

Delta II

# NPP

NPOESS Preparatory Project

**Delta II NPP** | Mission Overview  
Vandenberg Air Force Base, CA





United Launch Alliance (ULA) is proud to launch the NPOESS Preparatory Project (NPP) mission. The Delta II will deliver the NPP spacecraft into a polar earth orbit, where it will begin its mission to create a next-generation U.S. climate and weather monitoring system.

NPP is the fourth of five critical missions ULA is scheduled to launch for NASA in 2011. These missions will address important questions of science — ranging from climate and weather on planet earth to life on other planets and the origins of the solar system. We are delighted that NASA has chosen the Delta II for this mission developed by the Goddard Space Flight Center (GSFC) and manufactured by the Ball Aerospace and Technology Corporation.

ULA is focused on attaining Perfect Product Delivery for the NPP mission, which includes a relentless focus on mission success (the perfect product) one launch at a time, and also excellence and continuous improvement in meeting all of the needs of our customers (the perfect delivery).

I congratulate the entire ULA team and our mission partners for their significant efforts in bringing NPP to launch.

Go Delta, Go NPP!

A handwritten signature in black ink, appearing to read 'J. Spornick'.

**Jim Spornick**  
Vice President,  
Mission Operations

## NPP SPACECRAFT | Overview

The National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project represents a critical first step in building the next-generation satellite system. Goddard Space Flight Center is leading NASA's effort to launch a satellite that will carry the first of the new sensors developed for the next-generation system, previously called the National Polar-orbiting Operational Environmental Satellite System (NPOESS) and now the restructured Joint Polar Satellite System (JPSS), whose first satellite is scheduled in 2015.

The NPP spacecraft bus is the eighth of 11 spacecraft built on the same BCP 2000 core architecture. In all, this architecture has more than 50 years of successful on-orbit operations. The BCP 2000 was designed to accommodate a wide variety of Earth-observing payloads that require precision pointing control, flexible high-data throughput and downlinks, and controlled re-entry. The NPP spacecraft incorporates both MIL-STD-1553 and IEEE 1394 (FireWire) data networks to support the payload suite.

Under contract to NASA's Goddard Space Flight Center, Ball Aerospace designed and built the spacecraft bus, and is responsible for integrating the instruments and for performing satellite-level testing and launch support. The bus was completed in 2005, and has since undergone extensive risk reduction testing. All five instruments have been integrated to the spacecraft.

This satellite is the gateway to the creation of a U.S. climate monitoring system, blending climate and weather data, and will continue key data records critical for climate change science.



Image Courtesy of Ball Aerospace

## DELTA II 7920-10C LAUNCH VEHICLE | Overview

The Delta II vehicle will launch the NPP spacecraft from Space Launch Complex 2 West (SLC-2W) at Vandenberg Air Force Base down an initial flight azimuth of 196° from true north.

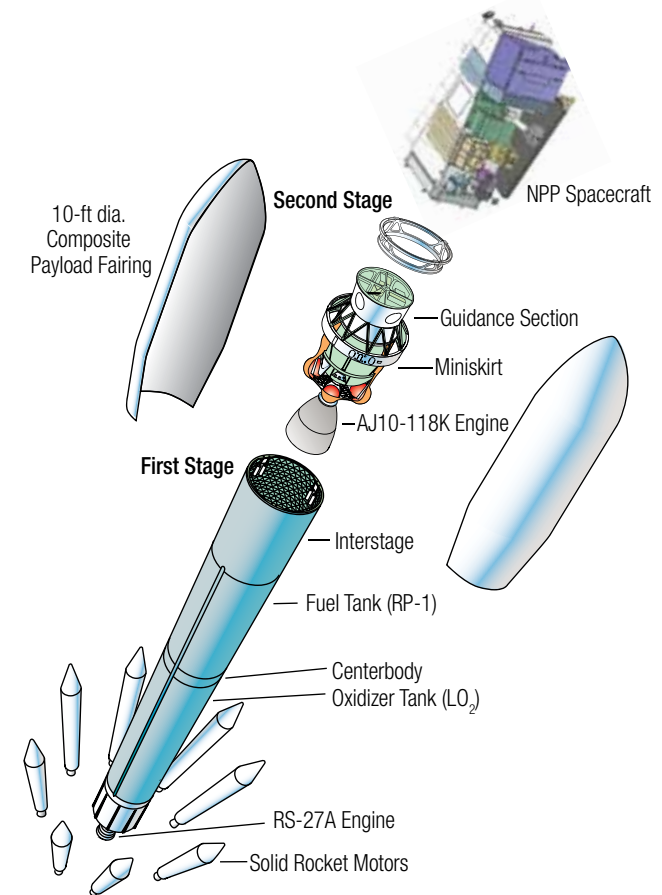
Six solid rocket motors (SRM) are lit on the ground and burn for approximately 64.0 seconds. Jettison occurs at 86.0 seconds after launch in order to satisfy range safety trajectory shaping constraints. Three air-lit SRMs are ignited at 65.5 seconds, burn until 130 seconds and are jettisoned 2 seconds after burnout.

