

EVENT DESCRIPTION

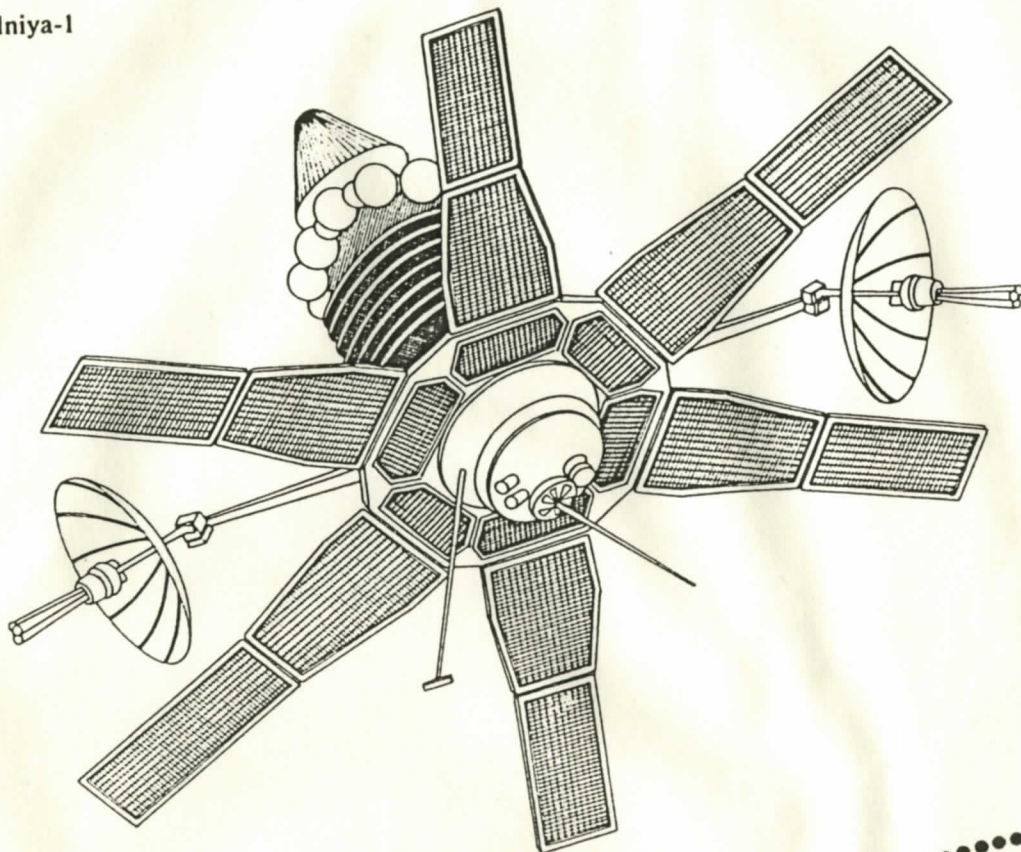
On the evening of January 20, 1989 at about 8:05 p.m. CST, the spent central core of the Soviet A2-e launch vehicle that had been used to launch Molniya 1-74 reentered the earth's atmosphere over the United States of America's mid-west region. Reentry occurred on rev # 376 and was witnessed by a number of casual observers in the midwest United States. At least two observers captured the reentry event on video tape (VHS).

