

\* Approximate orbits.

\*\* Apollo attached to LEM, separated from Saturn IVB on Apr 11.98.

† Apollo command module jettisoned Service module on Apr 17.55; and jettisoned LEM on Apr 17.70.

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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<br>R | Cosmos 333 †<br>1970-30A            | 1970 Apr 15.38<br>12.85 days<br>1970 Apr 28.23 | Sphere-cylinder<br>6300†          | 6.5 long?<br>2.4 dia  | 1970 Apr 15.6                  | 81.34                     | 89.11              | 6607                 | 219                 | 239                | 0.001                | 80                        |
| D      | Cosmos 333<br>rocket<br>1970-30B    | 1970 Apr 15.38<br>3.20 days<br>1970 Apr 18.58  | Cylinder<br>2500†                 | 7.5 long<br>2.6 dia   | 1970 Apr 15.7                  | 81.36                     | 88.99              | 6601                 | 213                 | 233                | 0.002                | 8                         |
| D      | Cosmos 333<br>engine<br>1970-30C    | 1970 Apr 15.38<br>16.64 days<br>1970 May 2.02  | Cone<br>600† full                 | 1.5 long?<br>2 dia?   | 1970 Apr 28.2                  | 81.34                     | 88.66              | 6585                 | 195                 | 218                | 0.002                | 331                       |
| D      | Fragment<br>1970-30D                |  |                                   |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D      | [ Titan 3B<br>Agena D ]<br>1970-31A | 1970 Apr 15.66<br>21 days<br>1970 May 6        | Cylinder<br>3000†                 | 8 long?<br>1.5 dia    | 1970 Apr 16.6<br>1970 Apr 24.3 | 110.97<br>110.96          | 89.70<br>89.91     | 6637<br>6648         | 130<br>131          | 388<br>408         | 0.019<br>0.021       | 120<br>121                |
|        | IntelSat 3G (P-7)<br>1970-32A       | 1970 Apr 23.03<br>> million<br>years           | Cylinder<br>293 full<br>137 empty | 1.04 long<br>1.42 dia | 1970 May 17.9                  | 0.21                      | 1436.2             | 42167                | 35772               | 35805              | 0.0004               | 345                       |
|        | IntelSat 3G<br>rocket<br>1970-32B   | 1970 Apr 23.03<br>20 years                     | Sphere-cone<br>66                 | 1.32 long<br>0.94 dia | 1970 Apr 23.7<br>1971 Dec 1.0  | 28.04<br>28.1             | 643.2<br>629.5     | 24682<br>24329       | 272<br>193          | 36336<br>35708     | 0.731<br>0.730       | 181<br>-                  |
| D      | Cosmos 334<br>1970-33A              | 1970 Apr 23.56<br>108.39 days<br>1970 Aug 9.95 | Ellipsoid<br>400†                 | 1.8 long<br>1.2 dia   | 1970 Apr 24.2                  | 70.92                     | 92.10              | 6755                 | 272                 | 482                | 0.016                | 81                        |
| D      | Cosmos 334<br>rocket<br>1970-33B    | 1970 Apr 23.56<br>23.05 days<br>1970 May 16.61 | Cylinder<br>1500†                 | 8 long<br>1.65 dia    | 1970 Apr 24.3                  | 70.92                     | 91.95              | 6748                 | 249                 | 491                | 0.018                | 76                        |
| D      | Fragments<br>1970-33C-E             |  |                                   |                       |                                |                           |                    |                      |                     |                    |                      |                           |

\* 1970-30C ejected from 1970-30A about 1970 Apr 28.2.

† Manoeuvrable

Year of launch 1970 continued

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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) |
|-------------------------------|--|-----------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| China 1                       | 1970 Apr 24.57<br>100 years                    | Spheroid?<br>173      | 1 dia?                | 1970 Apr 27.7                 | 68.44                     | 114.09             | 7792                 | 441                 | 2386               | 0.125                | 141                       |
| China 1<br>rocket<br>Fragment | 1970 Apr 24.57<br>50 years                     | Cylinder              | -                     | 1970 Apr 30.0                 | 68.45                     | 114.09             | 7792                 | 441                 | 2386               | 0.125                | 139                       |
| Cosmos 335*                   | 1970 Apr 24.94<br>58.15 days<br>1970 Jun 22.09 | Ellipsoid<br>400?     | 1.8 long<br>1.2 dia   | 1970 Apr 25.5                 | 48.40                     | 90.97              | 6704                 | 250                 | 401                | 0.011                | 127                       |
| Cosmos 335<br>rocket          | 1970 Apr 24.94<br>22.72 days<br>1970 May 17.66 | Cylinder<br>1500?     | 8 long<br>1.65 dia    | 1970 Apr 25.5                 | 48.44                     | 90.88              | 6699                 | 250                 | 392                | 0.011                | 127                       |
| Cosmos 336                    | 1970 Apr 25.71<br>10000 years                  | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1970 Apr 30.2                 | 74.04                     | 115.49             | 7855                 | 1464                | 1490               | 0.002                | 199                       |
| Cosmos 337                    | 1970 Apr 25.71<br>10000 years                  | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1970 Apr 27.1                 | 74.05                     | 116.27             | 7890                 | 1470                | 1554               | 0.005                | 258                       |
| Cosmos 338                    | 1970 Apr 25.71<br>10000 years                  | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1970 Apr 28.6                 | 74.03                     | 115.89             | 7873                 | 1472                | 1918               | 0.003                | 250                       |
| Cosmos 339                    | 1970 Apr 25.71<br>3000 years                   | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1970 Apr 30.2                 | 74.04                     | 115.10             | 7837                 | 1446                | 1472               | 0.002                | 111                       |
| Cosmos 340                    | 1970 Apr 25.71<br>3000 years                   | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1970 May 2.2                  | 74.04                     | 114.70             | 7819                 | 1409                | 1473               | 0.004                | 100                       |

\* Ultra-violet radiation studies

1970-36 continued on page 226

| 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) |
|----------------------|---|--------------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 341           | 1970 Apr 25.71<br>6000 years                  | Spheroid<br>407                | 1.0 long?<br>0.8 dia? | 1970 Apr 27.3                 | 74.04                     | 113.57             | 7786                 | 1345                | 1471               | 0.008                | 98                        |
| Cosmos 342           | 1970 Apr 25.71<br>5000 years                  | Spheroid<br>407                | 1.0 long?<br>0.8 dia? | 1970 Apr 27.3                 | 74.04                     | 113.62             | 7770                 | 1313                | 1471               | 0.010                | 94                        |
| Cosmos 343           | 1970 Apr 25.71<br>7000 years                  | Spheroid<br>407                | 1.0 long?<br>0.8 dia? | 1970 May 1.7                  | 74.02                     | 114.32             | 7802                 | 1374                | 1474               | 0.006                | 97                        |
| Cosmos 336<br>rocket | 1970 Apr 25.71<br>20000 years                 | Cylinder<br>2200?              | 7.4 long<br>2.4 dia   | 1970 May 3.1                  | 74.04                     | 116.69             | 7910                 | 1473                | 1590               | 0.007                | 257                       |
| Meteor 4             | 1970 Apr 28.45<br>60 years                    | Cylinder +<br>2 veins<br>2200? | 5 long?<br>1.5 dia?   | 1970 Apr 29.5                 | 81.23                     | 98.12              | 7046                 | 625                 | 710                | 0.006                | 89                        |
| Meteor 4<br>rocket   | 1970 Apr 28.45<br>60 years                    | Cylinder<br>1440               | 3.8 long<br>2.6 dia   | 1970 May 4.1                  | 81.24                     | 98.34              | 7056                 | 571                 | 785                | 0.015                | 136                       |
| Fragment             |   |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 344           | 1970 May 12.43<br>7.85 days<br>1970 May 20.28 | Sphere-<br>cylinder<br>5530?   | 5 long?<br>2.4 dia    | 1970 May 13.2                 | 72.90                     | 89.83              | 6644                 | 202                 | 329                | 0.010                | 45                        |
| Cosmos 344<br>rocket | 1970 May 12.43<br>7.61 days<br>1970 May 20.04 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1970 May 13.2                 | 72.90                     | 89.65              | 6635                 | 204                 | 309                | 0.008                | 34                        |

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Year of launch 1970 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<br>R       | Cosmos 345<br>1970-39A                    | 1970 May 20.39<br>7.98 days<br>1970 May 28.37   | Sphere-cylinder<br>55307             | 5 long?<br>2.4 dia    | 1970 May 21.5                                 | 51.75                     | 89.06                   | 6609                 | 192                 | 270                | 0.006                      | 13                        |
| D            | Cosmos 345<br>rocket<br>1970-39B          | 1970 May 20.39<br>2.70 days<br>1970 May 23.09   | Cylinder<br>25007                    | 7.5 long<br>2.6 dia   | 1970 May 20.8                                 | 51.76                     | 88.97                   | 6605                 | 185                 | 268                | 0.006                      | 0                         |
| D            | [Thorad<br>Asena D]<br>1970-40A           | 1970 May 20.90<br>27.53 days<br>1970 Jun 17.43  | Cylinder<br>20007                    | 8 long?<br>1.5 dia    | 1970 May 22.2                                 | 83.00                     | 88.62                   | 6583                 | 162                 | 247                | 0.006                      | 141                       |
| D            | Capsule<br>(Doppler Beacon 2)<br>1970-40B | 1970 May 20.90<br>1387.24 days<br>1974 Mar 8.14 | Octagon?<br>607                      | 0.3 long?<br>0.9 dia? | 1970 May 22.4<br>1971 Jul 1.0<br>1973 Feb 1.0 | 83.12<br>83.12<br>83.12   | 94.59<br>93.92<br>92.61 | 6875<br>6843<br>6779 | 491<br>460<br>397   | 503<br>469<br>405  | 0.0009<br>0.0007<br>0.0006 | 61<br>-<br>-              |
| D<br>2H<br>R | Scyz 9<br>1970-41A                        | 1970 Jun 1.79<br>17.71 days<br>1970 Jun 19.50   | Sphere-cylinder<br>+ 2 wings<br>6500 | 7.5 long<br>2.2 dia   | 1970 Jun 2.0<br>1970 Jun 2.2<br>1970 Jun 3.5  | 51.64<br>51.66<br>51.67   | 88.47<br>89.06<br>89.48 | 6580<br>6609<br>6630 | 176<br>208<br>244   | 227<br>254<br>259  | 0.004<br>0.003<br>0.001    | 166<br>125<br>213         |
| D            | Scyz 9<br>rocket<br>1970-41B              | 1970 Jun 1.79<br>1.85 days<br>1970 Jun 3.62     | Cylinder<br>25007                    | 7.5 long<br>2.6 dia   | 1970 Jun 2.2                                  | 51.67                     | 88.36                   | 6574                 | 194                 | 198                | 0.0003                     | 353                       |
| D<br>R       | Cosmos 346<br>1970-42A                    | 1970 Jun 10.40<br>7.00 days<br>1970 Jun 17.40   | Sphere-cylinder<br>55307             | 5 long?<br>2.4 dia    | 1970 Jun 14.0                                 | 51.74                     | 89.16                   | 6614                 | 197                 | 274                | 0.006                      | 36                        |
| D            | Cosmos 346<br>rocket<br>1970-42B          | 1970 Jun 10.40<br>3.51 days<br>1970 Jun 13.91   | Cylinder<br>25007                    | 7.5 long<br>2.6 dia   | 1970 Jun 12.6                                 | 51.74                     | 88.46                   | 6580                 | 167                 | 296                | 0.005                      | 352                       |

\* 1970-40B ejected from 1970-40A about 1970 May 20.97.

| 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<br>Cosmos 347             | 1970 Jun 12.40<br>51.18 days<br>1971 Nov 7.58   | Ellipsoid<br>4007            | 1.8 long<br>1.2 dia   | 1970 Jun 15.5<br>1970 Dec 1.0<br>1971 May 16.5 | 48.41<br>48.3<br>48.3     | 107.90<br>193.60<br>98.20 | 7511<br>7310<br>7054    | 216<br>213<br>204   | 2050<br>1650<br>1148    | 0.122<br>0.098<br>0.067 | 110<br>-<br>-             |
| D<br>Cosmos 347<br>rocket   | 1970 Jun 12.40<br>247.51 days<br>1971 Feb 14.91 | Cylinder<br>15007            | 8 long<br>1.65 dia    | 1970 Jun 15.5<br>1970 Oct 1.0                  | 48.41<br>48.37            | 107.77<br>103.56          | 7505<br>7308            | 215<br>209          | 2039<br>1650            | 0.121<br>0.099          | 110<br>-                  |
| D<br>Cosmos 348 *           | 1970 Jun 13.21<br>41.88 days<br>1970 Jul 25.09  | Ellipsoid<br>4007            | 1.8 long<br>1.2 dia   | 1970 Jun 13.9                                  | 70.99                     | 93.10                     | 6804                    | 201                 | 651                     | 0.033                   | 90                        |
| D<br>Cosmos 348<br>rocket   | 1970 Jun 13.21<br>25.88 days<br>1970 Jul 9.09   | Cylinder<br>15007            | 8 long<br>1.65 dia    | 1970 Jun 15.5                                  | 70.98                     | 92.78                     | 6788                    | 201                 | 619                     | 0.031                   | 88                        |
| D<br>Fragment               | 1970-44C  |                              |                       |  |                           |                           |                         |                     |                         |                         |                           |
| D<br>Cosmos 349<br>R        | 1970 Jun 17.54<br>7.79 days<br>1970 Jun 25.33   | Sphere-<br>cylinder<br>55307 | 5.1 long?<br>2.4 dia  | 1970 Jun 18.0                                  | 65.39                     | 89.81                     | 6644                    | 199                 | 332                     | 0.010                   | 46                        |
| D<br>Cosmos 349<br>rocket   | 1970 Jun 17.54<br>5.33 days<br>1970 Jun 22.87   | Cylinder<br>25007            | 7.5 long<br>2.6 dia   | 1970 Jun 17.8                                  | 65.40                     | 89.67                     | 6637                    | 191                 | 326                     | 0.010                   | 42                        |
| BREXIS 3<br>[Atlas Agena D] | 1970 Jun 19.48<br>10 years?                     | Cylinder<br>700 full?        | 1.7 long?<br>1.4 dia? | 1970 Jul 15.2                                  | 28.21                     | 588.85                    | 23310                   | 178                 | 33685                   | 0.719                   | 197                       |
| Agena D rocket              | 1970 Jun 19.48<br>10 years?                     | Cylinder<br>7007             | 6 long?<br>1.5 dia    | 1970 Sep 1.4<br>1972 Jul 1.0<br>1975 Mar 1.0   | 27.98<br>28.4<br>28.06    | 579.51<br>508.6<br>445.4  | 23041<br>21106<br>19317 | 171<br>194<br>224   | 33154<br>28282<br>25654 | 0.716<br>0.689<br>0.658 | 230<br>-<br>-             |

\* International atmospheric and auroral studies

| 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) |
|---|--|--------------------------------|---------------------|--|---------------------------|----------------------------|-------------------------|---------------------|-------------------------|-------------------------|---------------------------|
| Meteor 5<br>1970-47A                      | 1970 Jun 23.60<br>400 years                    | Cylinder +<br>2 vanes<br>2200? | 5 long?<br>1.5 dia? | 1970 Jun 25.3                                | 81.23                     | 102.16                     | 7238                    | 831                 | 888                     | 0.004                   | 248                       |
| Meteor 5<br>rocket<br>1970-47B            | 1970 Jun 23.60<br>300 years                    | Cylinder<br>1440               | 3.8 long<br>2.6 dia | 1970 Jun 27.1                                | 81.23                     | 102.34                     | 7246                    | 810                 | 926                     | 0.008                   | 189                       |
| [Titan 3B<br>Agena D]<br>1970-48A         | 1970 Jun 25.62<br>11 days<br>1970 Jul 6        | Cylinder<br>3000?              | 8 long?<br>1.5 dia  | 1970 Jun 26.9<br>1970 Jun 28.7               | 108.87<br>108.87          | 89.70<br>89.74             | 6657<br>6639            | 129<br>128          | 389<br>394              | 0.020<br>0.020          | 118<br>119                |
| Molniya 1P<br>1970-49A                    | 1970 Jun 26.14<br>2061 days<br>1976 Feb 16     | Windmill +<br>6 vanes<br>1000? | 3.4 long<br>1.6 dia | 1970 Jul 7.5<br>1970 Aug 1.0<br>1973 Feb 1.0 | 65.37<br>65.34<br>65.45   | 704.70<br>717.55<br>717.43 | 26232<br>26551<br>26548 | 448<br>475<br>1531  | 39250<br>39872<br>38808 | 0.740<br>0.742<br>0.702 | 285<br>-<br>-             |
| Molniya 1P<br>rocket<br>1970-49D          | 1970 Jun 26.14<br>2076 days<br>1976 Mar 2      | Cylinder<br>440                | 2.0 long<br>2.0 dia | 1970 Jul 8.4<br>1973 Feb 1.0                 | 65.39<br>65.43            | 700.30<br>700.30           | 26123<br>26123          | 469<br>1479         | 39021<br>38011          | 0.738<br>0.699          | 285<br>-                  |
| Molniya 1P<br>launcher rocket<br>1970-49C | 1970 Jun 26.14<br>21.70 days<br>1970 Jul 17.84 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia | 1970 Jun 27.7                                | 65.39                     | 91.30                      | 6717                    | 213                 | 464                     | 0.019                   | 63                        |
| Molniya 1P<br>launcher<br>1970-49B        | 1970 Jun 26.14<br>29.54 days<br>1970 Jul 25.68 | Irregular<br>-                 | -                   | 1970 Jun 27.7                                | 65.40                     | 91.40                      | 6722                    | 225                 | 462                     | 0.018                   | 69                        |
| Cosmos 350<br>1970-50A                    | 1970 Jun 26.50<br>11.93 days<br>1970 Jul 8.43  | Sphere-<br>cylinder<br>5700?   | 5.0 long<br>2.4 dia | 1970 Jun 27.5                                | 51.73                     | 89.04                      | 6608                    | 202                 | 298                     | 0.004                   | 26                        |
| Cosmos 350<br>rocket<br>1970-50B          | 1970 Jun 26.50<br>2.61 days<br>1970 Jun 29.11  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia | 1970 Jun 26.9                                | 51.74                     | 88.87                      | 6600                    | 190                 | 255                     | 0.005                   | 9                         |

|        | 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 351            | 1970 Jun 27.32<br>108.15 days<br>1970 Oct 13.47 | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia   | 1970 Jun 29.4                 | 70.99                     | 91.93              | 6747                 | 270                 | 467                | 0.015                | 82                        |
| D      | Cosmos 351<br>rocket  | 1970 Jun 27.32<br>52.2 days<br>1970 Aug 18.5    | Cylinder<br>1500?            | 8 long<br>1.65 dia    | 1970 Jun 28.5                 | 70.98                     | 91.75              | 6738                 | 270                 | 450                | 0.013                | 81                        |
| D<br>R | Cosmos 352            | 1970 Jul 7.44<br>7.95 days<br>1970 Jul 15.39    | Sphere-<br>cylinder<br>5530? | 5 long?<br>2.4 dia    | 1970 Jul 8.2                  | 51.78                     | 89.46              | 6629                 | 207                 | 294                | 0.007                | 51                        |
| D      | Cosmos 352<br>rocket  | 1970 Jul 7.44<br>4.59 days<br>1970 Jul 12.03    | Cylinder<br>2500?            | 7.5 long<br>2.6 dia   | 1970 Jul 8.3                  | 51.77                     | 89.33              | 6622                 | 187                 | 301                | 0.009                | 32                        |
| D<br>R | Cosmos 353            | 1970 Jul 9.57<br>11.72 days<br>1970 Jul 21.29   | Sphere-<br>cylinder<br>5700? | 5.0 long<br>2.4 dia   | 1970 Jul 11.2                 | 65.42                     | 89.38              | 6622                 | 204                 | 284                | 0.006                | 58                        |
| D      | Cosmos 353<br>rocket  | 1970 Jul 9.57<br>6.44 days<br>1970 Jul 16.01    | Cylinder<br>2500?            | 7.5 long<br>2.6 dia   | 1970 Jul 10.3                 | 65.44                     | 89.23              | 6615                 | 200                 | 274                | 0.006                | 58?                       |
| D      | [Thorad<br>Agena D]   | 1970 Jul 23.06<br>26.99 days<br>1970 Aug 19.05  | Cylinder<br>2000?            | 8 long?<br>1.5 dia    | 1970 Jul 25.2                 | 60.00                     | 90.04              | 6656                 | 158                 | 398                | 0.018                | 111                       |
|        | Intelsat 3H (P-8)     | 1970 Jul 23.97<br>1 million<br>years            | Cylinder<br>137 empty        | 1.04 long<br>1.42 dia | 1970 Jul 24.0<br>1970 Aug 1.0 | 27.98<br>13.3             | 642.7<br>1043      | 24666<br>34090       | 282<br>19400        | 36294<br>36030     | 0.730<br>0.244       | 189<br>-e                 |
|        | Intelsat 3H<br>rocket | 1970 Jul 23.97<br>20 years                      | Sphere-cone<br>66            | 1.32 long<br>0.94 dia | 1970 Aug 6.6                  | 27.98                     | 642.7              | 24666                | 282                 | 36294              | 0.730                | 189                       |

\* Approximate orbit (satellite lost).

|                     | 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<br>R <sup>*</sup> | 1970-56A<br>Cosmos 354                    | 1970 Jul 28.92<br>0.06 day<br>1970 Jul 28.98   | Cylinder                     | 2 long?<br>1 dia?   | 1970 Jul 29.2                 | 49.57                     | 87.13              | 6514                 | 114                 | 157                | 0.005                | 158                       |
| D                   | 1970-56B<br>Cosmos 354<br>rocket          | 1970 Jul 28.92<br>0.36 day<br>1970 Jul 29.28   | Cylinder<br>1500?            | 8 long?<br>2.5 dia? | 1970 Jul 29.2                 | 49.62                     | 87.54              | 6534                 | 134                 | 178                | 0.003                | 58                        |
| D                   | 1970-56C<br>Cosmos 354<br>launch platform | 1970 Jul 28.92<br>0.49 day<br>1970 Jul 29.41   | Irregular                    | -                   | 1970 Aug 9.3                  | 48.41                     | 99.70              | 7126                 | 200                 | 1295               | 0.077                | 110                       |
| D                   | 1970-57A<br>Intarcosmos 3                 | 1970 Aug 7.13<br>121.31 days<br>1970 Dec 6.44  | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia | 1970 Aug 9.7                  | 48.40                     | 99.61              | 7122                 | 201                 | 1287               | 0.076                | 112                       |
| D                   | 1970-57B<br>Intarcosmos 3<br>rocket       | 1970 Aug 7.13<br>102.57 days<br>1970 Nov 17.70 | Cylinder<br>1500?            | 8 long<br>1.65 dia  | 1970 Aug 8.4                  | 65.40                     | 89.71              | 6639                 | 199                 | 322                | 0.009                | 45                        |
| D<br>R              | 1970-58A<br>Cosmos 355                    | 1970 Aug 7.40<br>7.78 days<br>1970 Aug 15.18   | Sphere-<br>cylinder<br>5530? | 5 long?<br>2.4 dia  | 1970 Aug 9.1                  | 65.39                     | 89.45              | 6626                 | 191                 | 304                | 0.008                | 35                        |
| D                   | 1970-58B<br>Cosmos 355<br>rocket          | 1970 Aug 7.40<br>6.95 days<br>1970 Aug 14.35   | Cylinder<br>2500?            | 7.5 long<br>2.6 dia | 1970 Aug 11.3                 | 81.96                     | 92.62              | 6780                 | 231                 | 573                | 0.025                | 80                        |
| D                   | 1970-59A<br>Cosmos 356*                   | 1970 Aug 10.84<br>53.11 days<br>1970 Oct 2.95  | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia | 1970 Aug 11.4                 | 81.96                     | 92.49              | 6773                 | 236                 | 554                | 0.023                | 79                        |
| D                   | 1970-59B<br>Cosmos 356<br>rocket          | 1970 Aug 10.84<br>52.00 days<br>1970 Oct 1.84  | Cylinder<br>1500?            | 8 long<br>1.65 dia  |                               |                           |                    |                      |                     |                    |                      |                           |

\* Atmospheric and auroral studies

| 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<br>Venus 7<br>launcher rocket | 1970-60B<br>1970 Aug 17.23<br>1.17 days<br>1970 Aug 18.40  | Cylinder<br>2500?                 | 7.5 long<br>2.6 dia   | 1970 Aug 17.5                  | 51.75                     | 88.28              | 6570                 | 182                 | 202                | 0.002                | 280                       |
| D<br>Venus 7<br>launcher        | 1970-60C<br>1970 Aug 17.23<br>1.68 days<br>1970 Aug 18.91  | Irregular                         | -                     | 1970 Aug 17.4                  | 51.70                     | 88.51              | 6582                 | 174                 | 233                | 0.004                | 349                       |
| D<br>[Titan 3B<br>Agena D]      | 1970-61A<br>1970 Aug 18.62<br>16 days<br>1970 Sep 3        | Cylinder<br>3000?                 | 8 long?<br>1.5 dia    | 1970 Aug 21.2<br>1970 Aug 25.0 | 110.95<br>110.98          | 89.67<br>90.49     | 6636<br>6676         | 151<br>152          | 365<br>444         | 0.016<br>0.022       | 124<br>123                |
| Skynet 1B                       | 1970-62A<br>1970 Aug 19.51<br>uncertain                    | Cylinder<br>243 full<br>129 empty | 0.81 long<br>1.37 dia | 1970 Aug 20.2                  | 28.04                     | 636.5              | 24534                | 270                 | 36041              | 0.729                | 181*                      |
| Skynet 1B<br>rocket             | 1970-62B<br>1970 Aug 19.51<br>20 years                     | Sphere-<br>cone<br>66             | 1.32 long<br>0.94 dia | 1970 Aug 20.2                  | 28.04                     | 636.5              | 24534                | 270                 | 36041              | 0.729                | 181                       |
| Cosmos 357                      | 1970-63A<br>1970 Aug 19.63<br>97.30 days<br>1970 Nov 24.93 | Ellipsoid<br>400?                 | 1.8 long<br>1.2 dia   | 1970 Aug 21.1                  | 70.99                     | 92.04              | 6732                 | 272                 | 476                | 0.015                | 73                        |
| D<br>Cosmos 357<br>rocket       | 1970-63B<br>1970 Aug 19.63<br>57 days<br>1970 Oct 15       | Cylinder<br>1500?                 | 8 long<br>1.65 dia    | 1970 Aug 22.0                  | 70.98                     | 91.81              | 6741                 | 275                 | 450                | 0.013                | 70                        |
| Cosmos 358                      | 1970-64A<br>1970 Aug 20.61<br>20 years                     | Cylinder<br>+ paddles?<br>900?    | 2 long?<br>1 dia?     | 1970 Aug 27.3                  | 74.04                     | 95.19              | 6905                 | 515                 | 539                | 0.002                | 316                       |
| D<br>Cosmos 358<br>rocket       | 1970-64B<br>1970 Aug 20.61<br>8 1/2 years                  | Cylinder<br>2200?                 | 7.4 long<br>2.4 dia   | 1970 Aug 24.2<br>1973 Oct 1.0  | 74.03<br>74.03            | 95.08<br>94.40     | 6900<br>6867         | 505<br>471          | 539<br>507         | 0.003<br>0.003       | 325<br>-                  |
| D<br>Fragment                   | 1970-64C   |                                   |                       |                                |                           |                    |                      |                     |                    |                      |                           |

Space Vehicle: Venus 7, 1970-60A. \*transfer orbit: present orbit unknown.

Year of launch 1970 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 359*                  | 1970 Aug 22, 22<br>76.04 days<br>1970 Nov 6, 26 | Sphere-cylinder<br>1180            | 3.5 long<br>1.2 dia   | 1970 Aug 24.3                                  | 51.13                     | 95.57                   | 6927                 | 208                 | 890                | 0.049                    | 60                        |
| D Cosmos 359 launcher rocket   | 1970 Aug 22, 22<br>7.06 days<br>1970 Aug 29, 28 | Cylinder<br>2500†                  | 7.5 long<br>2.6 dia   | 1970 Aug 23.5                                  | 51.80                     | 89.49                   | 6631                 | 207                 | 298                | 0.007                    | 37                        |
| D Cosmos 359 rocket            | 1970 Aug 22, 22<br>410 days<br>1971 Oct 6       | Cylinder<br>2400**                 | 2.0 long<br>2.0 dia   | 1970 Sep 1.0<br>1971 Feb 1.0<br>1971 Jun 1.0   | 51.13<br>51.13<br>51.13   | 95.31<br>93.58<br>91.92 | 6914<br>6830<br>6749 | 205<br>202<br>195   | 867<br>701<br>546  | 0.048<br>0.037<br>0.026  | 79<br>288<br>-            |
| D Fragments                    | 1970-65C, E                                     |                                    |                       |  |                           |                         |                      |                     |                    |                          |                           |
| D [Thorad Agena D]             | 1970 Aug 26, 26<br>1673 days<br>1975 Mar 26     | Cylinder<br>2000†                  | 8 long?<br>1.5 dia    | 1970 Aug 29.3<br>1972 Apr 1.0<br>1974 Feb 15.0 | 74.99<br>74.99<br>74.99   | 94.51<br>93.87<br>92.57 | 6872<br>6841<br>6778 | 484<br>457<br>398   | 504<br>469<br>402  | 0.001<br>0.001<br>0.0003 | 259<br>-<br>-             |
| D Navy Navigation Satellite 19 | 1970 Aug 27, 56<br>1300 years                   | Octagon +<br>4 vanes +<br>boom 58† | 0.25 long<br>0.46 dia | 1970 Aug 29.2                                  | 90.02                     | 107.04                  | 7466                 | 955                 | 1221               | 0.018                    | 245                       |
| D Altair rocket                | 1970 Aug 27, 56<br>700 years                    | Cylinder<br>24                     | 1.5 long<br>0.46 dia  | 1970 Sep 6.9                                   | 90.04                     | 107.05                  | 7467                 | 952                 | 1225               | 0.018                    | 218                       |
| D Fragments                    | 1970-67C-E                                      |                                    |                       |  |                           |                         |                      |                     |                    |                          |                           |
| D Cosmos 360 †                 | 1970 Aug 29, 36<br>9.93 days<br>1970 Sep 8, 29  | Sphere-cylinder<br>6300†           | 6.5 long?<br>2.4 dia  | 1970 Sep 2.8                                   | 64.99                     | 89.64                   | 6635                 | 209                 | 305                | 0.007                    | 37                        |
| D Cosmos 360 rocket            | 1970 Aug 29, 36<br>4.34 days<br>1970 Sep 2, 70  | Cylinder<br>2500†                  | 7.5 long<br>2.6 dia   | 1970 Aug 31.1                                  | 65.00                     | 88.91                   | 6600                 | 187                 | 256                | 0.005                    | 26                        |
| D Cosmos 360 engine ***        | 1970 Aug 29, 36<br>11 days<br>1970 Sep 9        | Cone<br>600† full                  | 1.5 long?<br>2 dia?   | 1970 Sep 7.7                                   | 64.93                     | 88.61                   | 6585                 | 193                 | 220                | 0.002                    | 85                        |
| D Fragments                    | 1970-68D, E                                     |                                    |                       |  |                           |                         |                      |                     |                    |                          |                           |

\* Cosmos 359 was probably an attempted Venus probe.  
\*\* 1970-68C ejected from 1970-68A about 1970 Sep 7.4.

\*\* Mass before incomplete burn was approximately 54,000kg  
† Probably manoeuvrable

| 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) |
|------------------------------|---|-------------------------------------|----------------------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| BMS4 4<br>[Atlas Agena D]    | 1970 Sep 1.04<br>> million years              | Cylinder<br>700 full?<br>350 empty? | 1.7 long?<br>1.4 dia?            | 1970 Sep 1.0<br>1970 Oct 1.0   | 28.50<br>10.3             | 88.05<br>1441.9    | 6563<br>42279        | 179<br>31947        | 190<br>39855       | 0.001<br>0.094       | 242<br>-                  |
| Agena D<br>rocket            | 1970 Sep 1.04<br>10 years?                    | Cylinder<br>700?                    | 6 long?<br>1.5 dia               | 1970 Sep 4.9                   | 98.75                     | 101.30             | 7197                 | 764                 | 874                | 0.008                | 21                        |
| [Thor Burner 2]              | 1970 Sep 3.36<br>80 years                     | 12-faced<br>frustum<br>195          | 1.54 long<br>1.31 to<br>1.10 dia | 1970 Sep 9.2                   | 98.75                     | 101.29             | 7197                 | 765                 | 872                | 0.007                | 7                         |
| Burner 2 rocket              | 1970 Sep 3.36<br>60 years                     | Sphere-<br>cone<br>66               | 1.32 long<br>0.94 dia            | 1970 Sep 9.1<br>1970 Sep 13.2  | 72.87<br>72.87            | 89.99<br>90.09     | 6632<br>6656         | 209<br>205          | 298<br>353         | 0.007<br>0.011       | 56<br>37                  |
| D Cosmos 361                 | 1970 Sep 8.44<br>12.8 days<br>1970 Sep 21.2   | Sphere-<br>cylinder<br>6300?        | 6.5 long?<br>2.4 dia             | 1970 Sep 8.7                   | 72.85                     | 89.47              | 6626                 | 204                 | 291                | 0.007                | 54                        |
| D Cosmos 361<br>rocket       | 1970 Sep 8.44<br>5.57 days<br>1970 Sep 14.81  | Cylinder<br>2500?                   | 7.5 long<br>2.6 dia              | 1970 Sep 20.2                  | 72.87                     | 89.95              | 6650                 | 209                 | 334                | 0.009                | 25                        |
| D Cosmos 361<br>engine       | 1970 Sep 8.44<br>27 days<br>1970 Oct 5        | Cone<br>600? full                   | 1.5 long?<br>2 dia?              | 1970 Sep 12.9<br>1970 Sep 12.9 | 51.53                     | 88.70              | 6591                 | 185                 | 241                | 0.004                | 344                       |
| D Fragment                   | 1970 Sep 12.56<br>3.19 days<br>1970 Sep 15.75 | Cylinder<br>4000?                   | 12 long?<br>4 dia                | 1970 Sep 12.9                  | 51.50                     | 88.71              | 6592                 | 186                 | 241                | 0.004                | 334                       |
| D Luna 16<br>launcher rocket | 1970 Sep 12.56<br>3.29 days<br>1970 Sep 15.85 | -                                   | -                                | 1970 Sep 12.9                  | 51.50                     | 88.71              | 6592                 | 186                 | 241                | 0.004                | 334                       |
| D Luna 16<br>launcher        |   |                                     |                                  |                                |                           |                    |                      |                     |                    |                      |                           |

Space Vehicle: Luna 16, 1970-72A.

• 1970-71C ejected from 1970-71A about 1970 Sep 20.2.

## Year of Launch 1970 continued

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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 362            | 1970 Sep 16.50<br>392.40 days<br>1971 Oct 13.90 | Ellipsoid<br>4007            | 1.8 long<br>1.2 dia  | 1970 Sep 18.0<br>1971 Apr 1.0 | 70.96<br>70.96            | 95.65<br>93.26     | 6928<br>6812         | 270<br>255          | 829<br>613         | 0.040<br>0.026       | 82<br>-                   |
| D      | Cosmos 362<br>rocket  | 1970 Sep 16.50<br>193.33 days<br>1971 Mar 28.83 | Cylinder<br>15007            | 8 long<br>1.65 dia   | 1970 Sep 17.0<br>1971 Jan 1.0 | 70.96<br>70.96            | 95.51<br>93.27     | 6921<br>6813         | 271<br>252          | 815<br>617         | 0.039<br>0.027       | 83<br>252                 |
| B<br>R | Cosmos 363            | 1970 Sep 17.35<br>11.86 days<br>1970 Sep 29.21  | Sphere-<br>cylinder<br>57007 | 5.0 long<br>2.4 dia  | 1970 Sep 18.1                 | 65.01                     | 89.53              | 6629                 | 208                 | 294                | 0.007                | 62                        |
| D      | Cosmos 363<br>rocket  | 1970 Sep 17.35<br>5.44 days<br>1970 Sep 22.79   | Cylinder<br>25007            | 7.5 long<br>2.6 dia  | 1970 Sep 18.1                 | 65.00                     | 89.33              | 6619                 | 205                 | 277                | 0.006                | 54                        |
| D<br>R | Cosmos 364            | 1970 Sep 22.54<br>9.76 days<br>1970 Oct 2.30    | Sphere-<br>cylinder<br>63007 | 6.5 long?<br>2.4 dia | 1970 Sep 25.7<br>1970 Oct 1.5 | 65.41<br>65.43            | 89.49<br>89.50     | 6628<br>6628         | 202<br>196          | 297<br>304         | 0.007<br>0.008       | 75<br>52                  |
| D      | Cosmos 364<br>rocket  | 1970 Sep 22.54<br>5.96 days<br>1970 Sep 28.50   | Cylinder<br>25007            | 7.5 long<br>2.6 dia  | 1970 Sep 23.2                 | 65.40                     | 89.50              | 6628                 | 204                 | 296                | 0.007                | 59                        |
| D      | Cosmos 364<br>engine* | 1970 Sep 22.54<br>17 days<br>1970 Oct 9         | Cone<br>6007 full            | 1.5 long?<br>2 dia?  | 1970 Oct 5.2                  | 65.39                     | 91.16              | 6710                 | 222                 | 442                | 0.016                | 2                         |

\* 1970-75C ejected from 1970-75A about 1970 Oct 1.5.



Year of launch 1970 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) |
|-------------------------------------|--|--------------------------|---------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 367 <sup>†</sup><br>1970-79A | 1970 Oct 3.44<br>600 years                     | Cone-cylinder            | 6 long?<br>2 dia?   | 1970 Oct 6.8                  | 65.28                     | 104.53             | 7351                 | 922                 | 1024               | 0.007                | 312                       |
| D<br>Cosmos 367<br>rocket           | 1970 Oct 3.44<br>2.93 days<br>1970 Oct 6.37    | Cylinder<br>1500?        | 8 long?<br>2.5 dia? | 1970 Oct 4.9                  | 65.21                     | 89.21              | 6614                 | 226                 | 246                | 0.002                | 227                       |
| D<br>Cosmos 367<br>platform         | 1970 Oct 3.44<br>27.69 days<br>1970 Oct 31.13  | Irregular                | -                   | 1970 Oct 4.8                  | 65.09                     | 89.60              | 6633                 | 246                 | 264                | 0.001                | 298                       |
| D<br>Fragments<br>1970-79D,E        |  |                          |                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D<br>Cosmos 368                     | 1970 Oct 8.53<br>5.98 days<br>1970 Oct 14.51   | Sphere-cylinder<br>5900? | 5.9 long<br>2.4 dia | 1970 Oct 9.7                  | 64.99                     | 90.56              | 6680                 | 204                 | 400                | 0.015                | 56                        |
| D<br>Cosmos 368<br>rocket           | 1970 Oct 8.53<br>11.60 days<br>1970 Oct 20.13  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia | 1970 Oct 9.7                  | 65.00                     | 90.43              | 6674                 | 203                 | 389                | 0.014                | 52                        |
| D<br>Capelle*                       | 1970 Oct 8.53<br>27 days<br>1970 Nov 4         | Ellipsoid<br>200?        | 0.9 long<br>1.9 dia | 1970 Nov 1.0                  | 64.9                      | 88.70              | 6589                 | 178                 | 243                | 0.005                | -                         |
| D<br>Fragments<br>1970-80C,D        |  |                          |                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D<br>Cosmos 369                     | 1970 Oct 8.63<br>106.20 days<br>1971 Jan 22.83 | Ellipsoid<br>400?        | 1.8 long<br>1.2 dia | 1970 Oct 9.6                  | 70.93                     | 92.32              | 6766                 | 269                 | 506                | 0.018                | 86                        |
| D<br>Cosmos 369<br>rocket           | 1970 Oct 8.63<br>52.76 days<br>1970 Nov 30.39  | Cylinder<br>1500?        | 8 long<br>1.65 dia  | 1970 Oct 10.9                 | 70.93                     | 92.15              | 6757                 | 271                 | 486                | 0.016                | 84                        |

\*1970-80E ejected from 1970-80A on 1970 Oct 13

†1970-79B and 79C attached to 1970-79A until orbit change

|   | 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 370 <sup>†</sup> | 1970 Oct 9.46<br>12.84 days<br>1970 Oct 22.30  | Sphere-cylinder<br>6300?        | 6.5 long?<br>2.4 dia | 1970 Oct 10.9                 | 64.92                     | 89.40              | 6623                 | 202                 | 288                | 0.006                | 33                        |
| R |                         |  |                                 |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 370 rocket       | 1970 Oct 9.46<br>4.13 days<br>1970 Oct 13.59   | Cylinder<br>2500?               | 7.5 long<br>2.6 dia  | 1970 Oct 11.7                 | 64.93                     | 88.77              | 6592                 | 187                 | 241                | 0.004                | 9                         |
| D | Cosmos 370 engine*      | 1970 Oct 9.46<br>18 days<br>1970 Oct 27        | Cone<br>600? full               | 1.5 long?<br>2 dia?  | 1970 Oct 22.3                 | 64.92                     | 88.74              | 6591                 | 182                 | 243                | 0.005                | -                         |
|   | Cosmos 371              | 1970 Oct 12.58<br>100 years                    | Cylinder +<br>paddles?<br>750?  | 2 long?<br>1 dia?    | 1970 Oct 31.0                 | 74.00                     | 99.92              | 7132                 | 750                 | 758                | 0.0005               | 16                        |
|   | Cosmos 371 rocket       | 1970 Oct 12.58<br>80 years                     | Cylinder<br>2200?               | 7.4 long<br>2.4 dia  | 1970 Oct 12.9                 | 74.00                     | 99.81              | 7127                 | 743                 | 755                | 0.0009               | 107                       |
| D | Interkosmos 4           | 1970 Oct 14.48<br>95.20 days<br>1971 Jan 17.68 | Ellipsoid +<br>6 panels<br>400? | 1.8 long<br>1.2 dia  | 1970 Oct 16.9                 | 48.41                     | 93.56              | 6830                 | 255                 | 649                | 0.029                | 118                       |
| D | Interkosmos 4 rocket    | 1970 Oct 14.48<br>63.63 days<br>1970 Dec 17.11 | Cylinder<br>1500?               | 8 long<br>1.65 dia   | 1970 Oct 16.7                 | 48.41                     | 93.29              | 6817                 | 259                 | 619                | 0.026                | 117                       |
|   | Meteor 6                | 1970 Oct 15.48<br>60 years                     | Cylinder +<br>2 vanes<br>2200?  | 5 long?<br>1.5 dia?  | 1970 Oct 25.1                 | 81.21                     | 97.49              | 7015                 | 626                 | 648                | 0.002                | 56                        |
|   | Meteor 6 rocket         | 1970 Oct 15.48<br>60 years                     | Cylinder<br>1440                | 3.8 long<br>2.6 dia  | 1970 Oct 22.3                 | 81.23                     | 97.62              | 7022                 | 551                 | 736                | 0.013                | 155                       |
|   | Fragment                |  |                                 |                      |                               |                           |                    |                      |                     |                    |                      |                           |

\*1970-82C ejected from 1970-82A on 1970 Oct 21 or 22.

<sup>†</sup> Manoeuvrable

| 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) |
|----------------------------------|--|-----------------------------|---------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 372                       | 1970 Oct 16.63<br>100 years              | Cylinder + paddles?<br>750? | 2 long?<br>1 dia?   | 1970 Oct 29.2                  | 74.06                     | 100.80             | 7174                 | 785                 | 806                | 0.001                | 9                         |
| Cosmos 372 rocket                | 1970 Oct 16.63<br>80 years               | Cylinder<br>2200?           | 7.4 long<br>2.4 dia | 1970 Oct 29.2                  | 74.06                     | 100.70             | 7169                 | 776                 | 806                | 0.002                | 7                         |
| Fragments<br>Cosmos 373          | 1970 Oct 20.24<br>10 years               | Cylinder?                   | 4 long?<br>2 dia?   | 1970 Oct 20.5<br>1970 Oct 31.1 | 62.93<br>62.92            | 94.77<br>94.83     | 6886<br>6889         | 472<br>466          | 544<br>556         | 0.005<br>0.006       | 290<br>311                |
| Cosmos 373 rocket                | 1970 Oct 20.24<br>90 days<br>1971 Jan 18 | Cylinder<br>1500?           | 8 long?<br>2.5 dia? | 1970 Oct 23.2                  | 62.26                     | 95.45              | 6919                 | 145                 | 937                | 0.057                | 54                        |
| Zond 8 launcher rocket           | 1970 Oct 20.83<br>6 days<br>1970 Oct 26  | Cylinder<br>4000?           | 12 long?<br>4 dia   | 1970 Oct 21.6                  | 51.51                     | 88.68              | 6591                 | 202                 | 223                | 0.002                | 338                       |
| Cosmos 374*                      | 1970 Oct 23.18<br>150 years              | Cylinder?                   | 4 long?<br>2 dia?   | 1970 Oct 30.2                  | 62.95                     | 112.26             | 7709                 | 521                 | 2141               | 0.105                | 61                        |
| Cosmos 374 rocket                | 1970 Oct 23.18<br>100 years              | Cylinder<br>1500?           | 8 long?<br>2.5 dia? | 1970 Oct 28.5                  | 62.93                     | 111.83             | 7690                 | 517                 | 2106               | 0.103                | 62                        |
| Fragments:<br>[Titan 3B Agena D] | 1970 Oct 23.74<br>19 days<br>1970 Nov 11 | Cylinder<br>3000?           | 8 long?<br>1.5 dia  | 1970 Oct 24.3                  | 111.06                    | 89.83              | 6644                 | 135                 | 396                | 0.020                | 137                       |

Space Vehicle: Zond 8, 1970-88A, passed 1120 km beyond Moon on Oct 24.1; recovered on Earth Oct 27.58

\*1970-89A passed close to 1970-87A on Oct 23.34, then exploded.

