NOAA Satellite and Information Service
Deep Space Climate Observatory (DSCOVR)

Background:
DSCOVR will maintain the Nation's solar wind observations, which are critical to maintaining the accuracy and lead time of NOAA's space weather alerts and forecasts. DSCOVR is a partnership between NOAA, NASA and the U.S. Air Force (USAF). DSCOVR will succeed NASA's Advanced Composition Explorer (ACE). ACE is the only current satellite providing real-time solar wind observations from the L1 orbit (Lagrangian point 1, approximately 1 million miles away from Earth), and it is well past its design life. NOAA and its partners completed development and launch DSCOVR February 11, 2015.

DSCOVR (formerly known as Triana) was originally conceived in the late 1990s as a NASA Earth science mission that would provide a near continuous view of Earth and measure Earth's complete albedo. The mission was canceled and the satellite was put into storage in 2001. NOAA and the USAF had DSCOVR removed from storage and tested in 2008, and the same year the Committee on Space Environmental Sensor Mitigation Options (CSESMO) determined that DSCOVR was the optimal solution for meeting NOAA and USAF space weather requirements.

Applications:
Solar wind observations are the only data source to support 15 to 60 minute lead time for geomagnetic storm warnings. Without timely and accurate alerts and warnings, space weather has demonstrated the potential to disrupt virtually every major public infrastructure system, including transportation systems, power grids, telecommunications and GPS. NOAA will provide these critical services by supplying geomagnetic storm warnings to support key industries such as the commercial airline, electric power and GPS industries.

Program-at-a-Glance

Lifecycle Cost: $141M (NOAA's share through FY2022)
Launch Date: February 11, 2015
Launch Vehicle: SpaceX Falcon 9 v 1.1 launch vehicle
Orbit: L1 (Lagrangian point 1) orbit
Mission Life: 5 yrs planned
Key Partners: NASA (Spacecraft), USAF (Launch Vehicle)
Key Staff:
Mike Simpson, Program Mgr
Pat Mulligan, Deputy Program Mgr
Office Location: Silver Spring, MD

Website:
http://www.nesdis.noaa.gov/DSCOVR/

Our national security and economic well-being, which depend on advanced technologies, are at significant risk without accurate advanced warnings of impending geomagnetic storms. Aircraft that fly polar routes now include space weather as an integral part of pilots' weather pre-briefs, which provide the current status of the flight environment including potential impacts to critical communication and navigation systems, and the potential for hazardous solar radiation exposure. The Nation's advanced technology service providers will be looking to NOAA for the alerts, watches and warnings needed to protect lives and livelihood and to ensure continuity of critical operations.

According to a recent report by the National Academies,[1] geomagnetic storm-disabled electric power grids and collateral impacts could result in projected economic and societal costs of up to $1 to $2 trillion per extremely large storm, and full recovery could take 4 to 10 years. Precision GPS-enhanced

[1] *Severe Space Weather Events – Understanding Societal and Economic Impacts*, National Research Council 2009.

agriculture is an $8 billion per year enterprise, and the Next Generation Air Transportation System is based entirely on GPS-enabled positioning, navigation and timing, which is susceptible to geomagnetic storms.

Observational Gap and Mitigation:
DSCOVR is expected to succeed NASA's ACE satellite, which was launched in 1997 and is well beyond its expected life. NOAA will continue to rely on ACE as long as possible, but if ACE fails before DSCOVR is launched, there will be a gap in solar wind observations.

Space Segment Details:
DSCOVR was originally built in the 1990s and was kept in storage at the NASA Goddard Space Flight Center until 2008 when it was removed for testing and subsequent refurbishment. DSCOVR will be approximately 750kg at launch and has dimensions of 54 inches by 72 inches. It will carry the following instruments:

Instrument	Measurement	Responsible Agency
Solar Wind Plasma Sensor (Faraday Cup) and Magnetometer (MAG) (PlasMag)	Measures solar wind velocity distribution and the magnitude and direction of the solar wind magnetic field to provide rapid warning of geomagnetic storms	NOAA
National Institute of Standards and Technology Advanced Radiometer (NISTAR)	Measures whole absolute irradiance integrated over the sunlit face of Earth for climate science applications	NASA
Earth Polychromatic Imaging Camera (EPIC)	Provides images of the sunlit side of Earth for science applications such as ozone, aerosols and clouds	NASA
Electron Spectrometer (ES)	Provides high temporal resolution (< 1 sec) solar wind observations.	NASA
Pulse Height Analyzer (PHA)	Provides real-time measurements of particle events that may impact DSCOVR's electronics	NASA

NOAA had planned to contract with the Naval Research Laboratory to build a coronal mass ejection (CME) imager (named compact coronagraph [CCOR]) for integration onto DSCOVR. However, because of a lack of timely funding in FY 2011, it was not possible for CME CCOR to be included in the DSCOVR mission in time to meet a FY 2014 launch date. In consultation with the NOAA Space Weather Prediction Center, NOAA decided it was more important to have PlasMag space weather capabilities (for solar wind observations) on orbit in 2014 than to delay the launch of DSCOVR to integrate the CME CCOR.

Ground Segment Details:
NOAA will operate DSCOVR from its NOAA Satellite Operations Facility in Suitland, Maryland and distribute the data to its users and partner agencies. NOAA will process the space weather data, providing products and forecasts through the NOAA Space Weather Prediction Center in Boulder, Colorado, and archive the data at the NOAA National Geophysical Data Center in Boulder, Colorado. NASA is responsible for processing the Earth sensor data.

Acquisition Details:
NOAA is responsible for the DSCOVR mission, providing program management, operating the spacecraft and distributing all mission data. NOAA is funding NASA to refurbish the spacecraft and space weather

sensors and to provide technical management of the space segment. NASA is funding the refurbishment of the Earth science instruments and supports the analysis of their data. The USAF will provide the launch vehicle through their launch services contract with SpaceX.

Key Milestones:

FY 2012:

- Release RFPs forspacecraft components
- Refurbish spacecraft
- Recalibrate sensors

FY 2013:

- Sensors delivered to spacecraft

FY 2014:

- Environmental testing

FY 2015:

- Pre-ship review
- Ship spacecraft to Cape Canaveral, Florida
- Integrate to launch vehicle
- Launch DSCOVR
- Check-out and transition operations

FY 2016

- Handover spacecraft operations to NOAA
- SWPC geomagnetic storm products transition from ACE to DSCOVR data
- Operations continue"