



Major Features of the GOES Spacecraft and Subsystems

GENERAL SPACECRAFT DATA

Configuration	Body stabilized
Design Life	7-yr (5-yr mission)
Launch Vehicle	Atlas I or Atlas IIA
Maneuver Lifetime	7 to 11 years

SPACECRAFT DIMENSIONS

Launch Configuration Envelope:

Width Earth Face	2.5 m (97 in)
Height (T&C antenna deployed)	4.6 m (180 in)
Depth	2.9 m (113 in)

On-orbit Configuration:

Array to Body	6.1 m (242 in)
Solar Sail to Body	17.7 m (697 in)
Magnetometer to Body (true length)	3.0 m (118 in)
Overall Length (sail to array)	26.9 m (1060 in)
Overall Height (T&C antenna to Magnetometer boom)	5.9 m (232 in)
Overall Depth (Earth face to Magnetometer boom)	4.9 m (192 in)

SPACECRAFT MASS	GOES-I/J/K/L	GOES-M
Deployment Mass	2105 kg (4641 lb)	2270 kg (5005 lb)
Dry Mass	977 kg (2154 lb)	1042 kg (2297 lb)
Propellant and Pressurant	1128 kg (2487 lb)	1128 KG (2487 lb)

COMMAND

Receive:

Frequency	2034.2 MHz
Minimum EOC Antenna Gain (on-orbit)	-3.7 dBi
Minimum G/T	-40 dB/K

Dynamic Range:

Command only	-113 to -50 dBm
Command and Ranging	-95 to -50 dBm

Transmission Bandwidth:

Signal Bandwidth	
Without Ranging	<40 kHz
With Ranging	<1 MHz
Uplink Bit Rate	250 lbs

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ATTITUDE AND ORBIT CONTROL SUBSYSTEM (AOCS)

Transfer Orbit	3-axis stabilized w/thrusters
On-orbit Stabilization	3-axis stabilized momentum bias
Pointing Accuracy:	
Antenna Pointing (3σ)	
Roll	± 0.25 deg
Pitch	± 0.25 deg
Yaw	± 0.25 deg
Payload Operations	
Roll	± 9.1 μ rad
Pitch	± 9.4 μ rad
Yaw	± 73.3 μ rad in 90 minutes
Imaging Stability (15 min imaging interval)	42 μ rad E-W, N-S Noon ± 8 hr 70 μ rad E-W, N-S, Midnight ± 4 hr
Stationkeeping Window:	
North-South (N-S), latitude	± 0.5 deg about equator
East-West (E-W), on-station	± 0.5 deg in longitude

PROPULSION SUBSYSTEM

Propellant	Bipropellant
Tank Volumes/Capacity:	
Fuel - Monomethyl Hydrazine (MMH)	570.0 L (20.13 ft ³)/473 kg (1043 lb)
Oxidizer - Nitrogen Tetroxide (N ₂ O ₄)	570.0 L (20.13 ft ³)/776 kg (1711 lb)
Pressurant - Helium	75.7 L (2.67 ft ³)
Total Propellant Mass Required:	
Fuel	431.1 kg (950.4 lb)
Oxidizer	694.1 kg (1530.2 lb)
Helium	2.72 kg (6.00 lb)
Thrusters:	
AOC (12)	22 N (5 lb)
Apogee (1)	490 N (110 lb)



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ELECTRICAL POWER SUBSYSTEM

Solar Array:	Single axis, Sun tracking	
Number of Panels	2	
Panel Size (each)	236.2 cm x 268.0 cm (93 in x 105.5 in)	
Power Output (watts):	<u>Output</u>	<u>Load</u>
BOL Summer Solstice	1167	1026
BOL Autumnal Equinox	1304	1126
EOL Summer Solstice	1057	1026
EOL Autumnal Equinox	1164	1126
Transfer Orbit	638	596
Batteries:	2 Nickel-Cadmium	
Number of Cells	28 each	
Capacity	12 ampere-hour each	
Depth of Discharge	60% maximum with eclipse	
Eclipse Load Supported	400 watts, 72-minute eclipse	
Bus:	Single Bus System	
Voltage (Sunlight)	42.0 ±0.5 volts dc	
Voltage (Eclipse)	32.4 volts minimum	
Eclipse Load Control	Automatic load disconnect; sequentially reconnected in 6 selectable groups	

Major Features of the GOES Spacecraft and Subsystems

SEARCH AND RESCUE (SAR)

Receive:	
Frequency, Wideband Mode	406.050 MHz
Narrowband Mode	406.025 MHz
Minimum EOC Antenna Gain	9.9 dBi
Minimum G/T	-17.6 dB/K
Dynamic Range	Noise to -125 dBm
Transmission Signal Bandwidth:	
Wideband/Narrowband Mode	80/20 kHz
Transmit:	
Frequency	1544.5 MHz
Power	3 watts
Antenna	
Gain	12.3 dBi
Coverage	Earth
Polarization	RHC
EIRP	45.4 dBm