THE LAUNCH OF MOLNIYA AND ITS FUNCTION

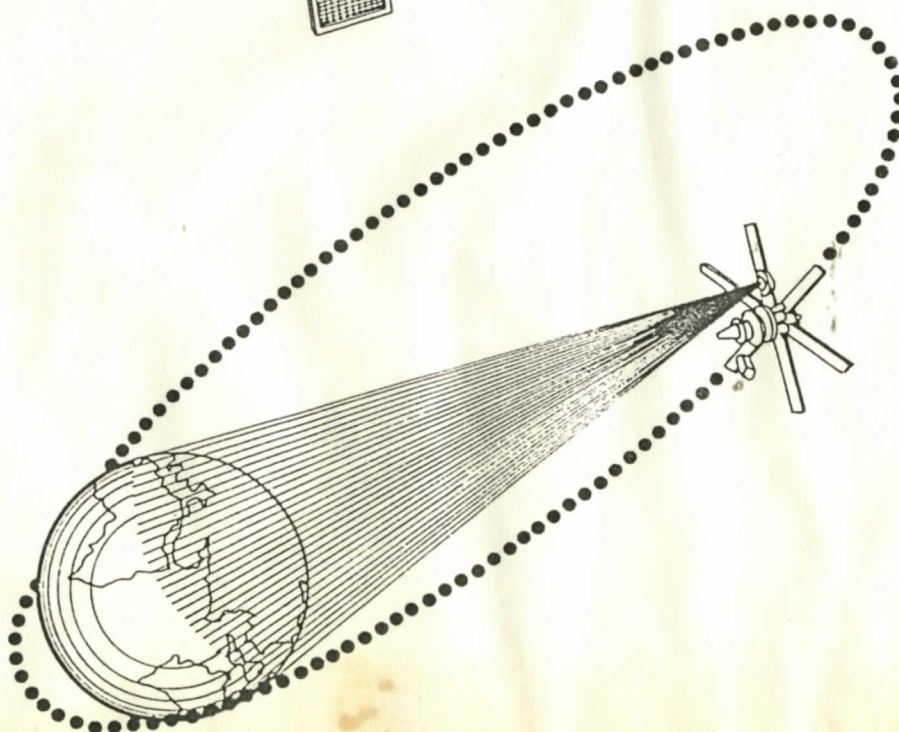
The launch that resulted in the reentry of part of the spent launch vehicle took place on 28 December 1988 in the USSR at the Plesetsk Missile and Space Complex. The purpose was the launching of a **Molinya-1** type spacecraft, # 74 in the series. The Molinya spacecraft are the Soviet communications satellites; the "dash one" was the first developed in a series of three types -- all in the series are still launched. Molinya satellites are launched into highly elliptical synchronous orbits (see Figure 1). "Lingering" near apogee allows any given Molniya to be useful as a communications satellite for about 8 hours. By using this class of satellite in synchronized constellations of three, 24 hour communications coverage may be achieved.

A Molinya-1 satellite itself consists of a central cylindrical body 5.25 ft. in diameter and 11.1 ft. tall, from which six panels of solar cells delivering a power of 700 watts and two parabolic antennae 2.95 ft. in diameter project (see Figure 1). Such satellites are used for television and telephone communications.

Molniya-1



Molniya orbit



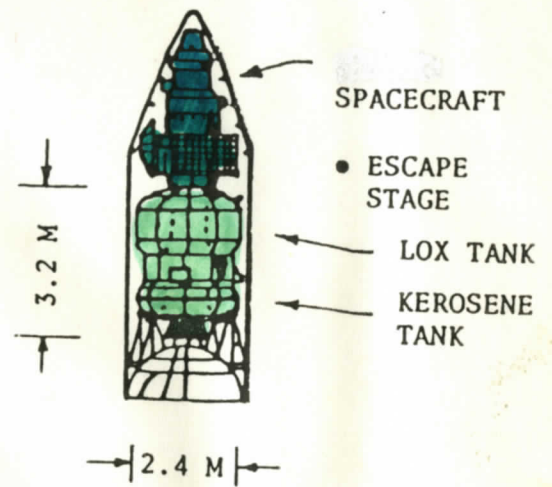
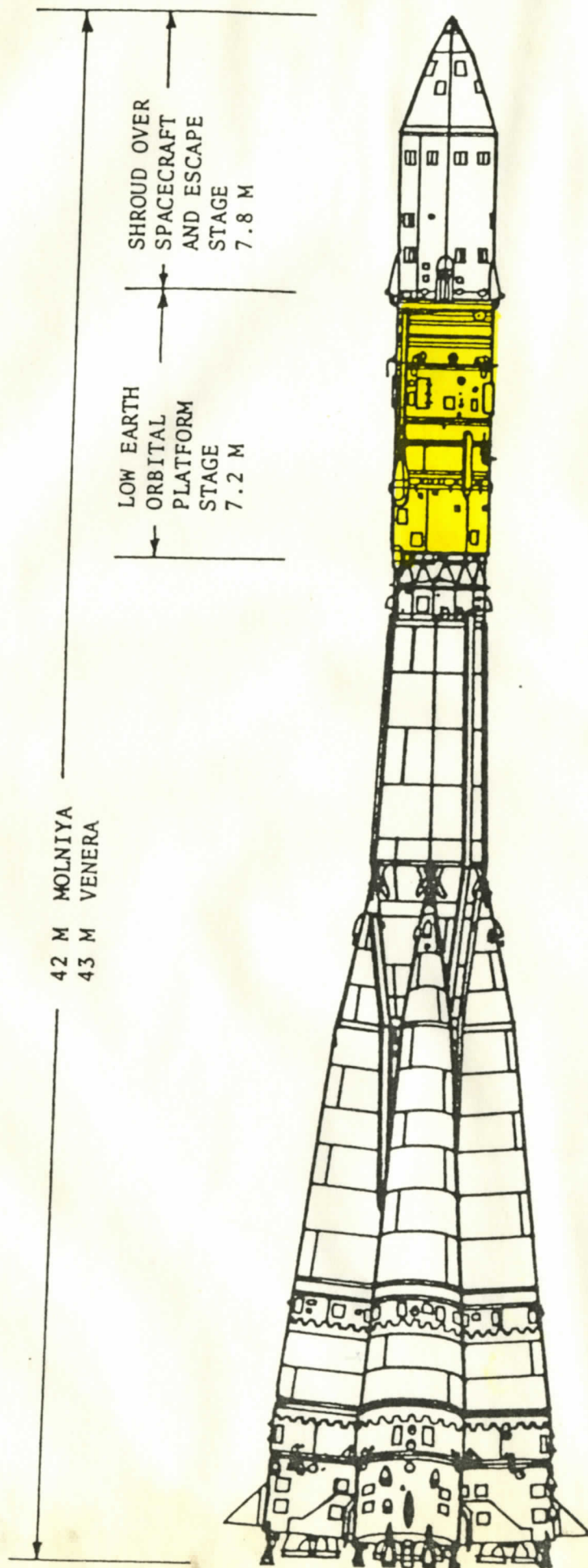
USSPACECOM CATALOGUED PIECES -- MOLNIYA 1-74