21d

D

| Name                     | Launch date, lifetime and descent date         | Shape and weight (kg)          | Size (in)            | 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) |
|--------------------------|--|--------------------------------|----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 375*              | 1970 Oct 30.09<br>150 years                    | Cylinder?                      | 4 long?<br>2 dia?    | 1970 Nov 3.0                   | 62.82                     | 111.82             | 7689                 | 524                 | 2098               | 0.102                | 56                        |
| Cosmos 375<br>rocket     | 1970 Oct 30.09<br>100 years                    | Cylinder<br>1500?              | 8 long?<br>2.5 dia?  | 1970 Nov 3.9                   | 62.78                     | 111.52             | 7674                 | 526                 | 2066               | 0.100                | 56                        |
| Fragments                |  |                                |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 376               | 1970 Oct 30.56<br>12.71 days<br>1970 Nov 12.27 | Sphere-<br>cylinder<br>6300?   | 6.5 long?<br>2.4 dia | 1970 Oct 31.9<br>1970 Nov 10.3 | 65.38<br>65.42            | 89.43<br>89.23     | 6625<br>6616         | 207<br>203          | 286<br>272         | 0.006<br>0.005       | 73<br>65                  |
| Cosmos 376<br>rocket     | 1970 Oct 30.56<br>5.61 days<br>1970 Nov 5.17   | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1970 Oct 31.8                  | 65.40                     | 89.22              | 6614                 | 209                 | 263                | 0.004                | 62                        |
| Cosmos 376<br>engine**   | 1970 Oct 30.56<br>21 days<br>1970 Nov 20       | Cone<br>600? full              | 1.5 long?<br>2 dia?  | 1970 Nov 15.6                  | 65.36                     | 88.67              | 6588                 | 192                 | 228                | 0.003                | 70                        |
| INERS 1†<br>[Titan 3C]   | 1970 Nov 6.44<br>1 million<br>years            | Cylinder<br>+ 4 panels<br>820? | 6 long?<br>2.5 dia?  | 1970 Nov 7.1<br>1970 Dec 1.0   | 26.29<br>7.8              | 635.1<br>1197.1    | 24473<br>37346       | 300<br>26050        | 35890<br>35886     | 0.727<br>0.132       | 180<br>-                  |
| Transstage               | 1970 Nov 6.44<br>million years                 | Cylinder<br>1500?              | 6 long?<br>3 dia     | Orbit similar to 1970-93A      |                           |                    |                      |                     |                    |                      |                           |
| Titan 3C<br>second stage | 1970 Nov 6.44<br>1.51 days<br>1970 Nov 7.95    | Cylinder<br>1900               | 6 long<br>3.0 dia    | 1970 Nov 7.1                   | 28.6                      | 89.15              | 6617                 | 147                 | 331                | 0.014                | 120                       |

\* 1970-91A passed close to 1970-87A on Oct 30.25.

\*\* Engine probably ejected about Nov 10.

† Integrated Missile Early Warning Satellite.

|   | 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 | Orbiting Frog                         | 1970 Nov 9.25                                   | Octagonal                       | 1.19 long             | 1970 Nov 11.1                  | 37.41                     | 92.64              | 6789                 | 304                 | 518                | 0.016                | 134                       |
| B | Qtolith 1<br>[Scout]                  | 180.96 days<br>1971 May 9.21                    | cylinder<br>133                 | 0.76 dia              | 1971 Feb 1.0                   | 37.41                     | 91.86              | 6750                 | 278                 | 466                | 0.014                | -                         |
| D | Radiation Meteoroid<br>- OFO 1 rocket | 1970 Nov 9.25<br>90.15 days<br>1971 Feb 7.40    | Cylinder<br>45<br>(payload 21)  | 1.68 long<br>0.76 dia | 1970 Nov 11.1                  | 37.41                     | 92.71              | 6793                 | 303                 | 526                | 0.016                | 133                       |
| D | Fragments                             | 1970-94C-E                                      |                                 |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Luna 17<br>launcher rocket            | 1970 Nov 10.61<br>2.96 days<br>1970 Nov 13.57   | Cylinder<br>4000?               | 12 long?<br>4 dia     | 1970 Nov 11.5                  | 51.53                     | 88.57              | 6584                 | 184                 | 228                | 0.003                | 299                       |
| D | Luna 17<br>launcher                   | 1970 Nov 10.61<br>3.00 days<br>1970 Nov 13.61   | -                               | -                     | 1970 Nov 10.8                  | 51.55                     | 88.73              | 6593                 | 192                 | 237                | 0.003                | 296                       |
| D | Cosmos 377                            | 1970 Nov 11.39<br>11.9 days<br>1970 Nov 23.3    | Sphere-<br>cylinder<br>5700?    | 5.0 long<br>2.4 dia   | 1970 Nov 11.8                  | 64.99                     | 89.40              | 6623                 | 204                 | 286                | 0.006                | 44                        |
| D | Cosmos 377<br>rocket                  | 1970 Nov 11.39<br>5.49 days<br>1970 Nov 16.88   | Cylinder<br>2500?               | 7.5 long<br>2.6 dia   | 1970 Nov 11.4                  | 64.98                     | 89.36              | 6621                 | 201                 | 285                | 0.006                | 39                        |
| D | Cosmos 378*                           | 1970 Nov 17.77<br>636.86 days<br>1972 Aug 17.63 | Octagonal<br>ellipsoid?<br>400? | 1.8 long?<br>1.5 dia? | 1970 Nov 20.0<br>1971 Oct 16.5 | 74.00<br>74.00            | 104.88<br>99.95    | 7366<br>7133         | 234<br>227          | 1742<br>1283       | 0.102<br>0.074       | 122<br>-                  |
| D | Cosmos 378<br>rocket                  | 1970 Nov 17.77<br>682.98 days<br>1972 Sep 30.75 | Cylinder<br>2200?               | 7.4 long<br>2.4 dia   | 1970 Nov 20.0<br>1971 Nov 16.0 | 74.00<br>74.00            | 104.75<br>99.99    | 7360<br>7135         | 233<br>222          | 1730<br>1292       | 0.102<br>0.075       | 121<br>-                  |

\* Ionospheric studies

Space Vehicle: Luna 17, 1970-95A

| 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 [Thorad Agena D] 1970-98A    | 1970 Nov 18.89<br>22.78 days<br>1970 Dec 11.67  | Cylinder<br>2000?     | 8 long?<br>1.5 dia    | 1970 Nov 21.0  | 82.99                                     | 88.70                                      | 6587                                   | 185                             | 232                                  | 0.004                                     | 164                       |
| D Capsule* 1970-98B            | 1970 Nov 18.89<br>24.92 days<br>1977 Sep 14     | Octagon?<br>60?       | 0.3 long?<br>0.9 dia? | 1970 Nov 20.6<br>1972 Sep 1.0  | 83.18<br>83.18                            | 94.63<br>93.95                             | 6877<br>6844                           | 487<br>455                      | 511<br>477                           | 0.002<br>0.002                            | 258<br>-                  |
| Cosmos 379 1970-99A            | 1970 Nov 24.22<br>11 years                      | -                     | -                     | 1970 Nov 24.9<br>1970 Nov 25.9<br>1970 Nov 30.2<br>1973 Jun 1.0<br>1970 Nov 24.9 | 51.62<br>51.62<br>51.69<br>51.70<br>51.61 | 88.67<br>98.73<br>259.64<br>225.2<br>88.46 | 6590<br>7078<br>13483<br>12262<br>6580 | 192<br>190<br>175<br>174<br>189 | 232<br>1210<br>14035<br>11593<br>214 | 0.003<br>0.072<br>0.514<br>0.466<br>0.002 | 80<br>62<br>72<br>-<br>59 |
| D Cosmos 379 rocket 1970-99B   | 1970 Nov 24.22<br>2.34 days<br>1970 Nov 26.56   | Cylinder<br>2500?     | 7.5 long<br>2.6 dia   | 1970 Nov 27.4  | 51.52                                     | 98.58                                      | 7071                                   | 187                             | 1198                                 | 0.071                                     | 67                        |
| D Cosmos 379 platform 1970-99C | 1970 Nov 24.22<br>81 days<br>1971 Feb 13        | -                     | -                     | 1970 Nov 25.2<br>1971 Mar 1.0  | 81.95<br>81.95                            | 102.15<br>98.39                            | 7238<br>7059                           | 199<br>195                      | 1520<br>1167                         | 0.091<br>0.069                            | 73<br>-                   |
| D Fragment 1970-99D            | 1970 Nov 24.46<br>205.43 days<br>1971 Jun 17.89 | Ellipsoid<br>400?     | 1.8 long<br>1.2 dia   | 1970 Nov 25.8<br>1971 Feb 1.0  | 81.96<br>81.96                            | 101.93<br>98.40                            | 7227<br>7060                           | 197<br>193                      | 1501<br>1170                         | 0.090<br>0.069                            | 71<br>-                   |
| D Cosmos 380 1970-100A         | 1970 Nov 24.46<br>135.76 days<br>1971 Apr 9.22  | Cylinder<br>1500?     | 8 long<br>1.65 dia    |  |   |  |  |                                 |                                      |   |                           |
| D Cosmos 380 rocket 1970-100B  |   |                       |                       |  |   |  |  |                                 |                                      |   |                           |

\* 1970-98B ejected from 1970-98A on 1970 Nov 18.96.

| 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 MoIniya IR 1970-101A                    | 1970 Nov 27.66<br>1824 days<br>1975 Nov 25     | Windmill *<br>6 vanes<br>1000? | 3.4 long<br>1.6 dia | 1970 Nov 29.2<br>1971 Jan 1.0<br>1973 Feb 1.0 | 65.48<br>65.49<br>65.50   | 707.09<br>717.81<br>717.73 | 26292<br>26557<br>26555 | 471<br>463<br>1379  | 39356<br>39895<br>38975 | 0.740<br>0.742<br>0.708 | 285<br>-<br>-             |
| D MoIniya IR 1970-101B<br>launcher rocket | 1970 Nov 27.66<br>13.69 days<br>1970 Dec 11.35 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia | 1970 Nov 28.8                                 | 65.42                     | 90.61                      | 6683                    | 213                 | 397                     | 0.014                   | 51                        |
| D MoIniya IR 1970-101C<br>launcher        | 1970 Nov 27.66<br>20.08 days<br>1970 Dec 17.74 | Irregular                      | -                   | 1970 Nov 29.5                                 | 65.39                     | 91.02                      | 6703                    | 216                 | 434                     | 0.016                   | 60                        |
| D MoIniya IR 1970-101D<br>rocket          | 1970 Nov 27.66<br>1862 days<br>1976 Jan 2      | Cylinder<br>440                | 2.0 long<br>2.0 dia | 1970 Nov 30.6<br>1973 Feb 1.0                 | 65.41<br>65.46            | 702.99<br>702.97           | 26190<br>26190          | 412<br>1350         | 39212<br>38273          | 0.741<br>0.705          | 285<br>-                  |
| Cosmos 381* 1970-102A                     | 1970 Dec 2.17<br>1200 years                    | Cylinder *<br>boom<br>700?     | 1.4 long<br>2.0 dia | 1970 Dec 7.6                                  | 74.04                     | 104.93                     | 7369                    | 968                 | 1013                    | 0.003                   | 270                       |
| Cosmos 381 1970-102B<br>rocket            | 1970 Dec 2.17<br>600 years                     | Cylinder<br>2200?              | 7.4 long<br>2.4 dia | 1970 Dec 4.6                                  | 74.03                     | 104.82                     | 7364                    | 967                 | 1004                    | 0.002                   | 263                       |
| Fragments 1970-102C-F                     |  |                                |                     |   |                           |                            |                         |                     |                         |                         |                           |
| Cosmos 382 1970-103A                      | 1970 Dec 2.69<br>1000 years                    | Sphere?                        | 5 dia?              | 1970 Dec 4.5<br>1970 Dec 7.4<br>1970 Dec 8.0  | 51.54<br>51.55<br>55.87   | 142.82<br>158.93<br>171.06 | 9053<br>9722<br>10,208  | 305<br>1615<br>2577 | 5045<br>5072<br>5082    | 0.262<br>0.178<br>0.123 | 261<br>258<br>248         |
| Cosmos 382 1970-103B<br>rocket            | 1970 Dec 2.69<br>30000 years                   | Cylinder<br>4000?              | 12 long?<br>4 dia   | 1970 Dec 5.1<br>1971 Jan 1.0                  | 51.53<br>51.54            | 144.07<br>158.74           | 9105<br>9714            | 409<br>1590         | 5045<br>5081            | 0.255<br>0.180          | 261<br>285                |
| Cosmos 382 1970-103C<br>platform          | 1970 Dec 2.69<br>30000 years                   | -                              | -                   | 1970 Dec 14.4                                 | 51.59                     | 159.07                     | 9727                    | 1614                | 5084                    | 0.178                   | 266                       |
| Fragments 1970-103D-F                     |  |                                |                     |   |                           |                            |                         |                     |                         |                         |                           |

2d

\* Topside ionospheric sounder

Year of launch 1970 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 383*                                | 1970 Dec 3.58                          | Sphere-cylinder 6300? | 6.5 long?<br>2.4 dia     | 1970 Dec 4.7                  | 65.41                     | 89.33              | 6620                 | 204                 | 279                | 0.006                | 57                        |
| R |  | 12.69 days<br>1970 Dec 16.27           |                       |                          | 1970 Dec 14.1                 | 65.42                     | 89.53              | 6630                 | 181                 | 323                | 0.011                | 53                        |
| D | Cosmos 383 rocket                          | 1970 Dec 3.58                          | Cylinder 2500?        | 7.5 long<br>2.6 dia      | 1970 Dec 4.4                  | 65.40                     | 89.15              | 6611                 | 200                 | 266                | 0.005                | 55                        |
| R |  | 6.12 days<br>1970 Dec 9.70             |                       |                          |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 384                                 | 1970 Dec 10.47                         | Sphere-cylinder 5900? | 5.9 long<br>2.4 dia      | 1970 Dec 11.5                 | 72.88                     | 89.46              | 6626                 | 203                 | 292                | 0.007                | 57                        |
| R |  | 11.80 days<br>1970 Dec 22.27           |                       |                          |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 384 rocket                          | 1970 Dec 10.47                         | Cylinder 2500?        | 7.5 long<br>2.6 dia      | 1970 Dec 12.4                 | 72.89                     | 89.16              | 6610                 | 195                 | 268                | 0.005                | 41                        |
| R |  | 5.31 days<br>1970 Dec 15.78            |                       |                          |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Capsule**                                  | 1970 Dec 10.47                         | Ellipsoid 200?        | 0.9 long<br>1.9 dia      | 1970 Dec 18.3                 | 72.88                     | 89.27              | 6616                 | 204                 | 271                | 0.005                | 44                        |
| R |  | 17 days<br>1970 Dec 27                 |                       |                          |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Fragments                                  | 1970-105C,D                            |                       |                          |                               |                           |                    |                      |                     |                    |                      |                           |
|   | NOAA 1 †<br>(ITOS)                         | 1970 Dec 11.42<br>10000 years          | Box 306               | 1.25 long<br>1.02 square | 1970 Dec 20.9                 | 101.94                    | 114.93             | 7829                 | 1429                | 1473               | 0.003                | 237                       |
|   | NOAA 1 second stage (CEP 1) ††<br>Fragment | 1970 Dec 11.48<br>5000 years           | Cylinder 350?         | 4.9 long<br>1.43 dia     | 1970 Dec 24.9                 | 101.92                    | 114.91             | 7828                 | 1425                | 1475               | 0.003                | 225                       |

\* Cosmos 383 manoeuvred, but the jettisoned engine was apparently not tracked or designated.

\*\* 1970-105E ejected from 1970-105A on 1970 Dec 17.6

† National Oceanic and Atmospheric Administration  
 †† Cylindrical Electrostatic Probe



Year of launch 1970 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<br>R | Cosmos 386 †               | 1970 Dec 15.42<br>12.9 days<br>1970 Dec 28.3    | Sphere-cylinder<br>6300?       | 6.5 long?<br>2.4 dia | 1970 Dec 16.5                 | 64.99                     | 89.40              | 6624                 | 215                 | 276                | 0.005                | 52                        |
| D      | Cosmos 386<br>rocket       | 1970 Dec 15.42<br>3.88 days<br>1970 Dec 19.30   | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1970 Dec 16.2                 | 65.01                     | 88.91              | 6599                 | 196                 | 245                | 0.004                | 8                         |
| D      | Cosmos 386<br>engine*      | 1970 Dec 15.42<br>19 days<br>1971 Jan 3         | Cone<br>600? full              | 1.5 long?<br>2 dia?  | 1970 Dec 29.6                 | 64.99                     | 89.77              | 6642                 | 213                 | 315                | 0.008                | 40                        |
| D      | Fragments<br>1970-110C,D,F |   |                                |                      |                               |                           |                    |                      |                     |                    |                      |                           |
|        | Cosmos 387                 | 1970 Dec 16.19<br>10 years                      | Cylinder +<br>paddles?<br>900? | 2 long?<br>1 dia?    | 1970 Dec 24.0                 | 74.01                     | 95.31              | 6911                 | 528                 | 538                | 0.0008               | 6                         |
|        | Cosmos 387<br>rocket       | 1970 Dec 16.19<br>10 years                      | Cylinder<br>2200?              | 7.4 long<br>2.4 dia  | 1970 Dec 24.0                 | 74.01                     | 95.13              | 6902                 | 513                 | 535                | 0.002                | 31                        |
| D      | Fragments<br>1970-111C-E   |   |                                |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D      | Cosmos 388                 | 1970 Dec 18.40<br>143.40 days<br>1971 May 10.80 | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia  | 1970 Dec 20.3<br>1971 Mar 1.0 | 70.95<br>70.95            | 92.32<br>91.51     | 6766<br>6726         | 271<br>257          | 505<br>439         | 0.017<br>0.014       | 78<br>-                   |
| D      | Cosmos 388<br>rocket       | 1970 Dec 18.40<br>61.35 days<br>1971 Feb 17.75  | Cylinder<br>1500?              | 8 long<br>1.65 dia   | 1970 Dec 20.4                 | 70.96                     | 92.18              | 6759                 | 268                 | 494                | 0.017                | 79                        |

† Manoeuvrable

\*1970-110E ejected from 1970-110A about 1970 Dec 28.



| 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<br>R<br>Cosmos 390 †          | 1971 Jan 12.40<br>12.83 days<br>1971 Jan 25.23  | Sphere-cylinder<br>6300?       | 6.5 long?<br>2.4 dia | 1971 Jan 14.1                 | 65.01                     | 89.28              | 6618                 | 204                 | 275                | 0.005                | 49                        |
| D<br>Cosmos 390<br>rocket       | 1971 Jan 12.40<br>5.05 days<br>1971 Jan 17.45   | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1971 Jan 13.2                 | 65.02                     | 89.13              | 6610                 | 202                 | 262                | 0.004                | 44                        |
| D<br>Cosmos 390<br>engine*      | 1971 Jan 12.40<br>20 days<br>1971 Feb 1         | Cone<br>600? full              | 1.5 long?<br>2 dia?  | 1971 Jan 23.8                 | 65.02                     | 89.06              | 6607                 | 204                 | 253                | 0.004                | 61                        |
| D<br>Fragments<br>1971-01D-F    |   |                                |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D<br>Cosmos 391                 | 1971 Jan 14.50<br>402.57 days<br>1972 Feb 21.07 | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia  | 1971 Jan 15.5<br>1971 Aug 1.0 | 70.91<br>70.91            | 95.31<br>93.54     | 6913<br>6827         | 267<br>256          | 803<br>641         | 0.039<br>0.028       | 86<br>-                   |
| D<br>Cosmos 391<br>rocket       | 1971 Jan 14.50<br>218.62 days<br>1971 Aug 21.12 | Cylinder<br>1500?              | 8 long<br>1.65 dia   | 1971 Jan 15.8<br>1971 May 1.0 | 70.92<br>70.92            | 95.20<br>93.33     | 6908<br>6816         | 267<br>253          | 792<br>623         | 0.038<br>0.027       | 86<br>-                   |
| D<br>Meteor 7<br>1971-03A       | 1971 Jan 20.48<br>60 years                      | Cylinder *<br>2 vanes<br>2200? | 5 long?<br>1.5 dia?  | 1971 Feb 1.0                  | 81.21                     | 97.60              | 7021                 | 629                 | 656                | 0.002                | 5                         |
| D<br>Meteor 7<br>rocket         | 1971 Jan 20.48<br>60 years                      | Cylinder<br>1440               | 3.8 long<br>2.6 dia  | 1971 Jan 28.6                 | 81.22                     | 97.76              | 7029                 | 564                 | 737                | 0.012                | 139                       |
| 1d<br>Fragments**<br>1971-00A-E |   |                                |                      |                               |                           |                    |                      |                     |                    |                      |                           |

\*1971-01C ejected from 1971-01A about 1971 Jan 23.7.

† Maneuverable  
\*\*These unidentified fragments were discovered in orbit, and catalogued on 1971 Feb 9 (A,B,C) and 1971 Jun 30 (D,E). 1971-00D decayed 1973 Jun 26.

## Year of launch 1971, continued

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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<br>R | Cosmos 392            | 1971 Jan 21.36<br>11.83 days<br>1971 Feb 2.19   | Sphere-cylinder<br>5700?           | 5.0 long<br>2.4 dia   | 1971 Jan 23.2                                  | 64.99                     | 89.32                     | 6619                    | 204                   | 278                     | 0.006                    | 45                        |
| D      | Cosmos 392<br>rocket  | 1971 Jan 21.36<br>5 days<br>1971 Jan 26         | Cylinder<br>2500?                  | 7.5 long<br>2.6 dia   | 1971 Jan 22.4                                  | 65.00                     | 89.17                     | 6612                    | 198                   | 270                     | 0.005                    | 20                        |
| D      | [Titan 3B<br>Agena D] | 1971 Jan 21.77<br>19 days<br>1971 Feb 9         | Cylinder<br>3000?                  | 8 long?<br>1.5 dia    | 1971 Jan 21.9                                  | 110.86                    | 90.09                     | 6657                    | 139                   | 418                     | 0.021                    | 144                       |
| D      | Fragments             | 1971-05B,C                                      |                                    |                       |  |                           |                           |                         |                       |                         |                          |                           |
|        | Intelsat 4A (F-2)     | 1971 Jan 26.03<br>> million years               | Cylinder<br>1410 full<br>707 empty | 2.82 long<br>2.39 dia | 1971 Jan 26.1<br>1971 Feb 17.2<br>1971 Apr 1.0 | 28.25<br>0.55<br>0.55     | 638.7<br>1450.8<br>1436.1 | 24553<br>42453<br>42165 | 548<br>35801<br>35779 | 35801<br>36349<br>35794 | 0.718<br>0.006<br>0.0002 | 179<br>59<br>-            |
|        | Intelsat 4A<br>rocket | 1971 Jan 26.03<br>7000 years                    | Cylinder<br>1815                   | 8.6 long<br>3.0 dia   | 1971 Feb 4.3                                   | 28.20                     | 654.5                     | 24966                   | 597                   | 36578                   | 0.721                    | 184                       |
| D      | Cosmos 393            | 1971 Jan 26.53<br>140.86 days<br>1971 Jun 16.39 | Ellipsoid<br>400?                  | 1.8 long<br>1.2 dia   | 1971 Jan 28.4<br>1971 Apr 1.0                  | 71.03<br>71.03            | 92.13<br>91.29            | 6757<br>6716            | 272<br>257            | 485<br>418              | 0.016<br>0.012           | 77<br>-                   |
| D      | Cosmos 393<br>rocket  | 1971 Jan 26.53<br>63.81 days<br>1971 Mar 31.34  | Cylinder<br>1500?                  | 8 long<br>1.65 dia    | 1971 Jan 27.9                                  | 71.03                     | 92.03                     | 6752                    | 271                   | 476                     | 0.015                    | 82                        |

| 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<br>3M<br>R<br>Apollo 14**      | 1971-08A<br>1971 Jan 31.88<br>9.00 days<br>1971 Feb 9.88 | Cone-cylinder<br>29229<br>initially             | 11.15 long<br>3.91 dia              | 1971 Jan 31.9<br>1971 Feb 1.1<br>In selenocentric orbit 1971 Feb 4.29 to Feb 7.07                    | 32.56<br>33.2             | 88.07<br>26320            | 6564<br>292520          | 186<br>200            | 186<br>572080           | 0<br>0.977               | -<br>30*                  |
| D<br>Saturn IV B<br>[Saturn 509] | 1971-08B<br>1971 Jan 31.88<br>3.44 days<br>1971 Feb 4.32 | Cylinder<br>13990                               | 18.7 long<br>6.6 dia                | 1971 Jan 31.9<br>1971 Feb 1.1<br>Crashed on Moon 1971 Feb 4.32                                       | 32.56<br>33.2             | 88.07<br>26320            | 6564<br>292520          | 186<br>200            | 186<br>572080           | 0<br>0.977               | -<br>30*                  |
| D<br>LEM 8<br>descent stage      | 1971-08D<br>1971 Jan 31.88<br>4.51 days<br>1971 Feb 5.39 | Octagon +<br>4 legs<br>10420 full<br>2139 empty | 1.57 high<br>3.13 wide              | 1971 Feb 1.1<br>Entered selenocentric orbit 1971 Feb 4.29<br>Landed on Moon 1971 Feb 5.39            | 33.2                      | 26320                     | 292520                  | 200                   | 572080                  | 0.977                    | 30*                       |
| D<br>LEM 8†<br>ascend stage      | 1971-08C<br>1971 Jan 31.88<br>6.15 days<br>1971 Feb 7.03 | Box + tanks<br>4857 full<br>2128 empty          | 2.52 high<br>3.76 wide<br>3.13 deep | 1971 Feb 1.1<br>On Moon's surface 1971 Feb 5.39 to Feb 6.78<br>Finally crashed on Moon 1971 Feb 7.03 | 33.2                      | 26320                     | 292520                  | 200                   | 572080                  | 0.977                    | 30*                       |
| 1d<br>NATO 2                     | 1971-09A<br>1971 Feb 3.07<br>> million years             | Cylinder<br>243 full<br>129 empty               | 0.81 long<br>1.37 dia               | 1971 Feb 15.0<br>1971 Mar 15.0<br>1975 May 1.0   | 27.83<br>2.8<br>0.8       | 587.5<br>1403.4<br>1436.3 | 23238<br>41523<br>42168 | 299<br>34429<br>35778 | 33420<br>35860<br>35802 | 0.713<br>0.017<br>0.0003 | 249*<br>-<br>-            |
| NATO 2<br>rocket                 | 1971-09B<br>1971 Feb 3.07<br>20 years                    | Sphere-cone<br>66                               | 1.32 long<br>0.94 dia               | 1971 Mar 1.0   | 25.9                      | 665.0                     | 25236                   | 283                   | 37433                   | 0.736                    | -                         |
| Fragments<br>Cosmos 394          | 1971-09C,D<br>1971-10A<br>1971 Feb 9.79<br>40 years      | Cylinder?                                       | 4 long?<br>2 dia?                   | 1971 Feb 12.2  | 65.84                     | 96.54                     | 6971                    | 572                   | 614                     | 0.003                    | 352                       |
| Cosmos 394<br>rocket             | 1971-10B<br>1971 Feb 9.79<br>30 years                    | Cylinder<br>2200?                               | 7.4 long<br>2.4 dia                 | 1971 Feb 16.3  | 65.84                     | 96.43                     | 6966                    | 564                   | 612                     | 0.003                    | 357                       |
| Fragment                         | 1971-10C   |   |                                     |  |                           |                           |                         |                       |                         |                          |                           |

\*Approximate orbits.

\*\*Apollo attached to LEM, separated from Saturn IVB on Feb 1.13.

† LEM with two crew members, separated from Apollo on Feb 5.20.

Ascend stage relaunched from Moon Feb 6.78; briefly docked with Apollo Feb 6.86.

| 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) |
|----------------------|--|--------------------------------|----------------------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Tansei*<br>[Mu 4S]   | 1971 Feb 16.17<br>1000 years           | 26-sided cylinder<br>62        | 0.83 long<br>0.71 dia            | 1971 Mar 1.7                  | 29.66                     | 105.95             | 7422                 | 984                 | 1103               | 0.008                | 219                       |
| Tansei rocket        | 1971 Feb 16.17<br>500 years            | Sphere-cone<br>90?             | 1.86 long<br>0.79 dia            | 1971 May 1.0                  | 29.66                     | 104.74             | 7361                 | 973                 | 993                | 0.001                | -                         |
| Fragment             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| [Thor Burner 2]      | 1971 Feb 17.16<br>80 years             | 12-faced frustum<br>195        | 1.64 long<br>1.31 to<br>1.10 dia | 1971 Feb 28.0                 | 98.83                     | 100.86             | 7176                 | 763                 | 833                | 0.005                | 327                       |
| Burner 2 rocket      | 1971 Feb 17.16<br>60 years             | Sphere-cone<br>66              | 1.32 long<br>0.94 dia            | 1971 Feb 19.0                 | 98.78                     | 100.96             | 7181                 | 779                 | 827                | 0.003                | 0                         |
| Calsphere 3**        | 1971 Feb 17.16<br>25 years             | Sphere<br>(Aluminium)<br>0.73  | 0.26 dia                         | 1971 Feb 28.0                 | 98.84                     | 100.89             | 7178                 | 765                 | 834                | 0.005                | 331                       |
| Calsphere 4          | 1971 Feb 17.16<br>25 years             | Sphere<br>(Aluminium)<br>0.73  | 0.26 dia                         | 1971 Feb 19.0                 | 98.84                     | 100.86             | 7176                 | 763                 | 833                | 0.005                | 353                       |
| Calsphere 5          | 1971 Feb 17.16<br>25 years             | Sphere<br>(Gold)<br>0.73       | 0.26 dia                         | 1971 Feb 27.9                 | 98.82                     | 100.95             | 7181                 | 773                 | 832                | 0.004                | 328                       |
| Cosmos 395           | 1971 Feb 17.88<br>10 years             | Cylinder +<br>paddles?<br>900? | 2 long?<br>1 dia?                | 1971 Mar 2.3                  | 74.04                     | 95.41              | 6916                 | 529                 | 546                | 0.001                | 48                        |
| Cosmos 395<br>rocket | 1971 Feb 17.88<br>10 years             | Cylinder<br>2200?              | 7.4 long<br>2.4 dia              | 1971 Feb 25.4                 | 74.03                     | 95.30              | 6910                 | 519                 | 545                | 0.002                | 48                        |
| Fragments            |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-11A             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-11B             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-11C             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-12A             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-12B             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-12C             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-12D             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-12E             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-13A             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-13B             |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| 1971-13C-E           |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |

\*Japanese satellite.

\*\* Calibration sphere.

Year of launch 1971, 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 396             | 1971 Feb 18.59<br>12.70 days<br>1971 Mar 3.29 | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1971 Feb 20.4<br>1971 Feb 25.8 | 65.42<br>65.42            | 89.40<br>89.30     | 6624<br>6619         | 205<br>189          | 286<br>292         | 0.006<br>0.008       | 63<br>37                  |
| D  | Cosmos 396<br>rocket   | 1971 Feb 18.59<br>6.98 days<br>1971 Feb 25.57 | Cylinder<br>2500?        | 7.5 long<br>2.6 dia  | 1971 Feb 20.4                  | 65.40                     | 89.18              | 6613                 | 206                 | 263                | 0.004                | 61                        |
| D  | Cosmos 396<br>engine*  | 1971 Feb 18.59<br>18 days<br>1971 Mar 8       | Cone<br>600? full        | 1.5 long?<br>2 dia?  | 1971 Mar 3.4                   | 65.42                     | 89.00              | 6604                 | 179                 | 272                | 0.007                | 33                        |
| D  | Fragments              | 1971-14C,D,F                                  |                          |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D  | Cosmos 397**           | 1971 Feb 25.47<br>150 years                   | Cylinder?                | 4 long?<br>2 dia?    | 1971 Mar 6.6                   | 65.73                     | 113.51             | 7766                 | 574                 | 2202               | 0.105                | 47                        |
| D  | Cosmos 397<br>rocket   | 1971 Feb 25.47<br>6.78 days<br>1971 Mar 4.25  | Cylinder<br>1500?        | 8 long?<br>2.5 dia?  | 1971 Feb 26.9                  | 65.10                     | 92.11              | 6757                 | 144                 | 613                | 0.035                | 53                        |
| 5d | Fragments              | 1971-15C-CH                                   |                          |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D  | Cosmos 398             | 1971 Feb 26.22<br>20 years                    | -                        | -                    | 1971 Feb 28.1<br>1971 Feb 28.4 | 51.61<br>51.59            | 88.86<br>216.13    | 6599<br>11931        | 189<br>203          | 252<br>10903       | 0.005<br>0.449       | 75<br>81                  |
| D  | Cosmos 398<br>rocket   | 1971 Feb 26.22<br>3.12 days<br>1971 Mar 1.34  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia  | 1971 Feb 26.9                  | 51.61                     | 88.69              | 6591                 | 186                 | 239                | 0.004                | 58                        |
| D  | Cosmos 398<br>platform | 1971 Feb 26.22<br>75 days<br>1971 May 12      | -                        | -                    | 1971 Mar 6.8                   | 51.60                     | 98.47              | 7065                 | 186                 | 1188               | 0.071                | 89                        |
| D  | Fragments              | 1971-16D,E                                    |                          |                      |                                |                           |                    |                      |                     |                    |                      |                           |

\*1971-14E ejected from 1971-14A about 1971 Mar 3.3.

\*\*1971-15A passed close to 1971-10A about 1971 Feb 25.60, then exploded.

|   | 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 399               | 1971 Mar 3.40                          | Sphere-cylinder 6300? | 6.5 long?<br>2.4 dia  | 1971 Mar 4.6                  | 65.00                     | 89.34              | 6620                 | 201                 | 283                | 0.006                | 36                        |
| R |                          | 13.84 days<br>1971 Mar 17.24           |                       |                       | 1971 Mar 10.9                 | 64.99                     | 90.86              | 6695                 | 196                 | 438                | 0.018                | -                         |
| D | Cosmos 399 rocket        | 1971 Mar 3.40                          | Cylinder 2500?        | 7.5 long<br>2.6 dia   | 1971 Mar 4.4                  | 65.01                     | 89.14              | 6611                 | 199                 | 266                | 0.005                | 30                        |
|   |                          | 5.09 days<br>1971 Mar 8.49             |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 399 engine*       | 1971 Mar 3.40                          | Cone 600? full        | 1.5 long?<br>2 dia?   | 1971 Mar 15.6                 | 64.99                     | 90.70              | 6687                 | 195                 | 423                | 0.017                | 34                        |
|   |                          | 22 days<br>1971 Mar 25                 |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Fragments                |  |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                          |  |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | China 2**                | 1971 Mar 3.51                          | Spheroid? 221         | 1 dia?                | 1971 Mar 5.0                  | 69.90                     | 106.18             | 7427                 | 268                 | 1830               | 0.105                | 191                       |
|   |                          | 8½ years                               |                       |                       | 1972 Oct 16.5                 | 69.89                     | 103.88             | 7320                 | 262                 | 1622               | 0.093                | -                         |
| D | China 2 rocket           | 1971 Mar 3.51                          | Cylinder              | -                     | 1971 Mar 13.5                 | 69.91                     | 106.10             | 7423                 | 265                 | 1825               | 0.105                | 180                       |
|   |                          | 1811 days<br>1976 Feb 16               |                       |                       | 1972 Mar 1.0                  | 69.89                     | 103.82             | 7317                 | 267                 | 1611               | 0.092                | -                         |
| D | Explorer 43 (Imp 8)      | 1971 Mar 13.68                         | 16-sided cylinder 288 | 1.82 long<br>1.36 dia | 1971 Mar 17.8                 | 28.80                     | 99.26              | 7099                 | 256                 | 1186               | 0.065                | -                         |
|   |                          | 1299 days<br>1974 Oct 2                |                       |                       | 1971 Mar 17.8                 | 28.80                     | 5956.1             | 108843               | 353                 | 204577             | 0.938                | 303                       |
| D | Explorer 43 second stage | 1971 Mar 13.68                         | Cylinder 350          | 4.9 long<br>1.43 dia  | 1971 Mar 13.8                 | 28.74                     | 92.22              | 6768                 | 237                 | 543                | 0.023                | 297                       |
|   |                          | 70.25 days<br>1971 May 22.93           |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Explorer 43 third stage  | 1971 Mar 13.68                         | Sphere-cone 66        | 1.32 long<br>0.94 dia | 1971 Mar 13.7                 | 28.75                     | 5628               | 104783               | 235                 | 196575             | 0.937                | 303                       |
|   |                          | 43 months?<br>1974 Oct?                |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Fragments                |  |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                          |  |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |

\* 1971-17C ejected from 1971-17A about 1971 Mar 15.2.

\*\*1971-18A and 1971-18B were probably joined until 1971 Mar 11.

| Name                             | Launch date, lifetime and descent date         | Shape and weight (kg)        | Size (m)             | Date of orbital determination                 | Orbital inclination (deg) | Modal period (min)      | Semi major axis (km)    | Perigee height (km) | Apogee height (km)      | Orbital eccentricity    | Argument of perigee (deg) |
|----------------------------------|--|------------------------------|----------------------|---|---------------------------|-------------------------|-------------------------|---------------------|-------------------------|-------------------------|---------------------------|
| Cosmos 400                       | 1971 Mar 18.91<br>1200 years                   | Cylinder?                    | 4 long?<br>2 dia?    | 1971 Mar 20.3                                 | 65.83                     | 104.99                  | 7373                    | 983                 | 1006                    | 0.002                   | 267                       |
| Cosmos 400<br>rocket<br>Fragment | 1971 Mar 18.91<br>600 years                    | Cylinder<br>2200?            | 7-4 long<br>2-4 dia  | 1971 Mar 27.9                                 | 65.82                     | 104.88                  | 7367                    | 983                 | 995                     | 0.001                   | 250                       |
| SDS-A †<br>[Titan 3B Agena D]    | 1971 Mar 21.16<br>12 years?                    | Cylinder?                    | -                    | 1971 Mar 21.4                                 | 63.19                     | 596.7                   | 23473                   | 390                 | 33800                   | 0.711                   | -                         |
| SDS-A<br>rocket                  | 1971 Mar 21.16<br>12 years?                    | Cylinder<br>700?             | 6 long?<br>1.5 dia   | 1971 May 19.6<br>1973 Dec 1.0<br>1975 Jan 1.0 | 63.19<br>63.0<br>63.02    | 700.5<br>700.1<br>700.1 | 26128<br>26118<br>26120 | 310<br>1148<br>931  | 39190<br>38332<br>38552 | 0.744<br>0.712<br>0.720 | 270<br>-<br>-             |
| D                                | 1971 Mar 24.88<br>18.81 days<br>1971 Apr 12.69 | Cylinder<br>2000?            | 8 long?<br>1.5 dia   | 1971 Mar 25.5                                 | 81.52                     | 88.56                   | 6580                    | 157                 | 246                     | 0.007                   | 136                       |
| D                                | 1971 Mar 27.46<br>12.81 days                   | Sphere-<br>cylinder<br>6300? | 6-5 long?<br>2-4 dia | 1971 Mar 31.1<br>1971 Apr 2.4<br>1971 Apr 3.7 | 72.83<br>72.84<br>72.83   | 89.26<br>89.85<br>90.40 | 6616<br>6645<br>6672    | 185<br>185<br>186   | 290<br>348<br>401       | 0.008<br>0.012<br>0.016 | 45<br>49<br>50            |
| D                                | 1971 Mar 27.46<br>5.94 days<br>1971 Apr 2.40   | Cylinder<br>2500?            | 7-5 long<br>2-6 dia  | 1971 Mar 28.7                                 | 72.84                     | 89.31                   | 6618                    | 197                 | 283                     | 0.006                   | 47                        |
| D                                | 1971 Mar 27.46<br>20 days<br>1971 Apr 16       | Cone<br>600? full            | 1-5 long?<br>2 dia?  | 1971 Apr 8.7                                  | 72.83                     | 90.26                   | 6665                    | 183                 | 390                     | 0.015                   | 39                        |
| D                                | 1971-230,E                                     | Fragments                    |                      |   |                           |                         |                         |                     |                         |                         |                           |

† 1971-23C ejected from 1971-23A about 1971 Apr 8.4.

† Satellite Data System.

|   | 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 | Isis 2<br>1971-24A                 | 1971 Apr 1.12<br>8000 years                  | Polyhedron<br>264            | 1.22 long<br>1.27 dia | 1971 Apr 9.9                  | 88.15                     | 113.67             | 7772                 | 1358                | 1429               | 0.005                | 120                       |
|   | Isis 2<br>rocket<br>1971-24B       | 1971 Apr 1.12<br>5000 years                  | Cylinder<br>24               | 1.50 long<br>0.46 dia | 1971 Apr 4.1                  | 88.16                     | 113.63             | 7770                 | 1355                | 1428               | 0.005                | 129                       |
|   | Fragment<br>1971-24C               |  |                              |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   | Cosmos 402 †<br>1971-25A           | 1971 Apr 1.48<br>600 years                   | Cone-<br>cylinder            | 6 long?<br>2 dia?     | 1971 Apr 1.5<br>1971 Apr 9.6  | 64.97<br>64.98            | 89.71<br>104.94    | 6639<br>7370         | 247<br>948          | 274<br>1036        | 0.002<br>0.005       | 231<br>264                |
| D | Cosmos 402<br>platform<br>1971-25B | 1971 Apr 1.48<br>35.10 days<br>1971 May 6.58 | Irregular                    | -                     | 1971 Apr 3.6                  | 64.97                     | 89.59              | 6633                 | 247                 | 263                | 0.001                | 229                       |
| D | Cosmos 402<br>rocket<br>1971-25C   | 1971 Apr 1.48<br>5 days<br>1971 Apr 6        | Cylinder<br>1500?            | 8 long?<br>2.5 dia?   | 1971 Apr 2.3                  | 64.96                     | 89.46              | 6627                 | 239                 | 258                | 0.001                | 271                       |
| D | Fragment<br>1971-25D               |  |                              |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 403<br>1971-26A             | 1971 Apr 2.35<br>11.8 days<br>1971 Apr 14.2  | Sphere-<br>cylinder<br>5700? | 5.0 long<br>2.4 dia   | 1971 Apr 4.1                  | 81.34                     | 88.96              | 6600                 | 214                 | 230                | 0.001                | 1                         |
| R |                                    |  |                              |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 403<br>rocket<br>1971-26B   | 1971 Apr 2.35<br>3.27 days<br>1971 Apr 5.62  | Cylinder<br>2500?            | 7.5 long<br>2.6 dia   | 1971 Apr 3.1                  | 81.33                     | 88.81              | 6593                 | 201                 | 228                | 0.002                | 346                       |
| D | Cosmos 404*<br>1971-27A            | 1971 Apr 4.60<br>0.4 day ?<br>1971 Apr 4?    | Cylinder?                    | 4 long?<br>2 dia?     | 1971 Apr 4.7<br>1971 Apr 5.4  | 65.74<br>65.15            | 103.12<br>94.22    | 7284<br>6862         | 802<br>169          | 1010<br>799        | 0.014<br>0.046       | 245<br>50                 |
| D | Cosmos 404<br>rocket<br>1971-27B   | 1971 Apr 4.60<br>7.44 days<br>1971 Apr 12.04 | Cylinder<br>1500?            | 8 long?<br>2.5 dia?   | 1971 Apr 5.6                  | 65.08                     | 92.34              | 6768                 | 148                 | 632                | 0.036                | 53                        |
| D | Fragments<br>1971-27C,D            |  |                              |                       |                               |                           |                    |                      |                     |                    |                      |                           |

\*Cosmos 404 passed close to Cosmos 400 about 1971 Apr 4.63, then de-orbited over ocean†

† 1971-25B and 25C attached to 1971-25A until orbit change.

|    | 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) |
|----|----------------------------|---|--------------------------------|------------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
|    | Cosmos 405                 | 1971 Apr 7, 30<br>60 years                      | Cylinder +<br>2 vanes<br>2500? | 5 long?<br>1.5 dia?    | 1971 Apr 8, 0                 | 81.24                     | 98.33              | 7056                 | 673                 | 683                | 0.001                | 139                       |
|    | Cosmos 405<br>rocket       | 1971 Apr 7, 30<br>60 years                      | Cylinder<br>1440               | 3.8 long<br>2.6 dia    | 1971 Apr 10, 3                | 81.25                     | 98.43              | 7061                 | 616                 | 749                | 0.009                | 180                       |
| 1d | Fragments                  |   |                                |                        |                               |                           |                    |                      |                     |                    |                      |                           |
|    | Cosmos 406 †               | 1971 Apr 14, 34<br>9.9 days<br>1971 Apr 24, 2   | Sphere-<br>cylinder<br>6300?   | 6.5 long?<br>2.4 dia   | 1971 Apr 14, 4                | 81.31                     | 89.16              | 6610                 | 217                 | 246                | 0.002                | 33                        |
| D  | Cosmos 406<br>rocket       | 1971 Apr 14, 34<br>3.62 days<br>1971 Apr 17, 96 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia    | 1971 Apr 14, 7                | 81.32                     | 89.02              | 6603                 | 211                 | 238                | 0.002                | 20                        |
| D  | Cosmos 406<br>engine*      | 1971 Apr 14, 34<br>14 days<br>1971 Apr 28       | Cone<br>600? full              | 1.5 long?<br>2 dia?    | 1971 Apr 25, 8                | 81.31                     | 88.31              | 6588                 | 184                 | 195                | 0.001                | -                         |
| D  | Fragments                  |   |                                |                        |                               |                           |                    |                      |                     |                    |                      |                           |
|    | Tournesol 1<br>[Diamant B] | 1971 Apr 15, 40<br>10 years                     | Cylinder +<br>4 vanes<br>96    | 0.80 long<br>0.70 dia  | 1971 Apr 19, 5                | 46.37                     | 96.16              | 6955                 | 457                 | 697                | 0.017                | 63                        |
|    | Tournesol 1<br>rocket      | 1971 Apr 15, 40<br>8½ years                     | Cylinder<br>68                 | 1.60 long?<br>0.65 dia | 1971 Apr 20, 9                | 46.38                     | 96.09              | 6952                 | 448                 | 699                | 0.018                | 67                        |
| D  | Fragments                  |   |                                |                        |                               |                           |                    |                      |                     |                    |                      |                           |

\* 1971-29E ejected from 1971-29A on 1971 Apr 22.