Main engine cutoff (MECO) occurs 263.4 seconds after liftoff when booster propellants are depleted. First stage separation follows 8 seconds later with second stage ignition occurring at 276.9 seconds. Payload fairing jettison occurs at 280 seconds when the free molecular heating rate has dropped below 0.1 BTU/ft<sup>2</sup>-sec (1135 W/m<sup>2</sup>).

Following the first cut-off of the second-stage engine (SECO-1) at 623.7 seconds, the second stage performs an attitude reorientation maneuver and begins a thermal conditioning roll. Upon completion of the thermal conditioning roll a maneuver is performed to orientate the second stage to the correct attitude for the first restart.

Following the first restart, the second stage is re-oriented to the desired attitude for spacecraft separation, which occurs at 3,525 seconds in view of the TDRS satellites for telemetry coverage. Spacecraft separation ends the primary portion of this Delta II mission at just short of 59 minutes after liftoff.

## DELTA II 7920-10C LAUNCH VEHICLE | Expanded View



## SLC-2W | Overview

- 1 Mobile Service Tower (MST)
- 2 Launch Vehicle
- 3 Fixed Umbilical Tower (FUT)



# Delta II NPP

## DELTA II NPP | Mission Overview

NPP will carry a diverse payload of scientific instruments to perform atmospheric temperature and moisture sounding, cloud imaging, sea surface temperature measurements, as well as measurements of ozone, land and ocean biological productivity, aerosol concentrations, and climate system radiation balance.

Data from NPP will be distributed to meteorologists at the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Defense (DOD), as well as to climate researchers around the globe. Many of NPP's measurements continue long-term climate data records from existing Earth-observing missions such as Terra, Aqua and Aura.

By flying a suite of new, advanced-technology remote sensing instruments, the NPP mission will continue critical weather and climate measurements and reduce risk for the next-generation meteorological satellite system. The measurements taken by NPP will provide critical data to support operational weather forecasting, as well as long-term climate research.

