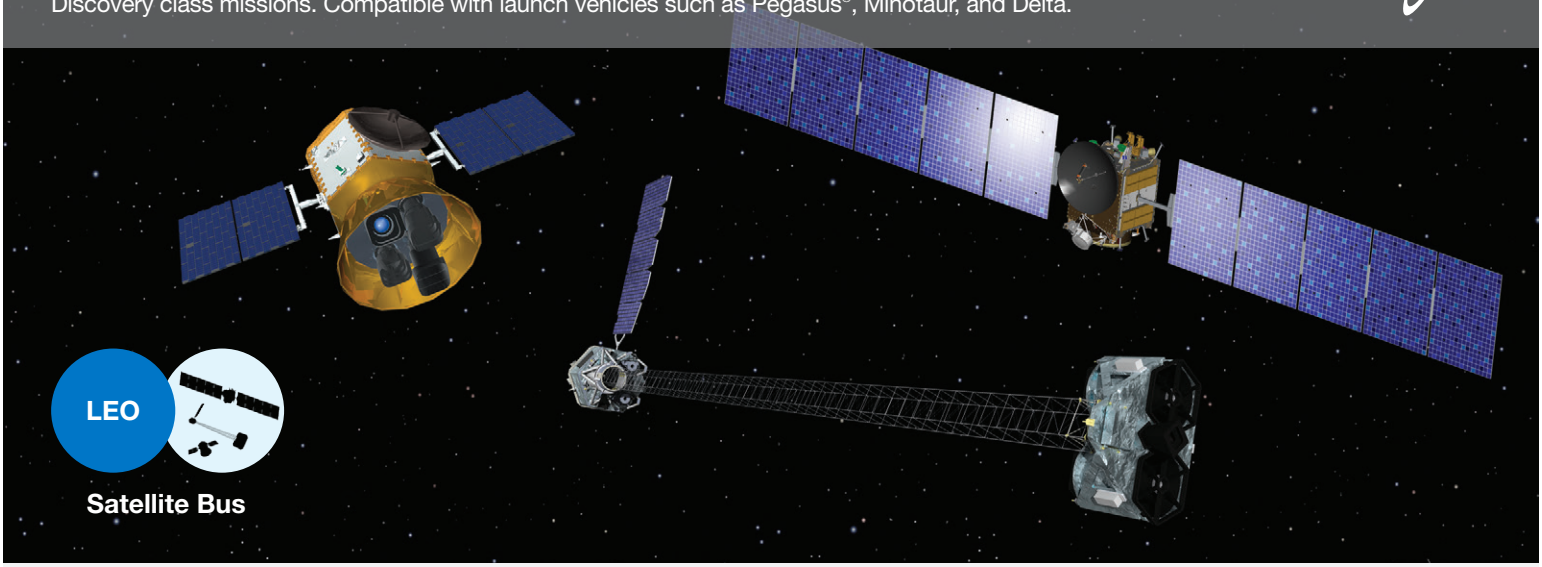
LEOStar™-2 Bus

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®, Minotaur, and Delta.

Orbital ATK



Orbital ATK's LEOStar-2 series of spacecraft have supported multiple missions for commercial and government customers over the past ten years. The current LEOStar-2 product line has an enviable on-orbit performance record with five on-orbit and two more in production.

Design

Originally designed for the Pegasus XL launch vehicle, Orbital ATK'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, 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 500 kg. Performance options include redundancy, propulsion capability, high data rate communications, and high-agility/high-accuracy pointing.

Payload Accomodations

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 compact avionics suite housed within a hexagonal bus platform, enabling Orbital ATK to deliver a significant launch vehicle fairing volume for 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 ATK has regularly delivered attitude control better than 15 arc-seconds, with attitude knowledge less than 6 arc-seconds. Through the inclusion of higher performance actuators, we can achieve greatly improved agility.

Dulles, Virginia SMF

Gilbert, Arizona SMF

FACTS AT A GLANCE

There are nine LEOStar-2 spacecraft delivered to customers with two currently in design and production.

LEOStar-2 "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 performed the first ultraviolet all-sky survey covering approximately 1 million galaxies.
- The NuSTAR satellite's X-ray instrument produces images 100 times the sensitivity and 10 times the resolution of previous X-ray observatories.