† Maneuvrable

| 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) |
|-----------------------------------|---|---|--|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Meteor 8                          | 1971 Apr 17.49<br>60 years                    | Cylinder +<br>2 vanes<br>2200?          | 5 long?<br>1.5 dia?                    | 1971 Apr 18.9                  | 81.24                     | 97.17              | 7000                 | 610                 | 633                | 0.002                | 280                       |
| Meteor 8<br>rocket                | 1971 Apr 17.49<br>60 years                    | Cylinder<br>1440                        | 3.8 long<br>2.6 dia                    | 1971 Apr 19.6                  | 81.24                     | 97.36              | 7009                 | 554                 | 708                | 0.011                | 177                       |
| Salyut 1*                         | 1971 Apr 19.07<br>175 days                    | Cylinder +<br>4 wings<br>18500          | 14 long<br>4.15 max dia<br>2.0 min dia | 1971 Apr 20.1<br>1971 Apr 28.8 | 51.56<br>51.57            | 88.53<br>89.67     | 6583<br>6639         | 200<br>251          | 210<br>271         | 0.0008<br>0.0014     | 341<br>188                |
| Salyut 1<br>rocket                | 1971 Apr 19.07<br>1 day<br>1971 Apr 20        | Cylinder<br>4000?                       | 12 long?<br>4 dia                      | 1971 Apr 19.4                  | 51.55                     | 88.30              | 6572                 | 176                 | 211                | 0.003                | 269                       |
| Fragments                         |   |   |  |                                |                           |                    |                      |                     |                    |                      |                           |
| [Titan 3B<br>Agena D]             | 1971 Apr 22.65<br>21 days<br>1971 May 13      | Cylinder<br>3000?                       | 8 long?<br>1.5 dia                     | 1971 Apr 23.2                  | 110.93                    | 89.85              | 6645                 | 132                 | 401                | 0.020                | 127                       |
| Soyuz 10**                        | 1971 Apr 23.00<br>1.99 days<br>1971 Apr 24.99 | Sphere-<br>cylinder + 2<br>wings. 6575? | 7.5 long<br>2.2 dia                    | 1971 Apr 23.7<br>1971 Apr 24.4 | 51.60<br>51.56            | 89.11<br>88.65     | 6612<br>6589         | 209<br>190          | 258<br>231         | 0.004<br>0.003       | 102<br>119                |
| Soyuz 10<br>rocket                | 1971 Apr 23.00<br>2.74 days<br>1971 Apr 25.74 | Cylinder<br>2500?                       | 7.5 long<br>2.6 dia                    | 1971 Apr 24.2                  | 51.59                     | 88.42              | 6578                 | 194                 | 205                | 0.0008               | 37                        |
| Cosmos 407                        | 1971 Apr 23.48<br>120 years                   | Cylinder +<br>paddles<br>750?           | 2 long?<br>1 dia?                      | 1971 Apr 28.6                  | 74.06                     | 100.99             | 7183                 | 791                 | 819                | 0.002                | 83                        |
| Cosmos 407<br>rocket<br>Fragments | 1971 Apr 23.48<br>100 years                   | Cylinder<br>2200?                       | 7.4 long<br>2.4 dia                    | 1971 Apr 27.5                  | 74.06                     | 100.90             | 7179                 | 783                 | 818                | 0.002                | 74                        |

\* De-orbited over Pacific Ocean.

\*\*Soyuz 10 docked with Salyut 1 from Apr 24.07 to Apr 24.30.

| 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 San Marco 3<br>1971-36A              | 1971 Apr 24.31<br>218.88 days<br>1971 Nov 29.19 | Sphere<br>164                  | 0.76 dia              | 1971 Apr 28.0<br>1971 Sep 1.0  | 3.23<br>3.23              | 93.82<br>92.17     | 6848<br>6766         | 222<br>214          | 718<br>562         | 0.036<br>0.026       | 4<br>-                    |
| D San Marco 3<br>rocket<br>1971-36B    | 1971 Apr 24.31<br>42 days<br>1971 Jun 5         | Cylinder<br>24                 | 1.50 long<br>0.46 dia | 1971 May 3.0                   | 3.25                      | 93.42              | 6828                 | 209                 | 691                | 0.035                | .*                        |
| D Cosmos 408<br>1971-37A               | 1971 Apr 24.47<br>248.80 days<br>1971 Dec 29.27 | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia   | 1971 Apr 25.2<br>1971 Aug 31.7 | 81.83<br>81.83            | 102.10<br>97.68    | 7235<br>7024         | 200<br>194          | 1514<br>1098       | 0.091<br>0.064       | 72<br>-                   |
| D Cosmos 408<br>rocket<br>1971-37B     | 1971 Apr 24.47<br>158.23 days<br>1971 Sep 29.70 | Cylinder<br>1500?              | 8 long<br>1.65 dia    | 1971 Apr 25.9<br>1971 Jul 16.5 | 81.83<br>81.83            | 101.89<br>97.95    | 7225<br>7038         | 201<br>194          | 1493<br>1125       | 0.089<br>0.066       | 70<br>-                   |
| Cosmos 409<br>1971-38A                 | 1971 Apr 28.61<br>3000 years                    | Spheroid +<br>paddles?<br>650? | 1.6 dia?              | 1971 May 2.3                   | 74.01                     | 109.36             | 7575                 | 1177                | 1216               | 0.003                | 218                       |
| Cosmos 409<br>rocket<br>1971-38B       | 1971 Apr 28.61<br>2000 years                    | Cylinder<br>2200?              | 7.4 long<br>2.4 dia   | 1971 Apr 30.9                  | 74.00                     | 109.23             | 7569                 | 1173                | 1208               | 0.002                | 204                       |
| INENS 2<br>[Titan 3C]<br>1971-39A      | 1971 May 5.33<br>>million years                 | Cylinder +<br>4 panels<br>820? | 6 long?<br>2.5 dia?   | 1971 May 5.3<br>1971 Jun 1.0   | 26.36<br>0.87             | 630.95<br>1434.0   | 24419<br>42124       | 295<br>35651        | 35787<br>35840     | 0.727<br>0.002       | 180<br>-                  |
| Transtage<br>1971-39B                  | 1971 May 5.33<br>>million years                 | Cylinder<br>1500?              | 6 long?<br>3 dia      | 1971 May 5.3<br>1971 Jun 1.0   | 26.36<br>0.87             | 630.95<br>1434.0   | 24419<br>42124       | 295<br>35651        | 35787<br>35840     | 0.727<br>0.002       | 180<br>-                  |
| D Titan 3C<br>second stage<br>1971-39C | 1971 May 5.33<br>1 day<br>1971 May 6            | Cylinder<br>1900               | 6 long<br>3.0 dia     | 1971 May 5.3                   | 28.5                      | 89.91              | 6655                 | 148                 | 406                | 0.019                | 114                       |

\*Approximate 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 | Cosmos 410                  | 1971 May 6.27<br>11.90 days<br>1971 May 18.17 | Sphere-cylinder<br>5900? | 5.9 long<br>2.4 dia   | 1971 May 7.4                  | 64.96                     | 89.35              | 6621                 | 205                 | 280                | 0.006                | 43                        |
| R |                             |   |                          |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 410 rocket           | 1971 May 6.27<br>5.19 days<br>1971 May 11.46  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia   | 1971 May 6.8                  | 64.96                     | 89.21              | 6614                 | 202                 | 270                | 0.005                | 37                        |
| D | Excess Radiation Package A* | 1971 May 6.27<br>19 days<br>1971 May 25       | Ellipsoid<br>200?        | 0.9 long<br>1.9 dia   | 1971 May 17.7                 | 64.95                     | 89.11              | 6609                 | 197                 | 264                | 0.005                | 36                        |
| D | Fragment                    |   |                          |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   | Cosmos 411                  | 1971 May 7.60<br>5000 years                   | Spheroid<br>40?          | 1.0 long?<br>0.8 dia? | 1971 May 10.0                 | 74.03                     | 113.91             | 7783                 | 1318                | 1492               | 0.011                | 100                       |
|   | Cosmos 412                  | 1971 May 7.60<br>10000 years                  | Spheroid<br>40?          | 1.0 long?<br>0.8 dia? | 1971 May 11.3                 | 74.04                     | 116.20             | 7888                 | 1482                | 1537               | 0.003                | 219                       |
|   | Cosmos 413                  | 1971 May 7.60<br>10000 years                  | Spheroid<br>40?          | 1.0 long?<br>0.8 dia? | 1971 May 8.6                  | 74.04                     | 115.84             | 7871                 | 1476                | 1509               | 0.002                | 205                       |
|   | Cosmos 414                  | 1971 May 7.60<br>9000 years                   | Spheroid<br>40?          | 1.0 long?<br>0.8 dia? | 1971 May 9.9                  | 74.02                     | 115.16             | 7840                 | 1428                | 1496               | 0.004                | 123                       |
|   | Cosmos 415                  | 1971 May 7.60<br>9000 years                   | Spheroid<br>40?          | 1.0 long?<br>0.8 dia? | 1971 May 10.9                 | 74.01                     | 115.50             | 7856                 | 1452                | 1503               | 0.003                | 145                       |
|   | Cosmos 416                  | 1971 May 7.60<br>7000 years                   | Spheroid<br>40?          | 1.0 long?<br>0.8 dia? | 1971 May 11.3                 | 74.02                     | 114.54             | 7812                 | 1373                | 1494               | 0.008                | 105                       |

1971-41 continued on page 260

\*1971-40C ejected from 1971-40A on 1971 May 17.

| 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) |
|-------------------------|--|-----------------------------------|-----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 417              | 1971 May 7.60<br>6000 years                    | Spheroid<br>40?                   | 1.0 long?<br>0.8 dia? | 1971 May 10.0                  | 74.01                     | 114.23             | 7798                 | 1344                | 1495               | 0.010                | 106                       |
| Cosmos 418              | 1971 May 7.60<br>8000 years                    | Spheroid<br>40?                   | 1.0 long?<br>0.8 dia? | 1971 May 11.2                  | 74.01                     | 114.85             | 7826                 | 1401                | 1495               | 0.006                | 111                       |
| Cosmos 411<br>rocket    | 1971 May 7.60<br>20000 years                   | Cylinder<br>2200?                 | 7.4 long<br>2.4 dia   | 1971 May 9.9                   | 74.04                     | 116.87             | 7918                 | 1487                | 1592               | 0.007                | 237                       |
| Cosmos 419*             | 1971 May 10.71<br>2.13 days<br>1971 May 12.84  | Cone-<br>cylinder?<br>23400? full | 16 long?<br>4 dia     | 1971 May 11.6                  | 51.53                     | 87.47              | 6530                 | 145                 | 159                | 0.001                | 297                       |
| Cosmos 420 †            | 1971 May 18.34<br>10.93 days<br>1971 May 29.27 | Sphere-<br>cylinder<br>6300?      | 6.5 long?<br>2.4 dia  | 1971 May 19.5                  | 51.75                     | 89.00              | 6606                 | 199                 | 257                | 0.004                | 21                        |
| Cosmos 420<br>rocket    | 1971 May 18.34<br>2.72 days<br>1971 May 21.06  | Cylinder<br>2500?                 | 7.5 long<br>2.6 dia   | 1971 May 19.0                  | 51.79                     | 88.60              | 6586                 | 186                 | 230                | 0.003                | 353                       |
| Cosmos 420<br>engine ** | 1971 May 18.34<br>16 days<br>1971 Jun 3        | Cone<br>600? full                 | 1.5 long?<br>2 dia?   | 1971 May 28.5                  | 51.77                     | 88.81              | 6597                 | 197                 | 240                | 0.003                | 62                        |
| Fragments               | 1971-43D,E                                     |                                   |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 421              | 1971 May 19.43<br>172.75 days<br>1971 Nov 8.18 | Ellipsoid<br>400?                 | 1.8 long<br>1.2 dia   | 1971 May 19.8<br>1971 Aug 16.5 | 70.96<br>70.96            | 91.99<br>91.23     | 6749<br>6713         | 273<br>259          | 469<br>470         | 0.014<br>0.011       | 75<br>-                   |
| Cosmos 421<br>rocket    | 1971 May 19.43<br>96.33 days<br>1971 Aug 23.76 | Cylinder<br>1500?                 | 8 long<br>1.65 dia    | 1971 May 19.7                  | 70.98                     | 91.85              | 6743                 | 274                 | 455                | 0.013                | 73                        |

\* Cosmos 419 was probably an attempted Mars probe.  
\*\*1971-43C ejected from 1971-43A about 1971 May 28.4

† Manoeuvrable

| 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 Mars 2 launcher rocket | 1971 May 19.68<br>2 days<br>1971 May 21         | Cylinder<br>4000?            | 12 long?<br>4 dia    | 1971 May 20.7                  | 51.52                     | 87.52              | 6533                 | 137                 | 172                | 0.003                | 24                        |
| D Mars 2 launcher        | 1971 May 19.68<br>2 days<br>1971 May 21         | -                            | -                    | 1971 May 20.7                  | 51.52                     | 87.53              | 6533                 | 137                 | 173                | 0.003                | 24                        |
| Cosmos 422               | 1971 May 22.03<br>1200 years                    | Cylinder +<br>boom? 700?     | 1.4 long<br>2.0 dia  | 1971 May 23.6                  | 74.03                     | 105.10             | 7377                 | 988                 | 1010               | 0.001                | 242                       |
| Cosmos 422 rocket        | 1971 May 22.03<br>600 years                     | Cylinder<br>2200?            | 7.4 long<br>2.4 dia  | 1971 May 22.4                  | 74.03                     | 104.99             | 7372                 | 983                 | 1004               | 0.001                | 210                       |
| D Cosmos 423             | 1971 May 27.50<br>183.16 days<br>1971 Nov 26.66 | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia  | 1971 May 28.8<br>1971 Aug 31.7 | 71.03<br>71.03            | 92.15<br>91.34     | 6758<br>6718         | 272<br>257          | 487<br>423         | 0.016<br>0.012       | 74<br>-                   |
| D Cosmos 423 rocket      | 1971 May 27.50<br>93.96 days<br>1971 Aug 29.46  | Cylinder<br>1500?            | 8 long<br>1.65 dia   | 1971 May 28.8                  | 71.03                     | 91.91              | 6746                 | 274                 | 461                | 0.014                | 72                        |
| D Cosmos 424             | 1971 May 28.44<br>12.71 days<br>1971 Jun 10.15  | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1971 May 30.6<br>1971 Jun 1.6  | 65.40<br>65.41            | 89.36<br>89.40     | 6621<br>6623         | 204<br>177          | 282<br>313         | 0.006<br>0.010       | 65<br>59                  |
| D Cosmos 424 rocket      | 1971 May 28.44<br>6.15 days<br>1971 Jun 3.59    | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1971 May 30.3                  | 65.40                     | 89.15              | 6611                 | 196                 | 270                | 0.006                | 46                        |

|   | 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 424 engine*     | 1971 May 28.44<br>18 days<br>1971 Jun 15 | Cone<br>600? full              | 1.5 long?<br>2 dia?   | 1971 Jun 9.6                  | 65.41                     | 89.15              | 6611                 | 175                 | 291                | 0.009                | 59                        |
| D | Fragments              |  |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Mars 3 launcher rocket | 1971 May 28.64<br>3 days<br>1971 May 31  | Cylinder<br>4000?              | 12 long?<br>4 dia     | 1971 May 29.9                 | 51.57                     | 88.21              | 6567                 | 139                 | 239                | 0.008                | 100                       |
| D | Mars 3 launcher        | 1971 May 28.64<br>3 days<br>1971 May 31  | -                              | -                     | 1971 May 29.9                 | 51.57                     | 88.17              | 6565                 | 140                 | 234                | 0.007                | 66                        |
| D | Fragment               |  |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   | Cosmos 425             | 1971 May 29.16<br>10 years               | Cylinder +<br>paddles?<br>900? | 2 long?<br>1 dia?     | 1971 Jun 6.9                  | 74.03                     | 95.24              | 6908                 | 506                 | 553                | 0.003                | 316                       |
|   | Cosmos 425 rocket      | 1971 May 29.16<br>10 years               | Cylinder<br>2200?              | 7.4 long<br>2.4 dia   | 1971 Jun 6.9                  | 74.04                     | 95.20              | 6906                 | 499                 | 556                | 0.004                | 310                       |
| D | Fragments              |  |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   | Cosmos 426             | 1971 Jun 4.76<br>35 years                | Octagonal<br>ellipsoid<br>400? | 1.8 long?<br>1.5 dia? | 1971 Jun 6.6                  | 74.03                     | 109.29             | 7571                 | 389                 | 1997               | 0.106                | 132                       |
|   | Cosmos 426 rocket      | 1971 Jun 4.76<br>30 years                | Cylinder<br>2200?              | 7.4 long<br>2.4 dia   | 1971 Jun 6.3                  | 74.03                     | 109.17             | 7565                 | 389                 | 1985               | 0.106                | 132                       |
| D | Fragments              |  |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |

\*1971-48C ejected from 1971-48A about 1971 Jun 9.5.

Space Vehicles: Mars 3, 1971-49A  
Mariner 9, 1971-51A; and Centaur rocket, 1971-51B

| 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 3M R Soyuz 11*           | 1971 Jun 6.21<br>23.76 days<br>1971 Jun 29.97 | Sphere-cylinder + 2 wings 6790? | 7.5 long<br>2.2 dia    | 1971 Jun 6.4<br>1971 Jun 6.6<br>1971 Jun 9.9 | 51.57<br>51.60<br>51.56   | 88.41<br>88.30<br>89.66 | 6577<br>6571<br>6638 | 189<br>177<br>256   | 209<br>209<br>264  | 0.002<br>0.002<br>0.001 | 285<br>291<br>74          |
| D Soyuz 11 rocket          | 1971 Jun 6.21<br>1.64 days<br>1971 Jun 7.85   | Cylinder 2500?                  | 7.5 long<br>2.6 dia    | 1971 Jun 6.5                                 | 51.63                     | 88.31                   | 6572                 | 176                 | 211                | 0.003                   | 286                       |
| SESP-1†<br>[Thor Burner 2] | 1971 Jun 8.59<br>10 years                     | Sphere-cone? 260?               | 3.0 long?<br>1.31 dia? | 1971 Jun 9.0                                 | 90.22                     | 95.95                   | 6941                 | 545                 | 581                | 0.003                   | 210                       |
| D R Cosmos 427             | 1971 Jun 11.42<br>11.8 days<br>1971 Jun 23.2  | Sphere-cylinder 6300?           | 6.5 long?<br>2.4 dia   | 1971 Jun 12.3<br>1971 Jun 22.9               | 72.84<br>72.85            | 89.70<br>89.48          | 6637<br>6626         | 204<br>177          | 314<br>319         | 0.008<br>0.011          | 58<br>46                  |
| D Cosmos 427 rocket        | 1971 Jun 11.42<br>8.88 days<br>1971 Jun 20.30 | Cylinder 2500?                  | 7.5 long<br>2.6 dia    | 1971 Jun 11.5                                | 72.80                     | 89.66                   | 6635                 | 205                 | 309                | 0.008                   | 59                        |
| D Cosmos 427 engine**      | 1971 Jun 11.42<br>17 days<br>1971 Jun 28      | Cone 600? full                  | 1.5 long?<br>2 dia?    | 1971 Jun 23.6                                | 72.85                     | 89.36                   | 6620                 | 176                 | 308                | 0.010                   | 47                        |
| D Fragments [Titan 3D]     | 1971 Jun 15.78<br>52 days<br>1971 Aug 6       | Cylinder 13300? full            | 15 long<br>3.0 dia     | 1971 Jun 16.1<br>1971 Jul 3.2                | 96.41<br>96.39            | 89.38<br>89.31          | 6620<br>6617         | 184<br>183          | 300<br>294         | 0.009<br>0.008          | 170<br>166                |
| D Titan 3D rocket          | 1971 Jun 15.78<br>4.65 days<br>1971 Jun 20.43 | Cylinder 1900                   | 6 long<br>3.0 dia      | 1971 Jun 17.4                                | 96.39                     | 88.93                   | 6599                 | 179                 | 262                | 0.006                   | 170                       |

\*Soyuz 11 docked with Salyut 1 from 1971 Jun 7.32 to Jun 29.77. Crew died from depressurisation after jettisoning orbital module Jun 29.95.

\*\*1971-55E ejected from 1971-55A on 1971 Jun 23.

† Space Experiments Support Program.

| 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 428                      | 1971 Jun 24.34<br>11.93 days<br>1971 Jul 6.27 | Sphere-cylinder<br>5900?              | 5.9 long<br>2.4 dia   | 1971 Jun 25.0                  | 51.76                     | 89.07              | 6610                 | 206                 | 257                | 0.004                | 39                        |
| D Cosmos 428 rocket               | 1971 Jun 24.34<br>4.33 days<br>1971 Jun 28.67 | Cylinder<br>2500?                     | 7.5 long<br>2.6 dia   | 1971 Jun 25.7                  | 51.74                     | 88.79              | 6596                 | 194                 | 241                | 0.004                | 21                        |
| D Cosmic Ray Package B*           | 1971 Jun 24.34<br>19 days<br>1971 Jul 13      | Ellipsoid<br>200?                     | 0.9 long<br>1.9 dia   | 1971 Jul 5.9                   | 51.76                     | 88.82              | 6597                 | 199                 | 239                | 0.003                | 80                        |
| D Fragments Explorer 44 (SR 10)** | 1971 Jul 8.96<br>8 years                      | 12-sided cylinder +<br>4 vanes<br>118 | 0.58 long<br>0.76 dia | 1971 Jul 9.1                   | 51.06                     | 95.23              | 6911                 | 433                 | 632                | 0.014                | 278                       |
| D Explorer 44 rocket              | 1971 Jul 8.96<br>1665 days<br>1976 Jan 28     | Cylinder<br>24                        | 1.50 long<br>0.46 dia | 1971 Jul 11.1<br>1972 Sep 16.0 | 51.06<br>51.06            | 95.23<br>94.48     | 6911<br>6875         | 435<br>418          | 630<br>575         | 0.014<br>0.011       | 284<br>-                  |
| D Fragments Meteor 9              | 1971 Jul 16.07<br>60 years                    | Cylinder +<br>2 vanes<br>2200?        | 5 long?<br>1.5 dia?   | 1971 Jul 16.2                  | 81.19                     | 97.29              | 7006                 | 614                 | 642                | 0.002                | 329                       |
| D Meteor 9 rocket                 | 1971 Jul 16.07<br>60 years                    | Cylinder<br>1440                      | 3.8 long<br>2.6 dia   | 1971 Jul 20.3                  | 81.21                     | 97.53              | 7017                 | 559                 | 719                | 0.011                | 174                       |
| D Fragment                        |   |                                       |                       |                                |                           |                    |                      |                     |                    |                      |                           |

\*1971-57G ejected from 1971-57A on 1971 Jul 5.

\*\* Solar Radiation.

|   | 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 | [Thorad Agena D]       | 1971 Jul 16.45<br>2603 days<br>1978 Aug 31    | Cylinder<br>2000?            | 8 long?<br>1.5 dia   | 1971 Jul 18.9<br>1973 Nov 1.0  | 75.00<br>74.99            | 94.59<br>94.00     | 6876<br>6848         | 488<br>462          | 508<br>477         | 0.001<br>0.001       | 243<br>-                  |
| D | Cosmos 429             | 1971 Jul 20.42                                | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1971 Jul 22.6<br>1971 Jul 24.2 | 51.76<br>51.76            | 88.98<br>88.81     | 6605<br>6597         | 202<br>179          | 252<br>258         | 0.004<br>0.006       | 34<br>66                  |
| R |                        | 12.9 days<br>1971 Aug 2.3                     |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 429<br>rocket   | 1971 Jul 20.42<br>2.94 days<br>1971 Jul 23.36 | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1971 Jul 21.2                  | 51.76                     | 88.76              | 6594                 | 185                 | 247                | 0.005                | 19                        |
| D | Cosmos 429<br>engine*  | 1971 Jul 20.42<br>15 days<br>1971 Aug 4       | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1971 Aug 3.2                   | 51.81                     | 89.89              | 6651                 | 185                 | 360                | 0.013                | 37                        |
| D | Fragments              |   |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 430             | 1971 Jul 23.46<br>12.7 days<br>1971 Aug 5.2   | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1971 Jul 24.4<br>1971 Jul 26.5 | 65.41<br>65.40            | 89.54<br>89.05     | 6630<br>6606         | 199<br>188          | 305<br>267         | 0.008<br>0.006       | 50<br>76                  |
| R |                        |   |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 430<br>rocket   | 1971 Jul 23.46<br>5.70 days<br>1971 Jul 29.16 | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1971 Jul 24.8                  | 65.41                     | 89.17              | 6612                 | 193                 | 274                | 0.006                | 29                        |
| D | Cosmos 430<br>engine** | 1971 Jul 23.46<br>16.74 days<br>1971 Aug 9.20 | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1971 Aug 5.3                   | 65.41                     | 88.68              | 6587                 | 181                 | 237                | 0.004                | 66                        |
| D | Fragments              |   |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |

\* 1971-61E ejected from 1971-61A about 1971 Aug 1.

\*\* 1971-62F ejected from 1971-62A about 1971 Aug 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<br>3M<br>R | Apollo 15**                   | 1971 Jul 26.57<br>12.30 days<br>1971 Aug 7.87  | Cone-cylinder<br>30340<br>initially              | 11.15 long<br>3.91 dia              | 1971 Jul 26.6<br>1971 Jul 26.8 | 32.56<br>33.2             | 87.77<br>26320     | 6549<br>292520       | 169<br>200          | 173<br>572080      | 0.0003<br>0.977      | -*<br>30*                 |
| D            | Saturn IVB<br>[Saturn 510]    | 1971 Jul 26.57<br>3.30 days<br>1971 Jul 29.87  | Cylinder<br>13990                                | 18.7 long<br>6.6 dia                | 1971 Jul 26.6<br>1971 Jul 26.8 | 32.56<br>33.2             | 87.77<br>26320     | 6549<br>292520       | 169<br>200          | 173<br>572080      | 0.0003<br>0.977      | -*<br>30*                 |
| D            | LEM 10<br>descent stage       | 1971 Jul 26.57<br>4.36 days<br>1971 Jul 30.93  | Octagon +<br>4 legs<br>11404 full?<br>2803 empty | 1.57 high<br>3.13 wide              | 1971 Jul 26.8                  | 33.2                      | 26320              | 292520               | 200                 | 572080             | 0.977                | 30*                       |
| D            | LEM 10 +<br>ascent stage      | 1971 Jul 26.57<br>7.56 days<br>1971 Aug 3.13   | Box + tanks<br>5030 full?<br>2127 empty          | 2.52 high<br>3.76 wide<br>3.13 deep | 1971 Jul 26.8                  | 33.2                      | 26320              | 292520               | 200                 | 572080             | 0.977                | 30*                       |
| D            | Molniya 1T                    | 1971 Jul 28.15<br>2183 days<br>1977 Jul 19     | Windmill +<br>6 vanes<br>10007                   | 3.4 long<br>1.6 dia                 | 1971 Aug 1.6<br>1971 Sep 1.0   | 65.37<br>65.43            | 704.99<br>717.75   | 26239<br>265556      | 468<br>478          | 39254<br>39877     | 0.739<br>0.742       | 285.<br>-                 |
| D            | Molniya 1T<br>launcher        | 1971 Jul 28.15<br>32.20 days<br>1971 Aug 29.35 | Irregular  | -                                   | 1971 Jul 28.6                  | 65.42                     | 91.29              | 6716                 | 217                 | 459                | 0.018                | 63                        |
| D            | Molniya 1T<br>launcher rocket | 1971 Jul 28.15<br>26.96 days<br>1971 Aug 24.11 | Cylinder<br>25007                                | 7.5 long<br>2.6 dia                 | 1971 Jul 30.0                  | 65.40                     | 91.28              | 6716                 | 202                 | 473                | 0.020                | 63                        |
| D            | Molniya 1T<br>rocket          | 1971 Jul 28.15<br>2209 days<br>1977 Aug 14     | Cylinder<br>440                                  | 2.0 long<br>2.0 dia                 | 1971 Aug 1.6                   | 65.37                     | 700.62             | 26131                | 442                 | 39064              | 0.739                | 285                       |
| D            | Fragments                     | 1971-64E, F                                    |  |                                     |                                |                           |                    |                      |                     |                    |                      |                           |

\*\* Apollo attached to LEM separated from Saturn IVB on Jul 26.74.

+ LEM with two crew members separated from Apollo on Jul 30.74

Ascent stage relaunched from Moon Aug 2.72; briefly docked with Apollo Aug 2.80. (Apollo 15 subsatellite, 1971-63D, in selenocentric orbit)

\*Approximate orbits.

In selenocentric orbit 1971 Jul 29.84 to Aug 4.89  
Crashed on Moon 1971 Jul 29.87  
Entered selenocentric orbit 1971 Jul 29.84  
Landed on Moon 1971 Jul 30.93  
On Moon's surface 1971 Jul 30.93 to Aug 2.72  
Finally crashed on Moon 1971 Aug 3.13

|        | 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<br>R | Cosmos 431<br>1971-65A            | 1971 Jul 30.36<br>11.91 days<br>1971 Aug 11.27 | Sphere-cylinder<br>5700? | 5.0 long<br>2.4 dia     | 1971 Jul 31.5                 | 51.77                     | 88.95              | 6604                 | 194                 | 257                | 0.005                | 21                        |
| D      | Cosmos 431<br>rocket<br>1971-65B  | 1971 Jul 30.36<br>5.06 days<br>1971 Aug 4.42   | Cylinder<br>2500?        | 7.5 long<br>2.6 dia     | 1971 Jul 31.3                 | 51.78                     | 88.84              | 6598                 | 202                 | 237                | 0.003                | 0                         |
| D      | Fragment<br>1971-65C              |  |                          |                         |                               |                           |                    |                      |                     |                    |                      |                           |
| D<br>R | Cosmos 432 +<br>1971-66A          | 1971 Aug 5.42<br>12.91 days<br>1971 Aug 18.33  | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia    | 1971 Aug 6.7                  | 51.74                     | 88.97              | 6605                 | 194                 | 259                | 0.005                | 73                        |
| D      | Cosmos 432<br>rocket<br>1971-66B  | 1971 Aug 5.42<br>3.91 days<br>1971 Aug 9.33    | Cylinder<br>2500?        | 7.5 long<br>2.6 dia     | 1971 Aug 5.7                  | 51.77                     | 88.88              | 6600                 | 191                 | 253                | 0.005                | 15                        |
| D      | Cosmos 432<br>engine*<br>1971-66D | 1971 Aug 5.42<br>16 days<br>1971 Aug 21        | Cone<br>600? full        | 1.5 long?<br>2 dia?     | 1971 Aug 18.4                 | 51.74                     | 88.62              | 6587                 | 187                 | 231                | 0.003                | -                         |
| D      | Fragments<br>1971-66C,E           |  |                          |                         |                               |                           |                    |                      |                     |                    |                      |                           |
| D      | OV1-20<br>1971-67A                | 1971 Aug 7.00<br>22.00 days<br>1971 Aug 29.00  | Cylinder<br>70?          | 2.05 long?<br>0.72 dia? | 1971 Aug 7.0                  | 92.00                     | 106.16             | 7423                 | 133                 | 1957               | 0.123                | 173                       |
| D      | OV1-21<br>rocket<br>1971-67B      | 1971 Aug 7.00<br>80 years                      | Cone-cylinder<br>70?     | 2.05 long<br>0.72 dia   | 1971 Aug 9.5                  | 87.64                     | 102.01             | 7231                 | 792                 | 914                | 0.008                | 216                       |
| D      | Cannonball 2<br>1971-67C          | 1971 Aug 7.00<br>177.72 days<br>1972 Jan 31.72 | Sphere<br>364            | 0.66 dia                | 1971 Aug 7.4                  | 92.01                     | 106.29             | 7430                 | 133                 | 1970               | 0.124                | 172                       |
| D      | Musketball<br>1971-67D            | 1971 Aug 7.00<br>43.60 days<br>1971 Sep 19.60  | Sphere<br>61             | 0.30 dia                | 1971 Aug 7.2                  | 87.61                     | 94.87              | 6889                 | 137                 | 884                | 0.054                | 167                       |

\*971-66D ejected from 1971-66A about 1971 Aug 17.

+ Manoeuvrable

1971-67 launch continued on page 268.

Year of launch 1971, 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) |
|----------------------------|--|---------------------------|---------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Rigid Sphere 2 (LCS 4) *   | 1971 Aug 7.00<br>75 years                | Sphere (magnesium)<br>37  | 1.12 dia            | 1971 Aug 9.2                  | 87.62                     | 102.03             | 7232                 | 795                 | 913                | 0.008                | 219                       |
| Ballon (Mylar)             | 1971 Aug 7.00<br>309 days<br>1972 Jun 11 | Inflated sphere<br>0.8    | 2.13 dia            | 1971 Aug 8.3<br>1972 Apr 10.6 | 87.61<br>87.62            | 101.86<br>98.77    | 7224<br>7082         | 777<br>684          | 914<br>724         | 0.009<br>0.003       | 214<br>119                |
| Grid sphere 2              | 1971 Aug 7.00<br>10 years                | Spherical skeleton<br>4.0 | 2.13 dia            | 1971 Aug 8.7                  | 87.64                     | 101.93             | 7227                 | 783                 | 915                | 0.009                | 216                       |
| Grid sphere 1              | 1971 Aug 7.00<br>15 years                | Spherical skeleton<br>6.2 | 2.13 dia            | 1971 Sep 1.0                  | 87.63                     | 101.92             | 7227                 | 777                 | 920                | 0.009                | -                         |
| Apogee rocket              | 1971 Aug 7.00<br>75 years                | Cone + nozzle<br>307      | 1.1 long<br>1.2 dia | 1971 Sep 1.0                  | 87.63                     | 102.05             | 7233                 | 792                 | 918                | 0.009                | -                         |
| Rigid Sphere 1             | 1971 Aug 7.00<br>20 years                | Sphere (aluminium)<br>1.6 | 0.61 dia            | 1971 Sep 1.0                  | 87.63                     | 101.98             | 7230                 | 786                 | 917                | 0.009                | -                         |
| Fragments                  | 1971 Aug 8.99<br>0.06 days               | Cylinder                  | 2 long?<br>1 dia?   | 1971 Aug 9.0                  | 49.41                     | 88.54              | 6584                 | 112                 | 299                | 0.014                | -                         |
| Cosmos 433                 | 1971 Aug 9.05<br>1.79 days               | Irregular                 | -                   | 1971 Aug 9.2                  | 49.41                     | 88.55              | 6584                 | 112                 | 300                | 0.014                | 169                       |
| Cosmos 433 launch platform | 1971 Aug 10.78                           | Cylinder<br>15007         | 8 long?<br>2.5 dia? | 1971 Aug 9.8                  | 49.50                     | 87.58              | 6536                 | 142                 | 174                | 0.003                | 113                       |

\* Lincoln Calibration Satellite

| 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) |
|-------------------------------|---|-----------------------|-----------------------|---|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 434                    | 1971 Aug 12.23<br>9 years                       | -                     | -                     | 1971 Aug 12.9<br>1971 Aug 16.4<br>1971 Aug 27.3 | 51.60                     | 88.98              | 6606                 | 188                 | 267                | 0.006                | 85                        |
| D Cosmos 434 rocket           | 1971 Aug 12.23<br>6 days<br>1971 Aug 18         | Cylinder<br>2500?     | 7.5 long<br>2.6 dia   | 1971 Aug 12.9                                   | 51.60<br>51.59            | 228.24<br>88.98    | 12373<br>6606        | 186<br>194          | 11804<br>261       | 0.469<br>0.005       | 93<br>86                  |
| D Cosmos 434 platform         | 1971 Aug 12.23<br>77 days<br>1971 Oct 28        | -                     | -                     | 1971 Aug 17.5                                   | 51.60                     | 99.90              | 7137                 | 189                 | 1328               | 0.080                | 92                        |
| D Fragment [Titan 3B Agena D] | 1971 Aug 12.59<br>22 days<br>1971 Sep 3         | Cylinder<br>3000?     | 8 long?<br>1.5 dia    | 1971 Aug 13.2<br>1971 Aug 30.2                  | 111.00<br>110.96          | 90.13<br>89.98     | 6659<br>6651         | 137<br>136          | 424<br>410         | 0.022<br>0.021       | 134<br>128                |
| D Fragment Eole 1*            | 1971 Aug 16.78<br>80 years                      | Cone-octagon<br>84    | 0.58 long<br>0.71 dia | 1971 Aug 28.1                                   | 50.16                     | 100.62             | 7169                 | 677                 | 904                | 0.016                | 353                       |
| D Eole 1 rocket               | 1971 Aug 16.78<br>60 years                      | Cylinder<br>24        | 1.50 long<br>0.46 dia | 1971 Aug 18.3                                   | 50.18                     | 100.55             | 7166                 | 667                 | 908                | 0.017                | 322                       |
| D Fragments                   | 1971-71C,D                                      |                       |                       |   |                           |                    |                      |                     |                    |                      |                           |
| D Cosmos 435                  | 1971 Aug 27.46<br>153.60 days<br>1972 Jan 28.06 | Ellipsoid<br>400?     | 1.8 long<br>1.2 dia   | 1971 Aug 28.0<br>1971 Nov 16.0                  | 70.96<br>70.96            | 92.09<br>91.28     | 6755<br>6715         | 271<br>257          | 482<br>417         | 0.016<br>0.012       | 79<br>-                   |
| D Cosmos 435 rocket           | 1971 Aug 27.46<br>84.67 days<br>1971 Nov 20.13  | Cylinder<br>1500?     | 8 long<br>1.65 dia    | 1971 Aug 28.0                                   | 70.98                     | 91.96              | 6748                 | 272                 | 468                | 0.015                | 80                        |

\*French Cooperative Applications Satellite 1, launched by NASA. To study southern-hemisphere winds: Eole is god of the winds.

| 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 Luna 18 launcher rocket | 1971 Sep 2.57<br>4.56 days<br>1971 Sep 7.13   | Cylinder<br>4000?              | 12 long?<br>4 dia     | 1971 Sep 3.7                   | 51.56                     | 88.64              | 6588                 | 193                 | 227                | 0.003                | 334                       |
| D Luna 18 launcher        | 1971 Sep 2.57<br>4.64 days<br>1971 Sep 7.21   | -                              | -                     | 1971 Sep 3.5                   | 51.57                     | 88.72              | 6592                 | 186                 | 242                | 0.004                | 327                       |
| D Fragment                |   |                                |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 436                | 1971 Sep 7.06<br>10 years                     | Cylinder +<br>paddles?<br>900? | 2 long?<br>1 dia?     | 1971 Sep 19.9                  | 74.04                     | 95.18              | 6905                 | 509                 | 545                | 0.003                | 309                       |
| Cosmos 436 rocket         | 1971 Sep 7.06<br>10 years                     | Cylinder<br>2200?              | 7-4 long<br>2-4 dia   | 1971 Sep 19.8                  | 74.04                     | 95.03              | 6898                 | 502                 | 537                | 0.002                | 329                       |
| D Fragments*              |   |                                |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 437                | 1971 Sep 10.15<br>10 years                    | Cylinder +<br>paddles?<br>900? | 2 long?<br>1 dia?     | 1971 Sep 10.4                  | 74.05                     | 95.31              | 6911                 | 519                 | 548                | 0.002                | 345                       |
| Cosmos 437 rocket         | 1971 Sep 10.15<br>10 years                    | Cylinder<br>2200?              | 7-4 long<br>2-4 dia   | 1971 Sep 10.3                  | 74.05                     | 95.18              | 6905                 | 508                 | 545                | 0.003                | 170                       |
| D Fragment                |   |                                |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D [Thorad Agena D]        | 1971 Sep 10.90<br>25.02 days<br>1971 Oct 5.92 | Cylinder<br>2000?              | 8 long?<br>1-5 dia    | 1971 Sep 11.6                  | 74.95                     | 88.48              | 6578                 | 156                 | 244                | 0.007                | 156                       |
| D Capsule                 | 1971 Sep 10.90<br>1607 days<br>1976 Feb 3     | Octagon?<br>60?                | 0-3 long?<br>0-9 dia? | 1971 Sep 11.5<br>1972 Nov 16.0 | 75.07<br>75.07            | 96.40<br>93.94     | 6877<br>6845         | 492<br>456          | 507<br>477         | 0.001<br>0.002       | 236<br>-                  |
| D Fragment                |   |                                |                       |                                |                           |                    |                      |                     |                    |                      |                           |

Space Vehicle: Luna 18, 1971-73A; and fragment, 1971-73B.

\*Fragments designated 1971-74H to Q probably belong to the 1971-75, -103, and -114 launches.

AD-A067 931

ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)  
REVISED TABLE OF EARTH SATELLITES. VOLUME 2. 1969 TO 1973.(U)  
JAN 79 J A PILKINGTON, D G KING-HELE

F/G 22/3

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RAE-TR-79001

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2 OF 2  
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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 438        | 1971 Sep 14.54                                  | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1971 Sep 15.2                 | 65.40                     | 89.54              | 6630                 | 208                 | 296                | 0.007                | 72                        |
| R |                   | 12.72 days<br>1971 Sep 27.26                    |                          |                      | 1971 Sep 21.7                 | 65.40                     | 89.44              | 6625                 | 175                 | 319                | 0.011                | 62                        |
| D | Cosmos 438 rocket | 1971 Sep 14.54<br>8 days<br>1971 Sep 22         | Cylinder<br>2500?        | 7.5 long<br>2.6 dia  | 1971 Sep 15.5                 | 65.39                     | 89.34              | 6620                 | 196                 | 288                | 0.007                | 63                        |
| D | Cosmos 438 engine | 1971 Sep 14.54<br>15.55 days<br>1971 Sep 30.09  | Cone<br>600? full        | 1.5 long?<br>2 dia?  | 1971 Sep 27.7                 | 65.40                     | 88.80              | 6593                 | 170                 | 260                | 0.007                | 62                        |
| D | Fragments         |   |                          |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 439        | 1971 Sep 21.50                                  | Sphere-cylinder<br>5700? | 5.0 long<br>2.4 dia  | 1971 Sep 23.4                 | 65.41                     | 89.41              | 6624                 | 207                 | 284                | 0.006                | 89                        |
| R |                   | 10.74 days<br>1971 Oct 2.24                     |                          |                      | 1971 Sep 22.4                 | 65.41                     | 89.28              | 6617                 | 203                 | 275                | 0.005                | 77                        |
| D | Cosmos 439 rocket | 1971 Sep 21.50<br>6.46 days<br>1971 Sep 27.96   | Cylinder<br>2500?        | 7.5 long<br>2.6 dia  | 1971 Sep 22.4                 | 65.41                     | 89.28              | 6617                 | 203                 | 275                | 0.005                | 77                        |
| D | Cosmos 440        | 1971 Sep 24.44<br>401.18 days<br>1972 Oct 29.62 | Ellipsoid<br>400?        | 1.8 long<br>1.2 dia  | 1971 Sep 30.9                 | 71.00                     | 95.21              | 6907                 | 272                 | 785                | 0.037                | 71                        |
|   |                   |   |                          |                      | 1972 Feb 1.0                  | 70.99                     | 94.36              | 6866                 | 267                 | 709                | 0.032                | -                         |
|   |                   |   | 1972 Jun 16.0            | 70.99                | 92.66                         | 6783                      | 254                | 555                  | 0.022               | -                  | -                    |                           |
| D | Cosmos 440 rocket | 1971 Sep 24.44<br>229.38 days<br>1972 May 10.82 | Cylinder<br>1500?        | 8 long<br>1.65 dia   | 1971 Sep 28.5<br>1972 Jan 1.0 | 71.00<br>71.00            | 95.19<br>93.98     | 6906<br>6847         | 270<br>265          | 785<br>672         | 0.037<br>0.030       | 74<br>-                   |

\*1971-77F ejected from 1971-77A about 1971 Sep 27.2.

| 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) |
|-------------------------------------|--|---------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Shinsei [170 US]<br>1971-80A        | 1971 Sep 28.17<br>5000 years                   | 26-faced polyhedron<br>65 | 0.75 long<br>0.71 dia | 1971 Oct 1.1                  | 32.06                     | 112.92             | 7745                 | 869                 | 1865               | 0.064                | 136                       |
| Shinsei rocket<br>1971-80B          | 1971 Sep 28.17<br>4000 years                   | Sphere-cone<br>907        | 1.86 long<br>0.79 dia | 1971 Sep 30.9                 | 32.05                     | 111.75             | 7689                 | 867                 | 1755               | 0.058                | 137                       |
| Cosmos 441<br>1971-81A              | 1971 Sep 28.32<br>11.91 days<br>1971 Oct 10.23 | Sphere-cylinder<br>63007  | 6.5 long?<br>2.4 dia  | 1971 Sep 28.8<br>1971 Oct 1.7 | 65.02<br>65.04            | 89.21<br>89.00     | 6614<br>6604         | 204<br>173          | 268<br>278         | 0.005<br>0.008       | 33<br>57                  |
| Cosmos 441 rocket<br>1971-81B       | 1971 Sep 28.32<br>5.09 days<br>1971 Oct 3.41   | Cylinder<br>25007         | 7.5 long<br>2.6 dia   | 1971 Sep 28.7                 | 65.03                     | 89.02              | 6605                 | 206                 | 247                | 0.003                | 35                        |
| Cosmos 441 engine<br>1971-81E       | 1971 Sep 28.32<br>15.25 days<br>1971 Oct 13.57 | Cone<br>6007 full         | 1.5 long?<br>2 dia?   | 1971 Oct 11.6                 | 65.04                     | 88.66              | 6587                 | 174                 | 244                | 0.005                | 53                        |
| Fragments<br>1971-81C,D,F,G         |  |                           |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| Luna 19 launcher<br>1971-82B        | 1971 Sep 28.42<br>3.45 days<br>1971 Oct 1.87   | -                         | -                     | 1971 Sep 28.5                 | 51.58                     | 88.76              | 6594                 | 172                 | 260                | 0.007                | 348                       |
| Luna 19 launcher rocket<br>1971-82D | 1971 Sep 28.42<br>3.39 days<br>1971 Oct 1.81   | Cylinder<br>40007         | 12 long?<br>4 dia     | 1971 Sep 29.1                 | 51.59                     | 88.44              | 6578                 | 198                 | 202                | 0.0003               | 357                       |

\*1971-81E ejected from 1971-81A about 1971 Oct 10.  
Space Vehicle: Luna 19, 1971-82A; and fragment, 1971-82C.

|   | Name               | Launch date, lifetime and descent date          | Shape and weight (kg)       | Size (m)                | Date of orbital determination                 | Orbital inclination (deg) | Modal period (min)      | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity    | Argument of perigee (deg) |
|---|--------------------|---|-----------------------------|-------------------------|---|---------------------------|-------------------------|----------------------|---------------------|--------------------|-------------------------|---------------------------|
| D | OSO 7              | 1971 Sep 29.41<br>1013.90 days<br>1974 Jul 9.31 | Monagonal box + vane<br>635 | 1.71 long?<br>1.42 dia? | 1971 Oct 2.9<br>1972 Jun 1.0<br>1973 May 16.5 | 33.13<br>33.13<br>33.13   | 93.40<br>92.84<br>91.86 | 6825<br>6798<br>6749 | 323<br>315<br>298   | 571<br>525<br>443  | 0.018<br>0.015<br>0.011 | 91<br>-<br>-              |
| D | TTS 3 †            | 1971 Sep 29.41<br>2547 days<br>1978 Sep 19      | Octahedron<br>20            | 0.30 side               | 1971 Oct 3.2<br>1973 May 1.0                  | 33.09<br>33.09            | 94.17<br>93.58          | 6863<br>6834         | 398<br>385          | 572<br>527         | 0.013<br>0.010          | 85<br>-                   |
| D | OSO 7 second stage | 1971 Sep 29.41<br>847.61 days<br>1974 Jan 24.02 | Cylinder<br>3507            | 4.9 long<br>1.43 dia    | 1971 Oct 1.1<br>1972 Jul 1.0<br>1973 Apr 16.0 | 33.08<br>33.08<br>33.08   | 93.88<br>93.17<br>92.13 | 6849<br>6814<br>6762 | 371<br>358<br>333   | 570<br>514<br>435  | 0.015<br>0.011<br>0.007 | 70<br>-<br>-              |
| D | Fragment           |   |                             |                         |   |                           |                         |                      |                     |                    |                         |                           |
| D | Cosmos 442         | 1971 Sep 29.48<br>12.75 days<br>1971 Oct 12.23  | Sphere-cylinder<br>6300?    | 6.5 long?<br>2.4 dia    | 1971 Oct 2.9<br>1971 Oct 6.3                  | 72.86<br>72.81            | 89.47<br>89.62          | 6626<br>6634         | 182<br>179          | 313<br>333         | 0.010<br>0.012          | 58<br>56                  |
| R |                    |   |                             |                         |   |                           |                         |                      |                     |                    |                         |                           |
| D | Cosmos 442 rocket  | 1971 Sep 29.48<br>6.51 days<br>1971 Oct 5.99    | Cylinder<br>2500?           | 7.5 long<br>2.6 dia     | 1971 Oct 2.8                                  | 72.85                     | 89.01                   | 6603                 | 195                 | 254                | 0.004                   | 74                        |
| D | Cosmos 442 engine  | 1971 Sep 29.48<br>18.38 days<br>1971 Oct 17.86  | Cone<br>600? full           | 1.5 long?<br>2 dia?     | 1971 Oct 12.2                                 | 72.85                     | 89.37                   | 6621                 | 177                 | 309                | 0.010                   | 41                        |
| D | Fragments          |   |                             |                         |   |                           |                         |                      |                     |                    |                         |                           |
| D | Cosmos 443         | 1971 Oct 7.52<br>11.67 days<br>1971 Oct 19.19   | Sphere-cylinder<br>5900?    | 5.9 long<br>2.4 dia     | 1971 Oct 8.9                                  | 65.40                     | 89.55                   | 6631                 | 204                 | 301                | 0.007                   | 61                        |
| R |                    |   |                             |                         |   |                           |                         |                      |                     |                    |                         |                           |
| D | Cosmos 443 rocket  | 1971 Oct 7.52<br>6.47 days<br>1971 Oct 13.99    | Cylinder<br>2500?           | 7.5 long<br>2.6 dia     | 1971 Oct 8.4                                  | 65.39                     | 89.42                   | 6624                 | 199                 | 293                | 0.007                   | 52                        |

† Test and Training Satellite.

