

Solar Radiation (SOLRAD) Satellite Summary Table as of 26 March 2004

	Satellite Name	Launch Date	Transmitter(s)
	Vanguard 3	18 September 1959	108.00 Mc/s 30 mW FM/PM IRIG 2, 3, 4 & 5
	Explorer 7	13 October 1959	19.9915 Mc/s 660 mW FM/AM IRIG 2, 3, 4 & 5
	Solrad Dummy	13 April 1960	Inert Test Article
20 inch sphere	Sun Ray 1	22 June 1960	108.00 Mc/s 40 mW FM/AM IRIG Ch 4 & Ch 5
	Sun Ray 2	30 November 1960 (Failure)	108.00 Mc/s 40 mW FM/AM IRIG Ch 4 & Ch 5
	Sun Ray 3	29 June 1961 (Partial failure)	108.00 Mc/s
	Sun Ray 4	24 January 1962 (Failure)	108.09 Mc/s 100 mW FM/AM
	Sun Ray 4B	26 April 1962 (Failure)	108.00 Mc/s 100 mW FM/AM
	Sun Ray 5	Not Launched	
24 inch sphere	Sun Ray 6	15 June 1963	136.890 MHz 100 mW FM/AM
	SolRad 7A	11 January 1964	136.887 MHz 100 mW FM/AM IRIG Ch 3 to 8
	SolRad 7B	9 March 1965	136.800 MHz 100 mW FM/AM IRIG Ch 3 to 8
	SolRad 8 Explorer 30 Solar Explorer A	19 November 1965	137.41 MHz 1W Stored data playback 136.44 MHz 100mW 136.53 MHz 100mW
	SolRad 9 Explorer 37 Solar Explorer B	5 March 1968	136.41 MHz 500 mW Stored data playback 136.52 MHz 150 mW Primary RT FM/AM IRIG 3 to 8 137.59 MHz 150 mW RT FM/AM IRIG 3 to 7, 12 PCM
	SolRad 10 Explorer 44 Solar Explorer-C	8 July 1971	136.38 MHz 250 mW 5W on cmd TM2 - PCM/PM or Stored Data or Stellrad on cmd 137.71 MHz 250 mW TM1 - PAM/PCM/FM/PM RT analog (chs 4-8, COSPAR Ch 7) and digital PCM (ch 12)
	SolRad 11A & SolRad 11B	14 March 1976	137.44 MHz 5W (11A), 136.53 MHz 5W (11B) 102.4 bps PCM/BiØ-L/PM convolutional encoded (R=1/2, k=7)

Early X-ray missions

Name Vanguard 3

Launch Date 1959 September 18.22 UTC

SAO ID 1959 ? (Eta)

COSPAR ID 1959-07A

Catalog No. 00020

Launch Site Atlantic Missile Range (AMR) LC 18A

Launcher Vanguard/X-248 SLV-7

Orbit 319 mile x 2329 mile x 33.3°

20" magnesium sphere, 50 lbs

Proton Precession magnetometer

2 NRL 2-8 Å Solar X-ray Ionization chambers, 120° apart

Environmental measuring devices

 3 Thermistors

 2 Differential pressure gauge

 3 Chromium strip erosion gauges with photosensitive detector

 4 Barium titanate microphones

4 metal antennas, 90 deg apart

Silver/zinc batteries

108.00 Mc/s, 30 mW, tracking signal modulated with X-ray and environmental data

108.03 Mc/s, 80 mW, on command, real time magnetometer data, 108.00 MHz transmitter off during interrogation

Both transmitters ceased after 85 days (12 Dec 1959)

Name Explorer 7

Launch Date 1959 October 13.65
SAO ID 1959 ? (Iota)
COSPAR ID 1959-09A
Catalog No. 00022
Launch Site AMR LC-05
Launcher Juno II AM-19A
Orbit 344 mile x 699 mile x 50.5°

Solar cells

Ni-Ca batteries

Solar X-ray and Lyman-alpha Photometry Experiments, NRL Friedman, Kreplin and Chubb.

X-ray detector

Lyman-alpha Detector

Solar Aspect detector

TDM on 960 cps VCO

PAM/FM/AM 19.9915 Mc/s, 660 mW

Name SolRad model (with Transit 1B)

Launch Date 1960 April 13.50

SAO ID 1960 ? (Lambda) 3

COSPAR ID 1960-03C

Catalog No. 00033

Launcher Thor AbleStar DM-21A #257

Launch site Eastern Test Range (ETR) LC 17B

Dummy Solrad/GRAB mass to test dual spacecraft launch concept, successfully separated, decayed 1961.

