

19. Technical Performance Summary

This section summarizes the typical and nominal capabilities of the GOES N-P system unless otherwise stated. The numbers quoted do not necessarily represent worst case parameter values for all extreme conditions in special modes.

General Spacecraft Data

Configuration	Body stabilized
Design life	10-yr (8-yr mission)
Launch vehicle	Delta IV
Maneuver lifetime	>10 years
Spacecraft dimensions	
Launch configuration envelope	
Width earth face	2.56 m (8.08 ft)
Height (Top of solar array to aft omni)	4.6 m (15 ft)
Depth	2.9 m (9.42 ft)
On-orbit configuration	
Array to body	6.0 m (19.25 ft)
Magnetometer to body (true length)	8.5 m (27.9 ft)
Overall length (Solar array to -Y radiator)	8.4 m (27.58 ft)
Overall height (Imager port to magnetometer boom)	9.1 m (29.83 ft)
Overall depth	2.9 m (9.42 ft)
Spacecraft mass	
Deployment mass	3217.3 kg (7092.9 lb)
Dry mass	1545.7 kg (3407.6 lb)
Propellant and pressurant	1671.6 kg (3685.3 lb)

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Command

Receive

Frequency	2034.200 MHz
Minimum EOC antenna gain (on-orbit)	-2.95 dBi ($\pm 55^\circ$)
Minimum G/T	-60 dB/K
Uplink bit rate	2 kbps

Dynamic Range

Command only	-115 to -50 dBmi
Command and ranging	-115 to -50 dBmi

Transmission signal bandwidth

Without ranging	80 kHz
With ranging	250 kHz
Uplink bit rate	2000 bps
COMSEC	Selectable

Attitude Control Subsystem (ACS)

Transfer orbit	Passively stable, LAM and final spindown maneuver are 3-axis stabilized with thrusters	
On-orbit stabilization	3-axis stabilized zero momentum	
Pointing accuracy		
Antenna pointing (3σ)	<u>Maneuver Mode</u>	<u>Normal Mode</u>
Roll	$\pm 0.25^\circ$	$\pm 0.01^\circ$
Pitch	$\pm 0.20^\circ$	$\pm 0.01^\circ$
Yaw	$\pm 0.25^\circ$	$\pm 0.01^\circ$
Payload operations (with DMC)		
Roll	$\pm 6.0 \mu\text{rad}$	
Pitch	$\pm 9.0 \mu\text{rad}$	
Yaw	$\pm 6.0 \mu\text{rad}$	
Imaging stability (15 minute imaging interval)	$\pm 6.0 \mu\text{rad}$ N-S $\pm 9.0 \mu\text{rad}$ E-W	
Stationkeeping window		
North-south (N-S), latitude	$\pm 0.5^\circ$ about equator	
East-west (E-W), on-station	$\pm 0.5^\circ$ in longitude	

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Propulsion Subsystem

Propellant	Bipropellant
Tank volumes/capacity	
Fuel—monomethylhydrazine (MMH)	367.8 L (12.99 ft ³)/319 kg (703 lb)
Oxidizer—nitrogen tetroxide (N ₂ O ₄)	367.8 L (12.99 ft ³)/529.5 kg (1167 lb)
Pressurant—helium	42.6 L (1.5 ft ³)
Total propellant mass required	
Fuel (2)	625 kg (1378 lb)
Oxidizer (2)	1043 kg (2299 lb)
Helium (2)	3.7 kg (8.2 lb)
Thrusters	
AOC (12)	9.25 Nm (2 lbf)
Apogee (1)	490 Nm (110 lb)