\*1971-84D ejected from 1971-84A about 1971 Oct 12.

1971-85 continued on page 274

| 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<br>Excess Radiation Package B* | 1971 Oct 7.52<br>23 days<br>1971 Oct 30 | Ellipsoid<br>2007     | 0.9 long<br>1.9 dia   | 1971 Oct 26.2                 | 65.40                     | 88.61              | 6584                 | 186                 | 225                | 0.003                | -                         |
| D<br>Fragments                   | 1971-85C-E                              |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 444                       | 1971 Oct 13.57<br>6000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1971 Oct 13.9                 | 74.03                     | 114.16             | 7795                 | 1324                | 1509               | 0.012                | 108                       |
| Cosmos 445                       | 1971 Oct 13.57<br>7000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1971 Oct 19.9                 | 74.03                     | 114.53             | 7811                 | 1353                | 1513               | 0.010                | 104                       |
| Cosmos 446                       | 1971 Oct 13.57<br>8000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1971 Oct 15.0                 | 74.03                     | 114.88             | 7827                 | 1384                | 1513               | 0.008                | 117                       |
| Cosmos 447                       | 1971 Oct 13.57<br>9000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1971 Oct 16.9                 | 74.03                     | 115.21             | 7843                 | 1414                | 1515               | 0.006                | 122                       |
| Cosmos 448                       | 1971 Oct 13.57<br>9000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1971 Oct 14.0                 | 74.03                     | 115.58             | 7860                 | 1441                | 1522               | 0.005                | 130                       |
| Cosmos 449                       | 1971 Oct 13.57<br>10000 years           | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1971 Oct 16.2                 | 74.04                     | 116.33             | 7892                 | 1484                | 1544               | 0.004                | 194                       |
| Cosmos 450                       | 1971 Oct 13.57<br>10000 years           | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1971 Oct 14.8                 | 74.03                     | 115.94             | 7876                 | 1465                | 1530               | 0.004                | 168                       |
| Cosmos 451                       | 1971 Oct 13.57<br>10000 years           | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1971 Oct 21.2                 | 74.03                     | 116.73             | 7911                 | 1492                | 1574               | 0.005                | 212                       |
| Cosmos 444<br>rocket             | 1971 Oct 13.57<br>20000 years           | Cylinder<br>22007     | 7.4 long<br>2.4 dia   | 1971 Oct 14.8                 | 74.03                     | 117.43             | 7943                 | 1501                | 1628               | 0.008                | 247                       |

\*1971-85F ejected from 1971-85A about 1971 Oct 19

Year of launch 1971, continued

| Name                        | Launch date, lifetime and descent date            | Shape and weight (kg)          | Size (m)                         | Date of orbital determination    | Orbital inclination (deg) | Modal period (min) | Semi-major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|-----------------------------|---|--------------------------------|----------------------------------|----------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| [Thor] Burner 2†            | 1971 Oct 14, 40<br>80 years                       | 12-faced frustum<br>195        | 1.64 long<br>1.31 to<br>1.10 dia | 1971 Oct 14, 9                   | 98.96                     | 101.68             | 7215                 | 796                 | 877                | 0.006                | 231                       |
| Burner 2 rocket             | 1971 Oct 14, 40<br>60 years                       | Sphere-cone<br>66              | 1.32 long<br>0.94 dia            | 1971 Oct 14, 4                   | 98.94                     | 101.78             | 7220                 | 796                 | 888                | 0.006                | 230                       |
| Cosmos 452                  | 1971 Oct 14, 38<br>12.83 days<br>1971 Oct 27, 21  | Sphere-cylinder<br>6300?       | 6.5 long?<br>2.4 dia             | 1971 Oct 15, 4<br>1971 Oct 19, 5 | 64.97<br>64.98            | 89.07<br>89.41     | 6607<br>6624         | 198<br>176          | 260<br>316         | 0.005<br>0.011       | 17<br>50                  |
| Cosmos 452 rocket           | 1971 Oct 14, 38<br>4.48 days<br>1971 Oct 16, 86   | Cylinder<br>2500?              | 7.5 long<br>2.6 dia              | 1971 Oct 15, 8                   | 64.98                     | 88.70              | 6589                 | 189                 | 233                | 0.003                | 359                       |
| Cosmos 452 engine*          | 1971 Oct 14, 38<br>16 days<br>1971 Oct 30         | Cone<br>600? full              | 1.5 long?<br>2 dia?              | 1971 Oct 28, 1                   | 64.97                     | 90.07              | 6657                 | 196                 | 362                | 0.012                | 18                        |
| Fragments                   | 1971-88C,D,F                                      |                                |                                  |                                  |                           |                    |                      |                     |                    |                      |                           |
| ASTEX**<br>[Thorad Agena D] | 1971 Oct 17, 57<br>200 years                      | Cylinder +<br>2 wings<br>1500? | 9.6 long?<br>1.5 dia<br>9.8 span | 1971 Oct 27, 0                   | 92.72                     | 100.65             | 7166                 | 773                 | 803                | 0.002                | 348                       |
| Cosmos 453                  | 1971 Oct 19, 53<br>151.55 days<br>1972 Mar 19, 08 | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia              | 1971 Oct 26, 2<br>1972 Jan 1, 0  | 71.00<br>71.00            | 92.19<br>91.47     | 6760<br>6725         | 271<br>259          | 493<br>434         | 0.016<br>0.013       | 67<br>-                   |
| Cosmos 453 rocket           | 1971 Oct 19, 53<br>73.61 days<br>1972 Jan 1, 14   | Cylinder<br>1500?              | 8 long<br>1.65 dia               | 1971 Oct 24, 9                   | 71.00                     | 92.08              | 6754                 | 270                 | 482                | 0.016                | 73                        |
| Fragment                    | 1971-90C  |                                |                                  |                                  |                           |                    |                      |                     |                    |                      |                           |

† DMSP: USAF Defense Meteorological Satellite Program

\* 1971-88E ejected from 1971-88A on 1971 Oct 26.

\*\*USAF Advanced Space Technology Experiments.

|    | Name                              | Launch date, lifetime and descent date        | Shape and weight (kg)        | Size (m)              | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|----|-----------------------------------|---|------------------------------|-----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D  | ITOS B*<br>second stage           | 1971 Oct 21.48<br>274 days<br>1972 Jul 21     | Cylinder<br>3507             | 4.9 long<br>1.43 dia  | 1971 Oct 23.9<br>1972 Mar 16.5 | 102.62<br>102.59          | 102.53<br>99.63    | 7255<br>7117         | 279<br>292          | 1474<br>1186       | 0.082<br>0.063       | 149<br>-                  |
| 3d | Fragments<br>1971-918-B           |   |                              |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D  | [Titan 3B<br>Agena D]             | 1971 Oct 23.72<br>25 days<br>1971 Nov 17      | Cylinder<br>30007            | 8 long ?<br>1.5 dia   | 1971 Oct 24.3<br>1971 Oct 31.4 | 110.94<br>110.96          | 90.02<br>89.95     | 6653<br>6650         | 134<br>133          | 416<br>410         | 0.021<br>0.021       | 135<br>133                |
| D  | Fragment<br>1971-928              |   |                              |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| T  | Prospero**<br>[Black Arrow]       | 1971 Oct 28.17<br>150 years                   | 26-faced<br>polyhedron<br>66 | 0.70 long<br>1.12 dia | 1971 Nov 1.0                   | 82.06                     | 106.53             | 7443                 | 547                 | 1562               | 0.069                | 329                       |
|    | Waxwing rocket<br>1971-938        | 1971 Oct 28.17<br>100 years                   | Cylinder +<br>nozzle 47      | 1.36 long<br>0.71 dia | 1971 Oct 30.5                  | 82.05                     | 106.62             | 7447                 | 546                 | 1563               | 0.070                | 333                       |
|    | Fragment***<br>1971-93C           |   |                              |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D  | Cosmos 454<br>1971-94A            | 1971 Nov 2.60<br>13.7 days<br>1971 Nov 16.3   | Sphere-<br>cylinder<br>63007 | 6.5 long?<br>2.4 dia  | 1971 Nov 2.9<br>1971 Nov 4.9   | 65.42<br>65.45            | 89.14<br>90.03     | 6611<br>6655         | 203<br>203          | 262<br>350         | 0.004<br>0.011       | 53<br>44                  |
| D  | Cosmos 454<br>rocket<br>1971-94B  | 1971 Nov 2.60<br>4.12 days<br>1971 Nov 6.72   | Cylinder<br>25007            | 7.5 long<br>2.6 dia   | 1971 Nov 2.9                   | 65.44                     | 89.05              | 6606                 | 199                 | 257                | 0.004                | 39                        |
| D  | Cosmos 454<br>engine†<br>1971-94D | 1971 Nov 2.60<br>22.45 days<br>1971 Nov 25.05 | Cone<br>6007 full            | 1.5 long?<br>2 dia?   | 1971 Nov 16.1                  | 65.45                     | 89.88              | 6647                 | 202                 | 336                | 0.010                | 35                        |
| D  | Fragments<br>1971-94C,E,F         |   |                              |                       |                                |                           |                    |                      |                     |                    |                      |                           |

\*The satellite ITOS B failed to achieve orbit  
† 1971-94D ejected from 94A on 1971 Nov 14.

\*\*UK technological satellite, known as X3 before launch.  
\*\*\*This object is probably an aerial about 1 m long.

| 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) |
|-------------------------|--|-------------------------------|-----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| DSCS 1†<br>[Titan 3C]   | 1971 Nov 3.13<br>> million years               | Cylinder +<br>2 dishes<br>522 | 1.83 long<br>2.74 dia | 1971 Nov 25.9                  | 2.70                      | 1435.2             | 42148                | 35065               | 36475              | 0.017                | 201                       |
| DSCS 2                  | 1971 Nov 3.13<br>> million years               | Cylinder +<br>2 dishes<br>522 | 1.83 long<br>2.74 dia | 1971 Nov 27.9                  | 2.28                      | 1438.0             | 42202                | 35349               | 36299              | 0.011                | 227                       |
| DSCS 1<br>rocket        | 1971 Nov 3.13<br>> million years               | Cylinder<br>1500?             | 6 long?<br>3.0 dia    | 1971 Nov 3.4                   | 2.63                      | 1481.3             | 43043                | 36089               | 37240              | 0.013                | 199                       |
| Explorer 45<br>(SSS-1)* | 1971 Nov 15.24<br>25 years?                    | Octagon<br>52                 | 0.76 long<br>0.68 dia | 1971 Nov 18.0                  | 3.58                      | 466.85             | 19942                | 233                 | 26895              | 0.669                | 261                       |
| Explorer 45<br>rocket   | 1971 Nov 15.24<br>20 years?                    | Cylinder<br>24                | 1.50 long<br>0.46 dia | 1972 Apr 15.1                  | 3.27                      | 457.7              | 19677                | 275                 | 26323              | 0.662                | 81                        |
| Cosmos 455              | 1971 Nov 17.47<br>143.55 days<br>1972 Apr 9.02 | Ellipsoid<br>400?             | 1.8 long<br>1.2 dia   | 1971 Nov 19.9<br>1972 Feb 1.0  | 71.00<br>71.00            | 92.19<br>91.46     | 6760<br>6724         | 272<br>259          | 491<br>433         | 0.016<br>0.013       | 73<br>-                   |
| Cosmos 455<br>rocket    | 1971 Nov 17.47<br>82.60 days<br>1972 Feb 8.07  | Cylinder<br>1500?             | 8 long<br>1.65 dia    | 1971 Nov 18.0                  | 70.98                     | 92.03              | 6752                 | 274                 | 473                | 0.015                | 77                        |
| Cosmos 456              | 1971 Nov 19.50<br>12.8 days<br>1971 Dec 2.3    | Sphere-<br>cylinder<br>6300?  | 6.5 long?<br>2.4 dia  | 1971 Nov 20.9<br>1971 Nov 26.4 | 72.86<br>72.87            | 89.34<br>89.98     | 6619<br>6651         | 178<br>186          | 304<br>360         | 0.010<br>0.013       | 55<br>64                  |
| Cosmos 456<br>rocket    | 1971 Nov 19.50<br>6.25 days<br>1971 Nov 25.75  | Cylinder<br>2500?             | 7.5 long<br>2.6 dia   | 1971 Nov 19.8                  | 72.87                     | 89.50              | 6627                 | 201                 | 297                | 0.007                | 57                        |

\*Small scientific satellite

†Defence Satellite Communication System

| Name                           | Launch date, lifetime and descent date            | Shape and weight (kg)           | Size (m)              | Date of orbital determination                     | Orbital inclination (deg) | Modal period (min)         | Semi major axis (km)    | Perigee height (km) | Apogee height (km)      | Orbital eccentricity    | Argument of perigee (deg) |
|--------------------------------|---|---------------------------------|-----------------------|---|---------------------------|----------------------------|-------------------------|---------------------|-------------------------|-------------------------|---------------------------|
| D Cosmos 456 engine*           | 1971 Nov 19, 50<br>21.27 days<br>1971 Dec 10, 77  | Cone<br>600? full               | 1.5 long?<br>2 dia?   | 1971 Dec 2, 4                                     | 72.84                     | 89.75                      | 6640                    | 187                 | 336                     | 0.011                   | 52                        |
| D Fragments                    |   |                                 |                       |   |                           |                            |                         |                     |                         |                         |                           |
| Cosmos 457                     | 1971 Nov 20, 75<br>3000 years                     | Spheroid +<br>gaddies?<br>650?  | 1.6 dia?              | 1971 Nov 23, 5                                    | 74.04                     | 109.50                     | 7581                    | 1185                | 1221                    | 0.002                   | 224                       |
| Cosmos 457 rocket              | 1971 Nov 20, 75<br>2000 years                     | Cylinder<br>2200?               | 7.4 long<br>2.4 dia   | 1971 Nov 27, 6                                    | 74.03                     | 109.37                     | 7575                    | 1182                | 1212                    | 0.002                   | 200                       |
| Mo'i niya 2A                   | 1971 Nov 24, 40<br>28 months?<br>1974 Mar?        | Windmill +<br>6 vanes?<br>1250? | 4.2 long?<br>1.6 dia? | 1971 Nov 24, 4<br>1972 Feb 1, 0<br>1972 Aug. 1, 0 | 65.47<br>65.47<br>65.47   | 712.03<br>717.71<br>717.73 | 26414<br>26555<br>26555 | 517<br>466<br>567   | 39554<br>39887<br>39787 | 0.739<br>0.742<br>0.739 | 285<br>-<br>-             |
| D Mo'i niya 2A launcher rocket | 1971 Nov 24, 40<br>25.13 days<br>1971 Dec 19, 53  | Cylinder<br>2500?               | 7.5 long<br>2.6 dia   | 1971 Nov 24, 7                                    | 65.42                     | 91.06                      | 6705                    | 218                 | 436                     | 0.016                   | 60                        |
| D Mo'i niya 2A launcher        | 1971 Nov 24, 40<br>36.33 days<br>1971 Dec 30, 73  | Irregular                       | -                     | 1971 Nov 24, 7                                    | 65.43                     | 91.42                      | 6723                    | 225                 | 465                     | 0.018                   | 68                        |
| D Mo'i niya 2A rocket          | 1971 Nov 24, 40<br>773 days<br>1974 Jan 5         | Cylinder<br>440                 | 2.0 long<br>2.0 dia   | 1972 Jan 1, 0<br>1972 Aug 1, 0<br>1973 Jun 1, 0   | 65.47<br>65.47<br>65.47   | 703.63<br>703.53<br>703.41 | 26206<br>26203<br>26200 | 450<br>551<br>348   | 39205<br>39099<br>39296 | 0.739<br>0.736<br>0.743 | -<br>-<br>-               |
| D Fragment                     |   |                                 |                       |   |                           |                            |                         |                     |                         |                         |                           |
| D Cosmos 458                   | 1971 Nov 29, 43<br>142.90 days<br>1972 Apr 20, 33 | Ellipsoid<br>400?               | 1.8 long<br>1.2 dia   | 1971 Nov 29, 7<br>1972 Feb 15, 5                  | 70.96<br>70.96            | 92.25<br>91.52             | 6763<br>6727            | 272<br>258          | 497<br>440              | 0.017<br>0.014          | 80<br>-                   |
| D Cosmos 458 rocket            | 1971 Nov 29, 43<br>77.49 days<br>1972 Feb 14, 92  | Cylinder<br>1500?               | 8 long<br>1.65 dia    | 1971 Nov 30, 1                                    | 70.96                     | 92.07                      | 6754                    | 270                 | 481                     | 0.016                   | 84                        |

\*1971-98E ejected from 1971-98A on 1971 Dec 1.

| Name                   | Launch date, lifetime and descent date         | Shape and weight (kg)          | Size (m)            | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|------------------------|--|--------------------------------|---------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D Cosmos 459           | 1971 Nov 29.73<br>27.92 days<br>1971 Dec 27.65 | Cylinder?                      | 4 long?<br>2 dia?   | 1971 Dec 3.2                  | 65.81                     | 89.34              | 6620                 | 224                 | 260                | 0.003                | 3                         |
| D Cosmos 459 rocket    | 1971 Nov 29.73<br>11.29 days<br>1971 Dec 11.02 | Cylinder<br>2200?              | 7.4 long<br>2.4 dia | 1971 Nov 30.2                 | 65.87                     | 89.34              | 6621                 | 223                 | 262                | 0.003                | 4                         |
| D Fragment             |  |                                |                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D Cosmos 460           | 1971 Nov 30.70<br>10 years                     | Cylinder +<br>paddles?<br>900? | 2 long?<br>1 dia?   | 1971 Nov 30.9                 | 74.01                     | 95.25              | 6908                 | 528                 | 532                | 0.0003               | 328                       |
| D Cosmos 460 rocket    | 1971 Nov 30.70<br>10 years                     | Cylinder<br>2200?              | 7.4 long<br>2.4 dia | 1971 Dec 1.9                  | 74.04                     | 95.14              | 6903                 | 508                 | 541                | 0.002                | 349                       |
| D Fragment             |  |                                |                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D Interkosmos 5        | 1971 Dec 2.35<br>126.84 days<br>1972 Apr 7.19  | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia | 1971 Dec 4.0                  | 48.42                     | 98.49              | 7068                 | 198                 | 1181               | 0.070                | 110                       |
| D Interkosmos 5 rocket | 1971 Dec 2.35<br>90.67 days<br>1972 Mar 2.02   | Cylinder<br>1500?              | 8 long<br>1.65 dia  | 1971 Dec 5.4                  | 48.43                     | 98.21              | 7054                 | 199                 | 1152               | 0.068                | 116                       |
| D Fragment             |  |                                |                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D Cosmos 461*          | 1971 Dec 2.73<br>7½ years                      | Cylinder?<br>950?              | -                   | 1971 Dec 5.5                  | 69.23                     | 94.61              | 6878                 | 488                 | 511                | 0.002                | 352                       |
| D Cosmos 461 rocket    | 1971 Dec 2.73<br>7½ years                      | Cylinder<br>2200?              | 7.4 long<br>2.4 dia | 1971 Dec 6.6                  | 69.23                     | 94.45              | 6870                 | 476                 | 507                | 0.002                | 11                        |
| D Fragments            |  |                                |                     |                               |                           |                    |                      |                     |                    |                      |                           |

\* Gamma radiation studies

## Year of launch 1971, continued

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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 462e         | 1971 Dec 3.55<br>1218.35 days<br>1975 Apr 4.90 | Cylinder?                    | 4 long?<br>2 dia?    | 1971 Dec 5.9<br>1972 Aug 1.0<br>1973 Oct 1.0<br>1971 Dec 5.0 | 65.75<br>65.75<br>65.75<br>62.31 | 105.43<br>103.06<br>98.80<br>101.96 | 7393<br>7282<br>7081<br>7230 | 230<br>212<br>220<br>143 | 1800<br>1595<br>1185<br>1561 | 0.106<br>0.095<br>0.068<br>0.098 | 53<br>-<br>-<br>57        |
| D | Cosmos 462 rocket   | 1971 Dec 3.55<br>33.23 days<br>1972 Jan 5.78   | Cylinder<br>1500?            | 8 long?<br>2.5 dia?  |  |                                  |                                     |                              |                          |                              |                                  |                           |
| D | Fragments           | 1971-106B, D-AS                                |                              |                      |  |                                  |                                     |                              |                          |                              |                                  |                           |
| D | Cosmos 463          | 1971 Dec 6.41<br>4.96 days<br>1971 Dec 11.37   | Sphere-<br>cylinder<br>5300? | 6.5 long?<br>2.4 dia | 1971 Dec 6.6<br>1971 Dec 9.6                                 | 64.97<br>64.97                   | 89.24<br>89.27                      | 6616<br>6617                 | 202<br>182               | 273<br>296                   | 0.005<br>0.009                   | 37<br>45                  |
| D | Cosmos 463 rocket   | 1971 Dec 6.41<br>5.39 days<br>1971 Dec 11.80   | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1971 Dec 6.8   | 64.99                            | 89.18                               | 6613                         | 202                      | 267                          | 0.005                            | 38                        |
| D | Cosmos 463 engine** | 1971 Dec 6.41<br>9.57 days<br>1971 Dec 15.98   | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1971 Dec 10.3  | 64.97                            | 89.17                               | 6612                         | 180                      | 288                          | 0.008                            | 48                        |
| D | Fragment            | 1971-107C                                      |                              |                      |  |                                  |                                     |                              |                          |                              |                                  |                           |
| D | Cosmos 464          | 1971 Dec 10.46<br>5.8 days<br>1971 Dec 16.3    | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1971 Dec 11.0<br>1971 Dec 14.9                               | 72.84<br>72.86                   | 90.34<br>89.23                      | 6669<br>6614                 | 206<br>178               | 375<br>293                   | 0.013<br>0.009                   | 72<br>30                  |
| D | Cosmos 464 rocket   | 1971 Dec 10.46<br>14.25 days<br>1971 Dec 24.71 | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1971 Dec 11.0  | 72.85                            | 90.26                               | 6665                         | 205                      | 369                          | 0.012                            | 69                        |
| D | Cosmos 464 engine + | 1971 Dec 10.46<br>9.23 days<br>1971 Dec 19.69  | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1971 Dec 15.4  | 72.86                            | 89.09                               | 6607                         | 166                      | 291                          | 0.009                            | 23                        |
| D | Fragments           | 1971-108C, D                                   |                              |                      |  |                                  |                                     |                              |                          |                              |                                  |                           |

\*Cosmos 462 passed close to Cosmos 459 on 1971 Dec 3.70,  
then exploded.

\*\*1971-107D ejected from 1971-107A on 1971 Dec 10.  
+ 1971-108E ejected from 1971-108A on 1971 Dec 15.

|    | Name                  | Launch date, lifetime and descent date         | Shape and weight (kg)           | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|----|-----------------------|--|---------------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D  | Ariel 4*              | 1971 Dec 11.86<br>2557.8 days<br>1978 Dec 12.7 | Cylinder +<br>4 paddles<br>99.5 | 0.91 long<br>0.76 dia | 1971 Dec 12.6<br>1973 Nov 1.0 | 82.99<br>82.99            | 95.35<br>94.74     | 6913<br>6883         | 477<br>457          | 593<br>552         | 0.008<br>0.007       | 242<br>-                  |
| D  | Ariel 4<br>rocket     | 1971 Dec 11.86<br>2433 days<br>1978 Aug 9      | Cylinder<br>24                  | 1.5 long<br>0.46 dia  | 1971 Dec 12.6<br>1973 Aug 1.0 | 83.00<br>82.99            | 95.33<br>94.72     | 6912<br>6882         | 477<br>457          | 591<br>550         | 0.008<br>0.007       | 244<br>-                  |
| D  | Fragments             |  |                                 |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| T  | [Thorad<br>Agena D]   | 1971 Dec 14.51<br>700 years                    | -                               | -                     | 1971 Dec 26.5                 | 70.00                     | 104.93             | 7369                 | 983                 | 999                | 0.001                | 235                       |
|    | Agena D<br>rocket     | 1971 Dec 14.51<br>600 years                    | Cylinder<br>700?                | 6 long?<br>1.5 dia    | 1971 Dec 29.2                 | 70.02                     | 104.17             | 7333                 | 943                 | 967                | 0.002                | 297                       |
| T7 | [Thorad<br>Agena D]** | 1971 Dec 14.51<br>700 years                    | Box +<br>aerials?               | 0.3 x 0.9<br>x 2.4?   | 1971 Dec 26.4                 | 70.01                     | 104.93             | 7369                 | 983                 | 999                | 0.001                | 242                       |
| T7 | [Thorad<br>Agena D]** | 1971 Dec 14.51<br>700 years                    | Box +<br>aerials?               | 0.3 x 0.9<br>x 2.4?   | 1972 Jan 1.5                  | 70.01                     | 104.90             | 7368                 | 982                 | 997                | 0.001                | 221                       |
| T7 | [Thorad<br>Agena D]** | 1971 Dec 14.51<br>700 years                    | Box +<br>aerials?               | 0.3 x 0.9<br>x 2.4?   | 1972 Jan 1.0                  | 70.01                     | 104.89             | 7367                 | 981                 | 997                | 0.001                | -                         |
|    | Cosmos 465            | 1971 Dec 15.19<br>1200 years                   | Cylinder +<br>boom?<br>700?     | 1.4 long<br>2.0 dia   | 1971 Dec 29.2                 | 74.03                     | 104.94             | 7369                 | 970                 | 1012               | 0.003                | 260                       |
|    | Cosmos 465<br>rocket  | 1971 Dec 15.19<br>600 years                    | Cylinder<br>2200?               | 7.4 long<br>2.4 dia   | 1971 Dec 26.9                 | 74.03                     | 104.83             | 7364                 | 970                 | 1002               | 0.002                | 263                       |

\*British satellite, known as UK4 before launch.

\*\* SSU precursors



| 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 Molniya 1U<br>1971-115A                    | 1971 Dec 19.96<br>1942 days<br>1977 Apr 13    | Windmill +<br>6 vanes<br>1000?     | 3.4 long<br>1.6 dia   | 1971 Dec 29.3<br>1972 Feb 1.0  | 55.42<br>55.42            | 703.28<br>717.79   | 26197<br>26557       | 499<br>417          | 39139<br>39940     | 0.738<br>0.744       | 285<br>-                  |
| D Molniya 1U<br>rocket<br>1971-115B          | 1971 Dec 19.96<br>2104 days<br>1977 Sep 22    | Cylinder<br>440                    | 2.0 long<br>2.0 dia   | 1971 Dec 31.2                  | 65.45                     | 699.22             | 26097                | 451                 | 38986              | 0.738                | 285                       |
| D Molniya 1U<br>launcher rocket<br>1971-115C | 1971 Dec 19.96<br>38 days<br>1972 Jan 26      | Cylinder<br>2500?                  | 7.5 long<br>2.6 dia   | 1971 Dec 21.7                  | 65.41                     | 91.56              | 6730                 | 222                 | 481                | 0.019                | 72                        |
| D Molniya 1U<br>launcher<br>1971-115D        | 1971 Dec 19.96<br>39 days<br>1972 Jan 27      | Irregular                          | -                     | 1971 Dec 21.7                  | 65.37                     | 91.64              | 6734                 | 222                 | 489                | 0.020                | 71                        |
| Intelsat 4B (F-3)<br>1971-116A               | 1971 Dec 20.05<br>>million years              | Cylinder<br>1410 full<br>707 empty | 2.82 long<br>2.39 dia | 1971 Dec 20.1<br>1972 Jan 1.0  | 28.23<br>0.4              | 640.3<br>1436.2    | 24616<br>42167       | 550<br>35749        | 35926<br>35828     | 0.719<br>0.001       | 179<br>-                  |
| Intelsat 4B<br>rocket<br>1971-116B           | 1971 Dec 20.05<br>6000 years                  | Cylinder<br>1815                   | 8.6 long<br>3.0 dia   | 1971 Dec 20.1                  | 28.23                     | 640.3              | 24616                | 550                 | 35926              | 0.719                | 179**                     |
| Cosmos 469<br>1971-117A                      | 1971 Dec 25.48<br>600 years                   | Cone-<br>cylinder                  | 6 long?<br>2 dia?     | 1971 Dec 26.0<br>1972 Jan 15.6 | 64.94<br>64.50            | 89.60<br>104.74    | 6634<br>7360         | 249<br>941          | 262<br>1023        | 0.001<br>0.006       | 286<br>346                |
| D Cosmos 469*<br>platform<br>1971-117B       | 1971 Dec 25.48<br>45.60 days<br>1972 Feb 9.08 | Irregular                          | -                     | 1972 Jan 4.4                   | 64.96                     | 89.57              | 6632                 | 247                 | 261                | 0.001                | 301                       |
| D Cosmos 469*<br>rocket<br>1971-117C         | 1971 Dec 25.48<br>13.16 days<br>1972 Jan 7.64 | Cylinder<br>1500?                  | 8 long?<br>2.5 dia?   | 1972 Jan 4.1                   | 64.96                     | 89.48              | 6628                 | 244                 | 255                | 0.001                | 305                       |

\*1971-117C, and probably 1971-117B, attached to 1971-117A until orbit change on 1972 Jan 4.29. \*\*Approximate 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<br>E<br>Comos 470  | 1971 Dec 27.59<br>9.76 days<br>1972 Jan 6.35   | Sphere-cylinder<br>5900?  | 5.9 long<br>2.4 dia  | 1971 Dec 28.6   | 65.42                                     | 89.03  | 6605                                 | 194                             | 260                               | 0.005                                     | 18                          |
| D<br>Comos 470<br>rocket   | 1971 Dec 27.59<br>2.95 days<br>1971 Dec 30.54  | Cylinder<br>2500?   | 7.5 long<br>2.6 dia  | 1971 Dec 28.6   | 65.43                                     | 88.75  | 6391                                 | 177                             | 249                               | 0.005                                     | 17                          |
| D<br>Capulee   | 1971 Dec 27.59<br>10.02 days<br>1972 Jan 6.61  | Ellipsoid<br>200?   | 0.9 long<br>1.9 dia  | 1972 Jan 6.3  | 65.43                                     | 88.43  | 6575                                 | 183                             | 211                               | 0.002                                     | 5                           |
| D<br>Fragments   | 1971-1180, E   |   |  |   |   |  |                                      |                                 |                                   |   |                             |
| Aurville (see<br>Aurville 1<br>rocket<br>Fragments<br>Meteor 10) | 1971 Dec 27.79<br>70 years<br>1971 Dec 27.79<br>50 years<br>1971 Dec 29.45<br>500 years<br>1971 Dec 29.45<br>400 years | Octagonal<br>ellipsoid<br>400?<br>Cylinder<br>2200?<br>Cylinder +<br>2 vanes<br>2200?<br>Cylinder<br>1440 | 1.8 long?<br>1.5 dia?<br>7.4 long<br>2.4 dia<br>5 long?<br>1.5 dia?<br>3.8 long<br>2.6 dia | 1972 Jan 1.9<br>1972 Jan 3.0<br>1972 Jan 2.2<br>1972 Feb 17.5<br>1972 Jan 2.6 | 73.98<br>74.00<br>81.25<br>81.25<br>81.26 | 114.65<br>114.51<br>102.66<br>102.32<br>102.72 | 7817<br>7810<br>7262<br>7245<br>7254 | 400<br>394<br>878<br>859<br>845 | 2477<br>2469<br>889<br>874<br>927 | 0.133<br>0.133<br>0.001<br>0.001<br>0.006 | 98<br>96<br>221<br>-<br>168 |
| D<br>Fragments   | 1971-1200-E  |   |  |   |   |  |                                      |                                 |                                   |   |                             |

1971-118C ejected from 1971-118A about 1972 Jan 6.

1971-118C ejected from 1971-118A, launched by USSR.

† Meteor 10 carried orbital adjustment motor.

|        | 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<br>R | Cosmos 471<br>1972-01A             | 1972 Jan 12.42<br>12.9 days<br>1972 Jan 25.3  | Sphere-cylinder<br>6300?             | 6.5 long?<br>2.4 dia  | 1972 Jan 12.8<br>1972 Jan 23.2 | 64.99<br>64.99            | 89.66<br>88.96     | 6637<br>6602         | 201<br>178          | 316<br>270         | 0.009<br>0.007       | 57<br>49                  |
| D      | Cosmos 471<br>rocket<br>1972-01B   | 1972 Jan 12.42<br>7.84 days<br>1972 Jan 20.26 | Cylinder<br>2500?                    | 7.5 long<br>2.6 dia   | 1972 Jan 12.8                  | 65.01                     | 89.58              | 6633                 | 198                 | 311                | 0.008                | 54                        |
| D      | Cosmos 471<br>engine*<br>1972-01G  | 1972 Jan 12.42<br>14 days<br>1972 Jan 26      | Cone<br>600? full                    | 1.5 long?<br>2 dia?   | 1972 Jan 26.2                  | 64.98                     | 88.50              | 6579                 | 181                 | 220                | 0.003                | 15                        |
| D      | Fragments<br>1972-01C-F            |   |                                      |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D      | [Titan 3D]<br>1972-02A             | 1972 Jan 20.77<br>40 days<br>1972 Feb 29      | Cylinder<br>13300? full              | 15 long<br>3.0 dia    | 1972 Jan 21.3<br>1972 Jan 31.8 | 97.00<br>97.00            | 89.41<br>89.47     | 6622<br>6625         | 157<br>149          | 331<br>344         | 0.013<br>0.015       | 140<br>126                |
| D      | Titan 3D<br>rocket<br>1972-02B     | 1972 Jan 20.77<br>2.70 days<br>1972 Jan 23.47 | Cylinder<br>1900                     | 6 long<br>3.0 dia     | 1972 Jan 20.9                  | 96.99                     | 89.23              | 6613                 | 163                 | 306                | 0.011                | 139                       |
| T      | Capsule<br>1972-02D                | 1972 Jan 20.77<br>74 years                    | Octagon<br>60?                       | 0.3 long?<br>0.9 dia? | 1972 Jan 31.4                  | 96.59                     | 94.86              | 6889                 | 472                 | 549                | 0.006                | 129                       |
| D      | Fragment<br>1972-02C               |   |                                      |                       |                                |                           |                    |                      |                     |                    |                      |                           |
|        | Intelcast 4C(F-4)<br>1972-03A      | 1972 Jan 23.01<br>> million years             | Cylinder +<br>2 aerials<br>1410 full | 2.88 long<br>2.29 dia | 1972 Jan 25.9<br>1972 Apr 16.0 | 28.22<br>0.4              | 654.5<br>1436.1    | 21967<br>42166       | 562<br>35781        | 36615<br>35794     | 0.722<br>0.0002      | 181**<br>-                |
|        | Intelcast 4C<br>rocket<br>1972-03B | 1972 Jan 23.01<br>6000 years                  | Cylinder<br>1815                     | 8.6 long<br>3.0 dia   | 1972 Jan 26.9                  | 28.22                     | 654.5              | 21967                | 562                 | 36615              | 0.722                | 181                       |

\*\* Approximate orbit

\* 1972-01G ejected from 1972-01A about 1972 Jan 23

| Name                         | Launch date, lifeline 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 472                 | 1972 Jan 25-47<br>206.48 days<br>1972 Aug 18.95 | Ellipsoid<br>4007            | 1.8 long<br>1.2 dia   | 1972 Jan 28.2<br>1972 May 1.0  | 82.01<br>81.99            | 102.26<br>98.57    | 72.3<br>7058         | 194<br>186          | 1536<br>1173       | 0.093<br>0.070       | 67<br>-                   |
| D Cosmos 472<br>rocket       | 1972 Jan 25-47<br>101.58 days<br>1972 May 6.05  | Cylinder<br>15007            | 8 long<br>1.65 dia    | 1972 Jan 27.9                  | 82.00                     | 102.15             | 7238                 | 193                 | 1526               | 0.092                | 69                        |
| D Heos 2 <sup>*</sup>        | 1972 Jan 31.72<br>913.73 days<br>1974 Aug 2.45  | 16-faced<br>cylinder<br>117  | 0.75 long<br>1.33 dia | 1972 Feb 3.5<br>1973 Jul 1.0   | 89.91<br>88.0             | 74.77-1<br>74.96-9 | 126663<br>126894     | 405<br>5442         | 240164<br>235589   | 0.946<br>0.907       | 310<br>-                  |
| D Heos 2<br>second stage     | 1972 Jan 31.72<br>2431 days<br>1978 Sep 27      | Cylinder<br>3507             | 4.9 long<br>1.43 dia  | 1972 Jan 31.8<br>1973 May 16.5 | 89.81<br>89.79            | 99.25<br>97.91     | 7100<br>7036         | 320<br>310          | 1123<br>1005       | 0.057<br>0.049       | 279<br>-                  |
| D Heos 2<br>rocket           | 1972 Jan 31.72<br>31 months?<br>1974 Aug?       | Cylinder<br>24               | 1.50 long<br>0.46 dia | Orbit similar to 1972-05A      |                           |                    |                      |                     |                    |                      |                           |
| D Fragments                  |   |                              |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D Cosmos 473                 | 1972 Feb 3.36<br>11.90 days<br>1972 Feb 15.26   | Sphere-<br>cylinder<br>5700? | 5.0 long<br>2.4 dia   | 1972 Feb 4.0                   | 65.01                     | 89.68              | 6638                 | 205                 | 314                | 0.008                | 51                        |
| D Cosmos 473<br>rocket       | 1972 Feb 3.36<br>8.24 days<br>1972 Feb 11.60    | Cylinder<br>25007            | 7.5 long<br>2.6 dia   | 1972 Feb 3.7                   | 65.04                     | 89.59              | 6633                 | 203                 | 307                | 0.008                | 46                        |
| D Luna 20<br>launcher        | 1972 Feb 14.14<br>5.57 days<br>1972 Feb 17.71   | -                            | -                     | 1972 Feb 14.5                  | 51.51                     | 88.73              | 6593                 | 191                 | 238                | 0.004                | 317                       |
| D Luna 20<br>launcher rocket | 1972 Feb 14.14<br>3.78 days<br>1972 Feb 17.92   | Cylinder<br>40007            | 12 long?<br>4 dia     | 1972 Feb 15.0                  | 51.48                     | 88.64              | 6588                 | 188                 | 232                | 0.003                | 322                       |

Space Vehicle: Luna 20, 1972-07A; Luna 20 rocket, 1972-07B \* Highly eccentric orbit satellite, launched for ESRO by NASA

|     | 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 474†           | 1972 Feb 16.40<br>12.9 days<br>1972 Feb 29.3  | Sphere-cylinder<br>6300?       | 6.5 long<br>2.4 dia | 1972 Feb 17.4                 | 64.97                     | 89.79              | 6643                 | 213                 | 317                | 0.008                | 72                        |
| D   | Cosmos 474 rocket     | 1972 Feb 16.40<br>7.50 days<br>1972 Feb 23.90 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia | 1972 Feb 17.9                 | 64.98                     | 89.63              | 6635                 | 202                 | 312                | 0.008                | 48                        |
| D   | Cosmos 474 engine*    | 1972 Feb 16.40<br>14 days<br>1972 Mar 1       | Cone<br>600? full              | 1.5 long?<br>2 dia? | 1972 Feb 29.3                 | 64.95                     | 90.45              | 6676                 | 195                 | 401                | 0.015                | 9                         |
| D   | Fragments             |   |                                |                     |                               |                           |                    |                      |                     |                    |                      |                           |
|     | Cosmos 475            | 1972 Feb 25.40<br>1200 years                  | Cylinder +<br>boom?<br>700?    | 1.4 long<br>2.0 dia | 1972 Feb 25.8                 | 74.08                     | 104.81             | 7363                 | 970                 | 1000               | 0.002                | 287                       |
|     | Cosmos 475 rocket     | 1972 Feb 25.40<br>600 years                   | Cylinder<br>2200?              | 7.4 long<br>2.4 dia | 1972 Feb 25.5                 | 74.09                     | 104.69             | 7357                 | 964                 | 994                | 0.002                | 291                       |
| T   | INELUS 3 [Titan 3C]   | 1972 Mar 1.40<br>>million years               | Cylinder +<br>4 panels<br>820? | 6 long?<br>2.5 dia? | 1972 Mar 1.5<br>1972 Apr 1.0  | 28.58<br>0.2              | 89.47<br>1429.9    | 6633<br>42067        | 153<br>35416        | 357<br>35962       | 0.015<br>0.006       | 114<br>-                  |
|     | Transtage             | 1972 Mar 1.40<br>>million years               | Cylinder<br>1500?              | 6 long?<br>3 dia    | 1972 Apr 1.0                  | 0.2                       | 1429.9             | 42067                | 35416               | 35962              | 0.006                | -                         |
| D   | Titan 3C second stage | 1972 Mar 1.40<br>2.00 days<br>1972 Mar 3.40   | Cylinder<br>1900               | 6 long<br>3.0 dia   | 1972 Mar 2.4                  | 28.63                     | 88.88              | 6604                 | 151                 | 300                | 0.011                | 123                       |

\* 1972-08E ejected from 1972-08A about 1972 Feb 28.