SR-1 Sun Ray-1 Solar Radiation Satellite

Launch Date 1960 June 22.25
SAO ID 1960 Eta 2
COSPAR ID 1960 7B
Catalog No. 00046
Launcher Thor Able Star DM-21A #281 with Transit-2A
Launch Site AMR CC LC 17B
Orbit 590 km x 940 km x 66.7°

Two 1050 – 1350 Å Lyman-alpha UV photometers, connected in parallel for redundancy

Two 2-8 Å X-ray ion chamber photometer

Single pre-amp with mid-scale bias

Solar Aspect sensor, vacuum tube photodiode

6 Skin Temperature sensors, more likely to be GRAB elint antennae

20" sphere

4 whip antennas

19 kgs, 42 lbs

Spin stabilized

Ni-Cd batteries

936 solar cells

Two channel FM/AM transmitter on 108.00 MHz at 40 mWatts

Solar aspect data on IRIG 5 sco (1300 Hz Centre Frequency $\pm 7.5\%$ deviation)

¼ second of +3.9 V cal and 0.0V cal, one second later, every 8 seconds

Multiplexed UV and X-ray data on IRIG 6 sco (1700 Hz)

¼ second of 0.0 V cal and 4.00V cal, one second later, every 8 seconds

Useful data until Nov 1960

SP-3048 p.821 “continuous output on channel 6, one negative pulse per revolution due to Lyman-alpha, one positive pulse due to X-ray, displaced in time by 180° of roll. Amplitude of pulse proportional to incident energy.

SR-2

Launch Date 1960 November 30
Launcher Thor AbleStar DM-21A #283 (with TRANSIT 3A)
Launch site ETR CC LC 17B

Launcher failure, Thor shutdown early.
Similar to SR-1

SR-3

Launch Date 1961 June 29.18
SAO ID 1961 Omicron 2
COSPAR ID 1960 15B
Catalog No. 00117
Launcher Thor AbleStar DM-21A #315 (Triple launch with Transit-4A and Injun-1)
Launch site ETR CC LC 17B
Orbit 869 km x 991 km x 66.8°

2-8 A or 1-8

8-16 A or 8-14

18 kgs, 55 lbs

partial success, SR-3 failed to separate from Injun-1
data until November 1961

SR-4 SR-4A

Launch Date 24 January 1962

Launcher Thor AbleStar DM-21A #311 (Composite-1, with Injun-2 (136.50), LOFTI-2A(136.38), SECOR(136.11))

Launch site ETR CC LC 17B

Launch failure, AbleStar produced insufficient thrust, second stage failure

4 Night Lyman-alpha detectors

4 X-ray detectors 2-8, 8-16, 0.5-3, 8-12 Å

Solar aspect sensor

Spinup rockets, two sets

20" Sphere

25 kgs

24 V battery

1044 Si solar cells

FM/AM transmitter on 108.090 MHz at 100 mW

Command receiver ? 123 MHz ?

(Early use of 136-138 MHz allocation)

SR-4B

Launch Date 26 April 1962

Launcher Scout X-2 #10

Launch site WTR VAFB LC-D

Launch Failure

Same as SR-4 ?

SR-5 cancelled

SR-6

Sunray-5

Launch Date 1963 June 15.61
COPAR ID 1963-21C
Catalog No. 00599
Launcher Thor Agena D #378 (Composite-3, plus LOFTI-2B, Surcal-3, Radose-1 and NRL PL-112)
Launch site WTR SLC 75-1-1
Orbit 170 km x 869 km x 69.9°

6 week lifetime

0.1-1.6

0.5-3

2-6

2-8

8-16

44-60

24" Sphere

38 kgs

6 solar cell panels

Vacuum photocell solar aspect sensor

Two spinup systems

FM/AM Transmitter on 136.890 MHz using turnstile antenna (four rigid tubes around spacecraft equator)

Vanguard type-1 Command receiver with single dipole whip on top, frequency?

Produced no data due quite sun

Decayed 1 August 1963 after six weeks in orbit.

SOLRAD-7A

Launch Date 1964 January 11.84
COSPAR ID 1964 1D
Catalog No. 00730
Launcher TAT Agena D #390 (Composite-4, plus SECOR-1, GGSE and NRL PL-135)
Launch site WTR VAFB SLC 75-3-5
Orbit 900 km x 921 km x 69.9°

40 kgs

1-8

8-14

8-16

44-55

44-60

4 UV photometers

2 Solar Aspect sensors

Transmitter on 136.887 MHz scos ? and 44-60, ? and 2-8, 8-14 and ?