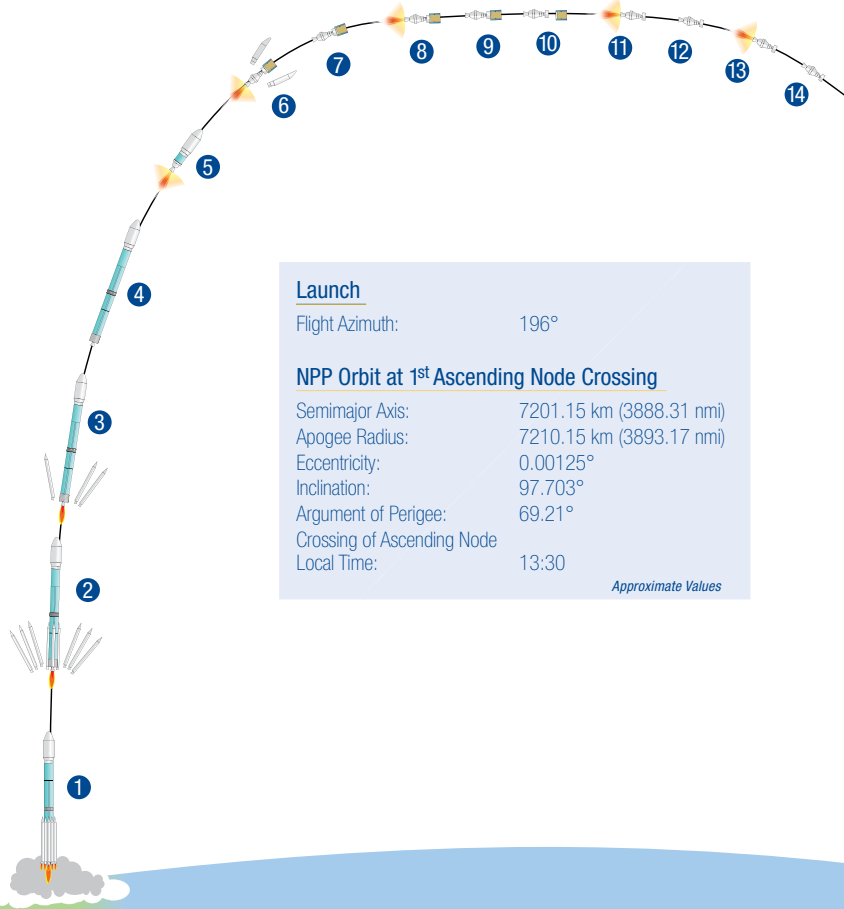
NPP's five-year mission duration will help to bridge critical weather data collection requirements until the Joint Polar Satellite System (JPSS), managed by the (NOAA), is launched in 2015.

The five instruments manifested for flight on the NPP spacecraft trace their heritage to instruments on NASA's Terra, Aqua and Aura missions, on NOAA's Polar Operational Environmental Satellite (POES) spacecraft, and on the DOD's Defense Meteorological Satellite Program (DMSP). These instruments are:

- Visible/Infrared Imager Radiometer Suite (VIIRS)
- Cross-track Infrared Sounder (CrIS)
- Advanced Technology Microwave Sounder (ATMS)
- Ozone Mapping and Profiler Suite (OMPS)
- Clouds and Earth Radiant Energy System (CERES)

The NPP spacecraft was built for the NASA Goddard Space Flight Center by the Ball Aerospace and Technologies Corporation of Boulder, CO.