† Maneuvrable

| 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) | Apoogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|-------------------------------|---|---------------------------------|---------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|---------------------|----------------------|---------------------------|
| Cosmos 476                    | 1972 Mar 1.47<br>60 years                     | Cylinder *<br>2 vanes?<br>2500? | 5 long?<br>1.5 dia? | 1972 Mar 5.9                  | 81.23                     | 97.24              | 7003                 | 617                 | 633                 | 0.001                | 180                       |
| Cosmos 476<br>rocket          | 1972 Mar 1.47<br>60 years                     | Cylinder<br>1440                | 3.8 long<br>2.6 dia | 1972 Mar 5.9                  | 81.23                     | 97.35              | 7009                 | 569                 | 692                 | 0.009                | 160                       |
| Pioneer 10<br>second stage    | 1972 Mar 3.08<br>168 days<br>1972 Aug 18      | Cylinder<br>1815                | 8.6 long<br>3.0 dia | 1972 Apr 1.0                  | 31.6                      | 1523.2             | 43852                | 1-8                 | 74789               | 0.851                | -                         |
| Cosmos 477                    | 1972 Mar 4.42<br>11.8 days<br>1972 Mar 16.2   | Sphere-<br>cylinder<br>5900?    | 5.9 long<br>2.4 dia | 1972 Mar 5.0                  | 72.85                     | 89.60              | 6632                 | 202                 | 306                 | 0.008                | 65                        |
| Cosmos 477<br>rocket          | 1972 Mar 4.42<br>5.99 days<br>1972 Mar 10.41  | Cylinder<br>2500?               | 7.5 long<br>2.6 dia | 1972 Mar 4.8                  | 72.84                     | 89.48              | 6626                 | 202                 | 294                 | 0.007                | 62                        |
| Excess Radiation<br>Package C | 1972 Mar 4.42<br>19.07 days<br>1972 Mar 23.49 | Ellipsoid<br>200?               | 0.9 long<br>1.9 dia | 1972 Mar 14.7                 | 72.85                     | 89.43              | 6624                 | 199                 | 292                 | 0.007                | 49                        |
| Fragments                     | 1972-13C, D, F                                |                                 |                     |                               |                           |                    |                      |                     |                     |                      |                           |

Space vehicle: Pioneer 10, 1972-12A; Burner 2 rocket, 1972-12B

| Name                | Launch date, lifetime and descent date         | Shape and weight (kg)    | Size (m)                 | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---------------------|--|--------------------------|--------------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| TD 1A* (ESRO)       | 1972 Mar 12.08<br>10 years                     | Box + paddles<br>472     | 2.12 x<br>0.99 x<br>0.89 | 1972 Mar 12.9                  | 97.55                     | 95.41              | 6916                 | 524                 | 551                | 0.002                | 323                       |
| TD 1A second stage  | 1972 Mar 12.08<br>10 years                     | Cylinder<br>350?         | 4.9 long<br>1.43 dia     | 1972 Mar 12.9                  | 97.54                     | 95.34              | 6912                 | 525                 | 543                | 0.001                | 323                       |
| Fragments           | 1972-14C-E                                     |                          |                          |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 478          | 1972 Mar 15.54<br>12.68 days<br>1972 Mar 28.22 | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia     | 1972 Mar 16.2<br>1972 Mar 23.8 | 65.39<br>65.40            | 89.48<br>89.65     | 6628<br>6636         | 204<br>177          | 295<br>339         | 0.007<br>0.012       | 75<br>58                  |
| Cosmos 478 rocket   | 1972 Mar 15.54<br>6.33 days<br>1972 Mar 21.87  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia      | 1972 Mar 15.8                  | 65.41                     | 89.46              | 6627                 | 177                 | 320                | 0.011                | 54                        |
| Cosmos 478 engine** | 1972 Mar 15.54<br>15 days<br>1972 Mar 30       | Cone<br>600? full        | 1.5 long?<br>2 dia?      | 1972 Mar 29.7                  | 65.42                     | 89.83              | 6645                 | 189                 | 345                | 0.012                | 19                        |
| Fragments           | 1972-15C-E                                     |                          |                          |                                |                           |                    |                      |                     |                    |                      |                           |
| [Titan 3B Agena D]  | 1972 Mar 17.71<br>25 days<br>1972 Apr 11       | Cylinder<br>3000?        | 8 long?<br>1.5 dia       | 1972 Mar 18.2                  | 110.98                    | 89.91              | 6648                 | 131                 | 409                | 0.021                | 149                       |

\* Thor Delta

\*\* 1972-15F ejected from 1972-15A about 1972 Mar 25

| 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) |
|----------------------|--|--------------------------------|----------------------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 479           | 1972 Mar 22.86<br>10 years                     | Cylinder +<br>paddles?<br>900? | 2 long?<br>1 dia?                | 1972 Apr 2.5                  | 74.06                     | 95.20              | 6906                 | 514                 | 542                | 0.002                | 306                       |
| Cosmos 479<br>rocket | 1972 Mar 22.86<br>10 years                     | Cylinder<br>2200?              | 7.4 long<br>2.4 dia              | 1972 Apr 1.5                  | 74.07                     | 95.10              | 6901                 | 506                 | 540                | 0.003                | 324                       |
| Fragments            |  |                                |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| [Thor Burner 2]†     | 1972 Mar 24.37<br>100 years                    | 12-sided<br>frustum<br>195     | 1.64 long<br>1.31 to<br>1.10 dia | 1972 Mar 28.1                 | 98.80                     | 101.83             | 7222                 | 803                 | 885                | 0.006                | 217                       |
| Burner 2<br>rocket   | 1972 Mar 24.37<br>80 years                     | Sphere-cone<br>66              | 1.32 long<br>0.94 dia            | 1972 Mar 27.5                 | 98.80                     | 101.72             | 7217                 | 801                 | 876                | 0.005                | 221                       |
| Cosmos 480           | 1972 Mar 25.10<br>3000 years                   | Spheroid +<br>paddles?<br>650? | 1.6 dia?                         | 1972 Mar 26.3                 | 82.97                     | 109.21             | 7567                 | 1175                | 1203               | 0.002                | 229                       |
| Cosmos 480<br>rocket | 1972 Mar 25.10<br>2000 years                   | Cylinder<br>2200?              | 7.4 long<br>2.4 dia              | 1972 Mar 27.7                 | 82.97                     | 109.07             | 7561                 | 1171                | 1194               | 0.001                | 207                       |
| Cosmos 481*          | 1972 Mar 25.45<br>161.39 days<br>1972 Sep 2.84 | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia              | 1972 Mar 26.2<br>1972 Jun 1.0 | 71.03<br>71.03            | 92.40<br>91.52     | 6770<br>6727         | 269<br>255          | 514<br>443         | 0.018<br>0.014       | 82<br>-                   |
| Cosmos 481<br>rocket | 1972 Mar 25.45<br>77.70 days<br>1972 Jun 11.15 | Cylinder<br>1500?              | 8 long<br>1.65 dia               | 1972 Mar 26.3                 | 71.03                     | 92.26              | 6763                 | 270                 | 499                | 0.017                | 83                        |

\* Geomagnetic studies

† DMSP

| Name                         | Launch date, lifetime and descent date                    | Shape and weight (kg)          | Size (m)            | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi-major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|------------------------------|---|--------------------------------|---------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D Venus 8 Launcher rocket    | 1972-21B<br>1972 Mar 27.18<br>2.26 days<br>1972 Mar 29.44 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia | 1972 Mar 27.9                  | 51.78                     | 86.57              | 6585                 | 191                 | 222                | 0.002                | 84                        |
| D Venus 8 Launcher           | 1972-21C<br>1972 Mar 27.18<br>2.73 days<br>1972 Mar 29.91 | Irregular                      | -                   | 1972 Mar 28.0                  | 51.77                     | 86.79              | 6596                 | 194                 | 241                | 0.004                | 110                       |
| Meteor 11                    | 1972-22A<br>1972 Mar 30.59<br>500 years                   | Cylinder +<br>2 vanes<br>2200? | 5 long?<br>1.5 dia? | 1972 Apr 1.6                   | 81.23                     | 102.59             | 7258                 | 868                 | 891                | 0.002                | 257                       |
| Meteor 11 rocket             | 1972-22B<br>1972 Mar 30.59<br>400 years                   | Cylinder<br>1440               | 3.8 long<br>2.6 dia | 1972 Apr 2.5                   | 81.24                     | 102.72             | 7264                 | 840                 | 932                | 0.006                | 172                       |
| Cosmos 482*                  | 1972-23A<br>1972 Mar 31.17<br>8 years                     | Sphere-cylinder<br>1180        | 3.5 long<br>1.2 dia | 1972 Mar 31.8<br>1973 Dec 16.5 | 52.22<br>52.19            | 201.44<br>185.50   | 11383<br>10777       | 205<br>209          | 9805<br>8589       | 0.422<br>0.389       | 42<br>-                   |
| D Cosmos 482 launcher rocket | 1972-23B<br>1972 Mar 31.17<br>1.74 days<br>1972 Apr 1.91  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia | 1972 Mar 31.5                  | 51.78                     | 86.54              | 6584                 | 196                 | 215                | 0.001                | 116                       |
| D Cosmos 482 Launcher        | 1972-23C<br>1972 Mar 31.17<br>2.38 days<br>1972 Apr 2.55  | Irregular                      | -                   | 1972 Mar 31.9                  | 51.74                     | 88.59              | 6586                 | 179                 | 237                | 0.004                | 125                       |
| D Cosmos 482 rocket          | 1972-23D<br>1972 Mar 31.17<br>9 years                     | Cylinder<br>5410? full         | 2.0 long<br>2.0 dia | 1972 Apr 3.2                   | 52.16                     | 200.93             | 11365                | 207                 | 9767               | 0.421                | 44                        |
| Fragment                     | 1972-23E  |                                |                     |                                |                           |                    |                      |                     |                    |                      |                           |

\*Probably an attempted Venus probe.

Space vehicle: Venus 8, 1972-21A

|   | 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 483 *               | 1972 Apr 3.43<br>11.82 days<br>1972 Apr 15.25 | Sphere-cylinder<br>6300?       | 6.5 long?<br>2.4 dia | 1972 Apr 3.8                                  | 72.81                     | 89.74                      | 6639                    | 209                 | 313                     | 0.008                   | 73                        |
| R |                            |   |                                |                      |   |                           |                            |                         |                     |                         |                         |                           |
| D | Cosmos 483 rocket          | 1972 Apr 3.43<br>8.47 days<br>1972 Apr 11.90  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1972 Apr 4.2                                  | 72.80                     | 89.64                      | 6634                    | 202                 | 310                     | 0.008                   | 63                        |
| D | Cosmos 483 engine**        | 1972 Apr 3.43<br>15.95 days<br>1972 Apr 19.38 | Cone<br>600? full              | 1.5 long?<br>2 dia?  | 1972 Apr 13.9                                 | 72.82                     | 89.47                      | 6626                    | 180                 | 315                     | 0.010                   | 33                        |
| D | Fragments                  |   |                                |                      |   |                           |                            |                         |                     |                         |                         |                           |
| D | Molniya 1v                 | 1972 Apr 4.86<br>666 days<br>1974 Jan 30      | Windmill *<br>6 vanes<br>1000? | 3.4 long<br>1.6 dia  | 1972 Apr 5.0<br>1972 May 1.0<br>1973 Mar 16.5 | 65.6<br>65.53<br>65.7     | 705.35<br>717.69<br>717.65 | 26248<br>26554<br>26553 | 480<br>442<br>360   | 39260<br>39910<br>39990 | 0.739<br>0.743<br>0.746 | 285<br>285<br>-           |
| D | Molniya 1v rocket          | 1972 Apr 4.86<br>703 days<br>1974 Mar 8       | Cylinder<br>440                | 2.0 long<br>2.0 dia  | 1972 May 1.0<br>1972 Nov 1.0<br>1973 Mar 16.5 | 65.5<br>65.6<br>65.7      | 700.02<br>700.00<br>698.5  | 26116<br>26116<br>26078 | 454<br>338<br>214   | 39022<br>39137<br>39186 | 0.738<br>0.743<br>0.747 | -<br>-<br>66              |
| D | Molniya 1v launcher rocket | 1972 Apr 4.86<br>23.70 days<br>1972 Apr 26.56 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1972 Apr 6.1                                  | 65.54                     | 91.28                      | 6716                    | 222                 | 454                     | 0.017                   |                           |
| D | Molniya 1v launcher        | 1972 Apr 4.86<br>33.29 days<br>1972 May 8.15  | Irregular                      | -                    | 1972 Apr 6.2                                  | 65.52                     | 91.57                      | 6730                    | 231                 | 473                     | 0.018                   | 70                        |
| D | SRET 1F                    | 1972 Apr 4.86<br>693 days?<br>1974 Feb 26?    | Octahedron<br>15.4             | 0.56 dia             | 1972 May 1.0                                  | 65.6                      | 704.70                     | 26232                   | 458                 | 39250                   | 0.739                   | -                         |
| D | Fragments                  |   |                                |                      |   |                           |                            |                         |                     |                         |                         |                           |

\* French "Satellite for Research on Environment and Technology".

\* Manoeuvrable.

\*\* 1972-240 ejected from 1972-24A on 1972 Apr 13.

|   | 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 484                | 1972 Apr 6.34<br>11.87 days            | Sphere-cylinder<br>5900?     | 5.9 long<br>2.4 dia | 1972 Apr 7.3                   | 81.30                     | 88.73              | 6588                 | 196                 | 224                | 0.002                | 302                       |
| R |                           | 1972 Apr 18.21                         |                              |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 484 rocket         | 1972 Apr 6.34<br>2.08 days             | Cylinder<br>2500?            | 7.5 long<br>2.6 dia | 1972 Apr 6.9                   | 81.31                     | 88.58              | 6581                 | 184                 | 221                | 0.003                | 333                       |
|   |                           | 1972 Apr 8.42                          |                              |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Solar Radiation Package A | 1972 Apr 6.34<br>12.52 days            | Ellipsoid<br>200?            | 0.9 long<br>1.9 dia | 1972 Apr 18.6                  | 81.30                     | 88.01              | 6553                 | 170                 | 179                | 0.001                | -                         |
|   |                           | 1972 Apr 18.86                         |                              |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Intercosmos 6             | 1972 Apr 7.42<br>4.0 days              | Cylinder?<br>5700?           | 5.0 long<br>2.4 dia | 1972 Apr 7.7                   | 51.78                     | 88.94              | 6604                 | 203                 | 248                | 0.003                | 24                        |
| R |                           | 1972 Apr 11.4                          | (payload 1070)               |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Intercosmos 6 rocket      | 1972 Apr 7.42<br>2.85 days             | Cylinder<br>2500?            | 7.5 long<br>2.6 dia | 1972 Apr 7.8                   | 51.73                     | 88.79              | 6596                 | 192                 | 244                | 0.004                | 4                         |
|   |                           | 1972 Apr 10.27                         |                              |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 485                | 1972 Apr 11.46<br>140.77 days          | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia | 1972 Apr 11.6<br>1972 Jun 16.0 | 70.99<br>70.99            | 92.05<br>91.14     | 6753<br>6709         | 271<br>254          | 479<br>408         | 0.015<br>0.012       | 87                        |
|   |                           | 1972 Aug 30.23                         |                              |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 485 rocket         | 1972 Apr 11.46<br>65.90 days           | Cylinder<br>1500?            | 8 long<br>1.65 dia  | 1972 Apr 11.5                  | 70.98                     | 91.85              | 6743                 | 276                 | 453                | 0.013                | 87                        |
|   |                           | 1972 Jun 16.36                         |                              |                     |                                |                           |                    |                      |                     |                    |                      |                           |
|   | Prognoz 1                 | 1972 Apr 14.04<br>10 years?            | Spheroid<br>+ 4 vanes<br>845 | 1.8 dia             | 1972 Apr 14.1<br>1972 May 1.0  | 64.92<br>65.0             | 91.22<br>5782.1    | 6713<br>106714       | 224<br>1005         | 446<br>199 667     | 0.016<br>0.931       | 60                        |
|   |                           |  |                              |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Prognoz 1 launcher rocket | 1972 Apr 14.04<br>27.56 days           | Cylinder<br>2500?            | 7.5 long<br>2.6 dia | 1972 Apr 14.8                  | 64.97                     | 91.20              | 6712                 | 227                 | 440                | 0.016                | 61                        |
|   |                           | 1972 May 11.60                         |                              |                     |                                |                           |                    |                      |                     |                    |                      |                           |

|    | 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  | Prognoz 1 launcher      | 1972 Apr 14.04<br>33.29 days           | Irregular                | -                      | 1972 Apr 15.9                  | 64.96                     | 91.40              | 6 722                     | 228  | 459                | 0.017                | 65                        |
|    | 1972-29C                | 1972 May 17.33                         |                          |                        |                                |                           |                    |                           |  |                    |                      |                           |
|    | Prognoz 1 rocket        | 1972 Apr 14.04<br>10 years?            | Cylinder<br>440          | 2.0 long<br>2.0 dia    |                                |                           |                    | Orbit similar to 1972-29A |  |                    |                      |                           |
| D  | Fragments               | 1972 Apr 14.34                         | Sphere-                  | 6.5 long?              | 1972 Apr 15.9                  | 81.33                     | 88.64              | 6 584                     | 178  | 234                | 0.004                | 67                        |
| D  | Cosmos 486              | 12.9 days                              | cylinder                 | 2.4 dia                | 1972 Apr 20.3                  | 81.33                     | 89.09              | 6 606                     | 186  | 270                | 0.006                | 65                        |
| R  | 1972-29D,E<br>1972-30A  | 1972 Apr 27.2                          | 6300?                    |                        |                                |                           |                    |                           |  |                    |                      |                           |
| D  | Cosmos 486 rocket       | 1972 Apr 14.34<br>3.59 days            | Cylinder<br>2500?        | 7.5 long<br>2.6 dia    | 1972 Apr 14.4                  | 81.32                     | 89.04              | 6 604                     | 209  | 243                | 0.003                | 21                        |
| D  | 1972-30B                | 1972 Apr 17.93                         |                          |                        |                                |                           |                    |                           |  |                    |                      |                           |
| D  | Cosmos 486 engine       | 1972 Apr 14.34<br>14 days              | Cone<br>600? full        | 1.5 long?<br>2 dia?    | 1972 Apr 28.0                  | 81.25                     | 88.83              | 6 594                     | 188  | 243                | 0.004                | 1                         |
| D  | 1972-30F                | 1972 Apr 28                            |                          |                        |                                |                           |                    |                           |  |                    |                      |                           |
| D  | Fragments               | 1972 Apr 16.75                         | Cone-                    | 11.15 long             | 1972 Apr 16.8                  | 32.56                     | 87.82              | 6 552                     | 169  | 178                | 0.0007               | -*                        |
| D  | Apollo 16**             | 11.07 days                             | cylinder                 | 3.91 dia               | 1972 Apr 17.0                  | 33.2                      | 26320              | 292 520                   | 200  | 572 080            | 0.977                | 30*                       |
| R  | 1972-31A                | 1972 Apr 27.82                         | 30358 full               |                        |                                |                           |                    |                           |  |                    |                      |                           |
| 3M | 1972-31B                | 1972 Apr 16.75                         | Cylinder<br>13970        | 18.7 long<br>6.6 dia   | 1972 Apr 16.8<br>1972 Apr 17.0 | 32.56<br>33.2             | 87.82<br>26320     | 6 552<br>292 520          | 169<br>200   | 178<br>572 080     | 0.0007<br>0.977      | -*<br>30*                 |
| D  | Saturn IVB [Saturn 511] | 3.13 days<br>1972 Apr 19.88            |                          |                        |                                |                           |                    |                           | Crashed on Moon 1972 Apr 19.88   |                    |                      |                           |
| D  | 1972-31E                | 1972 Apr 16.75                         | Octagon +                | 1.57 high              | 1972 Apr 17.0                  | 33.2                      | 26320              | 292 520                   | 200  | 572 080            | 0.977                | 30*                       |
|    | descent stage           | 4.35 days                              | legs, 11398              | 3.13 wide              |                                |                           |                    |                           | Entered selenocentric orbit 1972 Apr 19.85                                   |                    |                      |                           |
|    | 1972-31C                | 1972 Apr 21.10                         | 2759 empty               |                        |                                |                           |                    |                           | Landed on Moon 1972 Apr 21.10  |                    |                      |                           |
|    | LEM 11***               | 1972 Apr 16.75                         | Box + tanks<br>5040 full | 2.52 high<br>3.76 wide | 1972 Apr 17.0                  | 33.2                      | 26320              | 292 520                   | 200  | 572 080            | 0.977                | 30*                       |
|    | ascent stage            | Indefinite                             | 2134 empty               | 3.13 deep              |                                |                           |                    |                           | On Moon's surface 1972 Apr 21.10 to Apr 24.06<br>Now in selenocentric orbit. |                    |                      |                           |

\* Approximate orbits.

\*\* Apollo attached to LEM, separated from Saturn IVB on Apr 16.93.

\*\*\* LEM with two crew members separated from Apollo on Apr 20.76.

Ascent stage relaunched from Moon Apr 24.06; briefly docked with Apollo Apr 24.14

|   | 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 | [ Thorad Agena D] 1972-32A  | 1972 Apr 19.91<br>22.77 days<br>1972 May 12.68  | Cylinder 2000?        | 8 long?<br>1.5 dia   | 1972 Apr 20.5                 | 81.48                     | 88.85              | 6594                 | 155                 | 277                | 0.009                | 171                       |
| D | Cosmos 487 1972-33A         | 1972 Apr 21.50<br>155.59 days<br>1972 Sep 24.09 | Ellipsoid 400?        | 1.8 long<br>1.2 dia  | 1972 Apr 23.1<br>1972 Jul 1.0 | 70.97<br>70.97            | 92.29<br>91.43     | 6765<br>6723         | 268<br>255          | 505<br>435         | 0.018<br>0.013       | 86<br>-                   |
| D | Cosmos 487 rocket 1972-33B  | 1972 Apr 21.50<br>73.04 days<br>1972 Jul 3.54   | Cylinder 1500?        | 8 long<br>1.65 dia   | 1972 Apr 23.9                 | 70.96                     | 92.14              | 6757                 | 267                 | 491                | 0.017                | 87                        |
| D | Fragment 1972-33C           |   |                       |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 488 1972-34A         | 1972 May 5.48<br>12.7 days<br>1972 May 18.2     | Sphere-cylinder 6300? | 6.5 long?<br>2.4 dia | 1972 May 6.0<br>1972 May 14.6 | 65.41<br>65.41            | 89.50<br>89.79     | 6629<br>6643         | 207<br>176          | 294<br>353         | 0.007<br>0.013       | 65<br>44                  |
| R |                             |   |                       |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 488 rocket 1972-34B  | 1972 May 5.48<br>6.12 days<br>1972 May 11.60    | Cylinder 2500?        | 7.5 long<br>2.6 dia  | 1972 May 6.0                  | 65.40                     | 89.40              | 6624                 | 201                 | 290                | 0.007                | 54                        |
| D | Cosmos 488 engine* 1972-34E | 1972 May 5.48<br>18 days<br>1972 May 23         | Cone 600? full        | 1.5 long?<br>2 dia?  | 1972 May 17.2                 | 65.41                     | 89.65              | 6636                 | 178                 | 338                | 0.012                | -                         |
| D | Fragments 1972-34C,DF-H     |   |                       |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 489 1972-35A         | 1972 May 6.47<br>1200 years                     | Cylinder + boom? 700? | 1.4 long<br>2.0 dia  | 1972 May 6.9                  | 74.02                     | 104.82             | 7364                 | 969                 | 1002               | 0.002                | 282                       |
| D | Cosmos 489 rocket 1972-35B  | 1972 May 6.47<br>600 years                      | Cylinder 2200?        | 7.4 long<br>2.4 dia  | 1972 May 8.1                  | 74.02                     | 104.67             | 7356                 | 965                 | 991                | 0.002                | 286                       |

\* 1972-34E\* ejected from 1972-34A about 1972 May 17.

|   | 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 490                 | 1972 May 17.43<br>11.73 days<br>1972 May 29.16 | Sphere-cylinder<br>5900?       | 5.9 long<br>2.4 dia   | 1972 May 17.8                                 | 65.42                     | 89.39                      | 6623                    | 205                 | 285                     | 0.006                   | 63                        |
| D | Cosmos 490 rocket          | 1972 May 17.43<br>5.77 days<br>1972 May 23.20  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1972 May 17.8                                 | 65.40                     | 89.30                      | 6619                    | 204                 | 277                     | 0.005                   | 58                        |
| D | Cosmic Ray Package C*      | 1972 May 17.43<br>20.35 days<br>1972 Jun 6.78  | Ellipsoid<br>200?              | 0.9 long<br>1.9 dia   | 1972 May 27.8                                 | 65.39                     | 89.19                      | 6613                    | 202                 | 268                     | 0.005                   | 59                        |
| D | Fragment                   |  |                                |                       |   |                           |                            |                         |                     |                         |                         |                           |
| D | Molniya 2B                 | 1972 May 19.61<br>1768 days<br>1977 Mar 22     | Windmill +<br>6 vanes<br>1250? | 4.2 long?<br>1.6 dia? | 1972 May 24.6<br>1972 Jul 1.0<br>1973 Jul 1.0 | 65.42<br>65.42<br>65.8    | 705.11<br>720.11<br>716.19 | 26243<br>26614<br>26517 | 440<br>408<br>251   | 39290<br>40064<br>40027 | 0.740<br>0.745<br>0.750 | 285<br>-<br>-             |
| D | Molniya 2B launcher rocket | 1972 May 19.61<br>20.03 days<br>1972 Jun 8.64  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1972 May 19.8                                 | 65.41                     | 90.85                      | 6695                    | 217                 | 417                     | 0.015                   | 62                        |
| D | Molniya 2B launcher        | 1972 May 19.61<br>20.77 days<br>1972 Jun 9.38  | Irregular                      | -                     | 1972 May 19.8                                 | 65.40                     | 91.21                      | 6713                    | 207                 | 463                     | 0.019                   | 64                        |
| D | Molniya 2B rocket          | 1972 May 19.61<br>1839 days<br>1977 Jun 1      | Cylinder<br>440                | 2.0 long<br>2.0 dia   | 1972 Jul 1.0<br>1973 Jun 1.0                  | 65.3<br>65.7              | 704.07<br>703.38           | 26216<br>26198          | 453<br>323          | 39223<br>39317          | 0.739<br>0.744          | -<br>-                    |
| D | Fragments                  |  |                                |                       |   |                           |                            |                         |                     |                         |                         |                           |

\* 1972-360 ejected from 1972-36A about 1972 May 27.

|        | 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<br>R | Cosmos 491<br>1972-38A             | 1972 May 25.28<br>13.9 days<br>1972 Jun 8.1    | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1972 May 26.6<br>1972 May 30.4 | 64.98<br>64.98            | 88.95<br>89.92     | 6601<br>6649         | 177<br>173          | 269<br>369         | 0.007<br>0.015       | 57<br>54                  |
| D      | Cosmos 491<br>rocket<br>1972-38B   | 1972 May 25.28<br>5.47 days<br>1972 May 30.75  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia  | 1972 May 26.3                  | 64.96                     | 89.14              | 6611                 | 194                 | 271                | 0.006                | 24                        |
| D      | Cosmos 491<br>engine*<br>1972-38E  | 1972 May 25.28<br>17.25 days<br>1972 Jun 11.53 | Cone<br>600? full        | 1.5 long?<br>2 dia?  | 1972 Jun 7.4                   | 64.97                     | 89.49              | 6628                 | 173                 | 327                | 0.012                | 51                        |
| D      | Fragments<br>1972-38C,D,F          |  |                          |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D      | [Thorad<br>Agena D]<br>1972-39A    | 1972 May 25.78<br>10.20 days<br>1972 Jun 4.98  | Cylinder<br>2000?        | 8 long?<br>1.5 dia   | 1972 May 26.0                  | 96.34                     | 89.17              | 6610                 | 158                 | 305                | 0.011                | 143                       |
| D<br>R | Cosmos 492<br>1972-40A             | 1972 Jun 9.30<br>12.86 days<br>1972 Jun 22.16  | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1972 Jun 9.7<br>1972 Jun 15.1  | 64.97<br>64.97            | 89.77<br>89.34     | 6642<br>6621         | 205<br>173          | 323<br>312         | 0.009<br>0.010       | 54<br>55                  |
| D      | Cosmos 492<br>rocket<br>1972-40B   | 1972 Jun 9.30<br>9.10 days<br>1972 Jun 18.40   | Cylinder<br>2500?        | 7.5 long<br>2.6 dia  | 1972 Jun 10.4                  | 64.96                     | 89.56              | 6632                 | 201                 | 306                | 0.008                | 39                        |
| D      | Cosmos 492<br>engine**<br>1972-40D | 1972 Jun 9.30<br>18.50 days<br>1972 Jun 27.80  | Cone<br>600? full        | 1.5 long?<br>2 dia?  | 1972 Jun 21.6                  | 64.96                     | 89.35              | 6621                 | 180                 | 306                | 0.010                | 55                        |
| D      | Fragments<br>1972-40C,E            |  |                          |                      |                                |                           |                    |                      |                     |                    |                      |                           |

\* 1972-38E ejected from 1972-38A on 1972 Jun 7.

\*\* 1972-40D ejected from 1972-40A on 1972 Jun 21.

| Name                       | Launch date, lifetime and descent date        | Shape and weight (kg)              | Size (m)              | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|----------------------------|---|------------------------------------|-----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Intelsat 4D (F-5) 1972-41A | 1972 Jun 13.91<br>>million years              | Cylinder<br>1410 full<br>720 empty | 2.82 long<br>2.39 dia | 1972 Jun 14.0<br>1972 Jul 23.0 | 27.00<br>0.15             | 651.4<br>1436.2    | 24937<br>42166       | 548<br>35782        | 36570<br>35794     | 0.722<br>0.0001      | 189*                      |
| Intelsat 4D rocket         | 1972 Jun 13.91<br>6000 years                  | Cylinder<br>1815                   | 8.6 long<br>3.0 dia   | 1972 Jun 30.9                  | 27.00                     | 651.4              | 24937                | 548                 | 36570              | 0.722                | 189                       |
| Cosmos 493                 | 1972 Jun 21.27<br>11.89 days<br>1972 Jul 3.16 | Sphere-<br>cylinder<br>5700?       | 5.0 long<br>2.4 dia   | 1972 Jun 21.5                  | 64.98                     | 89.25              | 6617                 | 203                 | 274                | 0.005                | 33                        |
| Cosmos 493 rocket          | 1972 Jun 21.27<br>4.44 days<br>1972 Jun 25.71 | Cylinder<br>2500?                  | 7.5 long<br>2.6 dia   | 1972 Jun 22.0                  | 64.98                     | 89.06              | 6607                 | 195                 | 263                | 0.005                | 26                        |
| Fragment                   | 1972-42C                                      |                                    |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 494                 | 1972 Jun 23.39<br>120 years                   | Cylinder *<br>paddles?<br>750?     | 2 long?<br>1 dia?     | 1972 Jun 25.8                  | 74.06                     | 100.83             | 7175                 | 790                 | 804                | 0.001                | 51                        |
| Cosmos 494 rocket          | 1972 Jun 23.39<br>100 years                   | Cylinder<br>2200?                  | 7.4 long<br>2.4 dia   | 1972 Jun 29.5                  | 74.06                     | 100.70             | 7169                 | 779                 | 803                | 0.002                | 25                        |
| Fragments                  | 1972-43E                                      |                                    |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 495                 | 1972 Jun 23.48<br>12.7 days<br>1972 Jul 6.2   | Sphere-<br>cylinder<br>6300?       | 6.5 long?<br>2.4 dia  | 1972 Jun 24.5<br>1972 Jun 27.7 | 65.41<br>65.41            | 89.30<br>88.90     | 6618<br>6598         | 202<br>150          | 278<br>290         | 0.006<br>0.011       | 48<br>48                  |
| Cosmos 495 rocket          | 1972 Jun 23.48<br>5.61 days<br>1972 Jun 29.09 | Cylinder<br>2500?                  | 7.5 long<br>2.6 dia   | 1972 Jun 24.5                  | 65.40                     | 89.13              | 6610                 | 195                 | 268                | 0.006                | 40                        |
| Cosmos 495 engine**        | 1972 Jun 23.48<br>14.98 days<br>1972 Jul 8.46 | Cone<br>600? full                  | 1.5 long?<br>2 dia?   | 1972 Jul 7.0                   | 65.41                     | 88.98              | 6602                 | 165                 | 283                | 0.009                | -                         |
| Fragments                  | 1972-44C,E                                    |                                    |                       |                                |                           |                    |                      |                     |                    |                      |                           |

\* Approximate orbit.

\*\* 1972-44D ejected from 1972-44A about 1972 Jul 5.

|        | Name                                     | Launch date, lifetime and descent date         | Shape and weight (kg)                 | Size (m)            | Date of orbital determination | Orbital inclination (deg) | Modal period (min)                          | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|--------|--|--|---------------------------------------|---------------------|-------------------------------|---------------------------|---|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D<br>R | 1972-45A<br>Cosmos 496                   | 1972 Jun 26.62<br>6.0 days<br>1972 Jul 2.6     | Sphere-cylinder *<br>2 wings<br>6570? | 7.5 long<br>2.2 dia | 1972 Jun 27.6                 | 51.61                     | 89.53                                       | 6632                 | 187                 | 321                | 0.010                | 85                        |
| D      | 1972-45B<br>Cosmos 496<br>rocket         | 1972 Jun 26.62<br>5.96 days<br>1972 Jul 2.58   | Cylinder<br>2500?                     | 7.5 long<br>2.6 dia | 1972 Jun 26.9                 | 51.59                     | 89.49                                       | 6630                 | 185                 | 319                | 0.010                | 77                        |
| D      | 1972-45C<br>Fragment                     |  |                                       |                     |                               |                           |   |                      |                     |                    |                      |                           |
|        | 1972-46A<br>Prognoz 2                    | 1972 Jun 29.16<br>10 years?                    | Spheroid *<br>4 vanes<br>845          | 1.8 dia?            | 1972 Aug 1.0                  | 65.3                      | Initial orbit similar to 1972-46C<br>5849.2 | 107 539              | 517                 | 201 804            | 0.936                | -                         |
| D      | 1972-46B<br>Prognoz 2<br>launcher rocket | 1972 Jun 29.16<br>33.51 days<br>1972 Aug 1.67  | Cylinder<br>2500?                     | 7.5 long<br>2.6 dia | 1972 Jul 1.1                  | 64.96                     | 91.08                                       | 6707                 | 230                 | 427                | 0.015                | 64                        |
| D<br>P | 1972-46C<br>Prognoz 2*<br>launcher       | 1972 Jun 29.16<br>45.08 days<br>1972 Aug 13.24 | Irregular                             | -                   | 1972 Jul 1.6                  | 64.94                     | 91.57                                       | 6730                 | 235                 | 469                | 0.017                | 66                        |
|        | 1972-46F<br>Prognoz 2<br>rocket          | 1972 Jun 29.16<br>10 years?                    | Cylinder<br>440                       | 2.0 long<br>2.0 dia |                               |                           | Orbit similar to 1972-46A second orbit      |                      |                     |                    |                      |                           |
| D      | 1972-46D,E<br>Fragments                  |  |                                       |                     |                               |                           |   |                      |                     |                    |                      |                           |
| D      | 1972-47A<br>Interkosmos 7                | 1972 Jun 30.25<br>97.40 days<br>1972 Oct 5.65  | Ellipsoid *<br>6 panels?<br>400?      | 1.8 long<br>1.2 dia | 1972 Jul 1.8                  | 48.41                     | 92.60                                       | 6784                 | 260                 | 551                | 0.021                | 113                       |
| D      | 1972-47B<br>Interkosmos 7<br>rocket      | 1972 Jun 30.25<br>90.80 days<br>1972 Sep 29.05 | Cylinder<br>1500?                     | 8 long<br>1.65 dia  | 1972 Jul 1.8                  | 48.42                     | 92.35                                       | 6771                 | 265                 | 521                | 0.019                | 114                       |
| D      | 1972-47C<br>Fragment                     |  |                                       |                     |                               |                           |   |                      |                     |                    |                      |                           |

\*Fragments (spheroid) retrieved in Australia.

|   | 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 497            | 1972 Jun 30.39<br>484.80 days          | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia  | 1972 Jul 2.2<br>1972 Dec 16.5<br>1973 Jun 1.0 | 70.98<br>70.98<br>70.98   | 95.23<br>93.86<br>92.37 | 6908<br>6841<br>6769 | 271<br>265<br>252   | 788<br>661<br>529  | 0.037<br>0.029<br>0.020 | 80<br>-<br>-              |
| D | Cosmos 497<br>rocket  | 1972 Jun 30.39<br>259.88 days          | Cylinder<br>1500?              | 8 long<br>1.65 dia   | 1972 Jul 2.2<br>1972 Oct 1.0<br>1973 Jan 1.0  | 71.00<br>70.99<br>70.98   | 95.05<br>93.88<br>92.27 | 6899<br>6842<br>6764 | 273<br>263<br>251   | 768<br>664<br>520  | 0.036<br>0.029<br>0.020 | 80<br>-<br>-              |
| D | Fragment              | 1973 Mar 17.27                         |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
|   | 1972-48C              |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
|   | Meteor 12             | 1972 Jun 30.79<br>500 years            | Cylinder *<br>2 vanes<br>2200? | 5 long?<br>1.5 dia?  | 1972 Jul 2.5                                  | 81.22                     | 102.95                  | 7275                 | 889                 | 905                | 0.001                   | 30                        |
|   | 1972-49A              |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
|   | Meteor 12<br>rocket   | 1972 Jun 30.79<br>400 years            | Cylinder<br>1440               | 3.8 long<br>2.6 dia  | 1972 Jul 2.9                                  | 81.22                     | 103.05                  | 7280                 | 865                 | 939                | 0.004                   | 177                       |
|   | 1972-50A              |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
| D | Cosmos 498            | 1972 Jul 5.40<br>143.26 days           | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia  | 1972 Jul 6.7<br>1972 Sep 16.0                 | 70.95<br>70.95            | 92.12<br>91.26          | 6757<br>6715         | 267<br>256          | 490<br>418         | 0.017<br>0.012          | 70<br>-                   |
|   | 1972-50B              |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
| D | Cosmos 498<br>rocket  | 1972 Jul 5.40<br>83.80 days            | Cylinder<br>1500?              | 8 long<br>1.65 dia   | 1972 Jul 5.8                                  | 70.95                     | 91.95                   | 6748                 | 273                 | 467                | 0.014                   | 81                        |
|   | 1972-51A              |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
| D | Cosmos 499*           | 1972 Jul 6.45<br>10.88 days            | Sphere-<br>cylinder<br>6300?   | 6.5 long?<br>2.4 dia | 1972 Jul 6.7                                  | 51.77                     | 89.31                   | 6622                 | 204                 | 283                | 0.006                   | 39                        |
| R |                       | 1972 Jul 17.33                         |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
|   | 1972-51B              |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
| G | Cosmos 499<br>rocket  | 1972 Jul 6.45<br>3.77 days             | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1972 Jul 7.1                                  | 51.76                     | 89.18                   | 6615                 | 205                 | 269                | 0.005                   | 44                        |
|   | 1972-51C              |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
| D | Cosmos 499<br>engine† | 1972 Jul 6.45<br>14.13 days            | Cone<br>600? full              | 1.5 long?<br>2 dia?  | 1972 Jul 17.0                                 | 51.76                     | 88.84                   | 6598                 | 171                 | 269                | 0.007                   | 76                        |
|   | 1972-51E              |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
| D | Fragments             | 1972 Jul 20.58                         |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |
|   | 1972-51C,D            |  |                                |                      |   |                           |                         |                      |                     |                    |                         |                           |

\* Manoeuvrable.

† 1972-51E ejected from 1972-51A on 1972 Jul 16.



|        | Name                               | Launch date, lifetime and descent date        | Shape and weight (kg)        | Size (m)             | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|--------|------------------------------------|---|------------------------------|----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D<br>R | Cosmos 502<br>1972-55A             | 1972 Jul 13.61<br>11.7 days<br>1972 Jul 25.3  | Sphere-<br>cylinder<br>5900? | 5.9 long<br>2.4 dia  | 1972 Jul 14.3                  | 65.40                     | 89.16              | 6611                 | 204                 | 262                | 0.004                | 47                        |
| D      | Cosmos 502<br>rocket<br>1972-55B   | 1972 Jul 13.61<br>5 days<br>1972 Jul 18       | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1972 Jul 14.3                  | 65.40                     | 89.00              | 6603                 | 202                 | 248                | 0.004                | 24                        |
| D      | Capsule*<br>1972-55E               | 1972 Jul 13.61<br>13 days<br>1972 Jul 26      | Ellipsoid<br>200?            | 0.9 long<br>1.9 dia  | 1972 Jul 26.7                  | 65.39                     | 88.54              | 6580                 | 171                 | 233                | 0.005                | 2                         |
| D      | Fragments<br>1972-55C,D            |   |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D<br>R | Cosmos 503<br>1972-56A             | 1972 Jul 19.58<br>12.70 days<br>1972 Aug 1.28 | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1972 Jul 19.9<br>1972 Jul 25.5 | 65.43<br>65.41            | 89.40<br>89.33     | 6623<br>6620         | 202<br>169          | 288<br>314         | 0.006<br>0.011       | 59<br>51                  |
| D      | Cosmos 503<br>rocket<br>1972-56B   | 1972 Jul 19.58<br>7.49 days<br>1972 Jul 27.07 | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1972 Jul 20.1                  | 65.40                     | 89.32              | 6619                 | 207                 | 275                | 0.005                | 53                        |
| D      | Cosmos 503<br>engine**<br>1972-56E | 1972 Jul 19.58<br>14.70 days<br>1972 Aug 3.28 | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1972 Jul 31.4                  | 65.46                     | 89.08              | 6607                 | 163                 | 295                | 0.010                | 53                        |
| D      | Fragments<br>1972-56C,D            |   |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |

\* 1972-55E ejected from 1972-55A on 1972 Jul 25.

\*\* 1972-56E ejected from 1972-56A on 1972 Jul 31.

| Name                 | Launch date, lifetime and descent date | Shape and weight (kg) | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|----------------------|--|-----------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 504           | 1972 Jul 20.75<br>5000 years           | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1972 Jul 24.1                 | 74.02                     | 114.03             | 7789                 | 1324                | 1498               | 0.011                | 89                        |
| Cosmos 505           | 1972 Jul 20.75<br>6000 years           | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1972 Jul 29.9                 | 74.03                     | 114.37             | 7804                 | 1354                | 1498               | 0.009                | 84                        |
| Cosmos 506           | 1972 Jul 20.75<br>7000 years           | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1972 Jul 25.8                 | 74.02                     | 114.70             | 7819                 | 1384                | 1498               | 0.007                | 89                        |
| Cosmos 507           | 1972 Jul 20.75<br>8000 years           | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1972 Jul 24.2                 | 74.02                     | 115.03             | 7834                 | 1414                | 1498               | 0.005                | 94                        |
| Cosmos 508           | 1972 Jul 20.75<br>9000 years           | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1972 Jul 24.2                 | 74.02                     | 115.37             | 7850                 | 1446                | 1497               | 0.003                | 95                        |
| Cosmos 509           | 1972 Jul 20.75<br>10000 years          | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1972 Jul 26.2                 | 74.02                     | 115.73             | 7866                 | 1475                | 1501               | 0.002                | 124                       |
| Cosmos 510           | 1972 Jul 20.75<br>10000 years          | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1972 Jul 29.7                 | 74.02                     | 116.10             | 7883                 | 1497                | 1512               | 0.001                | 235                       |
| Cosmos 511           | 1972 Jul 20.75<br>10000 years          | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1972 Jul 26.2                 | 74.03                     | 116.48             | 7900                 | 1496                | 1548               | 0.003                | 246                       |
| Cosmos 504<br>rocket | 1972 Jul 20.75<br>20000 years          | Cylinder<br>2200?     | 7.4 long<br>2.4 dia   | 1972 Jul 22.9                 | 74.03                     | 117.08             | 7927                 | 1500                | 1598               | 0.006                | 265                       |

| 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) |
|--------------------------|---|--|----------------------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Landsat 1 (ERTS*)        | 1972 Jul 23.75<br>100 years                   | Conical skeleton<br>+ 2 paddles<br>816 | 3.0 long<br>1.45 dia             | 1972 Jul 30.9                 | 99.12                     | 103.27             | 7290                 | 903                 | 921                | 0.001                | 284                       |
| Landsat 1 second stage** | 1972 Jul 23.75                                | Cylinder<br>+ annulus<br>350?          | 6.4 long<br>1.52 and<br>2.44 dia | 1972 Jul 30.2                 | 98.51                     | 100.34             | 7152                 | 637                 | 910                | 0.019                | 221                       |
| Fragments                |   |  |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 512               | 1972 Jul 28.43<br>11.7 days<br>1972 Aug 9.1   | Sphere-cylinder<br>5700?               | 5.0 long<br>2.4 dia              | 1972 Jul 30.2                 | 65.39                     | 89.25              | 6616                 | 203                 | 273                | 0.005                | 47                        |
| Cosmos 512 rocket        | 1972 Jul 28.43<br>4.38 days<br>1972 Aug 1.81  | Cylinder<br>2500?                      | 7.5 long<br>2.6 dia              | 1972 Jul 29.3                 | 65.38                     | 89.06              | 6607                 | 190                 | 267                | 0.006                | 35                        |
| Cosmos 513               | 1972 Aug 2.35<br>12.86 days<br>1972 Aug 15.21 | Sphere-cylinder<br>6300?               | 6.5 long?<br>2.4 dia             | 1972 Aug 3.5<br>1972 Aug 4.1  | 64.97<br>64.97            | 89.73<br>89.36     | 6640<br>6621         | 203<br>174          | 320<br>312         | 0.009<br>0.010       | 44<br>56                  |
| Cosmos 513 rocket        | 1972 Aug 2.35<br>6.92 days<br>1972 Aug 9.27   | Cylinder<br>2500?                      | 7.5 long<br>2.6 dia              | 1972 Aug 3.2                  | 64.98                     | 89.56              | 6631                 | 203                 | 303                | 0.008                | 39                        |
| Cosmos 513 engine†       | 1972 Aug 2.35<br>22 days<br>1972 Aug 24       | Cone<br>600? full                      | 1.5 long?<br>2 dia?              | 1972 Aug 15.1                 | 64.95                     | 89.33              | 6620                 | 161                 | 322                | 0.012                | 55                        |
| Fragments                |   |  |                                  |                               |                           |                    |                      |                     |                    |                      |                           |

\* Earth Resources Technology Satellite.

† 1972-60E ejected from 1972-60A on 1972 Aug 14.