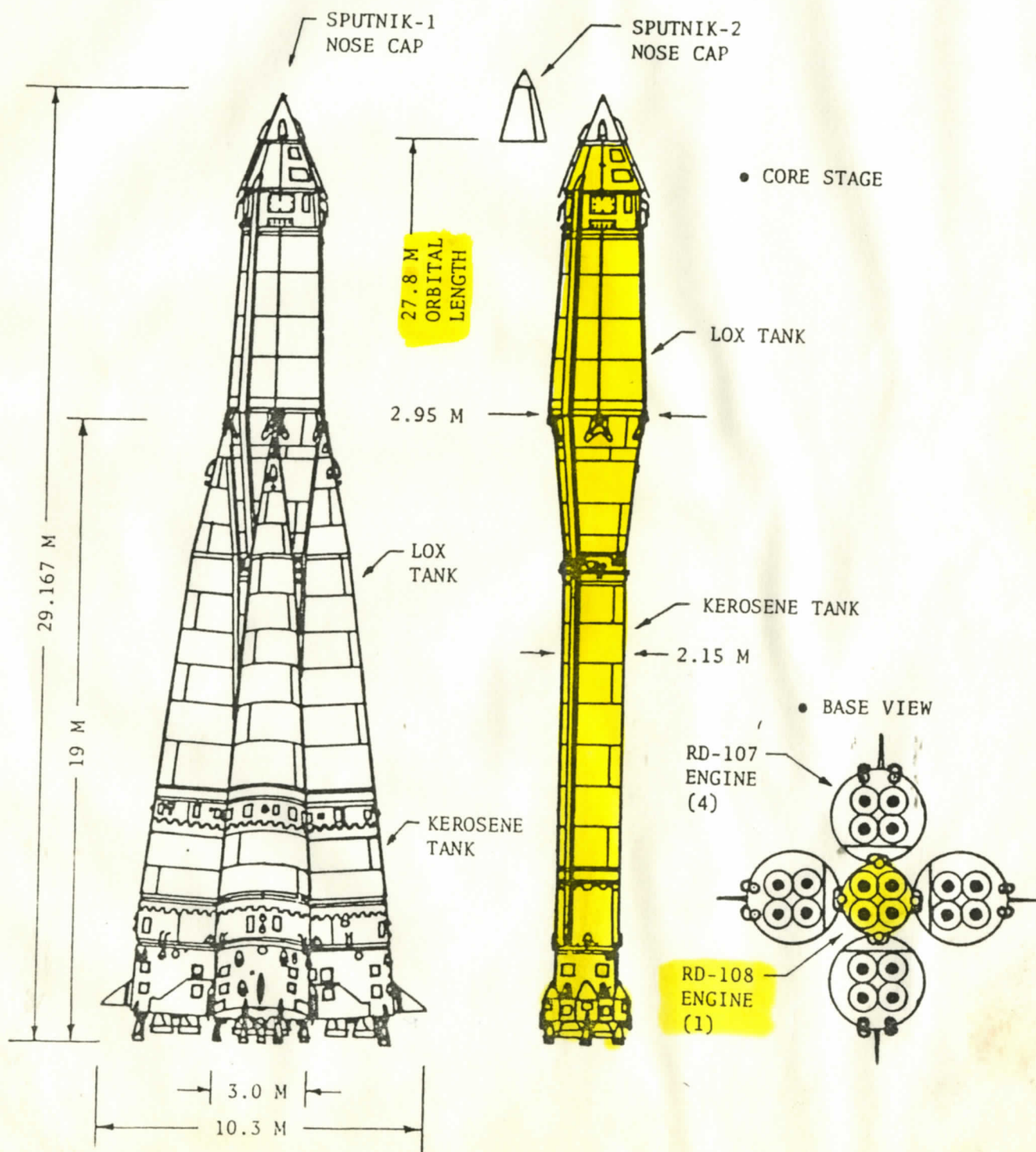
During any launch of a any spacecraft it is usual for several pieces of debris to be generated as a natural byproduct of operations. The debris pieces generated during the launch of the Soviet Molniya 1-74 were entered into the USSPACECOM catalog as follows . . .

