National Polar-orbiting Operational Environmental Satellite System Satellites Support Demanding Operational Requirements

NPOESS
Northrop Grumman · Raytheon · DOC • DoD • NASA

Overall Satellite

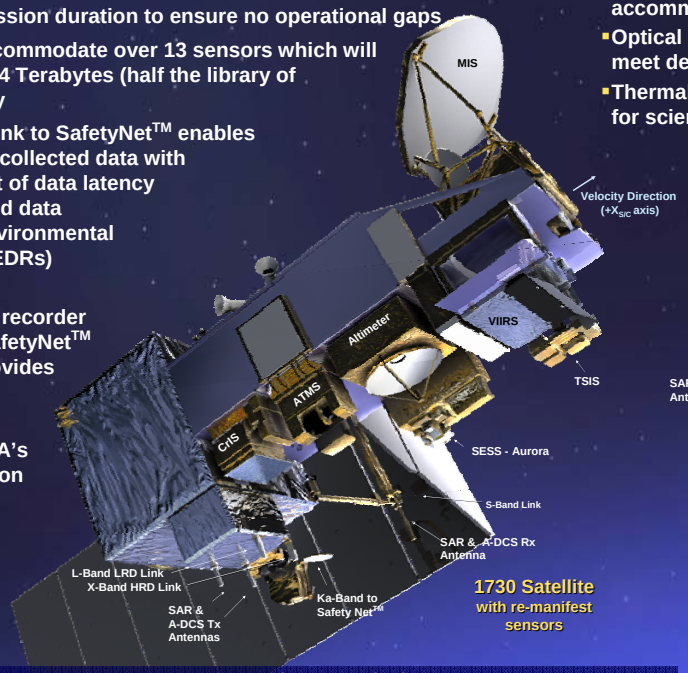
- Orbit: 828 km with C1 ascending node crossing at 13:30 and C2 ascending node crossing at 17:30
- 7-year mean mission duration to ensure no operational gaps
- Designed to accommodate over 13 sensors which will produce over 5.4 Terabytes (half the library of Congress) a day
- Ka-Band downlink to SafetyNet™ enables down link of all collected data with 4x improvement of data latency (95% of collected data delivered as Environmental Data Records (EDRs) in 28 min)
- Large on-board recorder capacity and SafetyNet™ architecture provides 99.99% data availability
- Leverages NASA's Earth Observation Satellite (EOS) heritage and experience

Spacecraft designed for earth observation missions

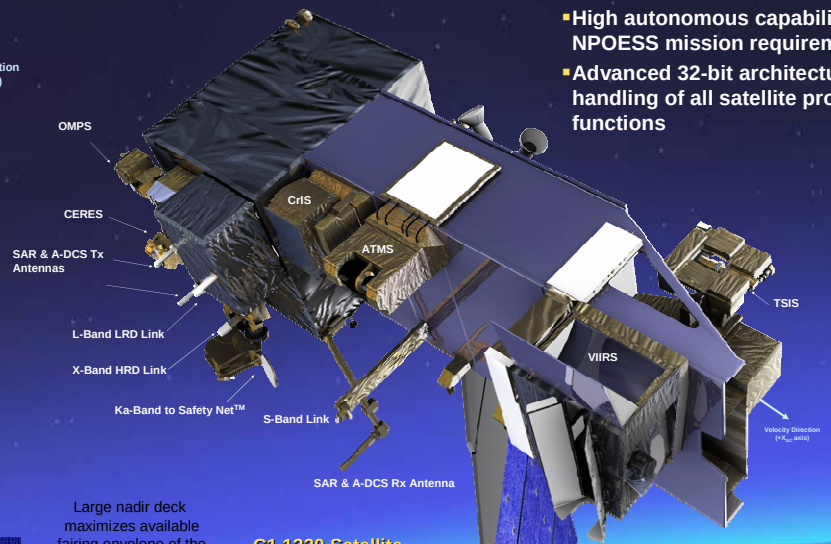
- Large nadir platform for maximum payload accommodation in the EELV launch vehicle
- Optical bench stability to ensure all sensors meet demanding pointing requirements
- Thermally optimized with large cold-side access for science payloads

Plug and play avionics architecture

- Accommodates 1553, 1394, unique and emerging payload interfaces
- 1553 and 1394 data ports available for future additional sensors
- On-board compression and data selection enables VIIRS imagery and CrIS sounding data to low rate data (LRD) field users
- High autonomous capability satisfies NPOESS mission requirements
- Advanced 32-bit architecture enables handling of all satellite processing functions



1730 Satellite with re-manifest sensors



C1 1330 Satellite
(note that C3 will have MIS)

Large nadir deck maximizes available fairing envelope of the 4 meter EELV launch vehicles.

NPOESS Sensor Characteristics

CrIS Instrument (ITT)
Cross-track Infrared Sounder
Fourier Transform Spectrometer providing high resolution Infra Red spectra that, with ATMS, provides atmospheric temperature, moisture, and pressure profiles

VIIRS Instrument (Raytheon)
Visible/Infrared Imager / Radiometer Suite
Collects visible/infrared imagery and radiometric data. Data types include atmospheric, clouds, clear-air landwater surfaces, sea surface temperature, ocean color, and low light visible imagery. Primary instrument for satisfying 22 EDRs.