\*\* Landsat 1 second stage disintegrated on 1975 May 22.77 near 33.3 deg South, 45.1 deg East. 1972-58B is now a fragment.

| Name                           | Launch date, lifetime and descent date         | Shape and weight (kg)    | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Orbital period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|--------------------------------|--|--------------------------|-----------------------|-------------------------------|---------------------------|----------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Explorer 46 (RTS*)             | 1972 Aug 13.63<br>18 years                     | Cylinder<br>175          | 3.2 long<br>0.5 dia?  | 1972 Sep 4.5                  | 37.70                     | 97.65                | 7030                 | 492                 | 811                | 0.023                | 267                       |
| Fragments                      |  |                          |                       |                               |                           |                      |                      |                     |                    |                      |                           |
| Cosmos 514                     | 1972 Aug 16.64<br>1200 years                   | Cylinder?<br>700?        | 1.3 long?<br>1.9 dia? | 1972 Sep 3.1                  | 82.97                     | 104.43               | 7345                 | 958                 | 975                | 0.001                | 100                       |
| Cosmos 514 rocket<br>Fragments | 1972 Aug 16.64<br>600 years                    | Cylinder<br>2200?        | 7.4 long<br>2.4 dia   | 1972 Sep 4.8                  | 82.97                     | 104.37               | 7342                 | 952                 | 975                | 0.002                | 94                        |
| Cosmos 515†                    | 1972 Aug 18.42<br>12.76 days<br>1972 Aug 31.18 | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia  | 1972 Aug 19.4                 | 72.86                     | 89.66                | 6635                 | 189                 | 325                | 0.010                | 50                        |
| Cosmos 515 rocket              | 1972 Aug 18.42<br>4.81 days<br>1972 Aug 23.23  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia   | 1972 Aug 19.5                 | 72.88                     | 89.13                | 6609                 | 207                 | 254                | 0.004                | 31                        |
| Cosmos 515 engine**            | 1972 Aug 18.42<br>17 days<br>1972 Sep 4        | Cone<br>600? full        | 1.5 long?<br>2 dia?   | 1972 Sep 1.0                  | 72.87                     | 88.82                | 6593                 | 174                 | 256                | 0.006                | -                         |
| Fragments                      |  |                          |                       |                               |                           |                      |                      |                     |                    |                      |                           |
| Denpa [Hu 4S]                  | 1972 Aug 19.11<br>8 years                      | Octagonal cylinder<br>75 | 0.68 long<br>0.71 dia | 1972 Sep 2.1                  | 31.03                     | 156.85               | 9646                 | 245                 | 6291               | 0.313                | 175                       |
| Denpa rocket                   | 1972 Aug 19.11<br>10 years                     | Sphere-cone<br>90        | 1.86 long<br>0.79 dia | 1973 Jan 2.3                  | 31.02                     | 157.55               | 9675                 | 235                 | 6358               | 0.316                | 275                       |

† Manoeuvrable

\* Meteoroid Technology Satellite  
 \*\* 1972-63D ejected from 1972-63A on 1972 Aug 29

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## Year of launch 1972 continued

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| Name                             | Launch date, lifetime and descent date         | Shape and weight (kg)      | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|----------------------------------|--|----------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| T<br>Copernicus (OAO 3)*         | 1972 Aug 21.44<br>500 years                    | Octagonal cylinder<br>2220 | 3.05 long<br>2.15 dia | 1972 Aug 22.1                 | 35.01                     | 99.49              | 7118                 | 736                 | 744                | 0.0006               | 293                       |
| Copernicus rocket                | 1972 Aug 21.44<br>200 years                    | Cylinder<br>1815           | 8.6 long<br>3.0 dia   | 1972 Sep 4.4                  | 35.02                     | 99.44              | 7116                 | 695                 | 780                | 0.006                | 350                       |
| Fragment                         |  |                            |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 516**                     | 1972 Aug 21.44<br>600 years                    | Cone-cylinder              | 6 long?<br>2 dia?     | 1972 Sep 1.5<br>1972 Oct 1.7  | 64.98<br>64.82            | 89.64<br>104.57    | 6635<br>7353         | 251<br>920          | 263<br>1030        | 0.0009<br>0.007      | 260<br>343                |
| D<br>Cosmos 516 rocket           | 1972 Aug 21.44<br>35.26 days<br>1972 Sep 25.70 | Cylinder<br>1500?          | 8 long?<br>2.5 dia?   | 1972 Sep 23.1                 | 64.98                     | 89.44              | 6625                 | 239                 | 255                | 0.001                | 312                       |
| D<br>Cosmos 516 platform         | 1972 Aug 21.44<br>60 days<br>1972 Oct 20       | Irregular                  | -                     | 1972 Sep 24.9                 | 64.98                     | 89.52              | 6629                 | 243                 | 259                | 0.001                | 270                       |
| D<br>Cosmos 517                  | 1972 Aug 30.35<br>11.86 days<br>1972 Sep 11.21 | Sphere-cylinder<br>5700?   | 5.0 long<br>2.4 dia   | 1972 Aug 31.1                 | 64.98                     | 89.42              | 6624                 | 204                 | 288                | 0.006                | 39                        |
| D<br>Cosmos 517 rocket           | 1972 Aug 30.35<br>4.51 days<br>1972 Sep 3.86   | Cylinder<br>2500?          | 7.5 long<br>2.6 dia   | 1972 Aug 31.2                 | 65.00                     | 89.15              | 6611                 | 197                 | 268                | 0.005                | 25                        |
| D<br>Fragment [Titan 3B Agena D] | 1972 Sep 1.74<br>29 days<br>1972 Sep 30        | Cylinder<br>3000?          | 8 long?<br>1.5 dia    | 1972 Sep 2.0                  | 110.50                    | 89.71              | 6638                 | 140                 | 380                | 0.018                | 147                       |

\* Orbiting Astronomical Observatory

\*\* 1972-66B and 66C attached to 1972-66A until orbit change about 1972 Sep 21.93

|   | Name                | Launch date, lifetime and descent date | Shape and weight (kg) | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|---------------------|--|-----------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| T | TRIAD 1 [Scout]     | 1972 Sep 2.74<br>90 years              | Dumb-bell 94          | 7.3 long<br>0.59 dia  | 1972 Sep 4.5                  | 90.14                     | 100.68             | 7168                 | 716                 | 863                | 0.010                | 352                       |
|   | Altair rocket       | 1972 Sep 2.74<br>70 years              | Cylinder 24           | 1.50 long<br>0.46 dia | 1972 Sep 4.2                  | 90.13                     | 100.70             | 7169                 | 738                 | 843                | 0.007                | 338                       |
|   | Fragment            |  |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 518          | 1972 Sep 15.40<br>8.85 days            | Sphere-cylinder 5900? | 5.9 long<br>2.4 dia   | 1972 Sep 16.2                 | 72.84                     | 89.64              | 6634                 | 204                 | 307                | 0.008                | 59                        |
| R |                     | 1972 Sep 24.25                         |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 518 rocket   | 1972 Sep 15.40<br>7.10 days            | Cylinder 2500?        | 7.5 long<br>2.6 dia   | 1972 Sep 16.2                 | 72.83                     | 89.46              | 6625                 | 199                 | 295                | 0.007                | 47                        |
| D | Capsule*            | 1972 Sep 15.40<br>12 days              | Ellipsoid 200?        | 0.9 long<br>1.9 dia   | 1972 Sep 23.7                 | 72.85                     | 89.30              | 6617                 | 200                 | 278                | 0.006                | 37                        |
|   |                     | 1972 Sep 27                            |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 519†         | 1972 Sep 16.35<br>9.90 days            | Sphere-cylinder 6300? | 6.5 long?<br>2.4 dia  | 1972 Sep 18.2                 | 71.33                     | 90.19              | 6662                 | 207                 | 360                | 0.012                | 47                        |
| R |                     | 1972 Sep 26.25                         |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 519 rocket   | 1972 Sep 16.35<br>8.35 days            | Cylinder 2500?        | 7.5 long<br>2.6 dia   | 1972 Sep 18.0                 | 71.36                     | 89.56              | 6630                 | 201                 | 302                | 0.008                | 41                        |
|   |                     | 1972 Sep 24.70                         |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 519 engine** | 1972 Sep 16.35<br>28 days              | Cone 600? full        | 1.5 long?<br>2 dia?   | 1972 Oct 1.0                  | 71.2                      | 89.76              | 6640                 | 200                 | 323                | 0.009                | -                         |
|   |                     | 1972 Oct 14                            |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Fragments           |  |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     |  |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |

† Manoeuvrable

\*1972-70C ejected from 1972-70A on 1972 Sep 23.

\*\*1972-71D ejected from 1972-71A on 1972 Sep 25.



| Name                                  | Launch date, lifetime and descent date        | Shape and weight (kg)           | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi-major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---------------------------------------|---|---------------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D Molniya 2C 1972-75A                 | 1972 Sep 30.85<br>1930 days<br>1978 Jan 12    | Windmill *<br>6 vanes?<br>1250? | 4.2 long?<br>1.6 dia? | 1972 Oct 9.2<br>1972 Nov 1.0  | 65.63<br>65.3             | 703.2<br>717.50    | 26192<br>26550       | 392<br>551          | 39240<br>39792     | 0.742<br>0.739       | 284<br>-                  |
| D Molniya 2C launcher rocket 1972-75B | 1972 Sep 30.85<br>26 days<br>1972 Oct 26      | Cylinder<br>2500?               | 7.5 long<br>2.6 dia   | 1972 Oct 1.3                  | 65.42                     | 91.34              | 6719                 | 216                 | 466                | 0.019                | 68                        |
| D Molniya 2C launcher 1972-75C        | 1972 Sep 30.85<br>32.14 days<br>1972 Nov 1.99 | Irregular                       | -                     | 1972 Oct 3.1                  | 65.39                     | 91.48              | 6726                 | 230                 | 466                | 0.017                | 71                        |
| D Molniya 2C rocket 1972-75D          | 1972 Sep 30.85<br>1970 days<br>1978 Feb 21    | Cylinder<br>440                 | 2.0 long<br>2.0 dia   | 1973 Jan 1.0                  | 65.4                      | 700.58             | 26130                | 517                 | 38987              | 0.736                | -                         |
| T Radcat* [Atlas Burner 2] 1972-76A   | 1972 Oct 2.84<br>20 years                     | Cylinder<br>208                 | 12.2 long<br>3.05 dia | 1972 Oct 5.7                  | 98.44                     | 99.64              | 7118                 | 731                 | 749                | 0.001                | 265                       |
| T Radsat** 1972-76B                   | 1972 Oct 2.84<br>20 years                     | 726                             | -<br>1.7 dia?         | 1972 Oct 5.7                  | 98.45                     | 99.69              | 7121                 | 732                 | 753                | 0.001                | 245                       |
| Burner 2 rocket 1972-76C              | 1972 Oct 2.84<br>20 years                     | Sphere-cone<br>66               | 1.32 long<br>0.94 dia | 1972 Oct 20.9                 | 98.44                     | 99.66              | 7119                 | 731                 | 751                | 0.001                | 202                       |
| Fragments 1972-76D, E                 |   |                                 |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D Cosmos 522 1972-77A                 | 1972 Oct 4.50<br>12.78 days<br>1972 Oct 17.28 | Sphere-cylinder<br>6300?        | 6.5 long?<br>2.4 dia  | 1972 Oct 6.4<br>1972 Oct 15.3 | 72.83<br>72.84            | 89.74<br>89.99     | 6639<br>6651         | 206<br>178          | 316<br>368         | 0.008<br>0.014       | 62<br>37                  |
| D Cosmos 522 rocket 1972-77B          | 1972 Oct 4.50<br>9.66 days<br>1972 Oct 14.16  | Cylinder<br>2500?               | 7.5 long<br>2.6 dia   | 1972 Oct 6.4                  | 72.84                     | 89.43              | 6624                 | 198                 | 294                | 0.007                | 56                        |

\*Radar calibration target.

\*\*Contains experiments on ultraviolet and gamma radiation.

| Name                 | Launch date, lifetime and descent date          | Shape and weight (kg)   | Size (m)              | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|----------------------|---|-------------------------|-----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D Cosmos 522 engine* | 1972 Oct 4.50<br>19.51 days<br>1972 Oct 24.01   | Cone<br>600? full       | 1.5 long?<br>2 dia?   | 1972 Oct 16.3                  | 72.82                     | 90.03              | 6653                 | 180                 | 370                | 0.014                | 35                        |
| D Fragment           | 1972-770  |                         |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D Cosmos 523         | 1972 Oct 5.48<br>153.49 days<br>1973 Mar 7.97   | Ellipsoid<br>400?       | 1.8 long<br>1.2 dia   | 1972 Oct 8.2<br>1972 Dec 16.5  | 71.03<br>71.03            | 92.09<br>91.22     | 6755<br>6713         | 272<br>257          | 481<br>413         | 0.015<br>0.012       | 73<br>-                   |
| D Cosmos 523 rocket  | 1972 Oct 5.48<br>62.92 days<br>1972 Dec 7.40    | Cylinder<br>1500?       | 8 long<br>1.65 dia    | 1972 Oct 6.0                   | 71.03                     | 91.88              | 6744                 | 272                 | 460                | 0.014                | 81                        |
| D Fragments          | 1972-78C-H                                      |                         |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D [Titan 3D]         | 1972-79A  |                         |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D Titan 3D rocket    | 1972 Oct 10.75<br>90 days<br>1973 Jan 8         | Cylinder<br>13300? full | 15 long<br>3.0 dia    | 1972 Oct 11.5<br>1972 Oct 21.5 | 96.47<br>96.46            | 88.93<br>88.84     | 6599<br>6594         | 160<br>164          | 281<br>267         | 0.009<br>0.008       | 186<br>157                |
| D Titan 3D rocket    | 1972 Oct 10.75<br>2.09 days<br>1972 Oct 12.84   | Cylinder<br>1900        | 6 long<br>3.0 dia     | 1972 Oct 11.4                  | 96.47                     | 88.59              | 6582                 | 150                 | 257                | 0.008                | 185                       |
| T? Capsule           | 1972 Oct 10.75<br>10000 years                   | Octagon<br>60?          | 0.3 long?<br>0.9 dia? | 1973 Sep 8.9                   | 95.62                     | 114.79             | 7824                 | 1423                | 1469               | 0.003                | 204                       |
| D Fragments          | 1972-79D,E                                      |                         |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D Cosmos 524         | 1972 Oct 11.56<br>164.64 days<br>1973 Mar 25.20 | Ellipsoid<br>400?       | 1.8 long<br>1.2 dia   | 1972 Oct 12.8<br>1973 Jan 1.0  | 70.99<br>70.99            | 92.33<br>91.37     | 6767<br>6721         | 267<br>251          | 512<br>434         | 0.018<br>0.014       | 86<br>-                   |
| D Cosmos 524 rocket  | 1972 Oct 11.56<br>69.92 days<br>1972 Dec 20.48  | Cylinder<br>1500?       | 8 long<br>1.65 dia    | 1972 Oct 12.8                  | 70.99                     | 92.08              | 6754                 | 265                 | 488                | 0.017                | 89                        |

\*1972-77C ejected from 1972-77A on 1972 Oct 16.

Year of launch 1972 continued

| Name   | Launch date, lifetime and descent date          | Shape and weight (kg)          | Size (m)                 | Date of orbital determination                  | Orbital inclination (deg) | Modal period (min)        | Semi major axis (km)   | Perigee height (km) | Apogee height (km)    | Orbital eccentricity    | Argument of perigee (deg) |
|--|---|--------------------------------|--------------------------|--|---------------------------|---------------------------|------------------------|---------------------|-----------------------|-------------------------|---------------------------|
| D<br>Molniya 1W<br>1972-81A                    | 1972 Oct 14.26<br>1844 days<br>1977 Nov 1       | Windmill *<br>6 vanes<br>1000? | 3.4 long<br>1.6 dia      | 1972 Oct 14.4<br>1972 Oct 16.0<br>1972 Nov 2.0 | 65.41<br>65.3<br>65.30    | 91.61<br>706.18<br>717.81 | 6732<br>26268<br>26557 | 226<br>480<br>636   | 481<br>39300<br>39722 | 0.019<br>0.739<br>0.736 | 65<br>285*<br>284         |
| D<br>Molniya 1W<br>launcher rocket<br>1972-81B | 1972 Oct 14.26<br>21.65 days<br>1972 Nov 4.91   | Cylinder<br>2500?              | 7.5 long<br>2.6 dia      | 1972 Oct 15.3                                  | 65.42                     | 91.30                     | 6717                   | 211                 | 467                   | 0.019                   | 60                        |
| D<br>Molniya 1W<br>launcher<br>1972-81C        | 1972 Oct 14.26<br>33.23 days<br>1972 Nov 16.49  | Irregular                      | -                        | 1972 Oct 15.2                                  | 65.39                     | 91.65                     | 6734                   | 223                 | 488                   | 0.020                   | 72                        |
| D<br>Molniya 1W<br>rocket<br>1972-81E          | 1972 Oct 14.26<br>883.47 days<br>1975 Mar 16.73 | Cylinder<br>440                | 2.0 long<br>2.0 dia      | 1972 Dec 12.3                                  | 65.53                     | 701.40                    | 26152                  | 474                 | 39074                 | 0.738                   | 284                       |
| D<br>Fragment<br>NOAA 2<br>(ITOS)<br>1972-81D  | 1972 Oct 15.72<br>10000 years                   | Box<br>334                     | 1.25 long<br>1.02 square | 1972 Oct 16.1                                  | 101.77                    | 115.01                    | 7833                   | 1451                | 1458                  | 0.0004                  | 223                       |
| T<br>Oscar 6<br>1972-82B                       | 1972 Oct 15.72<br>10000 years                   | Rectangular<br>box<br>16       | 0.43 x 0.30<br>x 0.15    | 1972 Oct 16.4                                  | 101.76                    | 115.01                    | 7833                   | 1450                | 1459                  | 0.0006                  | 239                       |
| D<br>NOAA 2<br>second stage<br>1972-82C        | 1972 Oct 15.72<br>1000 years                    | Cylinder<br>350?               | 4.9 long<br>1.43 dia     | 1972 Oct 23.9                                  | 102.80                    | 109.36                    | 7575                   | 918                 | 1475                  | 0.037                   | 306                       |
| D<br>Cosmos 525<br>1972-83A                    | 1972 Oct 18.50<br>10.71 days<br>1972 Oct 29.21  | Sphere-<br>cylinder<br>5900?   | 5.9 long<br>2.4 dia      | 1972 Oct 19.0                                  | 65.39                     | 89.25                     | 6616                   | 207                 | 269                   | 0.005                   | 66                        |
| D<br>Cosmos 525<br>rocket<br>1972-83B          | 1972 Oct 18.50<br>4.25 days<br>1972 Oct 22.75   | Cylinder<br>2500?              | 7.5 long<br>2.6 dia      | 1972 Oct 19.2                                  | 65.39                     | 89.14                     | 6611                   | 198                 | 267                   | 0.005                   | 43                        |

1972-83 continued on page 312

\*Approximate orbit.

|   | Name                | Launch date, lifetime and descent date                    | Shape and weight (kg)          | Size (m)             | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|---------------------|---|--------------------------------|----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D | Capsule*            | 1972-83C<br>1972 Oct 18.50<br>14.47 days<br>1972 Nov 1.97 | Ellipsoid<br>200?              | 0.9 long<br>1.9 dia  | 1972 Oct 27.3                  | 65.38                     | 89.01              | 6604                 | 192                 | 260                | 0.005                | 38                        |
| D | Fragment            | 1972-83D  |                                |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 526          | 1972-84A<br>1972 Oct 25.45<br>165 days<br>1973 Apr 8      | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia  | 1972 Oct 26.1<br>1973 Jan 16.5 | 70.96<br>70.96            | 92.15<br>91.26     | 6758<br>6715         | 273<br>256          | 486<br>418         | 0.016<br>0.012       | 73<br>-                   |
| D | Cosmos 526 rocket   | 1972-84B<br>1972 Oct 25.45<br>75.16 days<br>1973 Jan 8.61 | Cylinder<br>1500?              | 8 long<br>1.65 dia   | 1972 Oct 26.1                  | 70.96                     | 91.93              | 6747                 | 273                 | 465                | 0.014                | 71                        |
|   | Meteor 13           | 1972-85A<br>1972 Oct 26.92<br>500 years                   | Cylinder *<br>2 vanes<br>2200? | 5 long?<br>1.5 dia?  | 1972 Oct 28.5                  | 81.27                     | 102.57             | 7257                 | 867                 | 891                | 0.002                | 264                       |
|   | Meteor 13 rocket    | 1972-85B<br>1972 Oct 26.92<br>400 years                   | Cylinder<br>1440               | 3.8 long<br>2.6 dia  | 1972 Oct 28.8                  | 81.27                     | 102.67             | 7262                 | 841                 | 927                | 0.006                | 185                       |
| D | Cosmos 527          | 1972-86A<br>1972 Oct 31.57<br>12.7 days<br>1972 Nov 13.3  | Sphere-<br>cylinder<br>6300?   | 6.5 long?<br>2.4 dia | 1972 Oct 31.8<br>1972 Nov 2.3  | 65.37<br>65.40            | 89.62<br>89.11     | 6635<br>6609         | 207<br>178          | 306<br>284         | 0.007<br>0.008       | 80<br>47                  |
| R |                     |   |                                |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 527 rocket   | 1972-86B<br>1972 Oct 31.57<br>7.95 days<br>1972 Nov 8.52  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1972 Oct 31.8                  | 65.39                     | 89.51              | 6629                 | 207                 | 295                | 0.007                | 75                        |
| D | Cosmos 527 engine** | 1972-86E<br>1972 Oct 31.57<br>18 days<br>1972 Nov 18      | Cone<br>600? full              | 1.5 long?<br>2 dia?  | 1972 Nov 12.7                  | 65.43                     | 99.53              | 6630                 | 181                 | 323                | 0.011                | 46                        |
| D | Fragments           | 1972-86C,D,F  |                                |                      |                                |                           |                    |                      |                     |                    |                      |                           |

\* 1972-83C ejected from 1972-83A on 1972 Oct 26.43

\*\* 1972-86E ejected from 1972-86A on 1972 Nov 12.

| Name              | Launch date, lifetime and descent date | Shape and weight (kg) | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|-------------------|--|-----------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 528        | 1972 Nov 1.08<br>7000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1972 Nov 4.6                  | 74.03                     | 114.21             | 7797                 | 1368                | 1470               | 0.007                | 93                        |
| Cosmos 529        | 1972 Nov 1.08<br>8000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1972 Nov 4.6                  | 74.03                     | 114.61             | 7815                 | 1404                | 1470               | 0.004                | 96                        |
| Cosmos 530        | 1972 Nov 1.08<br>6000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1972 Nov 3.3                  | 74.03                     | 113.85             | 7781                 | 1336                | 1469               | 0.009                | 92                        |
| Cosmos 531        | 1972 Nov 1.08<br>9000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1972 Nov 3.9                  | 74.03                     | 114.83             | 7825                 | 1423                | 1471               | 0.003                | 110                       |
| Cosmos 532        | 1972 Nov 1.08<br>4000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1972 Nov 3.3                  | 74.04                     | 113.49             | 7764                 | 1302                | 1470               | 0.011                | 90                        |
| Cosmos 533        | 1972 Nov 1.08<br>5000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1972 Nov 4.3                  | 74.03                     | 113.68             | 7773                 | 1319                | 1470               | 0.010                | 95                        |
| Cosmos 534        | 1972 Nov 1.08<br>6000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1972 Nov 5.5                  | 74.04                     | 114.03             | 7789                 | 1351                | 1470               | 0.008                | 91                        |
| Cosmos 535        | 1972 Nov 1.08<br>8000 years            | Spheroid<br>407       | 1.0 long?<br>0.8 dia? | 1972 Nov 2.2                  | 74.04                     | 114.42             | 7806                 | 1385                | 1471               | 0.006                | 102                       |
| Cosmos 528 rocket | 1972 Nov 1.08<br>20000 years           | Cylinder<br>2200?     | 7.4 long<br>2.4 dia   | 1972 Nov 3.6                  | 74.03                     | 116.70             | 7910                 | 1470                | 1594               | 0.008                | 267                       |

| Name                   | Launch date, lifetime and descent date         | Shape and weight (kg)       | Size (m)                         | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|------------------------|--|-----------------------------|----------------------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 536             | 1972 Nov 3.07<br>10 years                      | Cylinder + paddles? 900?    | 2 long?<br>1 dia?                | 1972 Nov 4.2                   | 74.02                     | 95.27              | 6909                 | 518                 | 544                | 0.002                | 15                        |
| Cosmos 536 rocket      | 1972 Nov 3.07<br>10 years                      | Cylinder 2200?              | 7.4 long<br>2.4 dia              | 1972 Nov 4.3                   | 74.02                     | 95.16              | 6904                 | 508                 | 543                | 0.002                | 11                        |
| Fragments              |  |                             |                                  |                                |                           |                    |                      |                     |                    |                      |                           |
| [Thor Burner 2]†       | 1972 Nov 9.21<br>80 years                      | 12-faced frustum 195        | 1.64 long<br>1.31 to<br>1.10 dia | 1972 Nov 20.6                  | 98.65                     | 101.80             | 7221                 | 813                 | 872                | 0.004                | 200                       |
| Burner 2 rocket        | 1972 Nov 9.21<br>60 years                      | Sphere-cone 66              | 1.32 long<br>0.94 dia            | 1972 Nov 10.7                  | 98.64                     | 101.82             | 7222                 | 816                 | 871                | 0.004                | 221                       |
| Telesat 1 (Anik 1)     | 1972 Nov 10.05<br>>million years               | Cylinder 562 full 295 empty | 1.52 long<br>1.83 dia            | 1972 Dec 1.0<br>1973 Jan 1.0   | 0.4<br>0.1                | 1455.5<br>1436.0   | 4254.3<br>42164      | 35822<br>35780      | 36508<br>35791     | 0.008<br>0.0001      | -<br>-                    |
| Telesat 1 second stage | 1972 Nov 10.05<br>178.31 days<br>1973 May 7.36 | Cylinder + annulus 350?     | 6.4 long<br>1.52 and<br>2.44 dia | 1972 Nov 10.1<br>1973 Feb 15.0 | 28.57<br>28.57            | 103.78<br>98.45    | 7319<br>7066         | 203<br>181          | 1678<br>1194       | 0.101<br>0.072       | 183<br>-                  |
| Telesat 1 third stage  | 1972 Nov 10.05<br>20 years?                    | Sphere-cone 66              | 1.32 long<br>0.94 dia            | 1972 Nov 10.1                  | 28.57                     | 645.3              | 24734                | 203                 | 36508              | 0.734                | 181*                      |
| Explorer 48 (SAS 2)    | 1972 Nov 15.93<br>9 years                      | Cylinder + 4 paddles 186    | 1.29 long<br>0.55 dia            | 1972 Nov 17.0                  | 1.90                      | 95.20              | 6916                 | 444                 | 632                | 0.074                | 79                        |
| Explorer 48 rocket     | 1972 Nov 15.93<br>8 years?                     | Cylinder 24                 | 1.50 long<br>0.46 dia            | 1972 Nov 16.7<br>1973 Aug 27.8 | 1.84<br>1.90              | 95.12<br>94.68     | 6912<br>6890         | 450<br>430          | 618<br>594         | 0.013<br>0.012       | 71*<br>76                 |

\* Approximate orbits. Telesat 1 is Canadian.

† DMSP



|    | Name                          | Launch date, lifeline and descent date        | Shape and weight (kg)                         | Size (m)                            | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|----|-------------------------------|---|---|-------------------------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D  | Molniya 1X<br>1972-95A        | 1972 Dec 2.20<br>1166 days<br>1976 Feb 11     | Windmill +<br>6 vanes<br>1000?                | 3.4 long<br>1.6 dia                 | 1972 Dec 31.9<br>1973 Sep 1.0 | 65.01<br>65.01            | 717.70<br>717.74   | 26554<br>26555       | 555<br>582          | 39797<br>39772     | 0.739<br>0.738       | 285<br>-                  |
| D  | Molniya 1X<br>launcher rocket | 1972 Dec 2.20<br>39.72 days<br>1973 Jan 10.92 | Cylinder<br>2500?                             | 7.5 long<br>2.6 dia                 | 1972 Dec 4.2                  | 64.98                     | 91.23              | 6714                 | 230                 | 441                | 0.016                | 64                        |
| D  | Molniya 1X<br>launcher        | 1972 Dec 2.20<br>62.08 days<br>1973 Feb 2.28  | Irregular                                     | -                                   | 1972 Dec 3.1                  | 64.98                     | 91.93              | 6749                 | 210                 | 531                | 0.024                | 60                        |
| D  | Molniya 1X<br>rocket          | 1972 Dec 2.20<br>815 days<br>1975 Feb 25      | Cylinder<br>440                               | 2.0 long<br>2.0 dia                 | 1973 Mar 1.0<br>1973 Sep 1.0  | 65.00<br>64.99            | 699.14<br>699.18   | 26094<br>26095       | 545<br>571          | 38887<br>38863     | 0.735<br>0.734       | -<br>-                    |
| D  | Fragments                     | 1972-95D, E                                   |   |                                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D  | Apollo 17**                   | 1972 Dec 7.23<br>12.58 days<br>1972 Dec 19.81 | Cone-cylinder<br>30340<br>full                | 11.15 long<br>3.91 dia              | 1972 Dec 7.3<br>1972 Dec 7.5  | 32.56<br>33.2             | 87.82<br>26320     | 6552<br>292 520      | 169<br>200          | 178<br>572 080     | 0.0007<br>0.977      | -<br>30*                  |
| R  |                               |   |   |                                     |                               |                           |                    |                      |                     |                    |                      |                           |
| 3M |                               |   |   |                                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D  | Saturn IVB<br>[Saturn 512]    | 1972 Dec 7.23<br>3.63 days<br>1972 Dec 10.86  | Cylinder<br>13930                             | 18.7 long<br>6.6 dia                | 1972 Dec 7.3<br>1972 Dec 7.5  | 32.56<br>33.2             | 87.82<br>26320     | 6552<br>292 520      | 169<br>200          | 178<br>572 080     | 0.0007<br>0.977      | -<br>30*                  |
| D  | LEM 12<br>descent stage       | 1972 Dec 7.23<br>4.60 days<br>1972 Dec 11.83  | Octagon +<br>legs<br>11390 full<br>2792 empty | 1.57 high<br>3.13 wide              | 1972 Dec 7.5                  | 33.2                      | 26320              | 292 520              | 200                 | 572 080            | 0.977                | 30*                       |
| D  | LEM 12 +<br>ascent stage      | 1972 Dec 7.23<br>8.06 days<br>1972 Dec 15.29  | Box + tanks<br>5050 full<br>2145 empty        | 2.52 high<br>3.76 wide<br>3.13 deep | 1972 Dec 7.5                  | 33.2                      | 26320              | 292 520              | 200                 | 572 080            | 0.977                | 30*                       |

\*\* Apollo attached to LEM separated from Saturn IVB on Dec 7.41.

+ LEM with two crew members separated from Apollo on Dec 11.72.

Ascent stage relaunched from Moon Dec 14.96; briefly docked with Apollo Dec 15.04.

\* Approximate orbits.

In selenocentric orbit 1972 Dec 10.83 to Dec 16.98  
Crashed on Moon 1972 Dec 10.86  
Entered selenocentric orbit 1972 Dec 10.83  
Landed on Moon 1972 Dec 11.83  
On Moon's surface 1972 Dec 11.83 to Dec 14.96  
Finally crashed on Moon 1972 Dec 15.29

|   | Name                                      | Launch date, lifetime and descent date         | Shape and weight (kg)           | Size (m)                         | Date of orbital determination                 | Orbital inclination (deg) | Modal period (min)         | Semi major axis (km)    | Perigee height (km) | Apogee height (km)      | Orbital eccentricity    | Argument of perigee (deg) |
|---|---|--|---------------------------------|----------------------------------|---|---------------------------|----------------------------|-------------------------|---------------------|-------------------------|-------------------------|---------------------------|
| T | Nimbus 5<br>1972-97A                      | 1972 Dec 11.33<br>1600 years                   | Conical skeleton<br>770         | 3.00 long<br>1.45 dia            | 1972 Dec 14.0                                 | 99.95                     | 107.25                     | 7474                    | 1089                | 1102                    | 0.0008                  | 230                       |
|   | Nimbus 5<br>second stage<br>1972-97B      | 1972 Dec 11.33<br>1600 years                   | Cylinder<br>+ annulus<br>350?   | 9.4 long<br>1.52 and<br>2.44 dia | 1972 Dec 11.7<br>1973 Jan 1.0                 | 99.93<br>99.8             | 107.34<br>111.8            | 7478<br>7690            | 1088<br>1105        | 1112<br>1518            | 0.002<br>0.027          | 214<br>-<br>-             |
| D | Molniya 2D<br>1972-98A                    | 1972 Dec 12.29<br>771 days<br>1975 Jan 22      | Windmill +<br>6 vanes?<br>1250? | 4.2 long?<br>1.6 dia?            | 1972 Dec 12.3<br>1973 Jan 2.5<br>1974 Feb 1.0 | 65.26<br>65.31<br>65.42   | 706.48<br>717.67<br>717.53 | 26276<br>26554<br>26550 | 495<br>465<br>358   | 39300<br>39886<br>39986 | 0.738<br>0.742<br>0.746 | 285<br>285<br>-           |
| D | Molniya 2D<br>launcher rocket<br>1972-98B | 1972 Dec 12.29<br>31.71 days<br>1973 Jan 13.00 | Cylinder<br>2500?               | 7.5 long<br>2.6 dia              | 1972 Dec 16.0                                 | 65.41                     | 91.14                      | 6709                    | 218                 | 444                     | 0.017                   | 63                        |
| D | Molniya 2D<br>launcher<br>1972-98C        | 1972 Dec 12.29<br>38.24 days<br>1973 Jan 19.53 | Irregular                       | -                                | 1972 Dec 16.0                                 | 65.39                     | 91.39                      | 6721                    | 220                 | 467                     | 0.018                   | 64                        |
| D | Molniya 2D<br>rocket<br>1972-98D          | 1972 Dec 12.29<br>664 days<br>1974 Oct 7       | Cylinder<br>440                 | 2.0 long<br>2.0 dia              | 1973 Jan 31.5<br>1973 Jul 1.0                 | 65.38<br>65.40            | 702.02<br>701.90           | 26166<br>26163          | 441<br>484          | 39135<br>39086          | 0.739<br>0.738          | 284<br>-                  |
| D | Cosmos 538<br>1972-99A                    | 1972 Dec 14.58<br>12.7 days                    | Sphere-<br>cylinder<br>6300?    | 6.5 long?<br>2.4 dia             | 1972 Dec 15.6<br>1972 Dec 16.5                | 65.40<br>65.43            | 89.38<br>89.16             | 6622<br>6611            | 205<br>184          | 283<br>282              | 0.006<br>0.007          | 60<br>58                  |
| R |   | 1972 Dec 27.3                                  |                                 |                                  |   |                           |                            |                         |                     |                         |                         |                           |
| D | Cosmos 538<br>rocket<br>1972-99B          | 1972 Dec 14.58<br>8.24 days<br>1972 Dec 22.82  | Cylinder<br>2500?               | 7.5 long<br>2.6 dia              | 1972 Dec 15.1                                 | 65.40                     | 89.24                      | 6615                    | 199                 | 275                     | 0.006                   | 48                        |

Year of launch 1972 continued

| Name                      | Launch date, lifetime and descent date          | Shape and weight (kg)                | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---------------------------|---|--------------------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D Cosmos 538 engine*      | 1972 Dec 14.58<br>21 days<br>1973 Jan 4         | Cone<br>600?<br>full                 | 1.5 long?<br>2 dia?   | 1972 Dec 30.2                 | 65.40                     | 89.12              | 6609                 | 177                 | 285                | 0.008                | 41                        |
| D Fragments               |   |                                      |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D Aerios (GRS B)†         | 1972 Dec 16.48<br>248.91 days<br>1973 Aug 22.39 | Cylinder<br>127                      | 0.74 long<br>0.91 dia | 1972 Dec 18.1<br>1973 Apr 1.0 | 96.94<br>96.94            | 95.57<br>93.65     | 6923<br>6830         | 223<br>217          | 867<br>687         | 0.047<br>0.034       | 162<br>-                  |
| D Aerios rocket           | 1972 Dec 16.48<br>71.45 days<br>1973 Feb 25.93  | Cylinder<br>24                       | 1.50 long<br>0.46 dia | 1972 Dec 18.4                 | 96.94                     | 95.50              | 6920                 | 224                 | 859                | 0.046                | 161                       |
| T BREWS 5 [Atlas Agena D] | 1972 Dec 20.07?<br>> million years              | Cylinder?<br>700 full?<br>350 empty? | 1.7 long?<br>1.4 dia? | 1973 Jan 1.0                  | 9.7                       | 1440.4             | 42248                | 31012               | 40728              | 0.115                | -                         |
| Agena D rocket            | 1972 Dec 20.07?<br>10 years?                    | Cylinder<br>700?                     | 6 long?<br>1.5 dia?   | 1973 Feb 1.0                  | 28.12                     | 583.76             | 23163                | 200                 | 33370              | 0.716                | 210**                     |
| Cosmos 539                | 1972 Dec 21.08<br>5000 years                    | -<br>500?                            | -                     | 1972 Dec 28.1                 | 74.02                     | 112.98             | 7741                 | 1343                | 1383               | 0.003                | 225                       |
| Cosmos 539 rocket         | 1972 Dec 21.08<br>4000 years                    | Cylinder<br>2200?                    | 7.4 long<br>2.4 dia   | 1972 Dec 28.2                 | 74.02                     | 112.85             | 7735                 | 1339                | 1374               | 0.002                | 205                       |

\*1972-99E ejected from 1972-99A about 1972 Dec 26.

\*\* Approximate orbit.

† German Research Satellite.

|   | Name                              | Launch date, lifetime and descent date         | Shape and weight (kg)           | Size (m)            | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|-----------------------------------|--|---------------------------------|---------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D | [Titan 3B Agena D]<br>1972-103A   | 1972 Dec 21.74<br>33 days<br>1973 Jan 23       | Cylinder<br>3000?               | 8 long?<br>1.5 dia  | 1972 Dec 25.7<br>1972 Dec 25.9 | 110.45<br>110.44          | 89.68<br>89.81     | 6637<br>6643         | 139<br>132          | 378<br>398         | 0.018<br>0.020       | 151<br>153                |
|   | Cosmos 540<br>1972-104A           | 1972 Dec 25.96<br>120 years                    | Cylinder *<br>paddles<br>750?   | 2 long?<br>1 dia?   | 1972 Dec 29.2                  | 74.08                     | 100.79             | 7174                 | 781                 | 810                | 0.002                | 348                       |
|   | Cosmos 540<br>rocket<br>1972-104B | 1972 Dec 25.96<br>100 years                    | Cylinder<br>2200?               | 7.4 long<br>2.4 dia | 1972 Dec 27.1                  | 74.07                     | 100.60             | 7164                 | 769                 | 803                | 0.002                | 19                        |
| D | Fragments<br>1972-104C-E          |  |                                 |                     |                                |                           |                    |                      |                     |                    |                      |                           |
| R | Cosmos 541<br>1972-105A           | 1972 Dec 27.44<br>11.9 days<br>1973 Jan 8.3    | Sphere-<br>cylinder<br>5900?    | 5.9 long<br>2.4 dia | 1972 Dec 28.7                  | 81.31                     | 90.21              | 6662                 | 221                 | 346                | 0.009                | 72                        |
| D | Cosmos 541<br>rocket<br>1972-105B | 1972 Dec 27.44<br>16.33 days<br>1973 Jan 12.77 | Cylinder<br>2500?               | 7.5 long<br>2.6 dia | 1972 Dec 28.3                  | 81.33                     | 90.10              | 6656                 | 218                 | 338                | 0.009                | 63                        |
| D | Capsule *<br>1972-105F            | 1972 Dec 27.44<br>19 days<br>1973 Jan 15       | Ellipsoid<br>200?               | 0.9 long<br>1.9 dia | 1973 Jan 9.2                   | 81.32                     | 89.97              | 6650                 | 220                 | 323                | 0.008                | 25                        |
| D | Fragments<br>1972-105C-E          |  |                                 |                     |                                |                           |                    |                      |                     |                    |                      |                           |
|   | Cosmos 542<br>1972-106A           | 1972 Dec 28.46<br>20 years                     | Cylinder *<br>2 vanes?<br>2500? | 5 long?<br>1.5 dia? | 1972 Dec 31.0                  | 81.22                     | 96.38              | 6962                 | 527                 | 641                | 0.008                | 265                       |
|   | Cosmos 542<br>rocket<br>1972-106B | 1972 Dec 28.46<br>20 years                     | Cylinder<br>1440                | 3.8 long<br>2.6 dia | 1972 Dec 31.2                  | 81.21                     | 96.40              | 6963                 | 509                 | 661                | 0.011                | 224                       |

\*1972-105F ejected from 1972-105A about 1973 Jan 8.

|   | Name                       | Launch date, lifetime and descent date         | Shape and weight (kg)        | Size (m)             | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|----------------------------|--|------------------------------|----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D | Luna 21<br>launcher rocket | 1973 Jan 8.29<br>4 days<br>1973 Jan 12         | Cylinder<br>4000?            | 12 long?<br>4 dia    | 1973 Jan 9.0                   | 51.55                     | 88.68              | 6591                 | 190                 | 235                | 0.003                | 318                       |
| D | Luna 21<br>launcher        | 1973 Jan 8.29<br>5 days<br>1973 Jan 13         | -                            | -                    | 1973 Jan 9.3                   | 51.55                     | 88.62              | 6588                 | 183                 | 236                | 0.004                | 324                       |
| D | Cosmos 543                 | 1973 Jan 11.42<br>12.9 days<br>1973 Jan 24.3   | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1973 Jan 12.0<br>1973 Jan 13.6 | 64.98<br>64.97            | 89.62<br>89.28     | 6634<br>6618         | 203<br>175          | 309<br>304         | 0.008<br>0.010       | 54<br>47                  |
| D | Cosmos 543<br>rocket       | 1973 Jan 11.42<br>11 days<br>1973 Jan 22       | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1973 Jan 12.1                  | 64.98                     | 89.51              | 6629                 | 203                 | 299                | 0.007                | 53                        |
| D | Cosmos 543<br>engine*      | 1973 Jan 11.42<br>16.76 days<br>1973 Jan 28.18 | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1973 Jan 23.7                  | 64.98                     | 89.06              | 6607                 | 167                 | 290                | 0.009                | 40                        |
| D | Fragment                   |  |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
|   | Cosmos 544                 | 1973 Jan 20.15<br>8 years                      | Cylinder +<br>paddles? 900?  | 2 long?<br>1 dia?    | 1973 Jan 26.2                  | 74.03                     | 95.23              | 6907                 | 510                 | 548                | 0.003                | 345                       |
|   | Cosmos 544<br>rocket       | 1973 Jan 20.15<br>7 years                      | Cylinder<br>2200?            | 7.4 long<br>2.4 dia  | 1973 Jan 20.8                  | 74.03                     | 95.11              | 6901                 | 501                 | 545                | 0.003                | 0                         |
| D | Fragments                  |  |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |

Space Vehicle: Luna 21, 1973-01A

\*1973-02C ejected from 1973-02A on 1973 Jan 23



|   | Name                                | Launch date, lifetime and descent date        | Shape and weight (kg)          | Size (m)             | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi-major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|-------------------------------------|---|--------------------------------|----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D | Molniya 1Y 1973-07A                 | 1973 Feb 3.25<br>1723 days<br>1977 Oct 23     | Windmill *<br>6 vanes<br>1000? | 3.4 long<br>1.6 dia  | 1973 Feb 8.7<br>1973 Mar 1.0  | 65.00<br>65.00            | 703.15<br>717.65   | 26194<br>26553       | 470<br>578          | 39164<br>39772     | 0.739<br>0.738       | 285<br>-                  |
| D | Molniya 1Y launcher rocket 1973-07B | 1973 Feb 3.25<br>37.83 days<br>1973 Mar 13.08 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1973 Feb 6.0                  | 64.97                     | 91.23              | 6714                 | 229                 | 442                | 0.016                | 64                        |
| D | Molniya 1Y launcher 1973-07C        | 1973 Feb 3.25<br>42.79 days<br>1973 Mar 18.04 | Irregular                      | -                    | 1973 Feb 5.1                  | 64.96                     | 91.53              | 6728                 | 228                 | 472                | 0.018                | 67                        |
| D | Molniya 1Y rocket 1973-07E          | 1973 Feb 3.25<br>2008 days<br>1978 Aug 4      | Cylinder<br>440                | 2.0 long<br>2.0 dia  | 1973 Mar 1.0                  | 65.10                     | 702.53             | 26179                | 508                 | 39093              | 0.737                | -                         |
| D | Fragment 1973-07D                   |   |                                |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 548 1973-08A                 | 1973 Feb 8.56<br>12.7 days<br>1973 Feb 21.3   | Sphere-cylinder<br>6300?       | 6.5 long?<br>2.4 dia | 1973 Feb 9.2<br>1973 Feb 14.1 | 65.38<br>65.39            | 89.55<br>89.37     | 6631<br>6622         | 205<br>171          | 300<br>317         | 0.007<br>0.011       | 72<br>48                  |
| D | Cosmos 548 rocket 1973-08B          | 1973 Feb 8.56<br>8.12 days<br>1973 Feb 16.68  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1973 Feb 9.0                  | 65.38                     | 89.40              | 6624                 | 202                 | 289                | 0.007                | 60                        |
| D | Cosmos 548 engine * 1973-08F        | 1973 Feb 8.56<br>18 days<br>1973 Feb 26       | Cone<br>600? full              | 1.5 long?<br>2 dia?  | 1973 Feb 21.6                 | 65.42                     | 90.61              | 6684                 | 159                 | 453                | 0.022                | 7                         |
| D | Fragments 1973-08C-E, G             |   |                                |                      |                               |                           |                    |                      |                     |                    |                      |                           |

\* 1973-08F ejected from 1973-08A about 1973 Feb 20.

| Name                                       | Launch date, lifetime and descent date         | Shape and weight (kg)          | Size (m)             | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km)      | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|--|--|--------------------------------|----------------------|-------------------------------|---------------------------|--------------------|---------------------------|---------------------|--------------------|----------------------|---------------------------|
| Prognoz 3<br>1973-09A                      | 1973 Feb 15.05<br>10 years?                    | Spheroid +<br>4 vanes<br>845   | 1.8 dia?             | 1973 Feb 15.0                 | 65.0                      | 5783               | 106 670                   | 590                 | 200 000            | 0.935                | - *                       |
| D Prognoz 3<br>launcher rocket<br>1973-09B | 1973 Feb 15.05<br>35.69 days<br>1973 Mar 22.74 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1973 Feb 15.9                 | 65.00                     | 91.24              | 6714                      | 229                 | 442                | 0.016                | 64                        |
| D Prognoz 3<br>launcher<br>1973-09C        | 1973 Feb 15.05<br>36.25 days<br>1973 Mar 23.30 | Irregular                      | -                    | 1973 Feb 15.9                 | 65.03                     | 91.53              | 6728                      | 216                 | 484                | 0.020                | 67                        |
| Prognoz 3<br>rocket<br>1973-09D            | 1973 Feb 15.05<br>10 years?                    | Cylinder<br>440                | 2.0 long<br>2.0 dia  |                               |                           |                    | Orbit similar to 1973-09A |                     |                    |                      |                           |
| Cosmos 549<br>1973-10A                     | 1973 Feb 28.19<br>8 years                      | Cylinder<br>+ paddles?<br>900? | 2 long?<br>1 dia?    | 1973 Mar 1.1                  | 74.02                     | 95.23              | 6907                      | 513                 | 545                | 0.002                | 357                       |
| Cosmos 549<br>rocket<br>1973-10B           | 1973 Feb 28.19<br>7 years                      | Cylinder<br>2200?              | 7.4 long<br>2.4 dia  | 1973 Mar 1.6                  | 74.02                     | 95.11              | 6901                      | 504                 | 542                | 0.003                | 4                         |
| D Fragment<br>Cosmos 550<br>1973-11A       | 1973 Mar 1.53<br>9.8 days<br>1973 Mar 11.3     | Sphere-<br>cylinder<br>6300?   | 6.5 long?<br>2.4 dia | 1973 Mar 2.2<br>1973 Mar 10.8 | 65.42<br>65.42            | 89.73<br>89.29     | 6640<br>6618              | 206<br>183          | 317<br>296         | 0.008<br>0.008       | 78<br>55                  |
| D Cosmos 550<br>rocket<br>1973-11B         | 1973 Mar 1.53<br>8.27 days<br>1973 Mar 9.80    | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1973 Mar 2.2                  | 65.42                     | 89.63              | 6635                      | 204                 | 309                | 0.008                | 70                        |
| D Cosmos 550<br>engine<br>1973-11C         | 1973 Mar 1.53<br>17 days<br>1973 Mar 18        | Cone<br>600? full?             | 1.5 long?<br>2 dia?  | 1973 Mar 13.7                 | 65.42                     | 89.24              | 6615                      | 184                 | 290                | 0.008                | -                         |
| D Fragments<br>1973-11D-F                  |  |                                |                      |                               |                           |                    |                           |                     |                    |                      |                           |

\* Approximate 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<br>R | Cosmos 552<br>1973-16A                               | 1973 Mar 22.42<br>11.76 days<br>1973 Apr 3.28 | Sphere-cylinder<br>5900?       | 5.9 long<br>2.4 dia                    | 1973 Mar 22.8                                | 72.84                     | 89.68                   | 6636                 | 204                 | 312                | 0.008                   | 61                        |
| D      | Cosmos 552<br>rocket<br>1973-16B                     | 1973 Mar 22.42<br>8.54 days<br>1973 Mar 30.96 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia                    | 1973 Mar 23.0                                | 72.84                     | 89.52                   | 6628                 | 206                 | 294                | 0.007                   | 58                        |
| D      | Capsule*<br>1973-16C                                 | 1973 Mar 22.42<br>17.59 days<br>1973 Apr 9.01 | Ellipsoid<br>200?              | 0.9 long<br>1.9 dia                    | 1973 Mar 26.2                                | 72.85                     | 89.61                   | 6633                 | 199                 | 310                | 0.008                   | 51                        |
| D      | Salyut 2<br>1973-17A                                 | 1973 Apr 3.38<br>55.11 days<br>1973 May 28.49 | Cylinder +<br>4 wings<br>18500 | 14 long<br>4.15 max dia<br>2.0 min dia | 1973 Apr 4.0<br>1973 Apr 5.7<br>1973 Apr 8.6 | 51.56<br>51.57<br>51.57   | 88.99<br>89.42<br>89.81 | 6606<br>6626<br>6646 | 207<br>237<br>257   | 248<br>259<br>278  | 0.003<br>0.002<br>0.002 | 59<br>226<br>81           |
| D      | Salyut 2<br>rocket<br>1973-17B                       | 1973 Apr 3.38<br>3 days<br>1973 Apr 6         | Cylinder<br>4000?              | 12 long?<br>4 dia                      | 1973 Apr 3.6                                 | 51.48                     | 88.82                   | 6597                 | 194                 | 244                | 0.004                   | 2                         |
| D<br>D | Fragments**<br>Molniya 2E<br>1973-17C-AB<br>1973-18A | 1973 Apr 5.47<br>68 months?<br>1978 Dec?      | Windmill +<br>6 vanes<br>1250? | 4.2 long?<br>1.6 dia?                  | 1973 Apr 18.2<br>1973 Apr 18.7               | 65.49<br>65.24            | 702.19<br>717.73        | 26170<br>26555       | 477<br>532          | 39107<br>39822     | 0.738<br>0.740          | 285<br>285                |
| D      | Molniya 2E<br>launcher rocket<br>1973-18B            | 1973 Apr 5.47<br>19.05 days<br>1973 Apr 24.52 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia                    | 1973 Apr 6.2                                 | 65.39                     | 91.53                   | 6728                 | 188                 | 511                | 0.024                   | 70                        |
| D      | Molniya 2E<br>launcher<br>1973-18C                   | 1973 Apr 5.47<br>25.40 days<br>1973 Apr 30.87 | Irregular                      | -                                      | 1973 Apr 6.0                                 | 65.40                     | 91.25                   | 6715                 | 217                 | 456                | 0.018                   | 72                        |

\* 1973-16C ejected from 1973-16A about 1973 Mar 26.

