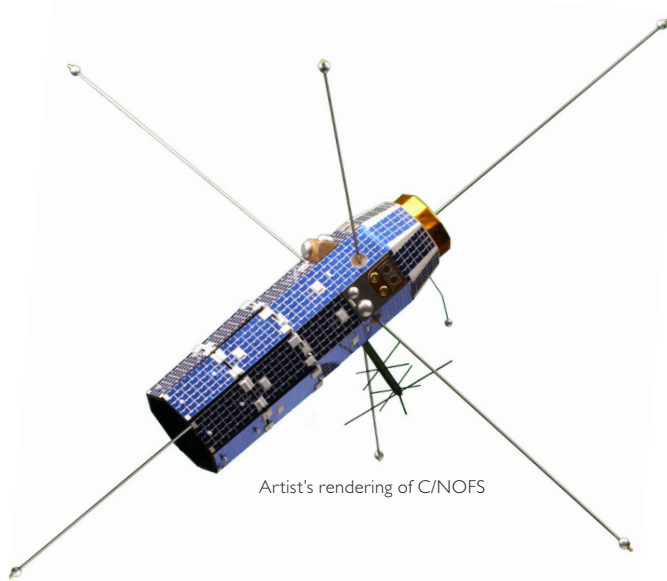




# C/NOFS

Ionospheric data remote sensor satellite



Artist's rendering of C/NOFS

## Mission Description

The Communication/Navigation Outage Forecasting System (C/NOFS) is a prototype of an operational system to forecast the ambient ionosphere and scintillations in the UHF band (300 - 3000 MHz) utilizing a spacecraft in Low-Earth Orbit (LEO). The spacecraft directly samples, measures, and stores ionospheric plasma and neutral atmosphere parameters; electric and magnetic fields data; and ionospheric scintillation data. The data is subsequently downlinked to the C/NOFS Data Center at Hanscom AFB, MA for processing.

Scintillations are caused by naturally occurring irregularities and lead to fluctuations in communication signals that decrease satellite-to-ground throughput and delay signal acquisition. C/NOFS' capture and delivery of scintillation data to Hanscom allows users to be alerted of impending UHF satellite link degradations that can affect services such as GPS, L-band satellite-based mobile telephones, L- and S-band satellite data links, and more.

The space weather data provided by C/NOFS better enables mission planners to optimize and tailor communications routes, paths, and/or priorities to make the most effective use of satellite communications, navigation, and surveillance assets.

## Spacecraft

Orbital was the space system integrator, designed and manufactured the spacecraft bus, and provided the Pegasus XL rocket. To enable the spacecraft to collect accurate data while flying highly sensitive instruments directly in the ionospheric plasma, extreme EMI/EMC and electrostatic surface-charge-control requirements were imposed. This resulted in unique design approaches, including shielding of all wiring harnesses, the shape and high level of electrical conductivity of the exterior, an extensive grounding system, and an electrostatically clean body-mounted solar array.

## QUICK FACTS:

- Launched April 16, 2008 on an Orbital Pegasus XL from Kwajalein, Marshall Islands
- 401 × 867 km, 13° inclination, Low Earth Orbit mission
- C/NOFS successfully completed its one-year mission in May 2009 and continues to perform after nearly three times its design life
- Six payload instruments collect sample data from near and within the ionospheric layer
- Spacecraft maintains extremely low electromagnetic emissions and electrostatic surface charge
- Simple, easily integrated design based on Orbital's flight-proven 300S modular spacecraft architecture that reduces assembly and test time
- Orbital was responsible for the entire space segment, including the Pegasus XL launch vehicle and associated integration and launch support

## Customers:

USAF SMC Space Development and Test Wing, Kirtland AFB, NM

The Air Force Research Laboratory Space Vehicles Directorate, Kirtland AFB, NM

USAF SMC Defense Weather Systems Directorate, LAAFB, CA



The C/NOFS spacecraft was designed, built, and tested at Orbital's 135,000 square foot satellite manufacturing and test facility in Gilbert, AZ

# Communication/Navigation Outage Forecasting System (C/NOFS)

## Specifications

### Spacecraft

Launch Mass:	383 kg (844 lbm)
Solar Arrays:	Body mounted, triple-junction GaAs cells, 329 W EOL, electrostatically clean
Orbit:	401 × 867 km @ 13° inclination
Stabilization:	3-axis, Pitch Momentum Bias
Pointing knowledge:	288 arcsec ( $3\sigma$ )
Data Storage:	4.0 Gbits
Data Downlink:	SGLS/AFSCN, 1024 kbps
Propulsion:	None
Mission Life:	1 year, 3 year goal
Current Status:	Operational

### Launch

Launch Vehicle:	Pegasus XL
Launch Site:	Reagan Test Site; Kwajalein, Marshall Islands
Date:	April 16, 2008

### Instruments

#### Plasma & Field Measurements:

Planar Langmuir Probe (PLP), Vector Electric Field Instrument (VEFI), and Ion Velocity Meter (IVM)

#### Neutral Atmospheric Measurements:

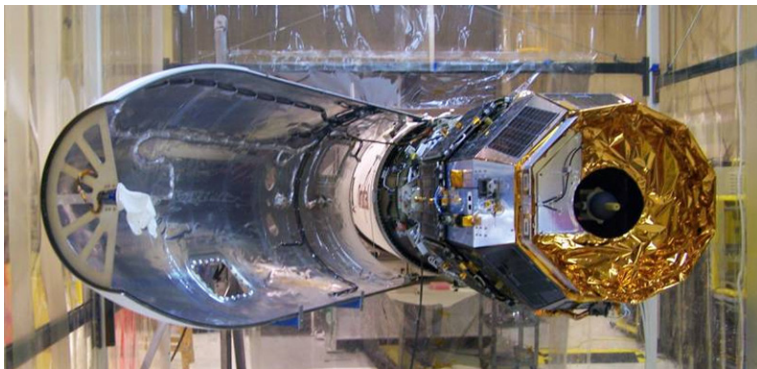
Neutral Wind Meter (NWM), includes ram wind sensor and cross-track sensor

#### Electron Density Profiles:

C/NOFS Occultation Receiver for Ionospheric Sensing and Specification (CORISS)

#### Scintillation Measurements:

Coherent Electromagnetic Radio Tomography (CERTO) radio beacon



C/NOFS integrated with Orbital's Pegasus XL launch vehicle



C/NOFS being readied for thermal vacuum testing at Orbital

## Key Mission Partners

### Orbital Sciences Corporation

Prime contractor and system integrator responsible for spacecraft bus design and manufacture, payload integration, and system test; Pegasus XL rocket; spacecraft integration with launch vehicle; launch support; and ongoing operations support

### USAF SMC Space Development and Test Wing:

Procuring agency, customer program management, initial operator of satellite on-orbit

### AFRL Space Vehicles Directorate, Kirtland AFB:

Developed the PLP instrument, assisted in PL suite integration, managing agency of Hanscom Data Center

### AFRL C/NOFS Data Center, Hanscom AFB:

Instrument data processing

### University of Texas at Dallas:

Developed the IVM and NWM instruments

### Naval Research Laboratory:

Developed the CERTO instrument

### Aerospace Corporation:

Developed the CORISS instrument

### NASA Goddard Space Flight Center:

Developed the VEFI instrument

### USAF SMC Defense Weather Systems Directorate:

On-orbit operator