## FLIGHT PROFILE | Liftoff to Spacecraft Separation

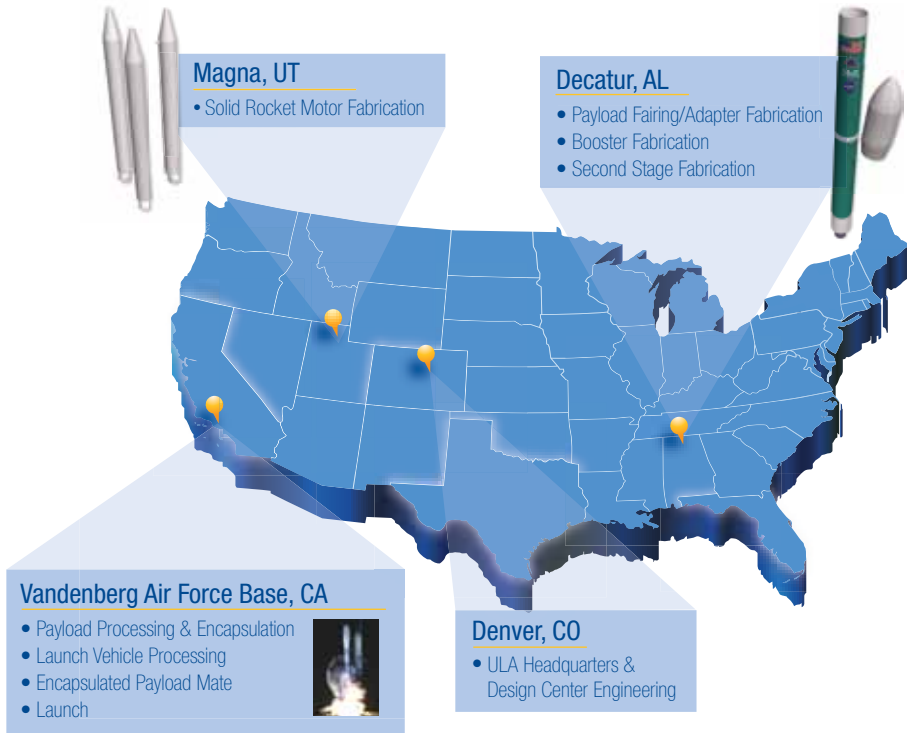


## SEQUENCE OF EVENTS | Liftoff to Spacecraft Separation

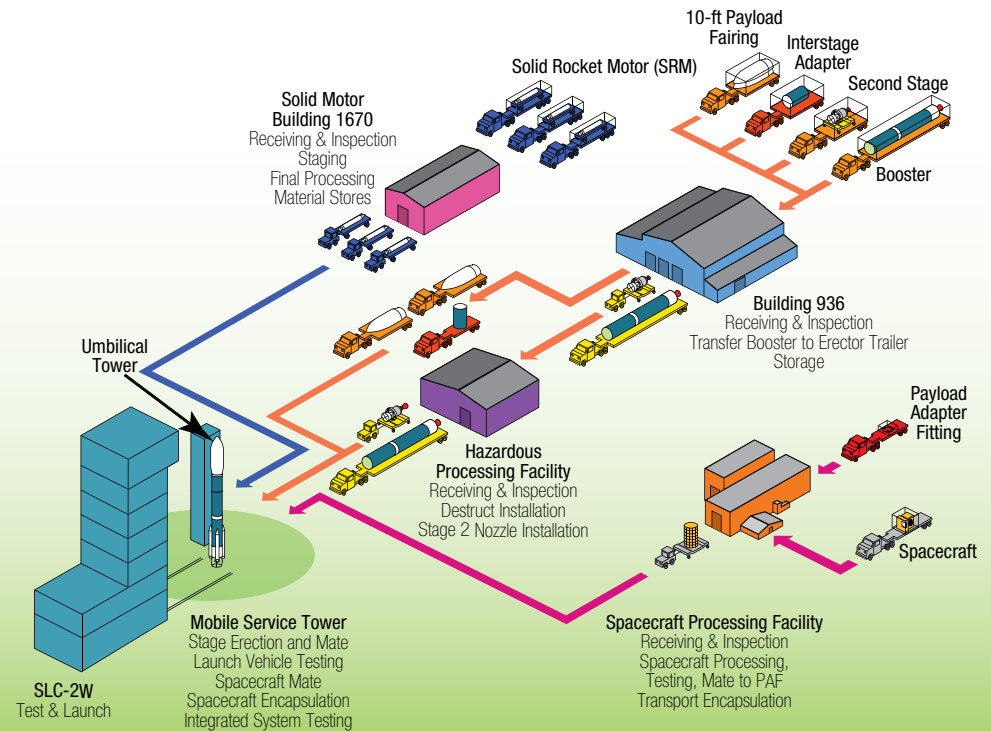
	Event	Time (seconds)	Time (hr:min:sec)
1	Liftoff	0.0	0:00:00.0
2	Ground-lit SRM Jettison (6)	86.0	0:01:26.0
3	Air-lit SRM Jettison (3)	131.5	0:02:11.5
4	Main Engine Cutoff (MECO)	263.4	0:04:23.4
5	Second-Stage Ignition	276.9	0:04:36.9
6	Payload Fairing Jettison	281.0	0:04:41.0
7	First Cutoff—Second Stage (SECO-1)	623.7	0:10:23.7
8	First Restart—Second Stage	3125.0	0:52:05.0
9	Second Cutoff—Second Stage (SECO-2)	3146.7	0:52:26.7
10	NPP Separation	3525.0	0:58:45.0
11	Second Restart—Second Stage	5550.0	1:32:30.0
12	SECO-3	5589.2	1:33:09.2
13	Third Restart—Second Stage	6898.6	1:54:58.6
14	SECO-4	6930.5	1:55:30.5