\*\* Fragments designated on 1973 Apr 4.45

1973-18 continued on page 326

| Name                            | Launch date, lifetime and descent date          | Shape and weight (kg)    | Size (m)             | Date of orbital determination                   | Orbital inclination (deg) | Modal period (min)      | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity    | Argument of perigee (deg) |
|---------------------------------|---|--------------------------|----------------------|---|---------------------------|-------------------------|----------------------|---------------------|--------------------|-------------------------|---------------------------|
| D Molniya 2E rocket             | 1973 Apr 5.47<br>68 months?<br>1978 Dec?        | Cylinder<br>440          | 2.0 long<br>2.0 dia  | 1973 May 2.2                                    | 65.44                     | 699.04                  | 26092                | 467                 | 38961              | 0.738                   | 284                       |
| D Pioneer 11 second stage       | 1973 Apr 6.09<br>577 days<br>1974 Nov 4         | Cylinder<br>1815         | 8.6 long<br>3.0 dia  | 1973 May 1.0                                    | 34.9                      | 2342.0                  | 58420                | 161                 | 103922             | 0.888                   | -                         |
| D Cosmos 553                    | 1973 Apr 12.50<br>213.45 days<br>1973 Nov 11.95 | Ellipsoid<br>400?        | 1.8 long<br>1.2 dia  | 1973 Apr 13.0<br>1973 Jul 31.9                  | 70.96<br>70.96            | 92.22<br>91.38          | 6761<br>6721         | 272<br>256          | 494<br>429         | 0.016<br>0.013          | 80                        |
| D Cosmos 553 rocket             | 1973 Apr 12.50<br>116.96 days<br>1973 Aug 7.46  | Cylinder<br>1500?        | 8 long<br>1.65 dia   | 1973 Apr 13.0                                   | 70.96                     | 92.10                   | 6755                 | 272                 | 482                | 0.016                   | 80                        |
| D Cosmos 554*                   | 1973 Apr 19.38<br>38 days<br>1973 May 27        | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1973 Apr 19.7<br>1973 Apr 21.7<br>1973 Apr 25.8 | 72.85<br>72.85<br>72.85   | 89.50<br>89.58<br>90.04 | 6627<br>6631<br>6654 | 194<br>171<br>171   | 304<br>335<br>380  | 0.008<br>0.012<br>0.016 | 45<br>57<br>48            |
| D Cosmos 554 rocket             | 1973 Apr 19.38<br>7.17 days<br>1973 Apr 26.55   | Cylinder<br>2500?        | 7.5 long<br>2.6 dia  | 1973 Apr 19.6                                   | 72.85                     | 89.47                   | 6626                 | 202                 | 293                | 0.007                   | 58                        |
| D Cosmos 554 engine**           | 1973 Apr 19.38<br>12 days<br>1973 May 1         | Cone<br>600? full        | 1.5 long<br>2 dia?   | 1973 Apr 27.0                                   | 72.85                     | 89.80                   | 6642                 | 169                 | 359                | 0.014                   | 43                        |
| D Fragments                     | 1973-21C,D,F,HE                                 |                          |                      |   |                           |                         |                      |                     |                    |                         |                           |
| D Intercomas 9 (Copernicus 500) | 1973 Apr 19.43<br>179.46 days<br>1973 Oct 15.89 | Ellipsoid<br>400?        | 1.8 long<br>1.2 dia  | 1973 Apr 21.0<br>1973 Jul 16.5                  | 48.42<br>48.39            | 102.12<br>97.73         | 7241<br>7030         | 199<br>192          | 1526<br>1111       | 0.092<br>0.065          | 108<br>-                  |
| D Intercomas 9 rocket           | 1973 Apr 19.43<br>181.37 days<br>1973 Oct 17.80 | Cylinder<br>1500?        | 8 long<br>1.65 dia   | 1973 Apr 21.0<br>1973 Jul 16.5                  | 48.41<br>48.39            | 102.12<br>97.71         | 7241<br>7029         | 199<br>194          | 1526<br>1107       | 0.092<br>0.065          | 108<br>-                  |

Space Vehicle: Pioneer 11, 1973-19A

Burner 2 rocket, 1973-19B

\* 1973-21A disintegrated about 1973 May 7.1

\*\* 1973-21E ejected from 1973-21A on 1973 Apr 26

|   | Name                   | Launch date, lifetime and descent date        | Shape and weight (kg)             | Size (m)                      | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi-major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|------------------------|---|-----------------------------------|-------------------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| T | Telesat 2 (Anik 2)     | 1973 Apr 20.98<br>> million years             | Cylinder<br>565 full<br>295 empty | 1.52 long<br>1.83 dia         | 1973 May 1.0<br>1973 Jun 1.0  | 0.1<br>0.1                | 1430.7<br>1436.2   | 42035<br>42167       | 35604<br>35786      | 35709<br>35792     | 0.001<br>0.0001      | -<br>-                    |
| D | Telesat 2 second stage | 1973 Apr 20.98<br>911 days<br>1975 Oct 18     | Cylinder + annulus<br>3507        | 6.4 long<br>1.52 and 2.44 dia | 1973 Apr 21.9<br>1973 Dec 1.0 | 29.48<br>29.48            | 115.80<br>111.30   | 7877<br>7673         | 215<br>212          | 2783<br>2377       | 0.163<br>0.141       | 188<br>-                  |
| D | Telesat 2 third stage  | 1973 Apr 20.98<br>20 years                    | Sphere-cone<br>66                 | 1.32 long<br>0.94 dia         | 1973 Apr 21.9                 | 29.48                     | 645.5              | 24740                | 215                 | 36508              | 0.734                | 188*                      |
| D | Cosmos 555             | 1973 Apr 25.45<br>11.9 days<br>1973 May 7.3   | Sphere-cylinder<br>5900?          | 5.9 long<br>2.4 dia           | 1973 Apr 25.6                 | 81.33                     | 89.02              | 6603                 | 216                 | 233                | 0.001                | 3                         |
| D | Cosmos 555 rocket      | 1973 Apr 25.45<br>3.22 days<br>1973 Apr 28.67 | Cylinder<br>2500?                 | 7.5 long<br>2.6 dia           | 1973 Apr 25.5                 | 81.32                     | 88.93              | 6598                 | 209                 | 231                | 0.002                | 334                       |
| D | Capsule**              | 1973 Apr 25.45<br>14.39 days<br>1973 May 9.84 | Ellipsoid<br>200?                 | 0.9 long<br>1.9 dia           | 1973 May 4.7                  | 81.33                     | 88.84              | 6594                 | 209                 | 222                | 0.001                | 327                       |
| D | Fragment               |   |                                   |                               |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 556             | 1973 May 5.29<br>8.9 days<br>1973 May 14.2    | Sphere-cylinder<br>6300?          | 6.5 long?<br>2.4 dia          | 1973 May 5.6<br>1973 May 6.4  | 81.33<br>81.32            | 88.97<br>89.31     | 6600<br>6617         | 218<br>210          | 225<br>267         | 0.0005<br>0.004      | 18<br>5                   |
| D | Cosmos 556 rocket      | 1973 May 5.29<br>3.69 days<br>1973 May 8.98   | Cylinder<br>2500?                 | 7.5 long<br>2.6 dia           | 1973 May 6.3                  | 81.32                     | 88.77              | 6590                 | 207                 | 216                | 0.0006               | 353                       |

\*Approximate orbit; Telesat 2 is Canadian  
\*\*1973-240 ejected from 1973-24A on 1973 May 4

1973-25 continued on page 328

| 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 556 engine*    | 1973 May 5.29<br>18.90 days<br>1973 May 24.19   | Cone<br>600? full               | 1.5 long?<br>2 dia?                    | 1973 May 13.8                  | 81.32                     | 89.19              | 6611                 | 210                 | 255                | 0.003                | 326                       |
| D Fragments             | 1973 May 11.02<br>11.11 days<br>1973 May 22.13  | Cylinder +<br>4 wings<br>18500  | 14 long<br>4.15 max dia<br>2.0 min dia | 1973 May 12.2                  | 51.59                     | 89.01              | 6607                 | 214                 | 243                | 0.002                | 83                        |
| D Cosmos 557**          | 1973 May 11.02<br>6.01 days<br>1973 May 17.03   | Cylinder<br>4000?               | 12 long?<br>4 dia                      | 1973 May 12.2                  | 51.60                     | 88.79              | 6596                 | 209                 | 226                | 0.001                | 57                        |
| D Cosmos 557 rocket     | 1973 May 14.73<br>6½ years†                     | Cylinders +<br>4 vanes<br>74783 | 25.64 long<br>6.6 dia<br>27.4 span     | 1973 May 16.5                  | 50.04                     | 93.18              | 6811                 | 427                 | 439                | 0.0009               | 285                       |
| D Skylab 1 [Saturn 513] | 1973 May 14.73<br>606.60 days<br>1975 Jan 11.33 | Cylinder<br>56100?              | 24.8 long<br>10.0 dia                  | 1973 May 15.0<br>1974 Feb 1.0  | 50.05<br>50.05            | 92.51<br>91.99     | 6779<br>6755         | 363<br>347          | 439<br>407         | 0.006<br>0.004       | 249<br>-                  |
| D Fragments             | 1973 May 16.69<br>28 days<br>1973 Jun 13        | Cylinder<br>3000?               | 8 long?<br>1.5 dia                     | 1973 May 16.8<br>1973 May 17.7 | 110.49<br>110.51          | 89.39<br>89.89     | 6622<br>6647         | 136<br>139          | 352<br>399         | 0.016<br>0.020       | 143<br>141                |
| D [Titan 3B Agena D]    | 1973 May 17.56<br>219.33 days<br>1973 Dec 22.89 | Ellipsoid<br>400?               | 1.8 long<br>1.2 dia                    | 1973 May 17.8<br>1973 Sep 1.0  | 70.98<br>70.98            | 92.76<br>91.54     | 6763<br>6729         | 269<br>256          | 501<br>445         | 0.017<br>0.014       | 86<br>-                   |
| D Cosmos 558            | 1973 May 17.56<br>116.33 days<br>1973 Sep 10.89 | Cylinder<br>1500?               | 8 long<br>1.65 dia                     | 1973 May 17.8                  | 70.98                     | 92.15              | 6758                 | 268                 | 491                | 0.016                | 89                        |

\* 1973-25C ejected from 1973-25A on 1973 May 13

\*\* Cosmos 557 was probably an intended Salyut.

† Subject to orbital manoeuvres

|                        | 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<br>R                 | Cosmos 559*               | 1973 May 18.46<br>4.8 days<br>1973 May 23.3    | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia   | 1973 May 18.6                                   | 65.41                     | 89.79                   | 6643                 | 204                 | 325                | 0.009                   | 68                        |
| D                      | Cosmos 559<br>rocket      | 1973 May 18.46<br>10 days<br>1973 May 28       | Cylinder<br>2500?        | 7.5 long<br>2.6 dia    | 1973 May 18.9                                   | 65.41                     | 89.74                   | 6640                 | 205                 | 319                | 0.009                   | 75                        |
| D                      | Cosmos 559<br>engine**    | 1973 May 18.46<br>24.87 days<br>1973 Jun 12.33 | Cone<br>600? full        | 1.5 long?<br>2 dia?    | 1973 May 22.8                                   | 65.39                     | 89.78                   | 6642                 | 211                 | 317                | 0.008                   | 84                        |
| D                      | Fragment                  |  |                          |                        |   |                           |                         |                      |                     |                    |                         |                           |
| D<br>R                 | Cosmos 560                | 1973 May 23.44<br>12.8 days<br>1973 Jun 5.2    | Sphere-cylinder<br>6300? | 6.5 long?<br>2.4 dia   | 1973 May 24.1<br>1973 May 25.3                  | 72.85<br>72.84            | 89.68<br>89.41          | 6637<br>6623         | 203<br>181          | 314<br>309         | 0.008<br>0.010          | 68<br>60                  |
| D                      | Cosmos 560<br>rocket      | 1973 May 23.44<br>8.85 days<br>1973 Jun 1.29   | Cylinder<br>2500?        | 7.5 long<br>2.6 dia    | 1973 May 24.1                                   | 72.84                     | 89.54                   | 6630                 | 201                 | 302                | 0.008                   | 52                        |
| D                      | Cosmos 560<br>engine      | 1973 May 23.44<br>20.17 days<br>1973 Jun 12.61 | Cone<br>600? full        | 1.5 long?<br>2 dia?    | 1973 Jun 5.7                                    | 72.85                     | 89.23                   | 6614                 | 175                 | 297                | 0.009                   | 29                        |
| D                      | Fragments                 |  |                          |                        |   |                           |                         |                      |                     |                    |                         |                           |
| D<br>3M<br>R<br>R<br>D | Skylab 2†<br>[Saturn 206] | 1973 May 25.54<br>28.04 days<br>1973 Jun 22.58 | Cone-cylinder<br>13780   | 10.36 long<br>3.91 dia | 1973 May 25.5<br>1973 May 25.7<br>1973 May 31.9 | 50.04<br>50.04<br>50.03   | 89.59<br>91.81<br>93.17 | 6636<br>6744<br>6811 | 156<br>359<br>425   | 359<br>373<br>440  | 0.015<br>0.001<br>0.001 | -<br>-<br>325             |
|                        | Skylab 2<br>rocket        | 1973 May 25.54<br>< ½ day<br>1973 May 25       | Cylinder<br>13600?       | 18.7 long<br>6.6 dia   | 1973 May 25.5                                   | 50.04                     | 89.52                   | 6632                 | 156                 | 352                | 0.015                   | -                         |

\* Manoeuvrable.

\*\* 1973-300 ejected from 1973-30A on 1973 May 22.

† SkyLab 2 rendezvous with SkyLab 1 on 1973 May 25.86; docked 1973 May 26.16; undocked 1973 Jun 22.37

| 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<br>R<br>Cosmos 561      | 1973 May 25.57<br>11.67 days<br>1973 Jun 6.24  | Sphere-cylinder<br>5900?     | 5.9 long<br>2.4 dia  | 1973 May 26.6                 | 65.41                     | 89.51              | 6629                 | 206                 | 295                | 0.007                | 68                        |
| D<br>Cosmos 561<br>rocket | 1973 May 25.57<br>7.72 days<br>1973 Jun 2.29   | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1973 May 26.7                 | 65.40                     | 89.34              | 6620                 | 200                 | 284                | 0.006                | 59                        |
| D<br>Capsule*             | 1973 May 25.57<br>25.61 days<br>1973 Jun 20.18 | Ellipsoid<br>200?            | 0.9 long<br>1.9 dia  | 1973 Jun 3.9                  | 65.39                     | 89.39              | 6623                 | 206                 | 283                | 0.006                | 69                        |
| D<br>Fragment             | 1973 May 29.43<br>500 years                    | Cylinder +<br>2 vanes, 2200? | 5 long?<br>1.5 dia?  | 1973 May 30.8                 | 81.22                     | 102.48             | 7253                 | 853                 | 896                | 0.003                | 284                       |
| D<br>Meteor 15            | 1973 May 29.43<br>400 years                    | Cylinder<br>1440             | 3.8 long<br>2.6 dia  | 1973 May 31.5                 | 81.23                     | 102.72             | 7264                 | 852                 | 920                | 0.005                | 178                       |
| D<br>Cosmos 562           | 1973 Jun 5.48<br>215.91 days<br>1974 Jan 7.39  | Ellipsoid<br>400?            | 1.8 long<br>1.2 dia  | 1973 Jun 5.7<br>1973 Sep 16.0 | 70.98<br>70.98            | 92.13<br>91.46     | 6757<br>6725         | 270<br>259          | 487<br>434         | 0.016<br>0.013       | 85                        |
| D<br>Cosmos 562<br>rocket | 1973 Jun 5.48<br>116.23 days<br>1973 Sep 29.71 | Cylinder<br>1500?            | 8 long<br>1.65 dia   | 1973 Jun 5.6                  | 70.99                     | 92.04              | 6752                 | 264                 | 484                | 0.016                | 80                        |
| D<br>R<br>Cosmos 563      | 1973 Jun 6.48<br>11.72 days<br>1973 Jun 18.20  | Sphere-cylinder<br>6300?     | 6.5 long?<br>2.4 dia | 1973 Jun 7.0<br>1973 Jun 8.6  | 65.40<br>65.40            | 89.53<br>89.17     | 6630<br>6612         | 206<br>177          | 298<br>291         | 0.007<br>0.009       | 64<br>64                  |
| D<br>Cosmos 563<br>rocket | 1973 Jun 6.48<br>7 days<br>1973 Jun 13         | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1973 Jun 7.0                  | 65.40                     | 89.40              | 6624                 | 200                 | 292                | 0.007                | 57                        |

\*1973-330 ejected from 1973-33A on 1973 Jun 3

1973-36 continued on page 331

| 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<br>Cosmos 563<br>engine*    | 1973 Jun 6.48<br>19 days<br>1973 Jun 25 | Cone<br>600? full     | 1.5 long?<br>2 dia?   | 1973 Jun 20.8                 | 65.40                     | 89.00              | 6604                 | 173                 | 278                | 0.008                | -                         |
| D<br>Fragments<br>1973-36C, E |   |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 564                    | 1973 Jun 8.65<br>8000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Jun 9.9                  | 74.03                     | 114.68             | 7818                 | 1395                | 1484               | 0.006                | 112                       |
| Cosmos 565                    | 1973 Jun 8.65<br>9000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Jun 10.2                 | 74.01                     | 115.36             | 7849                 | 1450                | 1492               | 0.003                | 155                       |
| Cosmos 566                    | 1973 Jun 8.65<br>9000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Jun 11.0                 | 74.01                     | 115.12             | 7838                 | 1435                | 1485               | 0.003                | 126                       |
| Cosmos 567                    | 1973 Jun 8.65<br>9000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Jun 11.0                 | 74.01                     | 114.88             | 7828                 | 1414                | 1486               | 0.005                | 122                       |
| Cosmos 568                    | 1973 Jun 8.65<br>8000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Jun 10.6                 | 74.02                     | 114.43             | 7808                 | 1378                | 1482               | 0.007                | 107                       |
| Cosmos 569                    | 1973 Jun 8.65<br>7000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Jun 10.2                 | 74.02                     | 114.23             | 7799                 | 1359                | 1482               | 0.008                | 106                       |
| Cosmos 570                    | 1973 Jun 8.65<br>6000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Jun 10.2                 | 74.02                     | 114.03             | 7789                 | 1341                | 1481               | 0.009                | 105                       |
| Cosmos 571                    | 1973 Jun 8.65<br>6000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Jun 10.9                 | 74.03                     | 113.81             | 7779                 | 1321                | 1481               | 0.010                | 98                        |
| Cosmos 564<br>rocket          | 1973 Jun 8.65<br>20000 years            | Cylinder<br>2200?     | 7.4 long<br>2.4 dia   | 1973 Jun 10.9                 | 74.02                     | 116.95             | 7921                 | 1479                | 1606               | 0.008                | 254                       |

\* 1973-36D ejected from 1973-36A on 1973 Jun 17

|    | 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 572               | 1973 Jun 10.43                         | Sphere-               | 6.5 long? | 1973 Jun 10.6                 | 51.66                     | 89.32              | 6622                 | 206                 | 281                | 0.006                | 57                        |
| R  | 1973-38A                 | 12.86 days                             | cylinder              | 2.4 dia   | 1973 Jun 15.0                 | 51.64                     | 88.89              | 6601                 | 174                 | 271                | 0.007                | 68                        |
|    |                          | 1973 Jun 23.29                         | 6300?                 |           |                               |                           |                    |                      |                     |                    |                      |                           |
| D  | Cosmos 572 rocket        | 1973 Jun 10.43                         | Cylinder              | 7.5 long  | 1973 Jun 10.6                 | 51.64                     | 89.22              | 6617                 | 199                 | 280                | 0.006                | 39                        |
|    |                          | 5.90 days                              | 2500?                 | 2.6 dia   |                               |                           |                    |                      |                     |                    |                      |                           |
|    |                          | 1973 Jun 16.33                         |                       |           |                               |                           |                    |                      |                     |                    |                      |                           |
| D  | Cosmos 572 engine*       | 1973 Jun 10.43                         | Cone                  | 1.5 long? | 1973 Jun 23.0                 | 51.65                     | 88.95              | 6604                 | 171                 | 280                | 0.008                | 91                        |
|    |                          | 16 days                                | 600? full             | 2 dia?    |                               |                           |                    |                      |                     |                    |                      |                           |
|    |                          | 1973 Jun 26                            |                       |           |                               |                           |                    |                      |                     |                    |                      |                           |
| D  | Fragment                 |  |                       |           | 1973 Jun 10.6                 | 29.11                     | 15013              | 201591               | 182                 | 390744             | 0.967                | 118                       |
| D  | Explorer 49 third stage  | 1973 Jun 10.59                         | Sphere--              | 1.32 long |                               |                           |                    |                      |                     |                    |                      |                           |
|    |                          | 5 years?                               | cone                  | 0.94 dia  |                               |                           |                    |                      |                     |                    |                      |                           |
|    |                          | 1978?                                  | 66                    |           |                               |                           |                    |                      |                     |                    |                      |                           |
| C  | Explorer 49 second stage | 1973 Jun 10.59                         | Cylinder              | 5.2 long  | 1973 Jun 11.7                 | 29.34                     | 107.80             | 7506                 | 182                 | 2074               | 0.176                | 125                       |
|    |                          | 233.10 days                            | 600?                  | 2.44 dia  | 1973 Oct 1.0                  | 29.34                     | 102.30             | 7249                 | 177                 | 1565               | 0.096                | -                         |
|    |                          | 1974 Jan 29.69                         |                       |           |                               |                           |                    |                      |                     |                    |                      |                           |
| 2d | Fragments                |  |                       |           |                               |                           |                    |                      |                     |                    |                      |                           |
| T  | INNEWS 4 [Titan 3C]      | 1973 June 12.4?                        | Cylinder *            | 6 long?   | 1973 Jun 12.7                 | 26.33                     | 633.0              | 24446                | 297                 | 35839              | 0.727                | 180                       |
|    |                          | > million years                        | 4 panels              | 2.5 dia?  | 1973 Jul 1.0                  | 0.3                       | 1435.9             | 42160                | 35777               | 35786              | 0.0001               | -                         |
|    |                          |  | 820?                  |           |                               |                           |                    |                      |                     |                    |                      |                           |
|    | Transtage                | 1973 Jun 12.4?                         | Cylinder              | 6 long?   | 1973 Jul 1.0                  | 0.3                       | 1435.9             | 42160                | 35777               | 35786              | 0.0001               | -                         |
|    |                          | > million years                        | 1500?                 | 3 dia     |                               |                           |                    |                      |                     |                    |                      |                           |

\* 1973-38C ejected from 1973-38A on 1973 Jun 22

Space Vehicle: Explorer 49 (RAE 2), 1973-39A;  
Explorer 49 retrorocket, 1973-39F;  
Fragment, 1973-39G.

\*\* Approximate orbits

|        | 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<br>R | Cosmos 573           | 1973 Jun 15, 25<br>2.0 days<br>1973 Jun 17.3   | Sphere-cylinder<br>6570? | 7.5 long<br>2.2 dia   | 1973 Jun 16.3                 | 51.58                     | 89.46              | 6629                 | 192                 | 309                | 0.009                | 77                        |
| D      | Cosmos 573<br>rocket | 1973 Jun 15, 25<br>5.95 days<br>1973 Jun 21.20 | Cylinder<br>2500?        | 7.5 long<br>2.6 dia   | 1973 Jun 16.3                 | 51.60                     | 89.26              | 6619                 | 189                 | 292                | 0.008                | 77                        |
| D      | Fragment             | 1973-41C                                       |                          |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|        | Cosmos 574           | 1973 Jun 20, 26<br>1400 years                  | Cylinder?<br>700?        | 1.3 long?<br>1.9 dia? | 1973 Jun 23.2                 | 82.94                     | 105.14             | 7378                 | 985                 | 1014               | 0.002                | 281                       |
|        | Cosmos 574<br>rocket | 1973 Jun 20, 26<br>750 years                   | Cylinder<br>2200?        | 7.4 long<br>2.4 dia   | 1973 Jun 22.2                 | 82.95                     | 105.03             | 7373                 | 984                 | 1005               | 0.001                | 261                       |
| D<br>R | Cosmos 575           | 1973 Jun 21, 56<br>11.71 days<br>1973 Jul 3.27 | Sphere-cylinder<br>5700? | 5.0 long<br>2.4 dia   | 1973 Jun 23.0                 | 65.41                     | 89.25              | 6616                 | 204                 | 271                | 0.005                | 50                        |
| D      | Cosmos 575<br>rocket | 1973 Jun 21, 56<br>5.68 days<br>1973 Jun 27.24 | Cylinder<br>2500?        | 7.5 long<br>2.6 dia   | 1973 Jun 22.5                 | 65.39                     | 89.10              | 6609                 | 196                 | 265                | 0.005                | 34                        |
| D<br>R | Cosmos 576           | 1973 Jun 27, 50<br>11.79 days<br>1973 Jul 9.29 | Sphere-cylinder<br>5900? | 5.9 long<br>2.4 dia   | 1973 Jun 28.6                 | 72.86                     | 89.88              | 6646                 | 204                 | 332                | 0.010                | 63                        |
| D      | Cosmos 576<br>rocket | 1973 Jun 27, 50<br>9.81 days<br>1973 Jul 7.31  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia   | 1973 Jun 29.7                 | 72.85                     | 89.66              | 6635                 | 199                 | 315                | 0.009                | 52                        |

|   | Name                                      | Launch date, lifetime and descent date         | Shape and weight (kg)          | Size (m)              | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|---|--|--------------------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D | Capsule*<br>1973-44H                      | 1973 Jun 27.50<br>17 days<br>1973 Jul 14       | Ellipsoid<br>200?              | 0.9 long<br>1.9 dia   | 1973 Jul 10.1                 | 72.90                     | 91.42              | 6723                 | 212                 | 478                | 0.020                | 359                       |
| D | Fragments<br>1973-44C-G                   |  |                                |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Molniya 2F<br>1973-45A                    | 1973 Jul 11.42<br>1822 days?<br>1978 Jul 7?    | Windmill +<br>6 vanes<br>1250? | 4.2 long?<br>1.6 dia? | 1973 Jul 27.1<br>1973 Sep 1.0 | 65.41<br>65.58            | 705.06<br>717.81   | 26241<br>26557       | 441<br>422          | 39285<br>39936     | 0.740<br>0.744       | 285<br>-                  |
| D | Molniya 2F<br>launcher<br>1973-45B        | 1973 Jul 11.42<br>41.74 days<br>1973 Aug 22.16 | Irregular                      | -                     | 1973 Jul 11.7                 | 65.41                     | 91.36              | 6720                 | 221                 | 463                | 0.018                | 67                        |
| D | Molniya 2F<br>launcher rocket<br>1973-45C | 1973 Jul 11.42<br>23.00 days<br>1973 Aug 3.42  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1973 Jul 12.4                 | 65.42                     | 91.34              | 6719                 | 197                 | 484                | 0.021                | 67                        |
| D | Molniya 2F<br>rocket<br>1973-45D          | 1973 Jul 11.42<br>1851 days<br>1978 Aug 5      | Cylinder<br>440                | 2.0 long<br>2.0 dia   | 1973 Jul 22.7                 | 65.40                     | 702.58             | 26179                | 439                 | 39163              | 0.740                | 285                       |
| D | [Titan 3D]<br>1973-46A                    | 1973 Jul 13.85<br>91 days<br>1973 Oct 12       | Cylinder<br>13300? full        | 15 long<br>3.0 dia    | 1973 Jul 15.7                 | 96.21                     | 88.77              | 6591                 | 156                 | 269                | 0.009                | 145                       |
| D | Titan 3D<br>rocket<br>1973-46B            | 1973 Jul 13.85<br>1.97 days<br>1973 Jul 15.82  | Cylinder<br>1900               | 6 long<br>3.0 dia     | 1973 Jul 15.1                 | 96.21                     | 88.11              | 6558                 | 145                 | 215                | 0.005                | 143                       |

\* 1973-44H ejected from 1973-44A on 1973 Jul 9

|   | 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 | Mars 4 launcher rocket     | 1973 Jul 21.81<br>1.45 days<br>1973 Jul 23.26  | Cylinder<br>4000?      | 12 long?<br>4 dia      | 1973 Jul 22.5                  | 51.52                     | 87.94              | 6553                 | 156                 | 194                | 0.003                | 315                       |
| D | Mars 4 launcher            | 1973 Jul 21.81<br>5 days<br>1973 Jul 26        | Irregular              | -                      | 1973 Jul 22.8                  | 51.52                     | 87.70              | 6541                 | 147                 | 179                | 0.002                | 321                       |
| D | Cosmos 577                 | 1973 Jul 25.48                                 | Sphere-                | 6.5 long?              | 1973 Jul 25.7                  | 65.39                     | 89.45              | 6626                 | 207                 | 289                | 0.006                | 56                        |
| R |                            | 12.71 days<br>1973 Aug 7.19                    | cylinder<br>6300?      | 2.4 dia                | 1973 Jul 28.6                  | 65.40                     | 89.33              | 6620                 | 171                 | 313                | 0.011                | 54                        |
| D | Cosmos 577 rocket          | 1973 Jul 25.48<br>6.59 days<br>1973 Aug 1.07   | Cylinder<br>2500?      | 7.5 long<br>2.6 dia    | 1973 Jul 27.3                  | 65.39                     | 89.17              | 6612                 | 192                 | 276                | 0.006                | 40                        |
| D | Cosmos 577 engine*         | 1973 Jul 25.48<br>18 days<br>1973 Aug 12       | Cone<br>600? full      | 1.5 long?<br>2 dia?    | 1973 Aug 6.8                   | 65.41                     | 89.03              | 6605                 | 172                 | 282                | 0.008                | 50                        |
| D | Fragments                  |  |                        |                        |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Mars 5 launcher rocket     | 1973 Jul 25.79<br>1.47 days<br>1973 Jul 27.26  | Cylinder<br>4000?      | 12 long?<br>4 dia      | 1973 Jul 26.6                  | 51.55                     | 87.86              | 6549                 | 153                 | 189                | 0.003                | 326                       |
| D | Mars 5 launcher            | 1973 Jul 25.79<br>2 days<br>1973 Jul 27        | Irregular              | -                      | 1973 Jul 26.5                  | 51.55                     | 87.77              | 6545                 | 159                 | 174                | 0.001                | -                         |
| D | Skylab 3**<br>[Saturn 207] | 1973 Jul 28.47<br>59.46 days<br>1973 Sep 25.93 | Cone-cylinder<br>13860 | 10.36 long<br>3.91 dia | 1973 Jul 28.5<br>1973 Jul 28.9 | 50.03<br>50.03            | 88.33<br>93.15     | 6573<br>6810         | 159<br>425          | 230<br>438         | 0.005<br>0.001       | -<br>-                    |
| D | Skylab 3 rocket            | 1973 Jul 28.47<br>0.24 day<br>1973 Jul 28.71   | Cylinder<br>13600?     | 18.7 long<br>6.6 dia   | 1973 Jul 28.5                  | 50.03                     | 88.26              | 6569                 | 159                 | 223                | 0.005                | 56                        |

\* 1973-48 D was ejected from 1973-48 A on 1973 Aug 6

Space Vehicles: Mars 4, 1973-47 A; and Mars 5, 1973-49 A

\*\* Skylab 3 docked with Skylab 1 on 1973 Jul 28.82

|   | 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 518             | 1973 Aug 1.59<br>11.7 days<br>1973 Aug 13.3  | Sphere-cylinder<br>5700? | 5.0 long<br>2.4 dia              | 1973 Aug 2.2                  | 65.38                     | 89.41              | 6624                 | 200                 | 292                | 0.007                | 47                        |
| D | Cosmos 518 rocket      | 1973 Aug 1.59<br>7.72 days<br>1973 Aug 9.31  | Cylinder<br>2500?        | 7.5 long<br>2.6 dia              | 1973 Aug 2.4                  | 65.38                     | 89.27              | 6617                 | 200                 | 278                | 0.006                | 48                        |
| D | Fragments              | 1973-51C-E                                   |                          |                                  |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Mars 6 launcher rocket | 1973 Aug 5.74<br>1.52 days<br>1973 Aug 7.26  | Cylinder<br>4000?        | 12 long?<br>4 dia                | 1973 Aug 6.5                  | 51.54                     | 87.92              | 6552                 | 155                 | 193                | 0.003                | 320                       |
| D | Mars 6 launcher        | 1973 Aug 5.74<br>2 days<br>1973 Aug 7        | Irregular<br>-           | -                                | 1973 Aug 6.5                  | 51.5                      | 87.91              | 6552                 | 154                 | 193                | 0.003                | -                         |
| D | Mars 7 launcher rocket | 1973 Aug 9.71<br>1.46 days<br>1973 Aug 11.17 | Cylinder<br>4000?        | 12 long?<br>4 dia                | 1973 Aug 10.4                 | 51.51                     | 87.91              | 6552                 | 154                 | 193                | 0.003                | 328                       |
| D | Mars 7 launcher        | 1973 Aug 9.71<br>2 days<br>1973 Aug 11       | Irregular<br>-           | -                                |                               |                           |                    |                      |                     |                    |                      |                           |
| T | [Thor Burner 2]*       | 1973 Aug 17.20<br>80 years                   | 12-faced frustum<br>195  | 1.64 long<br>1.31 to<br>1.10 dia | 1973 Aug 17.5                 | 98.86                     | 101.56             | 7210                 | 811                 | 852                | 0.003                | 242                       |
|   | Burner 2 rocket        | 1973 Aug 17.20<br>60 years                   | Sphere-cone<br>66        | 1.32 long<br>0.94 dia            | 1973 Aug 18.4                 | 98.84                     | 101.54             | 7208                 | 808                 | 851                | 0.003                | 245                       |

Orbit similar to 1973-53B

Space Vehicles: Mars 6, 1973-52A; and Mars 7, 1973-53A. \* DMSP

|   | Name                        | Launch date, lifetime and descent date          | Shape and weight (kg)              | Size (m)              | Date of orbital determination                  | Orbital inclination (deg) | Modal period (min)        | Semi major axis (km)    | Perigee height (km)   | Apogee height (km)      | Orbital eccentricity     | Argument of perigee (deg) |
|---|-----------------------------|---|------------------------------------|-----------------------|--|---------------------------|---------------------------|-------------------------|-----------------------|-------------------------|--------------------------|---------------------------|
| D | Cosmos 579                  | 1973 Aug 21.52                                  | Sphere-cylinder<br>6300?           | 6.5 long?<br>2.4 dia  | 1973 Aug 22.6<br>1973 Aug 24.7                 | 65.41<br>65.42            | 89.27<br>89.38            | 6617<br>6623            | 196<br>175            | 282<br>314              | 0.007<br>0.010           | 58<br>53                  |
| R |                             | 12.7 days<br>1973 Sep 3.2                       |                                    |                       |  |                           |                           |                         |                       |                         |                          |                           |
| D | Cosmos 579 rocket           | 1973 Aug 21.52<br>6.64 days<br>1973 Aug 28.16   | Cylinder<br>2500?                  | 7.5 long<br>2.6 dia   | 1973 Aug 23.2                                  | 65.41                     | 89.22                     | 6615                    | 194                   | 279                     | 0.006                    | 45                        |
| D | Cosmos 579 engine*          | 1973 Aug 21.52<br>14.86 days<br>1973 Sep 5.38   | Cone<br>600? full                  | 1.5 long?<br>2 dia?   | 1973 Sep 3.0                                   | 65.43                     | 88.65                     | 6586                    | 169                   | 247                     | 0.006                    | 49                        |
| D | Fragments                   |   |                                    | -                     | 1973 Sep 1.0                                   | 63.29                     | 705.68                    | 26256                   | 460                   | 39296                   | 0.740                    | 269                       |
|   | SDS-B<br>[Titan 3B Agena D] | 1973 Aug 21.67<br>10 years?                     | Cylinder?                          |                       |  |                           |                           |                         |                       |                         |                          |                           |
|   | Agena D rocket              | 1973 Aug 21.67<br>10 years?                     | Cylinder<br>700?                   | 6 long?<br>1.5 dia    | 1973 Sep 1.4<br>1975 Jan 1.0                   | 63.27<br>63.21            | 699.80<br>697.4           | 26111<br>26051          | 360<br>808            | 39105<br>38538          | 0.742<br>0.724           | 269<br>-                  |
| B | Cosmos 580                  | 1973 Aug 22.48<br>221.70 days<br>1974 Apr 1.18  | Ellipsoid<br>400?                  | 1.8 long<br>1.2 dia   | 1973 Aug 23.9<br>1973 Dec 16.5                 | 71.00<br>70.99            | 92.22<br>91.23            | 6761<br>6714            | 273<br>256            | 493<br>415              | 0.016<br>0.012           | 76<br>-                   |
| D | Cosmos 580 rocket           | 1973 Aug 22.48<br>100.48 days<br>1973 Nov 30.96 | Cylinder<br>1500?                  | 8 long<br>1.65 dia    | 1973 Aug 23.6                                  | 71.00                     | 92.08                     | 6754                    | 273                   | 479                     | 0.015                    | 75                        |
| T | Intelsat 4E (F-7)           | 1973 Aug 23.96<br>> million years               | Cylinder<br>1410 full<br>720 empty | 2.82 long<br>2.39 dia | 1973 Aug 24.0<br>1973 Aug 25.5<br>1973 Oct 1.0 | 27.38<br>0.4<br>0.3       | 657.0<br>1432.7<br>1436.3 | 25026<br>42111<br>42169 | 570<br>35539<br>35784 | 36726<br>35927<br>35797 | 0.722<br>0.005<br>0.0002 | 180<br>-<br>-             |
|   | Intelsat 4E rocket          | 1973 Aug 23.96<br>6000 years                    | Cylinder<br>1815                   | 8.6 long<br>3.0 dia   | 1973 Aug 28.7                                  | 27.50                     | 655.2                     | 24983                   | 597                   | 36612                   | 0.721                    | 182                       |

\* 1973-550 was ejected from 1973-55A on 1973 Sep 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<br>R | Cosmos 581<br>1973-59A        | 1973 Aug 24.47<br>12.8 days<br>1973 Sep 6.3   | Sphere-cylinder<br>6300?       | 6.5 long?<br>2.4 dia | 1973 Aug 25.3<br>1973 Aug 26.6 | 51.62<br>51.61            | 89.40<br>89.00     | 6626<br>6606         | 208<br>172          | 288<br>284         | 0.006<br>0.008       | 44<br>62                  |
| D      | Cosmos 581<br>rocket          | 1973 Aug 24.47<br>6.66 days<br>1973 Aug 31.13 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1973 Aug 25.6                  | 51.62                     | 89.15              | 6614                 | 202                 | 269                | 0.005                | 34                        |
| D      | Cosmos 581<br>engine*         | 1973 Aug 24.47<br>15.78 days<br>1973 Sep 9.25 | Cone<br>600? full              | 1.5 long?<br>2 dia?  | 1973 Sep 5.6                   | 51.62                     | 88.86              | 6599                 | 176                 | 266                | 0.007                | 103                       |
| D      | Fragments<br>1973-59C,D       |   |                                |                      |                                |                           |                    |                      |                     |                    |                      |                           |
|        | Cosmos 582                    | 1973 Aug 28.42<br>8 years                     | Cylinder +<br>paddles? 900?    | 2 long?<br>1 dia?    | 1973 Aug 31.3                  | 74.04                     | 95.27              | 6909                 | 519                 | 543                | 0.002                | 359                       |
|        | Cosmos 582<br>rocket          | 1973 Aug 28.42<br>7 years                     | Cylinder<br>2200?              | 7.4 long<br>2.4 dia  | 1973 Sep 1.0                   | 74.04                     | 95.19              | 6905                 | 510                 | 544                | 0.003                | 14                        |
| 2d     | Fragments<br>1973-60C-E       |   |                                |                      |                                |                           |                    |                      |                     |                    |                      |                           |
|        | Molniya 1Z                    | 1973 Aug 30.01<br>5 1/2 years                 | Windmill +<br>6 vanes<br>1000? | 3.4 long<br>1.6 dia  | 1973 Sep 6.2                   | 65.47                     | 717.77             | 26556                | 463                 | 39893              | 0.742                | 284                       |
| D      | Molniya 1Z<br>launcher rocket | 1973 Aug 30.01<br>3 1/2 days<br>1973 Oct 1.78 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia  | 1973 Aug 31.0                  | 65.43                     | 91.30              | 6717                 | 219                 | 458                | 0.018                | 65                        |
| D      | Molniya 1Z<br>launcher        | 1973 Aug 30.01<br>39.48 days<br>1973 Oct 8.49 | Irregular                      | -                    | 1973 Aug 30.9                  | 65.40                     | 91.57              | 6730                 | 223                 | 481                | 0.019                | 69                        |

\* 1973-59E ejected from 1973-59A on 1973 Sep 5.

