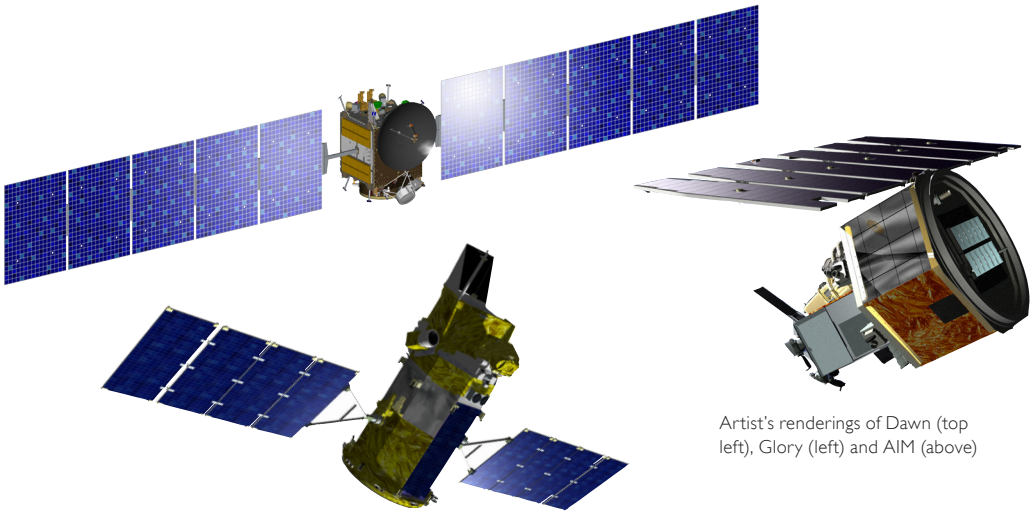
Orbital
Innovation You Can Count On™

FACT SHEET

LEOStar™

An affordable, versatile, small-to-medium size spacecraft bus suitable for SMEX, MIDEX, ESSP, and Discovery class missions. Compatible with launch vehicles such as Pegasus®, Taurus®, Minotaur, and Delta.



Artist's renderings of Dawn (top left), Glory (left) and AIM (above)

Orbital's LEOStar series of spacecraft have supported multiple missions for commercial and government customers over the past nine years. The current LEOStar product line has an enviable on-orbit performance record with five on-orbit and two more in production or awaiting launch.

Design

Originally designed for the Pegasus XL launch vehicle, Orbital's LEOStar-2 spacecraft bus provides a flexible, high performance platform for space and earth scientific, remote sensing, and other commercial applications on a variety of launch vehicles (Pegasus, Taurus, Minotaur, and Delta). The avionics architecture has been configured for both single-string and redundant applications, supporting missions with durations up to ten years. LEOStar-2 can accommodate various instrument interfaces, deliver up to 2 kW orbit average payload power, and support payloads up to 800 kg (1,764 lb.). Performance options include redundancy, propulsion capability, high data rate communications, and high-agility/high-accuracy pointing.

Payload Accommodations

The flexible LEOStar-2 spacecraft bus has been adapted to a variety of space science, remote sensing, and technology validation missions. The spacecraft employs a highly space-efficient avionics suite housed within a hexagonal bus platform, enabling Orbital to deliver a significant launch vehicle fairing volume allocation to support multiple instruments. Our modular approach to the spacecraft platform and instrument deck enables parallel integration and testing, reducing overall delivery schedule. With the LEOStar-2, Orbital has regularly delivered attitude control performance of less than 20 arc-seconds, with attitude knowledge less than 10 arc-seconds. Through the inclusion of higher performance actuators, we can achieve greatly improved agility.

QUICK FACTS:

Seven LEOStar spacecraft delivered to customers with two currently in production

LEOStar "Firsts"

- The Dawn planetary spacecraft is the first operational application of electric Ion propulsion, the first to orbit a body in the asteroid belt, and the first to rendezvous with and orbit two planetary bodies.
- The GALEX satellite is performing the first ultraviolet all-sky survey covering approximately 1 million galaxies.
- The GEMS satellite will be the first observatory to systematically measure X-ray polarization.

Dawn planetary spacecraft

LEOStar™

Mission Services

Customers can procure the LEOStar-2 spacecraft bus alone or as part of a "turn-key" service that includes mission design, instrument/payload integration, satellite environmental test, launch site operations, early orbit checkout, and mission operations, including instrument data delivery to principal investigators. Orbital has the end-to-end capability to build, integrate, test, launch and operate your mission.