LEOStar™-2 Bus

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 services, early orbit checkout, and mission operations, including instrument data delivery to principal investigators. Orbital ATK has the end-to-end capability to build, integrate, test, launch and operate missions.

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

Currently, Orbital ATK has five LEOStar based satellites on-orbit and has two in production. First developed for the GeoEye, OrbView-3, and OrbView-4 commercial high-resolution imagery system, the LEOStar-2 spacecraft has flown in a redundant configuration for NASA’s SORCE mission, in a selectively redundant configuration for NASA’s GALEX and OCO-2 missions, and in a single-string configuration for NASA's AIM and NuSTAR missions. Currently LEOStar-2 programs include the TESS and ICON spacecraft. Science applications include atmospheric monitoring, solar irradiance monitoring, and astronomical exploration. With appropriate modification, we have also adapted this bus for JPL’s Dawn interplanetary mission, currently en route to the asteroid Ceres.

Options

- Avionics components, actuators, or sensors to improve system capability and increase mission reliability and lifetime
- Expanded on-board solid state memory and X-band downlink for increased payload data storage and high rate data transfer
- Hydrazine propulsion capability to enable orbit maneuvers and increase mission lifetime
- 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 ATK can deliver highly capable flight systems under tight cost and schedule constraints

The Orbiting Carbon Observatory-2 (OCO-2) spacecraft in Orbital ATK's Gilbert, Arizona satellite manufacturing facility.

The NuSTAR satellite in Orbital ATK's Dulles, Virginia satellite manufacturing facility.

LEOSTAR-2 PROGRAMS

ICON
Mission: Space Weather
Launch: 2017, Pegasus
Status: In design

TESS
Mission: Exoplanet Exploration
Launch: 2017, TBD
Status: In design

Orbiting Carbon Observatory-2 (OCO-2)
Mission: Atmospheric Monitoring
Launch: 2014, Delta II
Status: Operational

Nuclear Spectroscopic Telescope Array (NuSTAR)
Mission: X-ray Detection of Black Holes
Launch: 2012, Pegasus XL
Status: Operational

Glory
Mission: Atmospheric and Solar Irradiance Monitoring
Launch: 2011, Taurus XL
Status: Lost due to LV failure

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

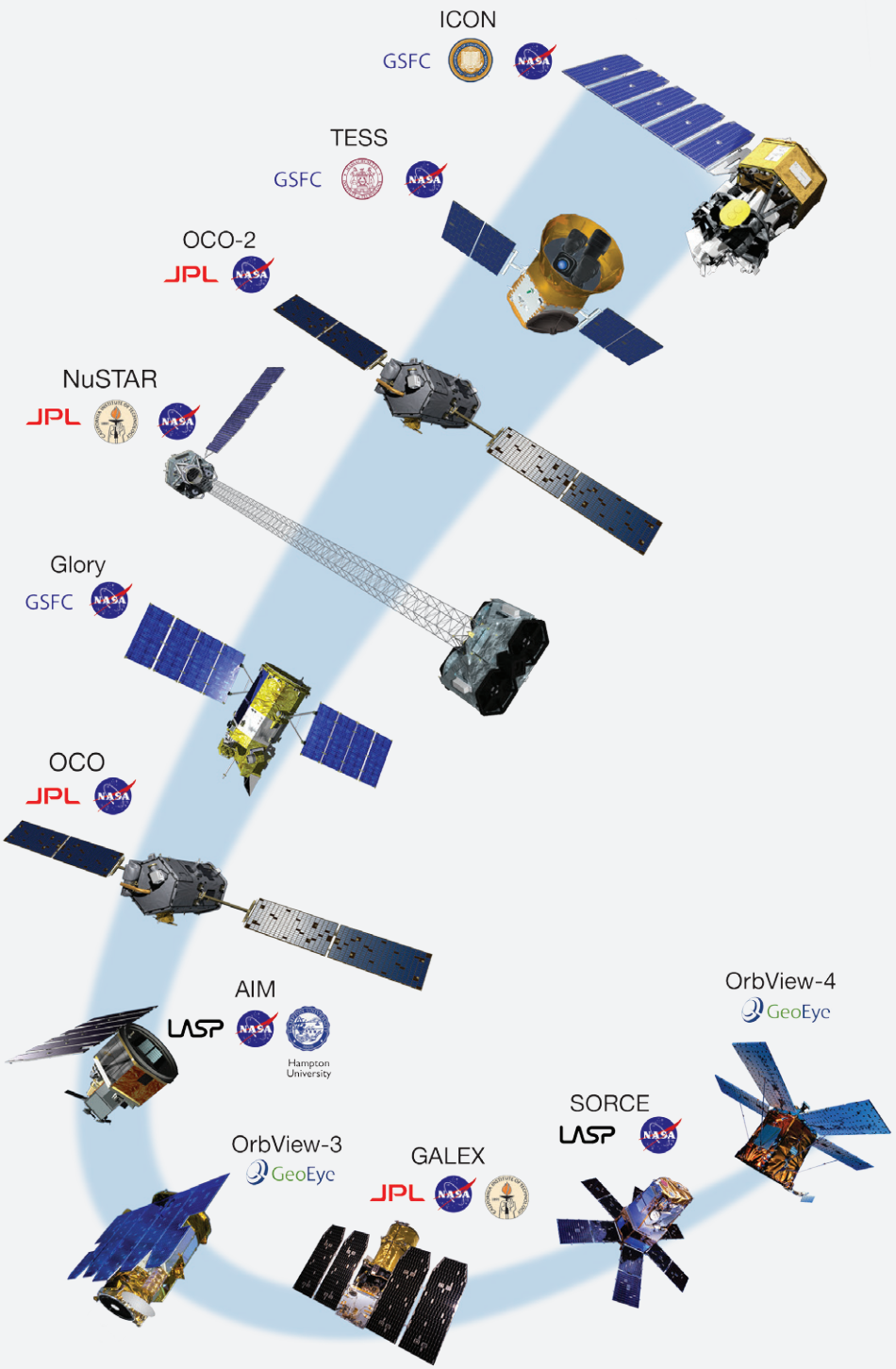
Aeronomy of Ice in the Mesosphere (AIM)
Mission: Atmospheric Monitoring
Launch: 2007, Pegasus XL
Status: Baseline mission complete, currently in extended operations