44-55 and 8-16 detectors failed immediately after launch

other operated until September 1964

data until 5/2/65

operated until July 1966

SOLRAD 7B

Launch Date 1965 March 9.77
COSPAR ID 1965 16D
Catalog No. 001291
Launcher Thor Agena D #419 (Composite-5, plus SECOR-3, Surcal-4, Dodecopole-1, Solrad-6B, GGSE-2 & 3 and Oscar-3)
Launch site WTR, VAFB SLC 75-1-2
Orbit 900 km x 928 km x 70.1°

61 cm dia sphere (24")

47 kg

1 GM counter

6 Ionization chambers, 0.5-3Å, 1-8Å, 8-16Å, 44-55Å, 44-60Å

no data may 25 to june 17 due to Solar Aspect Angle > 35°

sco 5 failed 10/65

RT data and HK at spin rate on 6 IRIG SCOs 44-60 and ?, 8-14/8-12

PAM/FM/PM Transmitter on 136.800 MHz at 100 mW

Four 56 cm tx antennas

Useful data 10/3/65 to 31/10/1965

SOLRAD 8

Explorer 30

Solar Explorer A

SE-1

IQSY - International Quite Sun Year

Launch Date 1965 November 1920
COSPAR ID 1965-93A
Catalog No. 01738
Launcher Scout X-4 #38
Launch Site Wallops Island LA-3
Orbit 667 km x 871 km x 59.7°

0.5-3 Å ion chamber photometer (ICP) replaced by Geiger-Müller Tube (GMT)

1-8 Å GMT

1-8 Å – two ICP with different apertures

8-16 Å

44-55 Å

44-60 Å

1080-1350 Å

1225-1350 Å, two each in parallel to a single pre-amp with mid scale bias

Two 24" hemispheres joined by 3 1/2" band

57 kg

Spin replenishment system - Ammonia gas thrusters

Active Attitude control failed august 1966

Data Storage System failed December 1965

Transmitters

136.53 MHz at 100 mW, prime

137.41 MHz at 1W Stored Data Playback

137.44 at 100 mW, secondary

Data until November 1967

SOLAR 9 Explorer 37 Solar Explorer-B SE-2

Launch Date 1968 March 5.77 UTC, 1828 UTC
COSPAR ID 1968 17A
Catalog No. 3141
Launcher Scout
Launch site Wallops Island LA-3
Orbit 522 km x 878 km x 59.4°

0.5-3 G-M tube with x2 sensitivity

0.5-3 Ion Chamber Photometer (ICP)

1-8 ICP with dual range electrometer amp

8-16 ICP with dual range electrometer amp

1-20 ICP

44-60 ICP

12-sided cylinder, 0.6m high, 0.76m dia, 90 kg. 24 solar panels, 7" x 10"

Spin replenishment system, One rpm nominal spin rate within $\pm 1^\circ$ sunline, Attitude Control System failed 2/74

54 kilobit core storage, held 14.25 hours of one minute data of 0.5-8, 1-8 and 8-16

Transmitters: Primary: 136.53 MHz 150 mW RT FM/AM, 6 IRIG 7.5% SCOs

IRIG 3 32 segment HK, 0.5 sec per segment

IRIG 4 1-8A ICP

IRIG 5 8-16A ICP with 16 bit Time Code every four minutes

IRIG 6 0.5-3A G-M and ICP

IRIG 7 1080-1350 and 1225-1350A Lyman-alpha detector

IRIG 8 Solar Aspect data

137.59 MHz at 150 mW, RT, FM/AM, 4 scos IRIG 3 HK, 6 earth albedo, 7 earth albedo, 12 PCM tlm

136.41 MHz at 500 mW, Stored data playback on command

Two command receivers 149 MHz, Two command decoders

Lifetime: 6 years

SOLRAD 10 Explorer 44 SE-C

Launch Date 1971 July 8.95 UTC
COSPAR No. 1971 58A
Catalog No. 5317
Launcher Scout-B #74
Launch Site WI
Orbit 436 km x 630 km x 51.0°

12 sided cylinder, 23" high, 30" across, 260 lbs (0.6m high, 0.76m dia, 118 kg)

4 solar cell panels, each 7" by 21"

Three spin-up systems

Four Spin axis attitude control system

Designed to maintain the spin rate at 60 rpm and the spin axis within $\pm 2^\circ$ of the Sun-spacecraft line

14 experiments

Transmitters:

TM1- PCM/FM/PM 137.71 MHz at 250 mW, RT analog on IRIG 3 to 8 plus RT data at 500 bps PCM on IRIG 12.

TM2 – PCM/PM on 136.38 MHz at 250 mW or 3W on command for Stored data

Last data 25/2/1974

Decayed 15 Dec 1975

SOLRAD 11 A

Launch Date 1976 March 15.06
COSPAR ID 1976 23C
Catalog No. 07848
Launcher Titan IIC
Launch site ETR CC LC-40
Orbit 118,109 km x 118,989 km x 25.3° (20 Earth radi)

SOLRAD 11 B

14 March 1976
COSPAR ID 1976 23D
Catalog No. 08749
Launched with SOLRAD 11A
Orbit 115,562 km x 116,940 km x 25.4°

182 kg each

25 experiments each

Telemetry:

12 bit words

32 words/subframe

32 subframe/frame

12,288 bits/frame

120 seconds/frame

Primary: 102.4 bps PCM/BiØ-L/PM convolutionally encoded ($R=1/2$ and $k=7$) on 137.44 MHz (11A) 5W, 136.53 MHz 5W (11B)

Secondary: PCM/FM/PM on IRIG channel 8

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