*All Times Approximate*

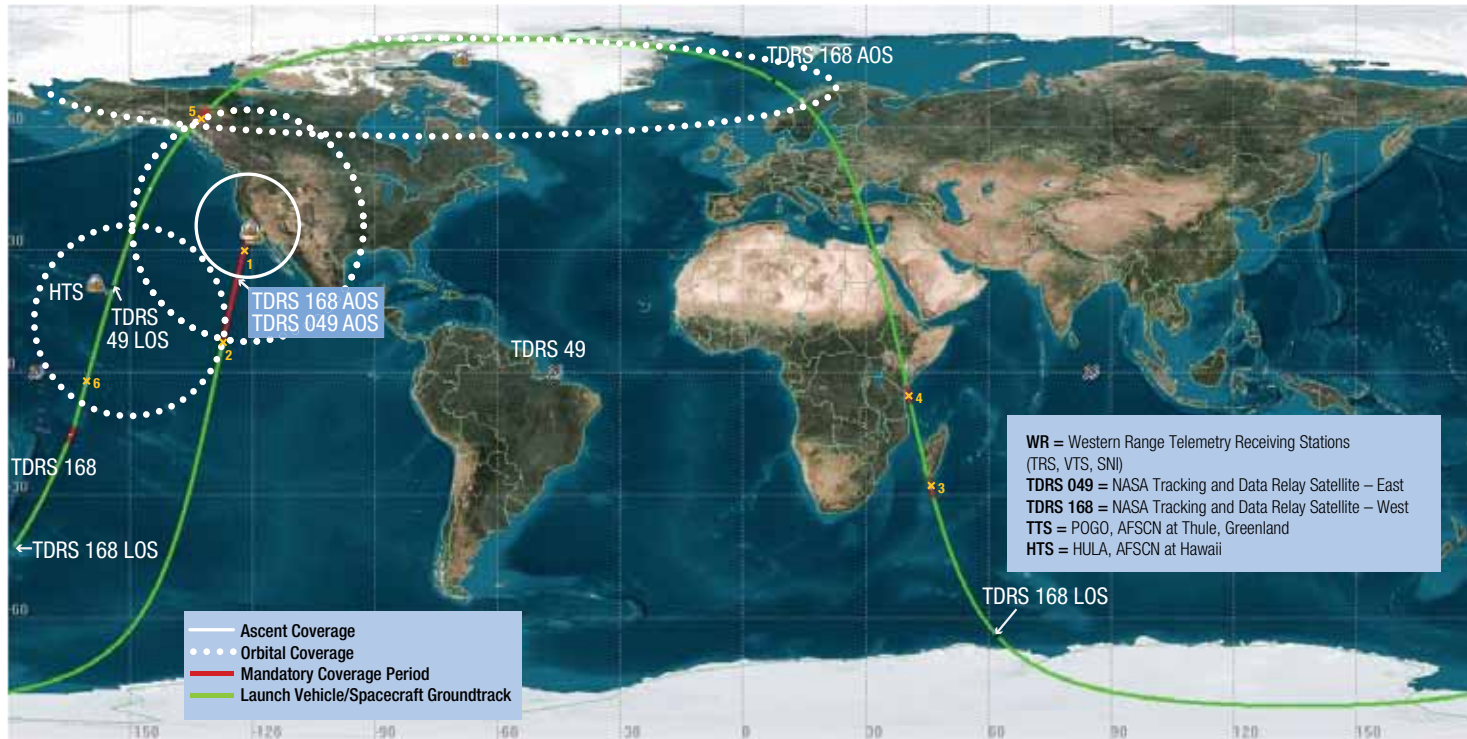
## DELTA II PRODUCTION & LAUNCH | Overview



