Under the joint NASA/Northrop Grumman Commercial Orbital Transportation Services (COTS) program, Northrop Grumman developed the Cygnus™ advanced maneuvering space vehicle, to deliver cargo to the International Space Station (ISS). In addition, Northrop Grumman privately developed the Antares™ launch vehicle, to provide low cost access to space for medium-class payloads.

With the successful completion of the COTS program in September 2013, Northrop Grumman commenced cargo resupply flights to the ISS under the Commercial Resupply Service (CRS) contract. This NASA contract authorizes eleven missions to carry approximately 30,000 kilograms of cargo to the ISS as well as disposal of space station waste. The first of these missions was successfully conducted in early 2014. Under the follow-on CRS contract, Northrop Grumman will provide at least 6 logistics serving missions carrying over 20,000 kg of cargo to the ISS.

Cygnus Advanced Maneuvering Spacecraft

The Cygnus spacecraft consists of a common service module and a modular pressurized cargo module. Based on the Multi-Purpose Logistics Module (MPLM), developed by Thales Alenia Space for the space station. After cargo for the station is loaded into the Cygnus spacecraft, it is launched into low-Earth orbit, and autonomously brings itself to the ISS. After maneuvering within 25 km of the station it is grappled by the robotic arm and berthed to the station. After the cargo is removed and any disposal items are added, Cygnus is steered to a safe destructive reentry over the Pacific Ocean.

Mission Partners

Northrop Grumman
Prime contractor and operator of the CRS program; Cygnus spacecraft mission and cargo operations, Antares launch vehicle

Thales Alenia Space - Italia
Pressurized Cargo Module

L-3 Cincinnati Electronics
Communications

Jena - Optronik
Rendezvous Sensing

Neptec Design Group
Rendezvous Sensing

KB Yuzhnoye/Yuzhmash
Antares Stage 1 core tank design, production and verification

NPO Energomash
Antares Stage 1 engines
**Antares Medium-Class Space Launch Vehicle**
Antares is used to conduct International Station commercial resupply services as well as future NASA science and exploration, commercial and national security space missions. The Antares launch system utilizes Northrop Grumman's proven MACH avionics system and many management approaches, engineering standards, production and test processes common to Northrop Grumman's family of successful small-class Pegasus® and Minotaur launch vehicles.

**Atlas V Space Launch Vehicle**
On the OA-4, OA-6 and OA-7 missions, Cygnus was boosted into orbit by an Atlas V rocket. Atlas V flew in the 401 configuration with a standard common core booster™ powered by a single RD-180 engine, no strap-on solid rocket boosters, a single engine Centaur upper stage and a 4 meter payload fairing.

**Antares Launch Vehicle**
- Diameter: 3.9 m
- Height: 42.5 m
- Mass: 290,000 - 310,000 kg

**Stage 2**
- Northrop Grumman CASTOR® 30XL solid motor with thrust vectoring

**Stage 1**
- Two Energomash RD-181 engines each with independent thrust vectoring
- Liquid oxygen/kerosene fueled
- Northrop Grumman responsible for system development and integration
- Core tank design and design verification by KB Yuzhnoye (Zenit-derived heritage)
- Core tank production by Yuzhmash

**Cygnus Advanced Maneuvering Spacecraft**
- Service Module incorporating advanced avionics, solar arrays, propulsion, guidance and navigation, and software
- Pressurized Cargo Module
- 3.5 kW power output
- 3,750 kg total cargo mass capability

**Mission Operations**
Cygnus mission operations are managed from Northrop Grumman's state-of-the-art Mission Control Complex in Dulles, Virginia, in concert with NASA Johnson Space Center in Houston, Texas.

**More Information**
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