MAAX Magnetospheric Auroral Asymmetry eXplorer — Fact Sheet (B.1)

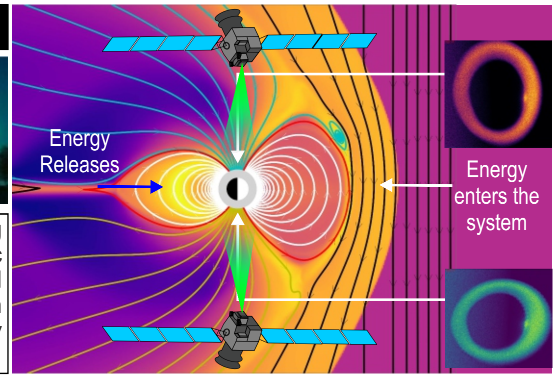
MAAX determines how magnetosphere - ionosphere electrodynamic coupling regulates multi-scale auroral energy flow through the near-Earth space environment

Objective 1	Objective 2	Objective 3
Understand how seasons and magnetic field geometry regulate large-scale energy flow from the solar-wind through the magnetosphere-ionosphere system	**Discover how the formation, evolution, and interhem-ispheric asymmetries of nightside mesoscale auroral features are regulated by the auroral background conductance**	**Determine how the time-dependent magnetospheric energy flow controls multi-scale auroral dynamics.**

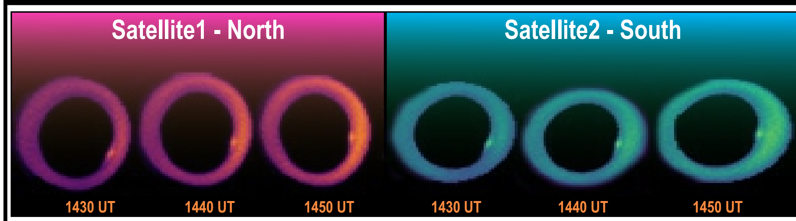
MAAX is 2 observatories in a 20,850 km altitude, circular, polar orbit, each with a single instrument: a dual-wavelength UV imager with high spatial and temporal resolution. Launching 2028, science operations is 2 years after a 6-month orbit-raising. When poleward of 35° latitude (>60% of the time), MAAX observes the time development and spatial asymmetries in both global and meso-scale auroral features.

Societal Relevance of Exploring the Aurora

The aurora is a beautiful, mysterious light display in the night sky, captivating humans since we first saw it. However, the aurora accompanies intense electric currents in near-Earth space that cause problems for technology here on Earth and in space. MAAX provides unprecedented imagery of the aurorae simultaneously in both hemispheres. MAAX propels our understanding of magnetospheric energy flow and enhances our ability to forecast and mitigate space weather impacts.



Simulated MAAX Images in Phase-2

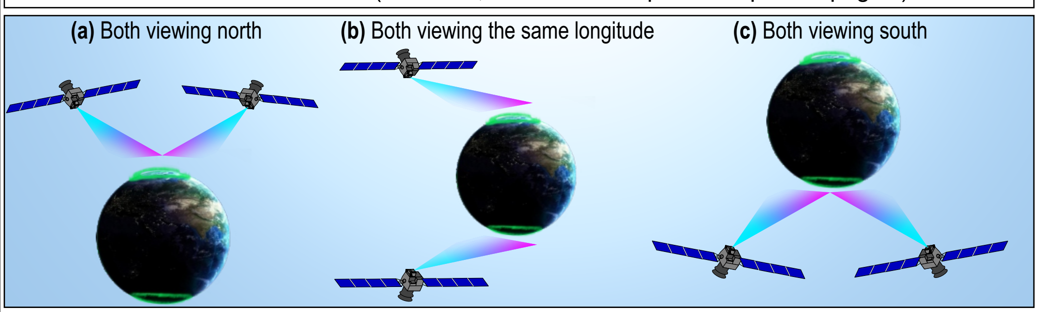


Simulated northern (Satellite 1, left) and southern (Satellite 2, right) images from MAAX during phase-2 of the mission for 1.5 hours. Small differences reveal physical processes.

During its 2-year prime mission, MAAX produces over one million high-resolution images of the full auroral oval, enabling detailed study of energy flow through the magnetosphere-ionosphere system.