Electrical Power Subsystem

Solar array	Single axis, Sun tracking	
No. of panels	1 main panel and 1 yoke panel with solar cells	
Panel sizes	270.5 cm × 386.8 cm (106.5 in × 152.3 in) main panel, 231.1 cm x 183.2 cm (91.0 in x 72.1 in) yoke panel	
Power output, W	<u>Output</u>	<u>Nominal Load</u>
BOL summer solstice	2313	1751
BOL autumnal equinox	2562	1998
EOL summer solstice	1900	1759
EOL autumnal equinox	2084	2014
Batteries	1 Nickel-Hydrogen (3 packs)	
No. of cells	24 (8 cells/pack)	
Capacity	123 A-hr	
Depth of discharge	75% maximum with eclipse	
Eclipse load supported	1950 W, 72-minute eclipse	
Bus	Multiple bus system	
Voltage (sunlight)	53.1 ±0.25, 42.0 ±0.5, 30.0 ±0.3 V dc	
Voltage (eclipse)	Same	

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Command & Data Acquisition (CDA) Station Telemetry

Transmission signal bandwidth	16 kHz
Data rate	4 kbps (nominal) or 1 kbps
Transmit	
Frequency	1694.000 MHz
Power	3.5 W
Antenna	
Minimum EOC Gain (90°)	-14dBi
Pattern	75% of 4pi steradian
EIRP Minimum EOL	15.9 dBmi

Deep Space Network Telemetry

Transmission signal bandwidth	2.5 MHz
Data rate	4 kbps (nominal) or 1 kbps
Transmit	
Frequency	2209.086 MHz
Power	8 W
Antenna	
Minimum EOC Gain	-14 dBi
Pattern	75% of 4pi steradian
EIRP Minimum EOL	20.3 dBmi

Deep Space Network Ranging

Receive	
Transmission signal bandwidth	250 kHz
Transmission frequency	2034.200 MHz
Transmit	
Frequency	2209.086 MHz
Power	8 W
Antenna	
Minimum EOC Gain	-14 dBi
Pattern	75% of 4pi steradian
EIRP-Minimum EOL	20 dBmi

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Data Collection Platform Report (DCPR)

Transponder

Receive

Frequency, Domestic	401.900 MHz
Frequency, International	402.200 MHz
Minimum EOC antenna gain	13.1 dBi ($\pm 9^\circ$)
Minimum G/T	-18.7 dB/K
Dynamic range	Below noise to -100 dBmi
Transponder bandwidth, domestic	400 kHz
Transponder bandwidth, International	400 kHz

Transmit

Frequency, Domestic	1694.500 MHz
Frequency, International	1694.800 MHz
Power	4 W
Antenna	
Minimum EOC Gain	14.5 dBi ($\pm 9^\circ$)
Coverage	Earth
EIRP-Minimum EOL	46 dBmi

Data Collection Platform Interrogate (DCPI)

Transponder

Receive

Frequency, Spare	2034.8875 MHz
Frequency, East	2034.9000 MHz
Frequency, West	2034.9125 MHz
Minimum EOC antenna gain	10.1 dBi ($\pm 9^\circ$)
Minimum G/T	-17.2 dB/K
Dynamic range	-114 to -104 dBmi
Transponder bandwidth	25.4 kHz channel 200 Hz signal

Transmit

Frequency, Spare	468.8125 MHz
Frequency, East	468.8250 MHz
Frequency, West	468.8375 MHz
Power	4 W
Antenna	
Minimum EOC Gain	10.65 dBi ($\pm 9^\circ$)
Coverage	Earth
EIRP Minimum EOL	41.3 dBmi

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Processed Data Relay (PDR)

Receive

Frequency	2027.700 MHz
Minimum EOC antenna gain	13.1 dBi ($\pm 9^\circ$)
Minimum G/T	-17.2 dB/K
Dynamic range	-96 to -86 dBmi
Transponder bandwidth	4.22 MHz

Transmit

Frequency	1685.700 MHz
Power	35 W
Antenna	
Minimum EOC Gain	14.5 dBi ($\pm 9^\circ$)
Coverage	Earth
EIRP Minimum EOL	55.5 dBmi

Multi-use Data Link (MDL)

Transmit

Transmission signal bandwidth	400 kHz
Frequency	1681.478 MHz
Power	8 W
Antenna	
Minimum EOC Gain	14.5 dBi
Coverage	Earth
EIRP-Minimum EOL	47.9 dBmi