Int'l. Designator	Sat. Number	Description	Apogee	Perigee	RCS(m ²)
1988-115A	19730	MONIYA 1-74	39719	618	3.50
1988-115B	19731	MOL.1-74 R/B (1)	314	174	14.43
1988-115C	19732	MOL.1-74 PLAT	372	172	8.22
1988-115D	19733	MOL.1-74 R/B (2)	38702	621	8.00
1988-115E	19742	MOL.1-74 DEB.	285	272	0.02
1988-115F	19748	MOL.1-74 DEB.	432	200	0.01

As can be seen, to insert the Molniya 1-74 satellite (# 19730) into its orbit, five additional catalogued pieces of debris were generated. This many operational debris pieces is fairly typical of this type of launch. Of the five pieces of debris, the first three have the largest radar cross sections -- 14.43, 8.22, and 8.00 m², respectively and correspond to clearly identifiable pieces of the launch vehicle as shown in Figure 2 (# 19732 and # 19733) and Figure 3 (# 19731) -- identified by their Sat. Numbers. Piece number 19731 was the piece observed to reenter the earth's atmosphere as described in the first paragraph of these notes.

The two pieces of debris, # 19742 and # 19748, are probably quite small (indicated by their RCS values) and likely represent bands, rings, or other misc. pieces





THE FINAL MINUTES OF OBJECT 1988-115 B (# 19731)

Using the most currently available orbital element set for # 19731 prior to its demise, from USSPACECOM, the ground track has been generate for the last part of Rev 375 and the first part of Rev 376 using one of the routines available as part of the Air Force SATRAK program suite. This data is presented in Table 1 and is sketched, in part, in Figure 4 and Figure 5.

The data in the table are based on an object in orbit -- the decay is not reflected; therefore, the altitudes above the earth's surface, especially those near the end of the time frame, are relatively meaningless. The calculations for the table were started at UT DOY=21 UT HOUR=01:00:00 and propagated at one minute intervals thereafter. Since, the UT time is six hours ahead of CST, the lcoal (mid-west) time becomes DOY=20 UT HOUR=19:00:00 (7:00 p.m. CST).

In Figure 4 it can be seen that the ground track of the Soviet rocket body during its final pass over the U.S. started in south Texas west of Brownsville and followed a generally northeast trajectory across Texas, the southeast corner of Oklahoma, northwest Arkansas, and on over Missouri and Illinois. Observers in northwest Arkansas and southwest Missouri reported seeing a large firey body streaking from southwest to northeast across the sky. By the time the object crossed the Missouri/Arkansas border it was clearly breaking up as verified by eyewitness accounts and (at least) two videotapes.

In Figure 5 the nominal fall trajectory is seen to pass close to Springfield, Missouri.

Judging from eyewitness accounts, videotapes, and the lack of additional reports much further north, it would be reasonable to accume that any surviving pieces fell to earth somewhere between Vienna, Missouri (south of the capitol, Jefferson City) and Chicago, Illinois. A detailed reentry model plus eyewitness accounts would be required to pin the location of any probable fall down any better.

TELEDYNE BROWN ENGINEERING
SPACE SYSTEMS GROUP

***** SATRAK *****
FORTRAN 77 ASTRODYNAMIC SOFTWARE FOR
SATELLITE LOOK ANGLE/GROUND TRACK GENERATION