WEATHER FACSIMILE (WEFAX)

Receive:	
Frequency	2033.00 MHz
Minimum EOC Antenna Gain	11.0 dBi
Minimum G/T	-18.4 dB/K
Transmission Bandwidth:	
Available Transmission Bandwidth	1 MHz
Occupied Signal Bandwidth	30 kHz
Offset	342 MHz
Transmit:	
Frequency	1691.00 MHz
Power	11 watts
Antenna	
Gain	16.5 dBi
Coverage	Earth
Polarization	Linear
EIRP	54.4 dBm



Major Features of the GOES Spacecraft and Subsystems

COMMAND & DATA ACQUISITION

(CDA) STATION TELEMETRY

Transmission Signal Bandwidth	<10kHz
Data Rate	2 kbits/sec
Transmit:	
Frequency	1694.0 MHz
Power	3 watts or 35 dBm
Antenna	
Gain (90°)	-3.5 dBi
Pattern	Cardioid
Polarization	RHC
EIRP	28.9 dBm

DEEP SPACE NETWORK TELEMETRY

Transmission Signal Bandwidth	2.1 MHz
Transmit:	
Frequency	2209.086 MHz
Power	1 watt
Antenna	
Gain	-2.7 dBi
Pattern	Cardioid
Polarization	RHC
EIRP	24.5 dBm

DEEP SPACE NETWORK RANGING

Transmission Signal Bandwidth	<1.0 MHz
Transmit:	
Frequency	2209.086 MHz
Power	<1 watt
Antenna	
Gain	-10 dBi
Pattern	Cardioid
Polarization	RHC
EIRP	17.2 dBm

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DATA COLLECTION PLATFORM REPORT (DCPR) TRANSPONDER

Receive:

Frequency, Band 1	401.900 MHz
Band 2	402.200 MHz
Minimum EOC Antenna Gain	10.2 dBi
Minimum G/T	-18.7 dB/K
Dynamic Range	Noise to -100 dBm

Transmission Signal Bandwidth

Transmit:

700 kHz	
Frequency, Band 1	1694.500 MHz
Band 2	1694.800 MHz
Power	0.15 watt
Antenna	
Gain	16.5 dBi
Coverage	Earth
Polarization	Linear
EIRP	33.7 dBm

DATA COLLECTION PLATFORM INTERROGATE (DCPR) TRANSPONDER

Receive:

Frequency 1	2034.9000 MHz
Frequency 2	2034.9125 MHz
Minimum EOC Antenna Gain	11.0 dBi
Minimum G/T	-18.4 dB/K
Dynamic Range	-110 to -90 dBm

Transmission Signal Bandwidth

Transmit:

200 kHz	
Frequency 1	468.8250 MHz
Frequency 2	468.8375 MHz
Power	4.5 watts
Antenna	
Gain	10.7 dBi
Coverage	Earth
Polarization	RHC
EIRP	45.4 dBm



Major Features of the GOES Spacecraft and Subsystems

PROCESSED DATA RELAY (PDR)

Receive:

Frequency	2027.7 MHz
Minimum EOC Antenna Gain	11.0 dBi
Minimum G/T	-18.4 dB/K
Dynamic Range	-92 to -86 dBm

Transmission Signal Bandwidth 5.2 MHz

Transmit:

Frequency	1685.7 MHz
Power	11 watts
Antenna	
Gain	16.5 dBi
Coverage	Earth
Polarization	Linear

EIRP 54.9 dBm

MULTI-USE DATALINK (MDL) (GOES-I & K)

Frequency 1681.48 MHz
Power 2 watts

Antenna:

Gain	16.5 dBi
Coverage	Earth
Polarization	Linear

EIRP 44.0 dBm

SENSOR DATA

Transmission Signal Bandwidth <4 MHz

Transmit:

Frequency	1676.00 MHz
Power	1.6 watts
Antenna	
Gain	16.5 dBi
Coverage	Earth
Polarization	Linear

EIRP 45.4 dBm

**Important Features of the
GOES Sensor Suite**

IMAGER INSTRUMENT

Field of View Defining Element	Detector
Optical Field of View	Square
5-Channel Imaging	Simultaneously
Scan Capability	Full earth/sector/area
Channel/Detector:	Instantaneous FOV:
Visible/Silicon	1 km
Shortwave/InSb	4 km
Moisture/HgCdTe	8 km
Longwave 1/HgCdTe	4 km
Longwave 2/HgCdTe	4 km
Radiometric Calibration	Space and 290 k IR internal blackbody
Signal Quantizing NEΔT or S/n	10 bits all channels Minimum 3X better than spec
Frequency of Calibration:	
Space	2.2 sec for full disk; 9.2 or 36.6 sec for sector/area
Infrared	30 minutes typical
System Absolute Accuracy	IR channel ≤1K Visible Channel 5% of maximum scene irradiance
System Relative Accuracy	IR channel ≤0.1 K