Sensor Data

Transmit

Transmission signal bandwidth	5.24 MHz – Imager 80 kHz - Sounder
Frequency	1676.000 MHz
Power	5 W
Antenna	
Minimum EOC Gain	14.5 dBi
Coverage	Earth
EIRP-Minimum EOL	47.5 dBmi

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Search and Rescue (SAR)

Receive

Frequency, wideband mode	406.050 MHz
Frequency, narrowband mode	406.025 MHz
Minimum EOC antenna gain	10.65 dBi ($\pm 9^\circ$)
Minimum G/T	-19.2 dB/K
Dynamic range	Below noise to -125 dBmi

Transponder bandwidth:

Wide/narrowband mode	80/20 kHz
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Transmit

Frequency	1544.500 MHz
Power	3 W
Antenna	
Minimum EOC Gain	14.6 dBi ($\pm 9^\circ$)
Coverage	Earth

EIRP-Minimum EOL	45.0 dBmi
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Weather Facsimile/Low Rate Information Transmission (WEFAX/LRIT)

Receive

Frequency	2033.000 MHz
Minimum EOC antenna gain	13.1 dBi ($\pm 9^\circ$)
Minimum G/T	-17.2 dB/K
Dynamic range	-107 to -97 dBmi

Transponder bandwidth	586 kHz
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Transmit

Frequency	1691.000 MHz
Power	9 W
Antenna	
Minimum EOC Gain	14.5 dBi ($\pm 9^\circ$)
Coverage	Earth

EIRP-Minimum EOL	48.2 dBmi
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Emergency Managers Weather Information Network (EMWIN)

Receive

Frequency	2034.700 MHz
Minimum EOC antenna gain	13.1 dBi
Minimum G/T	-17.2 dB/K
Dynamic range	-114 to -104 dBmi
Transponder bandwidth	50 kHz

Transmit

Frequency	1692.700 MHz
Power	3 W
Antenna	
Minimum EOC Gain	14.5 dBi
Coverage	Earth
EIRP Minimum EOL	43.2 dBmi

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 (GOES-N), 4 km (GOES O-P)
Longwave 1/HgCdTe	4 km
Longwave 2/HgCdTe	4 km
Radiometric calibration	Space and internal blackbody
Signal quantizing	10 bits all channels
Frequency of calibration	
Space Look	2.2 sec for full disk; 9.2 or 36.6 sec for sector/area
Infrared Blackbody	10 minutes (Auto BB Cal), 30 minutes typical on-orbit operation
System absolute accuracy	IR channel $\leq 1K$ Visible channel 5% of maximum scene irradiance
System relative accuracy	IR channel $\leq 0.1 K$

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Sounder Instrument

Field of view defining element	Field stop
Channel definition	Interference filters
19 Channels	
Longwave IR	7: 14.71–12.02 μm
Midwave IR	5: 11.03–6.51 μm
Shortwave IR	6: 4.57–3.74 μm
Visible	1 at 0.70 μm
Scan capability	Full earth and space
Frequency of calibration	
Space Look	2 minutes
Infrared Blackbody	20 minutes (Auto BB Cal), 30 minutes typical on-orbit operation
Nominal IGFOV	242 μrad , all channels
Sounding areas	10 \times 10 km 60° N-S and 60° E-W
Sounding period of 19 channels	100 ms
Sounding duration	all channels within 75 ms
North-south step size	1120 μrad
East-west step size	280 μrad
Signal quantizing	13 bits all channels
System absolute accuracy	IR channel \leq 1 K
System relative accuracy	IR channel \leq 0.1 K

Imager/Sounder Image Navigation and Registration (INR)

Imager Normal Operations Performance, μrad , 3σ

	<u>E-W</u>	<u>N-S</u>
Navigation	65*	65*
Within-frame registration (25 min)	54	54
Line-line shear (excluding Imager servo)	20	20
Frame-frame registration		
15 min	36	36
90 min	49	49
24 hr	114	114

* equivalent to 2 km ground resolution at nadir

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Sounder Normal Operations Performance, μrad , 3σ