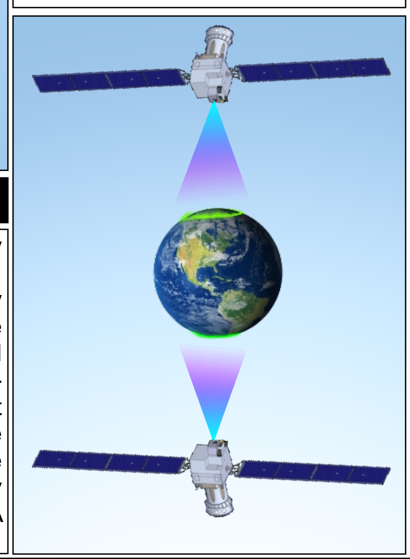
Phase 1 - 90° Spacing - Year 1

MAAX provides image of pairs where asymmetries exist: (a/c) dayside and nightside reconnection rates leading to energy storage or loss; and (b) nightside conductance in both hemispheres, quantifing the role on meso-scale structures. Furthermore, it provides near continuous observations of the full auroral oval (N-then-S, as seen in the operations plan on page 2).



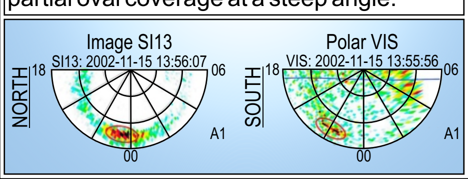
Phase 2 - 180° Spacing - Year 2

MAAX captures simultaneous images in both hemispheres, allowing direct comparison between the OCFLB (Obj 1), meso-scale structures (Obj 2), conductances (Obj 2), and allowing modeling and prediction of these features (Obj 3). Both ovals are observable for 3.75 hours at a time.



Conjugacy To-Date

Near the end of their mission lifetimes, IMAGE and Polar occasionally viewed conjugate auroral features, as seen here. About two dozen features were observed during these conjunctions, often with only partial oval coverage at a steep angle.



NASA Relevance

MAAX directly supports the 2012 National Academy of Sciences Heliophysics Decadal Survey, specifically addressing Heliophysics Decadal Survey goals #1 #2 and #4; and directly addresses the three science goals listed as priorities for proposed missions in the SMEX AO. MAAX provides multi-scale auroral observations in both hemispheres that quantify and track the energy storage and release cycle in the magnetosphere. As part of the Heliophysics Great Observatory, MAAX greatly enhances the supplementary science of future NASA missions GDC and TRACERS.

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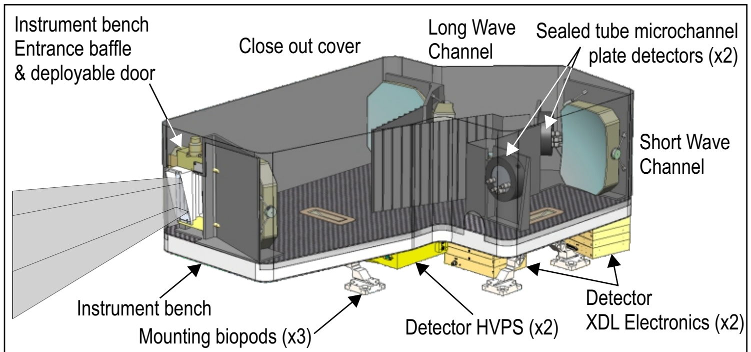
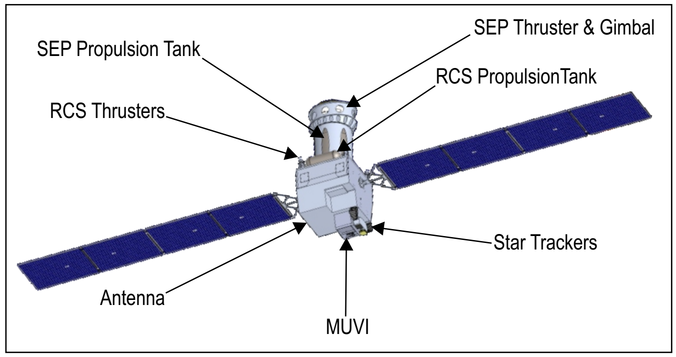
MAAX Magnetospheric Auroral Asymmetry eXplorer — Fact Sheet (B.2)

Instrument, Observatory and Mission Characteristics





Key Instrument Characteristics

Instrument Parameter	Value
Passband (short)	144nm peak / 8nm FWHM
Passband (long)	173nm peak / 8nm FWHM
Entrance aperture	30 x 12 mm
Field of View	15°
Detector area	28 mm (active area) / 512 x 512 pixels
Effective resolution element size (RSS detector, PSF, pixel size)	66 µm (short) 72 µm (long)
Effective nadir ground element size	13 km (short), 14 km (long)
Mass (MUVI + PIU)	26.11 kg
Power (MUVI + PIU)	39.8 w
Data Rate (MUVI to PIU)	280 kbps