Important Features of the GOES Sensor Suite

IMAGER IMAGE NAVIGATION AND REGISTRATION (INR)

Imaging Rate		60°N to 60°S ≤26 min 12 sec	
Time Delay		≤3 min	
Fixed Earth Projection and Grid Duration		24 hours	
Data Timeliness:			
Spacecraft Processing		≤30 sec	
Data Coincidence		≤5 sec	
Imaging Periods		<u>Noon±8 hr</u>	<u>Midnight±4 hr</u>
Image Navigation Accuracy at Nadir		4 km	6 km
Registration within an Image*	25 min	50 μrad	50 μrad
Registration between Repeated Images*	15 min	50 μrad	70 μrad
	90 min	84 μrad	105 μrad
	24 hr	168 μrad	168 μrad
	48 hr	210 μrad	210 μrad
Channel-to-channel Registration		28 μrad	28 μrad (IR only)

*For Spec Orbit

Important Features of the GOES Sensor Suite

SOUNDER INSTRUMENT

Field of View Defining Element	Field Stop
Channel Definition	Interference filters
19 Channels:	
Longwave IR	7: 14.7-12.02 μm
Midwave IR	5: 11.03-6.51 μm
Shortwave IR	6: 4.57-3.74 μm
Visible	1 at 0.67 μm
Scan Capability	Full Earth & space
Frequency of Calibration:	
Space	2 minutes
Infrared	30 minutes
Nominal IGFOV	242 μrad , all channels
Sounding Areas	10x10 km 60° N-S and 60° E-W
Sounding of 19 Channels (every 100 ms)	75 ms
North-South Step Size	1120 μrad
East-West Step Size	280 μrad
Signal Quantizing NE Δ N	13 bits all channels Minimum 4X better than spec
System Absolute Accuracy	IR channel ≤ 1 K
System Relative Accuracy	IR channel ≤ 0.1 K



Important Features of the GOES Sensor Suite

SOUNDER IMAGE NAVIGATION AND REGISTRATION (INR)

Sounding Rate		3000x3000 km ≤ 42 min	
Time Delay		≤3 min	
Fixed Earth Projection and Grid Duration		24 hours	
Visible Channel Quantization		≤0.1% to 100% albedo	
Infrared Channel Data		1/3 of specified NEΔN	
Data Timeliness:			
Spacecraft Processing		≤30 sec	
Sounding Periods		<u>Noon±8 hr</u>	<u>Midnight±4 hr</u>
Image Navigation Accuracy at Nadir		10 km	10 km
Registration within a 120-minute Sounding	120 min	84 μrad	112 μrad
Registration between repeated soundings	24 min	280 μrad	280 μrad
Channel-to-channel Registration		28 μrad (IR/Vis)	28 μrad (IR only)

Important Features of the GOES Sensor Suite

SPACE ENVIRONMENTAL MONITOR (SEM)

MAGNETOMETER

Function	Measure ambient magnetic field to \pm nT, w/ corrections
Sensor Element Sensor Assembly	Forster fluxgate probe Redundant magnetometers, 3 orthogonal fluxgate probes each mounted on 3.1 m boom
Dynamic Range	\pm 1000 nT, any orientation
Resolution	0.03 nT

SOLAR X-RAY SENSOR (XRS)

Function	Measure solar x-ray in 2 bands
Spectral Bands	0.5-3.0 and 1.0-8.0 Å
Resolution: Fluxes	
>20 times threshold	\leq 2% of reading
Sampling Rate	Once every 0.512 sec

Sun Tracking:

Diurnal	Mounted on solar array Sun tracking yoke
Seasonal	Single axis positioner with Sun sensor, closed loop, north-south tracking

ENERGETIC PARTICLES SENSOR (EPS)

Function	Measure flux of proton, alpha particles and electrons in 16 energy bands from 0.55 to 500 MeV
Sensor Elements Sensor Assemblies	Solid state nuclear detectors One 2-detector telescope, one dome assembly of three detectors
Sampling Rate	Once every 10.2 or 20.5 sec
Dynamic Range	Cosmic ray background to largest solar particle event



Important Features of the GOES Sensor Suite

HIGH ENERGY PROTON & ALPHA PARTICLE DETECTOR (HEPAD)

Function	Measure flux of protons and alpha particles from 350 to 3400 MeV
Spectral Bands:	
Protons	3 from 370 to 970 MeV
Alpha Particles	1 at ≥ 970 MeV
Sensor Element	Cerenkov Scintillation sensor
Sensor Assembly	Telescopic arrangement of Cerenkov crystal and 2 solid state detectors
Field of View	Conical, $\sim 34^\circ$ half angle
Dynamic Range	0 to 10^4 counts/second