	<u>E-W</u>	<u>N-S</u>
Navigation	280*	280*
Within-frame registration (120 min)	84	84
Frame-frame registration		
90 min	84	84
24 hr	224	224

* equivalent to 10 km ground resolution at nadir

Earth Coverage

Full performance	0° to 65° earth central angle (ECA)
INR supported with reduced performance	65° to 70° ECA

Extended Operational Coverage

INR supported with reduced performance

- Post station keeping period
- Eclipse period
- Post yaw flip period

Additional Key INR Features

- Fixed gridding or dynamic gridding modes selectable independently for Imager and Sounder
- INR data available within 3 minutes
- Housekeeping interruptions: Max 2 per day at 10 minutes
- Stationkeeping recovery E/W, immediate recovery N/S. Full performance within 6 hours
- Orbit box: Full performance over ± 0.5 E-W x $\pm 0.5^\circ$ N-S
- INR system does not degrade instrument channel-channel registration
- INR diagnostic data provided

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Solar X-ray Imager

<i>SXI Parameter</i>		<i>Performance</i>
Imaging exposure times		
Solar flare sites		<10 ms
Active regions		<100 ms
Coronal loops		<1 sec
Coronal hole boundaries		<10 sec
Spacecraft SXI boresight pointing (to center of solar disk)		Within 3 arc minute elevation, within 3.5 arc minute azimuth
Field of view		42 by 42 arc minute
Pixel size		5 by 5 arc second, square pixels
Spectral sensitivity (integration time 100 ms)		
Spectral band	Source	Minimum detectable photon radiance incident on the telescope entrance (photon cm ⁻² arc second ⁻² sec ⁻¹)
6 to 20 Å	Cu (13.3 Å)	85
6 to 60 Å	C (44.7 Å)	132
Dynamic range		1000 when measured with monochromatic illumination at 44.7 Å
Telemetry amplitude digitization		12 bits (linear or logarithmic channels)
Enpixeled energy	13.3 Å (Cu)	44.7 Å (C)
On axis		29%
10 arc minutes off axis		32%
20 arc minutes off axis		52%
Resolution		7 arc seconds (full width half max)
SXI on-orbit useful life		3 years with a goal of 5 years (after 5 years ground storage)

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Space Environment Monitor (SEM)

Magnetometer

Function	Measure ambient magnetic field to ± 1 nT
Sensor element	Fluxgate probe
Sensor assembly	Redundant magnetometers, 3 orthogonal fluxgate probes each mounted on 8.5 m boom
Dynamic range	± 512 nT, any orientation
Resolution	0.03 nT
Sampling rate	Once every 0.512 sec

Solar X-ray sensor (XRS)

Function	Measure solar x-ray in 2 bands
Spectral bands	0.05–0.3 and 0.1–0.8 nm
Resolution: Fluxes	
>20 times threshold	$\leq 2\%$ of reading
Sampling rate	Once every 2.048 sec

Extreme Ultraviolet Sensor (EUV)

Function	Measure solar ultraviolet in 5 bands
Spectral band	5 from 5 to 127 nm
Resolution	0.25 percent, full scale
Sampling rate	3 times every 32.768 sec

Energetic Particles Sensor (EPS)

Function	Measure flux of proton, alpha particles and electrons in 26 energy bands from 0.03 to 500 MeV
Sensor elements	Solid state nuclear detectors
Sensor assemblies	2 EPEADs, 1 MAGED, 1 MAGPD
Sampling rate	Once every 8.2 to 32.8 sec
Dynamic range	From typical particle background levels to largest likely event levels

High Energy Proton and Alpha Particle Detector (HEPAD)

Function	Measure flux of protons and alpha particles from 330 to >3400 MeV in six energy bands
Spectral bands	
Protons	4 from 330 to >700 MeV
Alpha particles	2 from 2560 to >3400 MeV
Sensor assembly	2 solid state detectors in telescope arrangement with fused silica Cerenkov radiation/PMT detector
Field of view	Conical, $\sim 34^\circ$ half angle
Dynamic range	From typical particle background levels to largest likely event levels