OrbView-3
Mission: Remote Sensing
Launch: 2003, Pegasus XL
Status: Spacecraft de-orbited after image sensor failure

Galaxy Evolution Explorer (GALEX)
Mission: Astronomical Exploration
Launch: 2003, Pegasus XL
Status: Mission complete

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™-2 Bus

Spacecraft Features

Spacecraft Mass:	150 kg to 500 kg (with propellant)
Launch Vehicle Compatibility:	Pegasus® XL, Minotaur, Delta II and Falcon
Design Life:	Up to 5 years
Orbit Options:	LEO: 450-1,000 km altitude, 5°-110° inclination. Adaptable to HEO, GEO and deep space.
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:	30-36 months after receipt of order

Attitude Control Subsystem

ADCS Approach:	S-band at 2 mbps, optional X-band at 15 mbps
Pointing Accuracy:	<15 arcsec/axis available (3σ)
Pointing Knowledge:	<6 arcsec/axis available (3σ)
Pointing Stability:	<1 arcsec per second
Agility:	Slew rate up to 1°/sec per axis (standard), Slew rate >3°/sec per axis (optional)
Propulsion:	Blowdown monopropellant hydrazine; up to 140 kg propellant (optional)

Communications

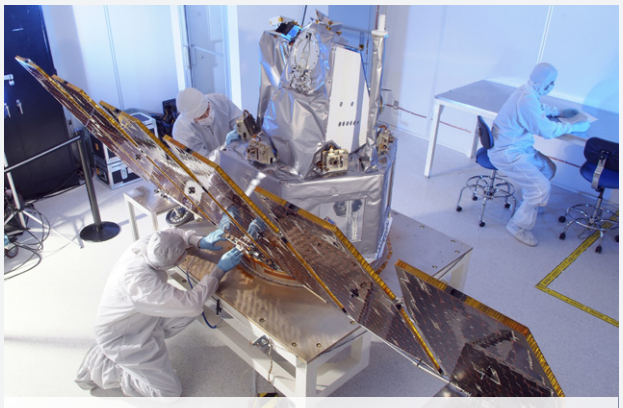
Payload Data Downlink:	2 Mbps S-band (standard), up to 150 Mbps X-band (optional)
Command Uplink:	2 Kbps S-band (standard), up to 128 Kbps (optional)

Payload Accomodation

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

For more information, please contact:

science@orbitalatk.com
(703) 406-5000

Orbital ATK

www.orbitalatk.com

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