Production Approach

Using mature designs, proven assembly procedures, and established vendor sources, the LEOStar-2 bus can be developed well within 36 months after receipt of order.

Heritage

To date, Orbital has five LEOStar based satellites on-orbit and has two currently in production. First developed for the GeoEye[1] OrbView-3[2] and OrbView-4 commercial high-resolution imagery system, the LEOStar spacecraft has flown in a redundant configuration for NASA's SORCE mission, in a selectively redundant configuration for NASA's GALEX mission, and in a single-string configuration for NASA's AIM mission. We are currently developing the NuSTAR and Glory[2] spacecraft. Science applications include atmospheric monitoring, solar irradiance monitoring, and astronomic exploration. With appropriate modification, we have also adapted this bus for JPL's Dawn interplanetary mission, currently in final spacecraft test.

Options

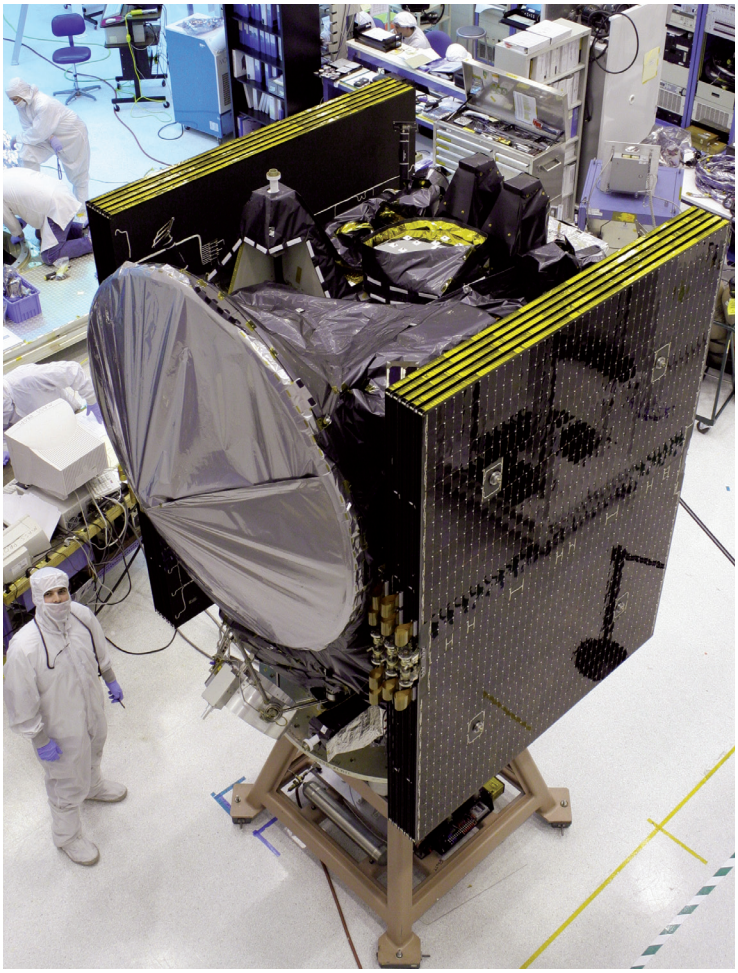
- Addition of avionics components, actuators, or sensors to improve system reliability and capability and increase mission lifetime
- Expanded on-board solid state memory and X-band downlink for increased payload data storage and high rate data transfer, respectively
- Addition of hydrazine propulsion capability to enable orbit maneuvers and increase mission lifetime
- Inclusion of spacecraft operations and data delivery

Additional Features

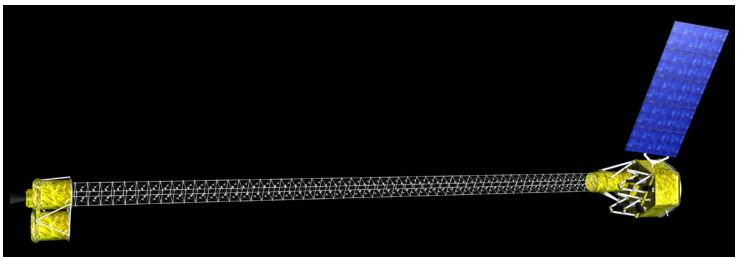
- Modular Design – Flexibility in design (ACS sensor and actuator selection, payload unique data services), assembly, integration and testing
- Low Cost with High Experience – As a world leader in developing and manufacturing affordable mission solutions, Orbital can deliver highly capable flight systems under tight cost and schedule constraints