## DELTA II PROCESSING | Vandenberg



## GROUND TRACE | Liftoff to Spacecraft Separation

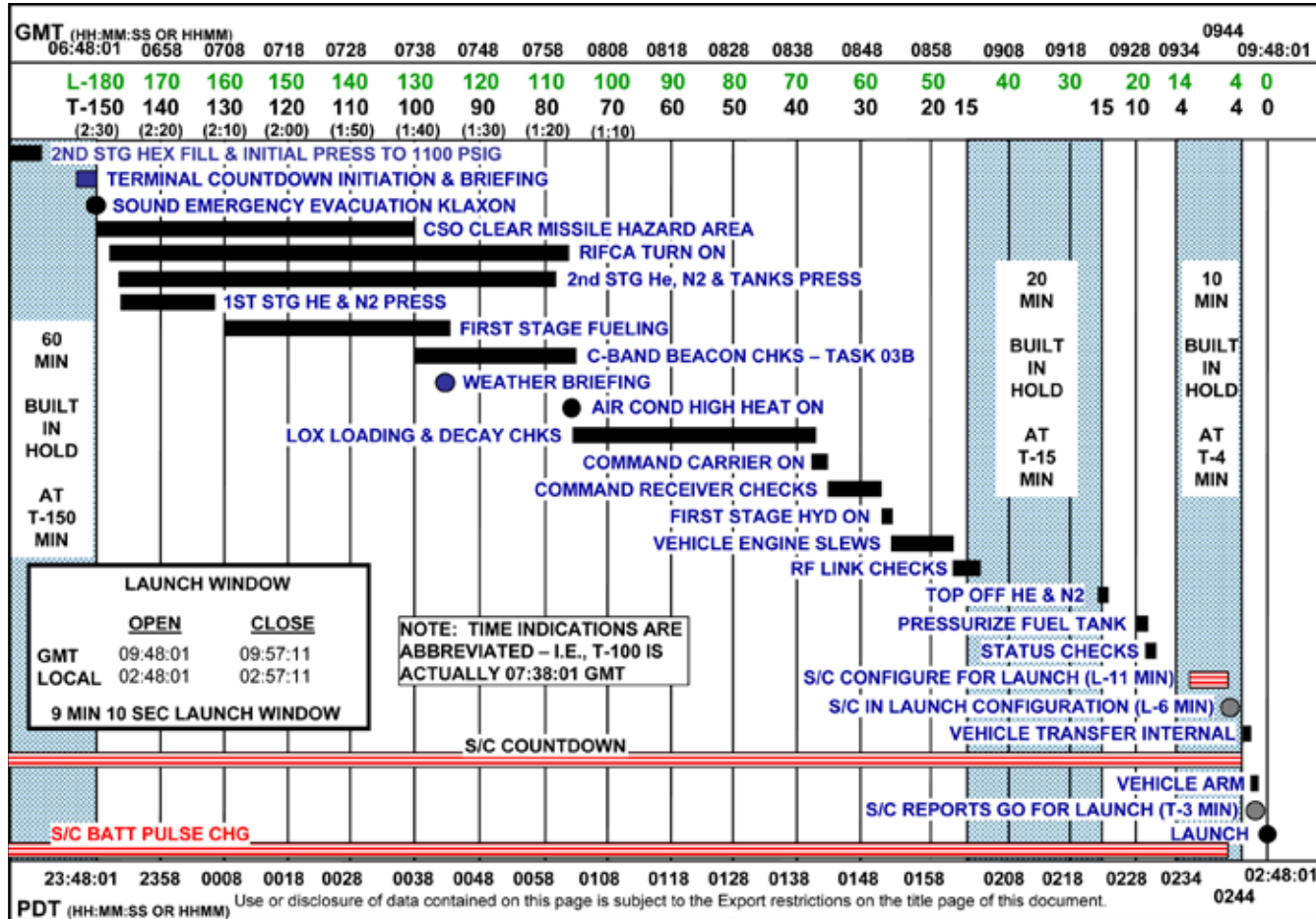


*All Times Approximate*

**1** = MECO (04:38.4) | **2** = SECO-1 (10:23.7) | **3** = Second Stage—Burn 2 (52:05.0 to 52:26.7) | **4** = Spacecraft Separation (58:45.0)  
**5** = Second Stage—Evasive Burn (01:32:30.0 to 01:33:09.2) | **6** = Second Stage—Depletion Burn (01:54:58.6 to 01:55:30.5)



# COUNTDOWN TIMELINE | Launch Day



All Times Approximate

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United Launch Alliance | P. O. Box 3788 Englewood, CO 80155 | [www.ulalaunch.com](http://www.ulalaunch.com)

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