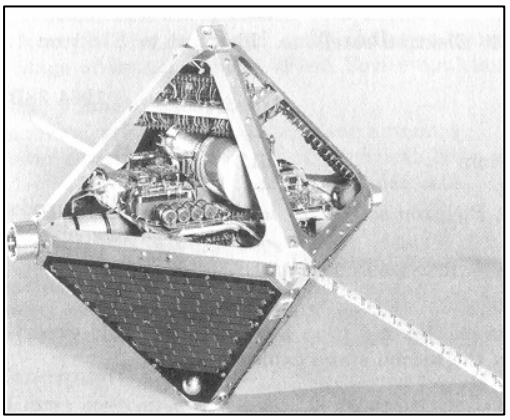
Environmental Research Satellite, ERS-20



ERS-17, an example of an ORS Mark III satellite

ERS-20 is a small United States Air Force material radiation research satellite that was launched as one of three secondary payloads from Cape Canaveral by a Titan 3C rocket in 1967.

ERS-20 conducted a United States Air Force Rocket Propulsion Laboratory (AFRPL) material studies experiment to determine the effects of the space environment, particularly of deep vacuumand radiation, on the coefficient of friction of various materials as stainless steel, Teflon, gold and silver. Both static and sliding surface frictions were investigated.

The experiment consisted of two identical assemblies mounted on opposite vertices of the satellite for redundancy. Each assembly had a sealed electric motor driving a cam that linked through a flexible bellows to sixteen wiper arms outside the satellite that swept across the exposed material samples.

In normal operation, wiper arm motion would occur only while the satellite is in communication with a NASA STADAN ground tracking station and upon ground command after verification of housekeeping data and at the discretion of the experimenter. This was to minimize the effects of wear on the frictional surfaces and to give greater flexibility to the experimenter. The experiment lifetime was estimated to be six months.

This satellite was one of a series of environmental research satellites that were built by TRW Systems Group for the United States Air Force Office of Aerospace Research (AFOAR).

The satellite is also known by the USAF designation of OV5-3, Orbital Vehicle series 5, article 3 or by the TRW designation of Octahedron Research Satellite, ORS Mark III, Item C.

ERS-20 is an octahedron of aluminum construction with edges 292 mm (11.5") long and weighs 9.1 kg (20 pounds).

Solar cell panels cover the eight triangular faces and a shelf, mounted in the equatorial plane of the satellite, carries the internal equipment. Two opposite vertices of the octahedron were used for mounting the experiment with the other two used for the antenna elements. The bottom vertex housed the launch vehicle attachment fitting.

Power is generated from 818, 10x20 mm solar cells, of which approximately 15% are exposed to sunlight at anyone time.

It uses passive thermal control to maintain the spacecraft internal temperature at around 15C. It does not have an attitude control or any propulsion system. For better thermal control, more even solar cell degradation and improved communications reliability, the satellite was set spinning by a cam system when it was ejected from the launch vehicle by a coiled spring separation mechanism.

The PAM/FM/PM telemetry system uses a 16 channel commutator and an IRIG Channel 5 Frequency Modulated Sub-Carrier Oscillator. Each channel or segment is sampled for 4.5s.

The one watt telemetry transmitter is connected through a diplexer and a matching balun to a conventional half wave dipole fabricated from half-inch ribbon steel, stiffened by concave forming. The two elements self-erected from the coiled position when ejected from the launch vehicle and projected unsupported from the satellite.

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Original created in June 2004. Last updated on May 2008

The one year transmitter cut-off timer has apparently failed to work as ERS-20 is still transmitting on 136.260 MHz as of May 2008. A 149 MHz command receiver and multi-tone decoder was provided to operate the experiment as required.

The telemetry transmitter and the command receiver were compatible with the NASA STADAN which used its world-wide ground stations to recorder the experiment and house-keeping telemetry data and send commands to operate the experiment.

ERS-20 orbital data

Date	Period (mins)	Inclination (º)	Apogee (km)	Perigee (km)	Eccentricity	Source
1 May 1967	2829.6	32.8	111229	8604	0.744	RAE[2,3]
31 May 1967	2830.97	35.12	109618	10205	0.75	RAE[2,3]
31 May 1968	2830.97	35.12	109607.55	10205.55	0.749	NASA TLE[11]
31 Jun 1995	2831.0	35.1	109619	10206		SSR V.35 N.1
31 Sep 1999	2823.4	41.3	118190	1399		SSR V.40 N.9
12 Sept 2007	2822.1	32.8	11431	5227	0.825	Hearsat[16]

Launch Data

Launch Date: 1967 April 28 10:04 UTC
Launch Site: Cape Canaveral Launch Complex 41
Launch Vehicle: Titan IIIC, Serial Number 10

Payloads launched			
Catalog Number	International Designation	Name and alternatives	Telemetry Characteristics
2765	1967-040A	OPS-6638 Vela Hotel 7 Vela 4A	Not known
2766	1967-040B	OPS-6679 Vela Hotel 8 Vela 4B	Not known
2767	1967-040C	ERS-18[7] ORS-4 ORS Mk III(B)	16 ch IRIG 5 PAM/FM/PM 136.530 MHz[1] 1W
2768	1967-040D	ERS-20[8] OV5-3 ORS Mk III(C)	16 ch IRIG 5 PAM/FM/PM 136.260 MHz 1W
2769	1967-040E	ERS-27[9] OV5-1 ORS Mk III(F)	16 ch IRIG 5 PAM/FM/PM 136.380 MHz 1W

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Abbreviations

IRIG	Inter-Range Instrumentation Group
PAM	Pulse Amplitude Modulation
FM	Frequency Modulation
PM	Phase Modulation
SCO	Sub Carrier Oscillator
IRIG 5	IRIG Channel 5: Centre Frequency, 1300 Hz ±7.5% deviation, Bandwidth ±98 Hz.
SSR	Satellite Situation Report, published monthly by NASA GSFC[10]
STADAN	An obsolete NASA VHF Satellite Tracking and Data Acquisition Network using 26m (85') or 14m (40') dishes or SATAN 16 Yagi antennae array for telemetry reception and SATAN 9 Yagi antennae for command transmission at ground stations around the world.
SATAN	Satellite Automatic Tracking Antenna