1 OrbImage renamed GeoEye in 2006.

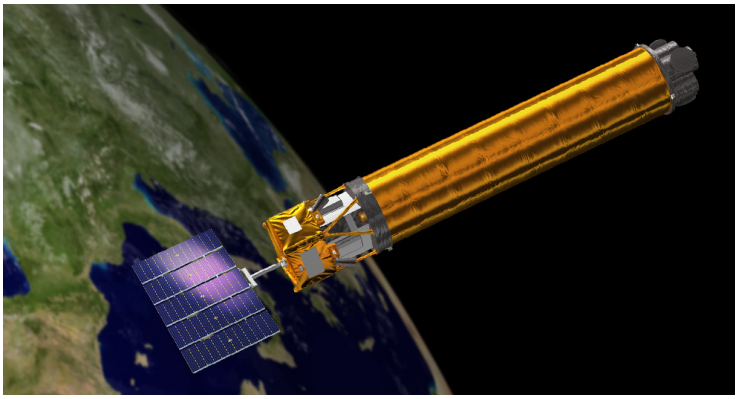
2 Glory and OrbView-3 architectures based on Orbital's LEOStar-1 spacecraft design, replaced by the enhanced LEOStar-2 bus.



The Dawn spacecraft in Orbital's Dulles, VA Satellite Manufacturing Facility



Artist's rendering of the NuSTAR satellite in orbit



Artist's rendering of the GEMS satellite in orbit

LEOStar™

LEOSTAR PROGRAMS

GEMS
Mission: X-ray Polarization of Black Holes and Magnetars
Launch: NLT 2015, LV TBD
Status: In Development

Nuclear Spectroscopic Telescope Array (NuSTAR)
Mission: X-Ray Detection of Black Holes
Launch: 2011, Pegasus XL
Status: In Development

Glory
Mission: Atmospheric and Solar Irradiance Monitoring
Launch: 2010, Taurus XL
Status: In Production

Orbiting Carbon Observatory (OCO)
Mission: Atmospheric Monitoring
Launch: 2009, Taurus XL
Status: Lost due to LV failure

Dawn
Mission: Asteroid Investigation
Launch: 2007, Delta II
Status: Fully operational since launch

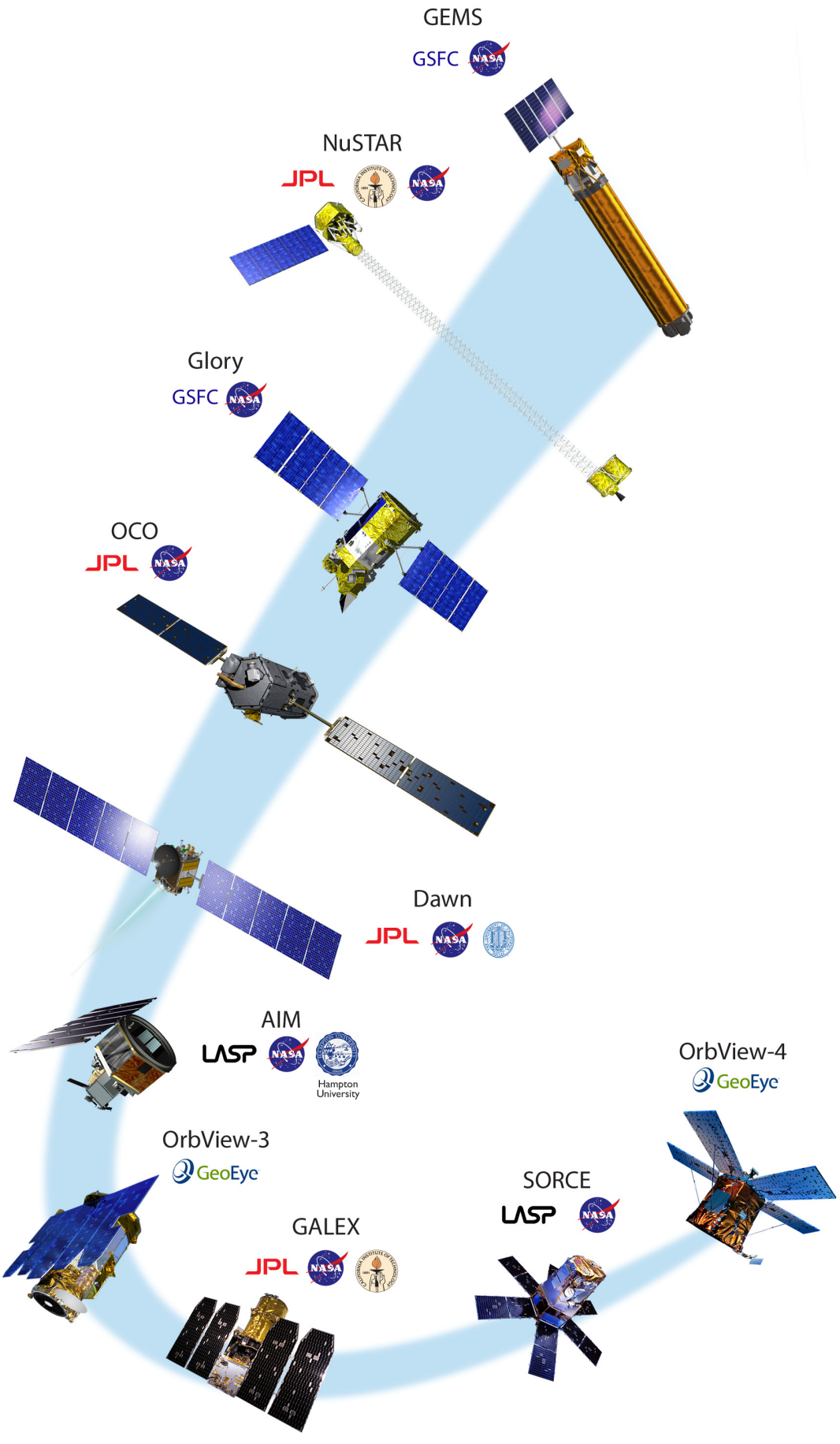
Aeronomy of Ice in the Mesosphere (AIM)
Mission: Atmospheric Monitoring
Launch: 2007, Pegasus XL
Status: Baseline mission complete, currently in extended operations

