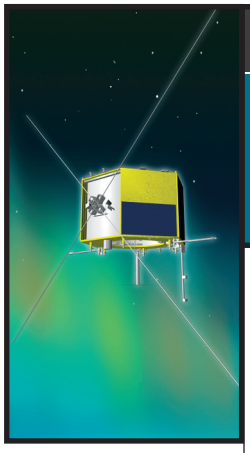


CASSIOPE

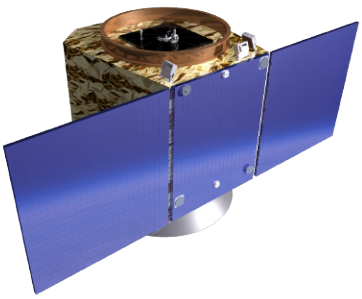
MDA is developing the CASSIOPE mission – a unique combination encompassing three major objectives: a technology demonstrator for the future space-based digital courier system CASCADE; a scientific mission using e-Pop's instruments, and a new small satellite bus for future Canadian Space Agency (CSA) missions.

THE CASSIOPE MISSION

CASSIOPE, which stands for 'Cascade Smallsat and Ionospheric Polar Explorer', is a small satellite class mission being developed by MDA and enabled by contributions from the Canadian Space Agency (CSA) and Technology Partnerships Canada (TPC). CASSIOPE will support two distinct payloads, and three key objectives.

The first payload is a suite of space science instruments that in sum are referred to as e-POP, the Enhanced Polar Outflow Probe. Developed by a scientific team led by the University of Calgary, e-POP will be Canada's first space environment sensor suite, providing Canadian scientists with the opportunity to understand the impact the variability the Sun has on the space environment.

The second payload is an experimental CASCADE payload (CASCADE CX). It will be used to demonstrate key aspects of what will be the first commercial space-based digital courier service. Analogous to a "FedEx™-in-the-Sky", the operational CASCADE system is envisioned to deliver extremely large digital data files, nominally ranging in size from 50 to 500 Gbytes, to and from anywhere on Earth typically within a day.



The experimental CASCADE payload on CASSIOPE will develop and demonstrate the key enabling CASCADE technologies, and demonstrate the feasibility of this very large end-to-end file transfer method.

The CASSIOPE mission will also develop and demonstrate the first CSA SmallSAT bus. This bus will be adaptable to support a wide variety of future CSA small satellite space missions.

MDA is the prime contractor for the CASSIOPE space and ground infrastructure, responsible for system engineering design, assembly, integration, testing, launch and operation of the spacecraft.

KEY SYSTEM AND SPACECRAFT PARAMETERS

Parameter	Value
Orbit	324 x 1500 km, polar inclination (not sun synchchronous), orbit maintenance not needed
Lifetime	Sized for 2 years on orbit
Spacecraft Mass	~500 kg
Spacecraft Size	Hexagonal 1.8 m hex corner to corner 1.2 m in height
Spacecraft Power	Payloads each take approximately 60 W OAP, CX payload peak of almost 400 W during communication passes
S-band TT&C	Nominally 4 kbps uplink, up to 4 Mbps downlink, near-omni coverage
Spacecraft Attitude	3-axis zero momentum Ram-Nadir fixed for typical e-POP operations Lat/long point tracking to within 0.8 degrees for CASCADE CX communications events to keep horn antenna pointed at ground terminals

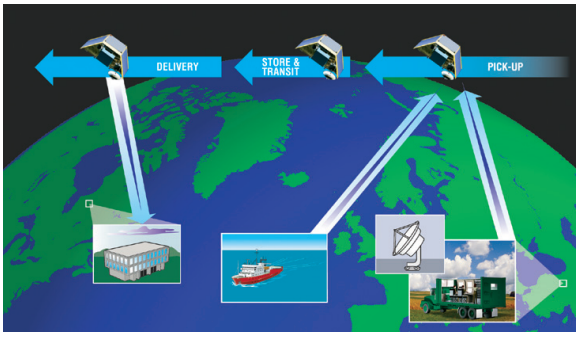
MDA™

SYSTEM OVERVIEW

The CASSIOPE system is composed of a single small satellite space segment and the associated ground segment. The spacecraft will be flown in an elliptical low-Earth orbit with a 325 km perigee and 1500 km apogee. Inclination will be between 70 and 90 degrees depending on the launch opportunity selected.

The Ground Segment consists of the following elements:

- Mission Control for tracking the spacecraft position, validating and coordinating the uplinking of spacecraft and payload commands, receiving telemetry for monitoring of the spacecraft health and status, and receiving the e-POP science data;
- a CX Ground Terminal in support of direct high-volume data exchange with the CX Payload;
- a CX Service Control Centre for coordinating the high volume data transfer between the CX Ground Terminal and the CX Payload;
- an e-POP Science Operation Centre (eSOC) for planning e-POP operations and for processing and distribution of e-POP data.



CASCADE CX

The CASCADE digital courier service will deliver virtually error-free, secure Giga-Packages to and from anywhere on Earth. Since CASCADE is focused on this high data volume store-and-forward market niche, its design is optimized to meet the unique needs of the market for very large and timely data file transfers.

CASCADE will be a digital courier service in the sky. A constellation of Low-Earth-Orbiting (LEO) Ka-band satellites will circle the earth, picking up very large digital data packages or "GigaPackages" that can be tens to hundreds of GigaBytes in size from remote locations on land or over any ocean and deliver the data directly into a user-specified data archive or processing center.

e-POP

The E-POP payload consists of a suite of eight scientific instruments that will investigate atmospheric and plasma outflows, and related wave-particle interaction in the topside polar ionosphere.

The e-POP team is comprised of scientists and engineers from seven Canadian universities and three research organizations: the University of Calgary; York University; the Universities of Alberta; Athabasca; Saskatchewan; Western Ontario; and New Brunswick. The Communications Research Centre, located in Ottawa, as well as the Institute of Space and Astronautical Science of Japan and the U.S. Naval Research Laboratory are also partners in the project.

e-POP Instruments

IRM	Imaging rapid scanning mass spectrometer	Composition, density, velocity, temperature (1-40 amu, 1-70 eV)
SEI	Suprathermal electron imager	Suprathermal electro and photoelectron energy and pitch angle pectra (<200 V)
NMS	~Neutral mass and velocity spectrometer	Neutral composition, density, velocity, temperature (1-40 amu, 0.1-2 km/s)
FAI	Fast auroral imager	Fast broadband visible (10 per sec) and slower monochromatic imgages (630 nm)
RRI	Radio receiver instrument	HF and VLF wave electic field polarization and propagation: E(_), k(_)
MGF	Magnetic field instrument	Magnetic field perturbation and field aligned currents DB __ FAC
GAP	GPS attitute, position occultation experiment	Ionospheric Irregularities (differential GPS); spacecraft attitude (GPS interferometry)
CER	Coherent EM radiation tomography experiment	Ionospheric Irregularities (differential line of-sight plasma wave propagation delays)

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