1973-61 continued on page 339

| Name                 | Launch date, lifetime and descent date        | Shape and weight (kg)        | Size (m)             | Date of orbital determination                  | Orbital inclination (deg) | Modal period (min)      | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity    | Argument of perigee (deg) |
|----------------------|---|------------------------------|----------------------|--|---------------------------|-------------------------|----------------------|---------------------|--------------------|-------------------------|---------------------------|
| Molniya 1Z rocket    | 1973 Aug 30.01<br>5.6 years                   | Cylinder<br>440              | 2.0 long<br>2.0 dia  | 1973 Oct 1.0                                   | 65.3                      | 678.2                   | 25572                | 435                 | 37953              | 0.733                   | -                         |
| D Fragments          |   |                              |                      |  |                           |                         |                      |                     |                    |                         |                           |
| D Cosmos 583         | 1973 Aug 30.44<br>12.9 days<br>1973 Sep 12.3  | Sphere-<br>cylinder<br>5700? | 5.0 long<br>2.4 dia  | 1973 Aug 31.6                                  | 64.92                     | 89.52                   | 6629                 | 204                 | 298                | 0.007                   | 46                        |
| R                    |   |                              |                      |  |                           |                         |                      |                     |                    |                         |                           |
| D Cosmos 583 rocket  | 1973 Aug 30.44<br>6.74 days<br>1973 Sep 6.18  | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1973 Aug 31.2                                  | 64.92                     | 89.35                   | 6621                 | 200                 | 285                | 0.006                   | 37                        |
| D Fragment           |   |                              |                      |  |                           |                         |                      |                     |                    |                         |                           |
| D Cosmos 584         | 1973 Sep 6.45<br>13.74 days<br>1973 Sep 20.19 | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1973 Sep 7.5<br>1973 Sep 11.0<br>1973 Sep 15.4 | 72.85<br>72.84<br>72.85   | 89.95<br>89.21<br>89.70 | 6649<br>6613<br>6637 | 205<br>204<br>204   | 336<br>265<br>314  | 0.010<br>0.005<br>0.008 | 63<br>65<br>60            |
| R                    |   |                              |                      |  |                           |                         |                      |                     |                    |                         |                           |
| D Cosmos 584 rocket  | 1973 Sep 6.45<br>10.70 days<br>1973 Sep 17.15 | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1973 Sep 7.2                                   | 72.85                     | 89.83                   | 6643                 | 202                 | 327                | 0.009                   | 60                        |
| D Cosmos 584 engine* | 1973 Sep 6.45<br>22.44 days<br>1973 Sep 28.89 | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1973 Sep 19.5                                  | 72.85                     | 89.60                   | 6632                 | 203                 | 305                | 0.008                   | 47                        |
| D Fragments          |   |                              |                      |  |                           |                         |                      |                     |                    |                         |                           |
| D Cosmos 585         | 1973 Sep 8.07<br>6000 years                   | -<br>500?                    | -                    | 1973 Sep 8.4                                   | 73.99                     | 113.63                  | 7770                 | 1368                | 1416               | 0.003                   | 237                       |
| D Cosmos 585 rocket  | 1973 Sep 8.07<br>4000 years                   | Cylinder<br>2200?            | 7.4 long<br>2.4 dia  | 1973 Sep 8.7                                   | 73.97                     | 113.49                  | 7763                 | 1375                | 1395               | 0.001                   | 218                       |
| D Fragment           |   |                              |                      |  |                           |                         |                      |                     |                    |                         |                           |

\*1973-63E ejected from 1973-63A on 1973 Sep 19

| Name                       | Launch date, lifetime and descent date        | Shape and weight (kg)        | Size (m)              | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|----------------------------|---|------------------------------|-----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 586                 | 1973 Sep 14.02<br>1200 years                  | Cylinder?<br>700?            | 1.3 long?<br>1.9 dia? | 1973 Sep 16.9                  | 82.94                     | 104.89             | 7368                 | 971                 | 1009               | 0.003                | 267                       |
| Cosmos 586<br>rocket       | 1973 Sep 14.02<br>600 years                   | Cylinder<br>2200?            | 7.4 long<br>2.4 dia   | 1973 Sep 16.1                  | 82.95                     | 104.75             | 7361                 | 969                 | 997                | 0.002                | 260                       |
| Cosmos 587                 | 1973 Sep 21.55<br>12.8 days<br>1973 Oct 4.3   | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia  | 1973 Sep 22.5<br>1973 Sep 26.6 | 65.42<br>65.44            | 89.55<br>89.18     | 6631<br>6612         | 205<br>174          | 300<br>294         | 0.007<br>0.009       | 66<br>57                  |
| Cosmos 587<br>rocket       | 1973 Sep 21.55<br>6.49 days<br>1973 Sep 28.04 | Cylinder<br>2500?            | 7.5 long<br>2.6 dia   | 1973 Sep 22.2                  | 65.41                     | 89.41              | 6624                 | 201                 | 290                | 0.007                | 60                        |
| Cosmos 587<br>engine*      | 1973 Sep 21.55<br>17 days<br>1973 Oct 8       | Cone<br>600? full            | 1.5 long?<br>2 dia?   | 1973 Oct 3.3                   | 65.42                     | 89.40              | 6623                 | 170                 | 320                | 0.011                | 50                        |
| Fragments                  | 1973-66C, E                                   |                              |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| Soyuz 12                   | 1973 Sep 27.51<br>1.97 days<br>1973 Sep 29.48 | Sphere-<br>cylinder<br>6570? | 7.5 long<br>2.2 dia   | 1973 Sep 27.6<br>1973 Sep 27.8 | 51.58<br>51.58            | 88.54<br>91.20     | 6583<br>6713         | 181<br>326          | 229<br>344         | 0.004<br>0.001       | 10<br>301                 |
| Soyuz 12<br>rocket         | 1973 Sep 27.51<br>2.02 days<br>1973 Sep 29.53 | Cylinder<br>2500?            | 7.5 long<br>2.6 dia   | 1973 Sep 27.8                  | 51.58                     | 88.49              | 6581                 | 186                 | 219                | 0.003                | 70                        |
| Soyuz 12<br>orbital module | 1973 Sep 27.51<br>116 days<br>1974 Jan 21     | Spheroid<br>1200?            | 2.5 long<br>2.2 dia   | 1973 Oct 1.0                   | 51.58                     | 91.07              | 6707                 | 311                 | 346                | 0.003                | -                         |
| Fragment                   | 1973-67D                                      |                              |                       |                                |                           |                    |                      |                     |                    |                      |                           |

\*1973-66D ejected from 1973-66A on 1973 Oct 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) |
|-----------------------------|--|-----------------------|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| [Titan 3B Agena D] 1973-68A | 1973 Sep 27.72<br>32 days<br>1973 Oct 29 | Cylinder<br>3000?     | 8 long?<br>1.5 dia    | 1973 Sep 28.3                 | 110.48                    | 89.67              | 6636                 | 131                 | 385                | 0.019                | 146                       |
| Cosmos 588 1973-69A         | 1973 Oct 2.91<br>10000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Oct 3.0                  | 74.00                     | 115.37             | 7851                 | 1451                | 1494               | 0.003                | 150                       |
| Cosmos 589 1973-69B         | 1973 Oct 2.91<br>9000 years              | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Oct 3.0                  | 74.01                     | 114.95             | 7831                 | 1419                | 1487               | 0.004                | 123                       |
| Cosmos 590 1973-69C         | 1973 Oct 2.91<br>10000 years             | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Oct 3.0                  | 74.00                     | 115.15             | 7840                 | 1438                | 1486               | 0.003                | 125                       |
| Cosmos 591 1973-69D         | 1973 Oct 2.91<br>6000 years              | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Oct 3.0                  | 74.00                     | 114.20             | 7797                 | 1349                | 1488               | 0.009                | 108                       |
| Cosmos 592 1973-69E         | 1973 Oct 2.91<br>6000 years              | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Oct 3.0                  | 74.00                     | 114.01             | 7788                 | 1333                | 1486               | 0.010                | 102                       |
| Cosmos 593 1973-69F         | 1973 Oct 2.91<br>7000 years              | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Oct 3.0                  | 74.00                     | 114.39             | 7805                 | 1366                | 1487               | 0.008                | 108                       |
| Cosmos 594 1973-69G         | 1973 Oct 2.91<br>8000 years              | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Oct 3.0                  | 74.01                     | 114.57             | 7813                 | 1382                | 1488               | 0.007                | 110                       |
| Cosmos 595 1973-69H         | 1973 Oct 2.91<br>8000 years              | Spheroid<br>40?       | 1.0 long?<br>0.8 dia? | 1973 Oct 3.0                  | 74.00                     | 114.77             | 7822                 | 1402                | 1486               | 0.005                | 111                       |
| Cosmos 588 rocket 1973-69J  | 1973 Oct 2.91<br>20000 years             | Cylinder<br>2200?     | 7.4 long<br>2.4 dia   | 1973 Oct 3.0                  | 74.01                     | 117.19             | 7933                 | 1485                | 1625               | 0.009                | 260                       |

|   | 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 596          | 1973 Oct 3.54                          | Sphere-cylinder 5900? | 5.9 long?<br>2.4 dia  | 1973 Oct 3.8                  | 65.41                     | 89.42              | 6625                 | 206                 | 287                | 0.006                | 66                        |
| R |                     | 5.78 days                              |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     | 1973 Oct 9.32                          |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 596 rocket   | 1973 Oct 3.54                          | Cylinder 2500?        | 7.5 long<br>2.6 dia   | 1973 Oct 4.3                  | 65.41                     | 89.24              | 6616                 | 200                 | 275                | 0.006                | 51                        |
|   |                     | 5.85 days                              |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     | 1973 Oct 9.39                          |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Capsule* ?          | 1973 Oct 3.54                          | Ellipsoid? 200?       | 0.9 long?<br>1.9 dia? | 1973 Oct 9.4                  | 65.40                     | 89.25              | 6616                 | 203                 | 273                | 0.005                | 61                        |
|   |                     | 13.93 days                             |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     | 1973 Oct 17.47                         |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 597          | 1973 Oct 6.52                          | Sphere-cylinder 6300? | 6.5 long?<br>2.4 dia  | 1973 Oct 6.8                  | 65.42                     | 89.45              | 6626                 | 206                 | 290                | 0.006                | 64                        |
| R |                     | 5.8 days                               |                       |                       | 1973 Oct 8.6                  | 65.42                     | 89.07              | 6607                 | 207                 | 251                | 0.003                | 79                        |
|   |                     | 1973 Oct 12.3                          |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 597 rocket   | 1973 Oct 6.52                          | Cylinder 2500?        | 7.5 long<br>2.6 dia   | 1973 Oct 6.9                  | 65.40                     | 89.35              | 6621                 | 206                 | 280                | 0.006                | 59                        |
|   |                     | 8.07 days                              |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     | 1973 Oct 14.59                         |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 597 engine** | 1973 Oct 6.52                          | Cone 600? full        | 1.5 long?<br>2 dia?   | 1973 Oct 11.7                 | 65.45                     | 88.75              | 6591                 | 200                 | 226                | 0.002                | 83                        |
|   |                     | 12 days                                |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     | 1973 Oct 18                            |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Fragments           |  |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     | 1973 Oct 10.45                         | Sphere-cylinder 6300? | 6.5 long?<br>2.4 dia  | 1973 Oct 10.8                 | 72.84                     | 89.94              | 6649                 | 208                 | 334                | 0.010                | 66                        |
| D | Cosmos 598          | 5.8 days                               |                       |                       | 1973 Oct 14.0                 | 72.84                     | 89.02              | 6604                 | 204                 | 247                | 0.003                | 72                        |
| R |                     | 1973 Oct 16.3                          |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     | 1973 Oct 10.45                         |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 598 rocket   | 1973 Oct 10.45                         | Cylinder 2500?        | 7.5 long<br>2.6 dia   | 1973 Oct 11.1                 | 72.84                     | 89.82              | 6643                 | 203                 | 327                | 0.009                | 60                        |
|   |                     | 10.58 days                             |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |
|   |                     | 1973 Oct 21.03                         |                       |                       |                               |                           |                    |                      |                     |                    |                      |                           |

\* 1973-70C ejected from 1973-70A on 1973 Oct 9

\*\* 1973-71E ejected from 1973-71A on 1973 Oct 11

|   | Name                | Launch date, lifetime and descent date         | Shape and weight (kg)        | Size (m)             | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|---------------------|--|------------------------------|----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D | Cosmos 598 engine*  | 1973 Oct 10.45<br>10 days<br>1973 Oct 20       | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1973 Oct 15.8                  | 72.85                     | 88.92              | 6599                 | 199                 | 242                | 0.003                | 67                        |
| D | Fragments           |  |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 599          | 1973 Oct 15.37<br>12.9 days<br>1973 Oct 28.3   | Sphere-<br>cylinder<br>5700? | 5.0 long<br>2.4 dia  | 1973 Oct 15.5                  | 64.94                     | 89.32              | 6619                 | 202                 | 280                | 0.006                | 38                        |
| R |                     |  |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 599 rocket   | 1973 Oct 15.37<br>5.73 days<br>1973 Oct 21.10  | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1973 Oct 16.3                  | 64.94                     | 89.18              | 6612                 | 200                 | 268                | 0.005                | 35                        |
| D | Fragments           |  |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 600          | 1973 Oct 16.51<br>6.8 days<br>1973 Oct 23.3    | Sphere-<br>cylinder<br>6300? | 6.5 long?<br>2.4 dia | 1973 Oct 17.1<br>1973 Oct 18.7 | 72.83<br>72.82            | 89.97<br>88.90     | 6651<br>6597         | 205<br>201          | 340<br>237         | 0.010<br>0.003       | 71<br>105                 |
| R |                     |  |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 600 rocket   | 1973 Oct 16.51<br>11.64 days<br>1973 Oct 28.15 | Cylinder<br>2500?            | 7.5 long<br>2.6 dia  | 1973 Oct 17.0                  | 72.83                     | 89.90              | 6647                 | 205                 | 333                | 0.010                | 73                        |
| D | Cosmos 600 engine** | 1973 Oct 16.51<br>13 days<br>1973 Oct 29       | Cone<br>600? full            | 1.5 long?<br>2 dia?  | 1973 Oct 26.4                  | 72.85                     | 90.62              | 6683                 | 256                 | 354                | 0.007                | 355                       |
| D | Fragments           |  |                              |                      |                                |                           |                    |                      |                     |                    |                      |                           |

\* 1973-72D ejected from 1973-72A on 1973 Oct 15

\*\* 1973-74E ejected from 1973-74A on 1973 Oct 22

|   | 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 601                    | 1973 Oct 16.59<br>303 days<br>1974 Aug 15       | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia   | 1973 Oct 18.5<br>1974 Mar 1.0  | 81.91<br>81.91            | 102.28<br>98.43    | 7244<br>7060         | 200<br>194          | 1531<br>1169       | 0.092<br>0.069       | 68<br>-                   |
| D | Cosmos 601<br>rocket          | 1973 Oct 16.59<br>162.98 days<br>1974 Mar 28.57 | Cylinder<br>1500?              | 8 long<br>1.65 dia    | 1973 Oct 22.5<br>1974 Jan 1.0  | 81.92<br>81.92            | 102.05<br>98.30    | 7232<br>7053         | 210<br>204          | 1497<br>1146       | 0.089<br>0.067       | 58<br>-                   |
| D | Fragments                     | 1973-758,D-P                                    |                                |                       |                                |                           |                    |                      |                     |                    |                      |                           |
|   | Molniya 26                    | 1973 Oct 19.44<br>9 years                       | Windmill *<br>6 vanes<br>1250? | 4.2 long?<br>1.6 dia? | 1973 Oct 25.6                  | 62.84                     | 717.93             | 26560                | 509                 | 39855              | 0.741                | 289                       |
| D | Molniya 26<br>launcher rocket | 1973 Oct 19.44<br>45-53 days<br>1973 Dec 3.97   | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1973 Oct 21.6                  | 62.81                     | 91.94              | 6748                 | 216                 | 524                | 0.023                | 123                       |
| D | Molniya 26<br>launcher        | 1973 Oct 19.44<br>60-23 days<br>1973 Dec 18.67  | Irregular                      | -                     | 1973 Oct 21.6                  | 62.82                     | 92.62              | 6782                 | 209                 | 599                | 0.029                | 122                       |
|   | Molniya 26<br>rocket          | 1973 Oct 19.44<br>9 years                       | Cylinder<br>440                | 2.0 long<br>2.0 dia   | 1973 Oct 29.2                  | 62.87                     | 733.19             | 26935                | 597                 | 40517              | 0.741                | 288                       |
| D | Cosmos 602                    | 1973 Oct 20.43<br>8.8 days<br>1973 Oct 29.2     | Sphere-<br>cylinder<br>6300?   | 6.5 long?<br>2.4 dia  | 1973 Oct 20.7<br>1973 Oct 23.0 | 72.88<br>72.86            | 89.97<br>89.31     | 6651<br>6618         | 210<br>170          | 335<br>309         | 0.009<br>0.011       | 70<br>40                  |
| R |                               |   |                                |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 602<br>rocket          | 1973 Oct 20.43<br>10.90 days<br>1973 Oct 31.33  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1973 Oct 21.1                  | 72.85                     | 89.84              | 6644                 | 201                 | 331                | 0.010                | 60                        |
| D | Cosmos 602<br>engine*         | 1973 Oct 20.43<br>12 days<br>1973 Nov 1         | Cone<br>600? full              | 1.5 long?<br>2 dia?   | 1973 Oct 28.7                  | 72.87                     | 88.71              | 6588                 | 169                 | 250                | 0.006                | 25                        |
| D | Fragment                      | 1973-770  |                                |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Fragment                      | 1973-77C  |                                |                       |                                |                           |                    |                      |                     |                    |                      |                           |

\*1973-770 ejected from 1973-77A on 1973 Oct 28

|   | Name                     | Launch date, lifetime and descent date         | Shape and weight (kg)         | Size (m)               | Date of orbital determination  | Orbital inclination (deg) | Modal period (min) | Semi-major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|--------------------------|--|-------------------------------|------------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| T | Explorer 50 (Imp 10)     | 1973 Oct 26, 10<br>> million years             | 16-sided cylinder<br>371 full | 1.58 long<br>1.35 dia  | 1973 Oct 26.1<br>1973 Oct 29.3 | 26.77<br>28.67            | 6971.0<br>17279    | 120881<br>221399     | 197<br>141185       | 228809<br>288857   | 0.946<br>0.333       | 120<br>52                 |
| D | Explorer 50 first stage  | 1973 Oct 26, 10<br>3 days<br>1973 Oct 29       | Cylinder<br>2750?             | 21.64 long<br>2.44 dia | 1973 Oct 26.5                  | 28.74                     | 90.98              | 6708                 | 147                 | 513                | 0.027                | 76                        |
|   | Explorer 50 second stage | 1973 Oct 26, 10<br>25 years                    | Cylinder<br>350?              | 4.9 long<br>1.43 dia   | 1973 Oct 27.2                  | 28.85                     | 112.30             | 7720                 | 363                 | 2321               | 0.127                | 172                       |
| D | Explorer 50 third stage  | 1973 Oct 26, 10<br>3.4 years?<br>1977 Mar ?    | Sphere<br>- cone<br>66        | 1.32 long<br>0.94 dia  | 1973 Oct 26.1                  | 28.77                     | 6971.0             | 120881               | 197                 | 228809             | 0.946                | 120                       |
| D | Fragment                 |  |                               |                        |                                |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 603               | 1973 Oct 27.47<br>12.8 days<br>1973 Nov 9.3    | Sphere-cylinder<br>6300?      | 6.5 long?<br>2.4 dia   | 1973 Oct 28.5<br>1973 Nov 5.4  | 72.86<br>72.84            | 90.15<br>89.12     | 6659<br>6608         | 205<br>172          | 357<br>288         | 0.011<br>0.009       | 67<br>41                  |
| D | Cosmos 603 rocket        | 1973 Oct 27.47<br>12.53 days<br>1973 Nov 9.00  | Cylinder<br>2500?             | 7.5 long<br>2.6 dia    | 1973 Oct 28.7                  | 72.84                     | 90.00              | 6652                 | 202                 | 345                | 0.011                | 63                        |
| D | Cosmos 603 engine*       | 1973 Oct 27.47<br>17.26 days<br>1973 Nov 13.73 | Cone<br>600? full             | 1.5 long?<br>2 dia?    | 1973 Nov 10.3                  | 72.84                     | 88.77              | 6591                 | 169                 | 257                | 0.007                | 32                        |
| D | Fragments<br>Cosmos 604  | 1973 Oct 29.59<br>60 years                     | Cylinder*<br>2.500?<br>2.500? | 5 long?<br>1.5 dia?    | 1973 Oct 31.0                  | 81.23                     | 97.25              | 7004                 | 615                 | 636                | 0.002                | 290                       |
|   | Cosmos 604 rocket        | 1973 Oct 29.59<br>60 years                     | Cylinder<br>1440              | 3.8 long<br>2.6 dia    | 1973 Oct 30.5                  | 81.21                     | 97.25              | 7004                 | 583                 | 668                | 0.005                | 203                       |

\* 1973-79F ejected from 1973-79A about 1973 Nov 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 | Navy Navigation Satellite 20 | 1973 Oct 30.03<br>900 years                    | Octagon +<br>4 vanes 58?       | 0.25 long?<br>0.46 dia? | 1973 Oct 30.7                 | 90.18                     | 105.62             | 7400                 | 895                 | 1149               | 0.017                | 327                       |
|   | Altair rocket                | 1973 Oct 30.03<br>600 years                    | Cylinder<br>24                 | 1.50 long<br>0.46 dia   | 1973 Oct 31.0                 | 90.19                     | 105.59             | 7399                 | 879                 | 1162               | 0.019                | 325                       |
| D | Interkosmos 10               | 1973 Oct 30.79<br>1340 days<br>1977 Jul 1      | Octagonal<br>Ellipsoid<br>550? | 1.8 long?<br>1.5 dia?   | 1973 Oct 31.6                 | 74.03                     | 102.10             | 7235                 | 260                 | 1454               | 0.083                | 120                       |
| D | Interkosmos 10 rocket        | 1973 Oct 30.79<br>1439 days<br>1977 Oct 8      | Cylinder<br>2200?              | 7.4 long<br>2.4 dia     | 1973 Oct 31.5                 | 74.03                     | 102.00             | 7230                 | 258                 | 1446               | 0.082                | 120                       |
| D | Fragment                     |  |                                |                         |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 605 *                 | 1973 Oct 31.77<br>21.5 days<br>1973 Nov 22.3   | Sphere-<br>cylinder<br>5900?   | 5.9 long<br>2.4 dia     | 1973 Nov 1.8                  | 62.80                     | 90.66              | 6686                 | 213                 | 403                | 0.014                | 112                       |
| R |                              |  |                                |                         |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 605 rocket            | 1973 Oct 31.77<br>27.75 days<br>1973 Nov 28.52 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia     | 1973 Nov 1.6                  | 62.78                     | 90.59              | 6683                 | 213                 | 396                | 0.014                | 110                       |
| D | Capsule**                    | 1973 Oct 31.77<br>77 days<br>1974 Jan 16       | Ellipsoid<br>200?              | 0.9 long<br>1.9 dia     | 1973 Dec 1.0                  | 62.3                      | 90.22              | 6664                 | 193                 | 379                | 0.014                | -                         |
| D | Fragments                    |  |                                |                         |                               |                           |                    |                      |                     |                    |                      |                           |

\* Biological satellite.

\*\* 1973-83C ejected from 1973-83A on 1973 Nov 22.

| 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) |
|------------|--|---------------------------------|--------------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 606 | 1973 Nov 2.54<br>15 years?                         | Windmill +<br>6 vanes?<br>1250? | 4.2 long?<br>1.6 dia?    | 1973 Nov 3.6<br>1973 Dec 1.0   | 62.91<br>62.79            | 709.92<br>717.51   | 26361<br>26550       | 657<br>635          | 39310<br>39708     | 0.733<br>0.736       | 318<br>-                  |
| D          | Cosmos 606<br>launcher rocket                      | Cylinder<br>2500?               | 7.5 long<br>2.6 dia      | 1973 Nov 3.4                   | 62.79                     | 92.38              | 6770                 | 218                 | 566                | 0.026                | 118                       |
| D          | Cosmos 606<br>launcher                             | Irregular                       | -                        | 1973 Nov 3.7                   | 62.82                     | 92.90              | 6796                 | 215                 | 621                | 0.030                | 120                       |
|            | Cosmos 606<br>rocket                               | Cylinder<br>440                 | 2.0 long<br>2.0 dia      | 1973 Dec 2.5                   | 62.75                     | 706.54             | 26277                | 654                 | 39144              | 0.732                | 318                       |
|            | NOAA 3<br>(ITOS)                                   | Box<br>306                      | 1.25 long<br>1.02 square | 1973 Nov 7.0                   | 102.08                    | 116.12             | 7883                 | 1500                | 1509               | 0.0006               | 255                       |
|            | NOAA 3<br>second stage*<br>Fragments<br>Cosmos 607 | Cylinder<br>350?                | 4.9 long<br>1.43 dia     | 1973 Nov 8.8                   | 102.06                    | 116.18             | 7886                 | 1503                | 1512               | 0.0006               | 230                       |
| D          |  | Sphere-<br>cylinder<br>6300?    | 6.5 long?<br>2.4 dia     | 1973 Nov 11.5<br>1973 Nov 17.8 | 72.83<br>72.84            | 89.98<br>89.70     | 6651<br>6637         | 204<br>173          | 341<br>344         | 0.010<br>0.013       | 66<br>59                  |
| D          | Cosmos 607<br>rocket                               | Cylinder<br>2500?               | 7.5 long<br>2.6 dia      | 1973 Nov 10.8                  | 72.82                     | 89.88              | 6646                 | 204                 | 332                | 0.010                | 69                        |
| D          | Cosmos 607<br>engine**                             | Cone<br>600? full               | 1.5 long?<br>2 dia?      | 1973 Nov 21.7                  | 72.82                     | 89.56              | 6630                 | 169                 | 334                | 0.012                | 50                        |
| D          | Fragments  |                                 |                          |                                |                           |                    |                      |                     |                    |                      |                           |

\* NOAA 3 second stage disintegrated on 1973 Dec 28.38 near 37 deg South, 178 deg West

\*\* 1973-870 ejected from 1973-87A on 1973 Nov 21.

Space Vehicle: Mariner 10 (1973-85A) and Centaur rocket (1973-85B).



|   | 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 | Skylab 4*<br>[Saturn 208] | 1973 Nov 16.58<br>84.06 days<br>1974 Feb 8.64                 | Cone-cylinder<br>13980?     | 10.36 long<br>3.91 dia | 1973 Nov 16.6<br>1973 Nov 17.0 | 50.04<br>50.04            | 88.22<br>93.11     | 6567<br>6808         | 154<br>422          | 224<br>437         | 0.005<br>0.001       | -<br>322                  |
| D | Skylab 4<br>rocket        | 1973 Nov 16.58<br>< 1/2 day<br>1973 Nov 16                    | Cylinder<br>13600?          | 18.7 long<br>6.6 dia   | 1973 Nov 16.8                  | 50.06                     | 88.16              | 6564                 | 150                 | 222                | 0.005                | 44                        |
| D | Cosmos 608                | 1973 Nov 20.52<br>231.64 days<br>1974 Jul 10.16               | Ellipsoid<br>400?           | 1.8 long<br>1.2 dia    | 1973 Nov 21.2                  | 70.97                     | 92.29              | 6765                 | 270                 | 503                | 0.017                | 81                        |
| D | Cosmos 608<br>rocket      | 1973 Nov 20.52<br>122.59 days<br>1974 Mar 23.11               | Cylinder<br>1500?           | 8 long<br>1.65 dia     | 1973 Nov 21.4                  | 70.97                     | 92.11              | 6756                 | 274                 | 481                | 0.015                | 82                        |
| D | Cosmos 609                | 1973 Nov 21.42<br>12.9 days                                   | Sphere-cylinder<br>6300?    | 6.5 long?<br>2.4 dia   | 1973 Nov 22.4<br>1973 Nov 22.8 | 69.95<br>69.94            | 90.07<br>89.67     | 6656<br>6636         | 241<br>174          | 314<br>341         | 0.006<br>0.013       | 58<br>58                  |
| D | Cosmos 609<br>rocket      | 1973 Dec 4.3<br>1973 Nov 21.42<br>12.90 days<br>1973 Dec 4.32 | Cylinder<br>2500?           | 7.5 long<br>2.6 dia    | 1973 Nov 22.5                  | 69.95                     | 89.86              | 6645                 | 207                 | 327                | 0.009                | 40                        |
| D | Cosmos 609<br>engine**    | 1973 Nov 21.42<br>15.14 days<br>1973 Dec 6.56                 | Cone<br>600? full           | 1.5 long?<br>2 dia?    | 1973 Dec 4.0                   | 69.96                     | 88.94              | 6599                 | 173                 | 269                | 0.007                | 34                        |
| D | Fragment                  | 1973 Nov 27.01<br>7 years                                     | Cylinder +<br>paddles? 900? | 2 long?<br>1 dia?      | 1973 Nov 27.4                  | 74.04                     | 95.27              | 6909                 | 515                 | 546                | 0.002                | 4                         |
| D | Cosmos 610                | 1973 Nov 27.01<br>7 years                                     | Cylinder<br>2200?           | 7.4 long<br>2.4 dia    | 1973 Dec 1.6                   | 74.04                     | 95.09              | 6900                 | 500                 | 544                | 0.003                | 22                        |
| D | Fragment                  | 1973-93C  |                             |                        |                                |                           |                    |                      |                     |                    |                      |                           |

\* Skylab 4 rendezvous with Skylab 1 on 1973 Nov 16.89; docked 1973 Nov 16.92; undocked 1974 Feb 8.44  
 \*\* 1973-92C ejected from 1973-92A on 1973 Dec 3

|   | Name                         | Launch date, lifetime and descent date          | Shape and weight (kg)                  | Size (m)             | Date of orbital determination | Orbital inclination (deg) | Modal period (min) | Semi major axis (km) | Perigee height (km) | Apogee height (km) | Orbital eccentricity | Argument of perigee (deg) |
|---|------------------------------|---|--|----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| D | Cosmos 611                   | 1973 Nov 28.42<br>203.35 days<br>1974 Jun 19.77 | Ellipsoid<br>400?                      | 1.8 long<br>1.2 dia  | 1973 Nov 30.3                 | 70.97                     | 92.06              | 6754                 | 270                 | 481                | 0.016                | 86                        |
| D | Cosmos 611<br>rocket         | 1973 Nov 28.42<br>118.31 days<br>1974 Mar 26.73 | Cylinder<br>1500?                      | 8 long<br>1.65 dia   | 1973 Nov 30.6                 | 70.97                     | 91.86              | 6744                 | 271                 | 460                | 0.014                | 88                        |
| D | Cosmos 612                   | 1973 Nov 28.49<br>12.8 days<br>1973 Dec 11.3    | Sphere-<br>cylinder<br>6300?           | 6.5 long?<br>2.4 dia | 1973 Nov 28.8<br>1973 Dec 4.5 | 72.82<br>72.84            | 90.05<br>89.78     | 6654<br>6641         | 206<br>187          | 346<br>338         | 0.010<br>0.011       | 69<br>47                  |
| R | Cosmos 612<br>rocket         | 1973 Nov 28.49<br>14.17 days<br>1973 Dec 12.66  | Cylinder<br>2500?                      | 7.5 long<br>2.6 dia  | 1973 Nov 28.8                 | 72.84                     | 89.95              | 6649                 | 205                 | 337                | 0.010                | 67                        |
| D | Cosmos 612<br>engine*        | 1973 Nov 28.49<br>17.66 days<br>1973 Dec 16.15  | Cone<br>600? full                      | 1.5 long?<br>2 dia?  | 1973 Dec 10.4                 | 72.84                     | 89.16              | 6610                 | 167                 | 297                | 0.010                | 50                        |
| D | Fragments                    |   |  |                      |                               |                           |                    |                      |                     |                    |                      |                           |
| D | Cosmos 613                   | 1973 Nov 30.22<br>60.1 days<br>1974 Jan 29.3    | Sphere-<br>cylinder * 2<br>wings 6570? | 7.5 long<br>2.2 dia  | 1973 Dec 1.1<br>1973 Dec 8.4  | 51.60<br>51.59            | 89.05<br>90.99     | 6609<br>6704         | 188<br>255          | 273<br>396         | 0.006<br>0.011       | 85<br>296                 |
| R | Cosmos 613<br>rocket         | 1973 Nov 30.22<br>4.29 days<br>1973 Dec 4.51    | Cylinder<br>2500?                      | 7.5 long<br>2.6 dia  | 1973 Dec 1.1                  | 51.60                     | 88.90              | 6601                 | 184                 | 262                | 0.006                | 86                        |
| D | Cosmos 613<br>orbital module | 1973 Nov 30.22<br>99 days<br>1974 Mar 9         | Spheroid<br>1200?                      | 2.5 long<br>2.2 dia  | 1974 Jan 31.9                 | 51.60                     | 90.49              | 6679                 | 239                 | 363                | 0.009                | -                         |

\* 1973-95C ejected from 1973-95A on 1973 Dec 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) |
|----------------------------------|---|--------------------------------|---------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Molniya 1AB                      | 1973 Nov 30.55<br>11½ years                     | Windmill +<br>6 vanes<br>1000? | 3.4 long<br>1.6 dia | 1973 Dec 2.6<br>1974 Feb 1.0  | 62.89<br>62.7             | 740.03<br>717.71   | 27102<br>26555       | 619<br>484          | 40829<br>39869     | 0.742<br>0.742       | 284<br>-                  |
| D Molniya 1AB<br>launcher rocket | 1973 Nov 30.55<br>29.92 days<br>1973 Dec 30.47  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia | 1973 Dec 1.7                  | 62.80                     | 90.82              | 6694                 | 216                 | 415                | 0.015                | 128                       |
| D Molniya 1AB<br>launcher        | 1973 Nov 30.55<br>30.52 days<br>1973 Dec 31.07  | Irregular                      | -                   | 1973 Dec.1.7                  | 62.80                     | 90.98              | 6702                 | 207                 | 440                | 0.017                | 126                       |
| Molniya 1AB<br>rocket            | 1973 Nov 30.55<br>11½ years                     | Cylinder<br>440                | 2.0 long<br>2.0 dia | 1974 Feb 19.2                 | 62.79                     | 734.90             | 26995                | 452                 | 40782              | 0.747                | 281                       |
| Cosmos 614                       | 1973 Dec 4.63<br>120 years                      | Cylinder +<br>paddles? 750?    | 2 long?<br>1 dia?   | 1973 Dec 4.8                  | 74.06                     | 100.66             | 7167                 | 770                 | 805                | 0.002                | 2                         |
| Cosmos 614<br>rocket             | 1973 Dec 4.63<br>100 years                      | Cylinder<br>2200?              | 7.4 long<br>2.4 dia | 1973 Dec 6.2                  | 74.06                     | 100.56             | 7162                 | 765                 | 803                | 0.003                | 356                       |
| Fragment                         |   |                                |                     |                               |                           |                    |                      |                     |                    |                      |                           |
| D Cosmos 615                     | 1973 Dec 13.47<br>734 days<br>1975 Dec 17       | Ellipsoid<br>400?              | 1.8 long<br>1.2 dia | 1973 Dec 13.8                 | 71.02                     | 95.70              | 6930                 | 270                 | 834                | 0.041                | 83                        |
| D Cosmos 615<br>rocket           | 1973 Dec 13.47<br>406.98 days<br>1975 Jan 24.45 | Cylinder<br>1500?              | 8 long<br>1.65 dia  | 1973 Dec 15.3                 | 71.02                     | 95.61              | 6926                 | 271                 | 824                | 0.040                | 83                        |

| 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) |
|-----------------------------|---|---|-----------------------|-------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| DSCS 3<br>[Titan 3C]        | 1973 Dec 14.00<br>>million years                | Cylinder *<br>2 dishes 565                                  | 1.83 long<br>2.74 dia | 1974 Jan 1.0                  | 2.5                       | 1436.3             | 42169                | 35790               | 35791              | 0                    | -                         |
| DSCS 4                      | 1973 Dec 14.00<br>>million years                | Cylinder *<br>2 dishes 565                                  | 1.83 long<br>2.74 dia | 1974 Jan 1.0                  | 2.5                       | 1436.7             | 42177                | 35797               | 35801              | 0                    | -                         |
| Titan 3C<br>second stage    | 1973 Dec 14.00<br>3.80 days<br>1973 Dec 17.80   | Cylinder<br>1900  | 6 long<br>3.0 dia     | 1973 Dec 15.4                 | 28.60                     | 89.79              | 6641                 | 133                 | 393                | 0.020                | 135                       |
| Transstage                  | 1973 Dec 14.00<br>>million years                | Cylinder<br>1500?   | 6 long?<br>3.0 dia    | 1974 Jan 1.0                  | 2.5                       | 1445.5             | 42349                | 35806               | 36136              | 0.004                | -                         |
| Explorer 51<br>(AE-C) *     | 1973 Dec 16.26<br>1822 days<br>1978 Dec 12      | 16-sided<br>cylinder 659<br>(490 empty)<br>Cylinder<br>600? | 1.14 long<br>1.36 dia | 1973 Dec 17.3                 | 68.12                     | 132.50             | 8609                 | 158                 | 4303               | 0.241                | 166                       |
| Explorer 51<br>second stage | 1973 Dec 16.26<br>241.38 days<br>1974 Aug 14.64 | Cylinder<br>600?  | 5.2 long<br>2.44 dia  | 1973 Dec 17.3                 | 68.11                     | 132.43             | 8607                 | 159                 | 4298               | 0.240                | 166                       |
| Cosmos 616                  | 1973 Dec 17.50<br>10.80 days<br>1973 Dec 28.30  | Sphere-<br>cylinder<br>5900?                                | 5.9 long<br>2.4 dia   | 1973 Dec 17.7                 | 72.86                     | 89.90              | 6647                 | 206                 | 332                | 0.009                | 66                        |
| Cosmos 616<br>rocket        | 1973 Dec 17.50<br>13.67 days<br>1973 Dec 31.17  | Cylinder<br>2500?   | 7.5 long<br>2.6 dia   | 1973 Dec 18.2                 | 72.88                     | 89.83              | 6644                 | 204                 | 327                | 0.009                | 60                        |
| Capsule **                  | 1973 Dec 17.50<br>16 days<br>1974 Jan 2         | Ellipsoid<br>200?   | 0.9 long<br>1.9 dia   | 1973 Dec 28.4                 | 72.90                     | 89.50              | 6627                 | 197                 | 301                | 0.008                | -                         |
| Fragments                   | 1973-102C, DF                                   |   |                       |                               |                           |                    |                      |                     |                    |                      |                           |

\* Atmospheric Explorer C, Manoeuvrable satellite. The orbit was changed many times.

\*\* 1973-102E ejected from 1973-102A about 1973 Dec 28.

| Name                        | Launch date,<br>lifetime and<br>descent date    | Shape and<br>weight (kg)                  | Size<br>(m)          | Date of<br>orbital<br>determination | Orbital<br>inclina-<br>tion<br>(deg) | Nodal<br>period<br>(min) | Semi<br>major<br>axis<br>(km) | Perigee<br>height<br>(km) | Apogee<br>height<br>(km) | Orbital<br>eccen-<br>tricity | Argument<br>of<br>perigee<br>(deg) |
|-----------------------------|---|---|----------------------|-------------------------------------|--------------------------------------|--------------------------|-------------------------------|---------------------------|--------------------------|------------------------------|------------------------------------|
| D<br>ZM<br>R<br>Soyuz 13    | 1973 Dec 18, 50<br>7.87 days<br>1973 Dec 26, 37 | Sphere-<br>cylinder +<br>2 wings<br>6680? | 7.5 long<br>2.2 dia  | 1973 Dec 18, 6<br>1973 Dec 19, 8    | 51.57<br>51.57                       | 88.80<br>89.22           | 6596<br>6617                  | 188<br>223                | 247<br>254               | 0.004<br>0.002               | 72<br>59                           |
| D<br>Soyuz 13<br>rocket     | 1973 Dec 18, 50<br>3.60 days<br>1973 Dec 22, 10 | Cylinder<br>2500?                         | 7.5 long<br>2.6 dia  | 1973 Dec 19, 2                      | 51.57                                | 88.79                    | 6595                          | 187                       | 247                      | 0.004                        | 84                                 |
| D<br>Fragment<br>Cosmos 617 | 1973 Dec 19, 40<br>5000 years                   | Spheroid<br>40?                           | 1.0 long<br>0.8 dia? | 1973 Dec 26, 6                      | 74.03                                | 114.04                   | 7789                          | 1336                      | 1486                     | 0.010                        | 91                                 |
| D<br>Cosmos 618             | 1973 Dec 19, 40<br>9000 years                   | Spheroid<br>40?                           | 1.0 long<br>0.8 dia? | 1973 Dec 20, 7                      | 74.02                                | 115.28                   | 7846                          | 1446                      | 1489                     | 0.003                        | 120                                |
| D<br>Cosmos 619             | 1973 Dec 19, 40<br>9000 years                   | Spheroid<br>40?                           | 1.0 long<br>0.8 dia? | 1973 Dec 20, 4                      | 74.02                                | 115.06                   | 7836                          | 1423                      | 1493                     | 0.004                        | 127                                |
| D<br>Cosmos 620             | 1973 Dec 19, 40<br>10000 years                  | Spheroid<br>40?                           | 1.0 long<br>0.8 dia? | 1973 Dec 21, 0                      | 74.01                                | 115.51                   | 7856                          | 1461                      | 1495                     | 0.002                        | 156                                |
| D<br>Cosmos 621             | 1973 Dec 19, 40<br>8000 years                   | Spheroid<br>40?                           | 1.0 long<br>0.8 dia? | 1973 Dec 20, 7                      | 74.03                                | 114.84                   | 7826                          | 1410                      | 1485                     | 0.005                        | 108                                |
| D<br>Cosmos 622             | 1973 Dec 19, 40<br>7000 years                   | Spheroid<br>40?                           | 1.0 long<br>0.8 dia? | 1973 Dec 20, 7                      | 74.01                                | 114.44                   | 7807                          | 1371                      | 1487                     | 0.007                        | 105                                |
| D<br>Cosmos 623             | 1973 Dec 19, 40<br>7000 years                   | Spheroid<br>40?                           | 1.0 long<br>0.8 dia? | 1973 Dec 20, 4                      | 74.02                                | 114.63                   | 7816                          | 1389                      | 1487                     | 0.006                        | 106                                |

| 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) |
|-------------------------------|--|--------------------------------|-----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Cosmos 624                    | 1973 Dec 19.40<br>6000 years                   | Spheroid<br>407                | 1.0 long?<br>0.8 dia? | 1973 Dec 20.7                  | 74.02                     | 114.24             | 7798                 | 1366                | 1474               | 0.008                | 104                       |
| Cosmos 617<br>rocket          | 1973 Dec 19.40<br>20000 years                  | Cylinder<br>2200?              | 7.4 long<br>2.4 dia   | 1973 Dec 20.8                  | 74.03                     | 117.13             | 7929                 | 1476                | 1626               | 0.009                | 258                       |
| Cosmos 625                    | 1973 Dec 21.52<br>12.78 days<br>1974 Jan 3.30  | Sphere-<br>cylinder<br>6300?   | 6.5 long?<br>2.4 dia  | 1973 Dec 21.9<br>1973 Dec 27.4 | 72.83<br>72.83            | 89.77<br>89.80     | 6641<br>6642         | 204<br>188          | 321<br>340         | 0.009<br>0.012       | 70<br>51                  |
| Cosmos 625<br>rocket          | 1973 Dec 21.52<br>10.75 days<br>1974 Jan 1.27  | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1973 Dec 22.3                  | 72.83                     | 89.65              | 6635                 | 202                 | 311                | 0.008                | 68                        |
| Cosmos 625<br>engine*         | 1973 Dec 21.52<br>15.61 days<br>1974 Jan 6.13  | Cone<br>600? full              | 1.5 long?<br>2 dia?   | 1973 Dec 30.8                  | 72.81                     | 89.37              | 6621                 | 166                 | 319                | 0.012                | 55                        |
| Fragments<br>Molniya 2H       | 1973 Dec 25.47<br>10½ years                    | Windmill +<br>6 vanes<br>1250? | 4.2 long?<br>1.6 dia  | 1973 Dec 26.5<br>1974 Feb 1.0  | 62.89<br>62.90            | 736.95<br>718.01   | 27027<br>26562       | 488<br>434          | 40809<br>39934     | 0.746<br>0.744       | 281<br>-                  |
| Molniya 2H<br>launcher        | 1973 Dec 25.47<br>30.44 days<br>1974 Jan 24.91 | Irregular                      | -                     | 1973 Dec 25.9                  | 62.84                     | 90.95              | 6700                 | 194                 | 450                | 0.019                | 121                       |
| Molniya 2H<br>launcher rocket | 1973 Dec 25.47<br>22.65 days<br>1974 Jan 17.12 | Cylinder<br>2500?              | 7.5 long<br>2.6 dia   | 1973 Dec 23.4                  | 62.83                     | 90.79              | 6692                 | 193                 | 435                | 0.018                | 122                       |
| Molniya 2H<br>rocket          | 1973 Dec 25.47<br>10½ years                    | Cylinder<br>440                | 2.0 long<br>2.0 dia   | 1974 Jul 22.9                  | 62.80                     | 733.61             | 26945                | 611                 | 40522              | 0.741                | 280                       |

\* 1973-105E ejected from 1973-105A on 1973 Dec 30

| 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) |
|------------------------------|--|-----------------------------|-----------------------|--------------------------------|---------------------------|--------------------|----------------------|---------------------|--------------------|----------------------|---------------------------|
| Aureole 2                    | 1973 Dec 26-69<br>30 years                     | Octagonal ellipsoid<br>400? | 1.8 long?<br>1.5 dia? | 1973 Dec 28.0                  | 74.01                     | 109.16             | 7566                 | 400                 | 1975               | 0.184                | 118                       |
| Aureole 2<br>rocket          | 1973 Dec 26.69<br>20 years                     | Cylinder<br>2200?           | 7.4 long<br>2.4 dia   | 1973 Dec 27.2                  | 74.01                     | 109.02             | 7559                 | 396                 | 1965               | 0.104                | 119                       |
| Cosmos 626                   | 1973 Dec 27.85<br>600 years                    | Cone-<br>cylinder           | 6 long?<br>2 dia?     | 1973 Dec 29.0<br>1974 Feb 14.7 | 65.02<br>64.91            | 89.65<br>104.04    | 6636<br>7328         | 257<br>910          | 259<br>990         | 0.0001<br>0.005      | 321<br>180                |
| D<br>Cosmos 626*<br>rocket   | 1973 Dec 27.85<br>58 days<br>1974 Feb 23       | Cylinder<br>1500?           | 8 long?<br>2.5 dia?   | 1974 Feb 11.7                  | 65.02                     | 89.79              | 6643                 | 234                 | 296                | 0.005                | 176                       |
| D<br>Cosmos 626*<br>platform | 1973 Dec 27.85<br>84.63 days<br>1974 Mar 22.48 | Irregular                   | -                     | 1974 Feb 19.4                  | 65.01                     | 89.43              | 6625                 | 237                 | 257                | 0.002                | 260                       |
| D<br>Fragments               | 1973-108B, E                                   |                             |                       |                                |                           |                    |                      |                     |                    |                      |                           |
| Cosmos 627                   | 1973 Dec 29.17<br>1200 years                   | Cylinder?<br>700?           | 1.3 long?<br>1.9 dia? | 1973 Dec 30.6                  | 82.95                     | 105.08             | 7375                 | 974                 | 1049               | 0.003                | 274                       |
| Cosmos 627<br>rocket         | 1973 Dec 29.17<br>600 years                    | Cylinder<br>2200?           | 7.4 long<br>2.4 dia   | 1973 Dec 29.5                  | 82.95                     | 104.93             | 7367                 | 970                 | 1008               | 0.003                | 268                       |

\* 1973-108C and 1973-108D attached to 1973-108A until orbit change about 1974 Feb 11

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| 17. Abstract<br><br>The RAE Table of satellites at present runs to more than 550 pages, and is divided into three columns. Volume 1, with satellites launched in the years 1957-1968, was issued in revised form early in 1978. Volume 2, covering the years 1969-1973, was originally issued in 1974, and the present revised version incorporates more than a thousand amendments that have accumulated in the past five years. Volume 3 will cover the years 1974-1978, but so far only Parts 1-3 (1974-1976) have been issued.<br><br>The present volume lists 559 satellite launches, arranged chronologically. For each launch, the Table gives the name and international designation of each instrumented satellite and its associated rocket(s), with the date of launch, lifetime (actual or estimated), mass, shape, dimensions and at least one set of orbital parameters. Other fragments associated with a launch are listed without these details.<br><br>The main Table, which occupies 171 pages, is prefaced by six pages of introduction and explanation, and followed by a seven-page index. |  |   |   |

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