OrbView-3
Mission: Remote Sensing
Launch: 2003, Pegasus XL
Status: Spacecraft operational, image sensor failure precludes new data acquisition

Galaxy Evolution Explorer (GALEX)
Mission: Astronomic Exploration
Launch: 2003, Pegasus XL
Status: Baseline mission complete, currently in extended operations

Solar Radiation and Climate Experiment (SORCE)
Mission: Solar Irradiance Measurement and Monitoring
Launch: 2003, Pegasus XL
Status: Baseline mission complete, currently in extended operations

OrbView-4
Mission: Remote Sensing
Launch: 2001, Taurus
Status: Lost due to LV failure



LEOStar™

Spacecraft Features

Spacecraft Mass:	225 kg to 1,000 kg (496 lb. to 2,205 lb.) (with propellant)
Launch Vehicle Compatibility:	Pegasus XL, Taurus, Minotaur, Delta II
Design Life:	Up to 10 years with fully redundant avionics
Orbit Options:	LEO: 450 to 1,000 km altitude, 28° to 110° inclination
Geolocation:	<12 m @ 90% Circular Error, post processing (Optional)
Operations:	Simultaneous data acquisition by payload(s) and data transmission capability
Onboard Data Storage Capability:	Scalable to 1,600 Gbit in data recorder and 32 Gbit in flight computer
Delivery:	21-36 months after receipt of order

Attitude Control Subsystem

ADCS Approach:	3-axis zero momentum bias, solar stellar inertial or nadir referenced
Pointing Accuracy:	<15 arcsec/axis available (3σ)
Pointing Knowledge:	<6 arcsec/axis available (3σ)
Orbit Knowledge:	15 m available
Pointing Stability:	<1 arcsec per second
Agility:	Slew rate up to 1.0°/sec per axis (Standard), Slew rate >3°/sec per axis (Optional)
Propulsion:	Blowdown monopropellant hydrazine; up to 140 kg propellant (Optional)

Communications

Payload Data Downlink:	2 Mbps S-band (Standard), Up to 300 Mbps X-band (Optional)
Command Uplink:	2 Kbps S-band (Standard), Up to 128 Kbps (Optional)

Payload Accommodation

External Volume:	Up to 1.388 m3 in Pegasus XL
Maximum Payload Mass:	210 kg (463 lb.) (Standard), Up to 550 kg (1,213 lb.) (Optional)
Maximum Payload Power:	118 W orbit average (Standard), Up to 2 kW (Optional)
Interface Architecture:	RS-422/RS-485, LVDS, MIL-STD-1553

Galaxy Evolution Explorer (GALEX) satellite

SORCE solar irradiance monitoring satellite

Aeronomy of Ice in the Mesosphere (AIM) satellite

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