OMPS Instrument (Ball)
Ozone Mapping & Profiler Suite
Will collect total column and vertical profile ozone data continuing collection currently performed by Solar Backscatter Ultraviolet radiometer (SBUV/2) and Total Ozone Mapping Spectrometer (TOMS)

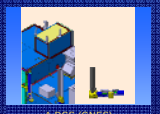
ATMS Instrument (NGES)
Advanced Technology Microwave Sounder
with CrIS provides atmospheric temperature, moisture, and pressure profiles

CERES Instrument (NGST)
Clouds and Earth's Radiant Energy System
Provides data on incoming and outgoing radiant energy

MIS Instrument (NRL)
Microwave Imager Sounder
Provides microwave imagery, soil moisture and sea surface winds

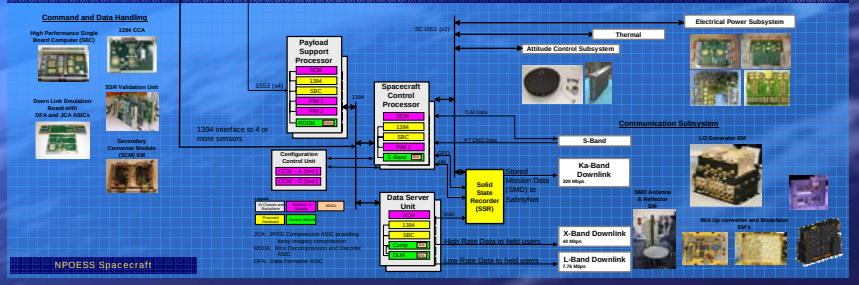
TSIS Instrument (LASP)
Total Solar Irradiance Sensor
Provides data on the amount of energy emitted by the Sun incident on Earth

SEM Instrument (JHU/APL)
Space Environment Monitor
Provides data on charged particles entering the Earth's atmosphere supporting space weather

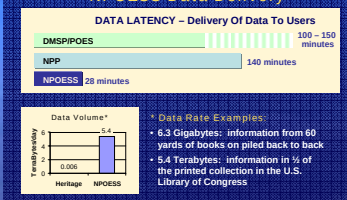


A-DCS (CNES)
Advanced Data Collection System
Monitors data from unmanned sites

SARR (DND) SARP (CNES)
Search and Rescue Repeater and Processor
Relays distress signals from mariners and aviators in distress



NPOESS Data Delivery

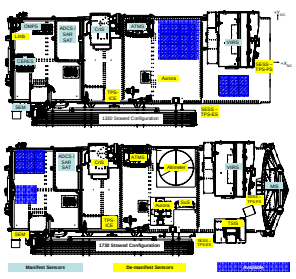


* Data Rate Examples
- 6.3 Gigabytes: information from 60 yards of books on piled back to back
- 5.4 Terabytes: information in ½ of the printed collection in the U.S. Library of Congress

NPOESS improves robustness, accuracy, and timeliness of delivery of essential weather and climate data

NPOESS Satellite Supports Planned and Future Sensors

- **New Sensor Accommodation Philosophy**
  - Available deck area identified for Pre-Planned Product Improvement (P³I) instrument accommodations shown in blue
  - To achieve a common spacecraft layout, area occupied by a payload in one orbit will not be used for spacecraft hardware in another orbit plane in which the payload does not fly
  - Currently these areas are identified as "unused" although more P³I area may actually be "available"
- **Resources reserved for P3I include:**
  - 326 watts (TBR)
  - 365 kg (TBR)
  - Up to 100 Kbps on a 1553 data interface and the potential for over 1 Mbps on the 1394 data interface for mission telemetry & command resources
  - Deck space
- Additions to the C2 1730 Satellite could be potentially accommodated with agreement reached by 2010 (TBD)
- Contact Stan Schneider at the IPO to for further information
  301 713-4800
  Stanley.Schneider@noaa.gov



C1 and C2 Sensor Manifest & Environmental Data Records

Sensor	C1 (1330)	C2 (1730)	EDR attributes
VIIRS	Manifest	Manifest	22
CrIS	Manifest	A	3 (with ATMS)
ATMS	Manifest	A	3 (with CrIS)
OMPS-Nadir	Manifest		1
MIS		Manifest	10*
CERES/ERBS	Manifest		4
SARSAT	Manifest	Manifest	NA
A-DCS	Manifest	Manifest	NA
SEM	Manifest	A	5
OMPS-Limb	A		1
TSIS	Manifest^	A	1
APS	A		4
ALT	TBD	A	2
SUS	A	A	NA
SESS	A	A	11

De-manifested
Not compatible with orbit
A: Accommodation - technically feasible
* Number of EDRs to be determined based on acquisition
^ TSIS added to the C1 manifest by contract
A: Accommodation and orbit compatibility under evaluation
TBD: Accommodation and orbit compatibility under evaluation

C3 and C4 Sensor Manifest & Environmental Data Records

Sensor	C3 (1330)	C4 (1730)	EDR attributes
VIIRS	Manifest	Manifest	22
CrIS	Manifest	A	3 (with ATMS)
ATMS	Manifest	A	3 (with CrIS)
OMPS-Nadir	Manifest		1
MIS	Manifest	Manifest	10*
CERES/ERBS	A		4
SARSAT	Manifest	Manifest	NA
A-DCS	Manifest	Manifest	NA
SEM	Manifest	A	5
OMPS-Limb	A		1
TSIS		A	1
APS	A		4
ALT		A	2
SUS	A	A	NA
SESS	A	A	11

Not compatible or sensor supported in other orbit

Mustufa Bahrain, Jim Morris, Stan Schneider: NPOESS IPO
MaryAnn Chory, Derrick Day, Jim Nelson, Michael Wehner, Andrea Yeiser, Rick Ohlemacher: Northrop Grumman Space Technology