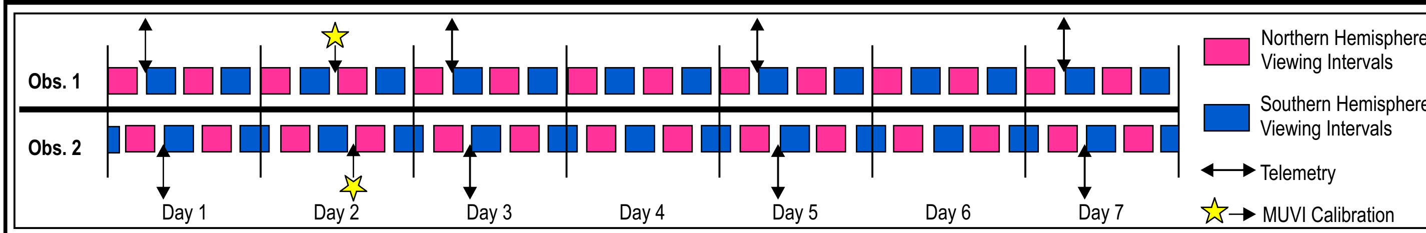
Key Observatory Characteristics

Resource	Characteristics	Value
Mass (MEV)	Dry Mass	173.5 kg
Power (MEV)	Science Mode	103.8 w
	Thrust Mode	902.4 w
	Safe Mode	89 w
Science Data	Total Data Volume	7.2 Gb/d
Point. Cnt.	Science, Thrust	0.3°, 1.0° (3σ)
Propulsion	Solar Electric	ΔV = 3858 m/s
	Nitrogen Cold Gas	ΔV = 7.33 m/s
Telecom	Ka-Band (Science Data)	300 Mbps
	S-Band (Engineering TLM)	4.9 Mbps
Attitude	3 Axis Stabilized, Inertially Pointed	
Deployments	LV Separation, Solar Array, MUVI Door	

Key Mission Characteristics

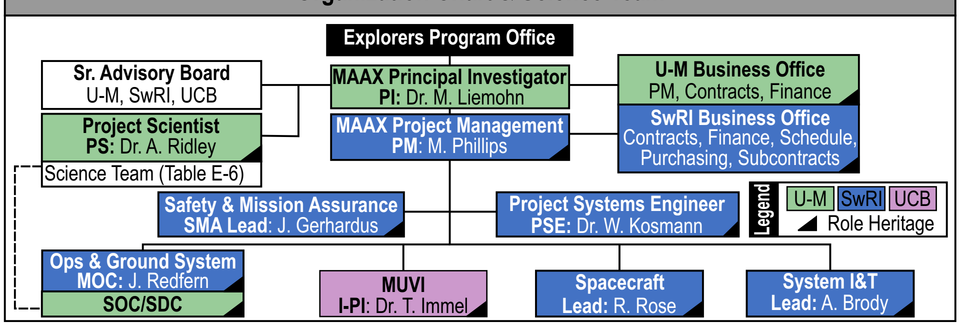
Resource	Characteristics	Value
LV	Option B	1 LV
Orbit	Inclination	90°
	Altitude	20,850 km
	Eccentricity	0
Launch Mass	2 Observatories + Custom LV Adaptor	542 kg
Constellation	2 Observatories	Seperated by 90° (1yr) 180° (1yr)

Phase 1 Week-in-the-Life Operations Plan



Management, Cost and Schedule

Organization Chart & Science Team



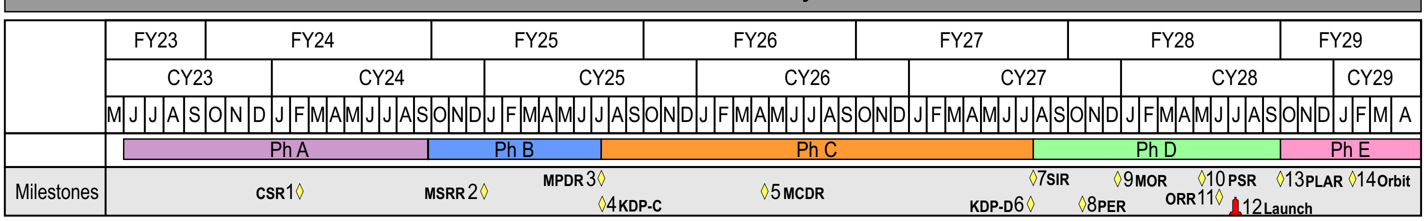
Cost Summary

Mission Phase	Cost $M	Reserves $M	Total $M
Phase A	2.0	-	2.0
Phase B/C/D[1]	106.09	29.81	135.90
Phase E/F	15.42	2.67	18.10
Total PIMMC	**123.51**	**32.49**	**156.00**
Contributions[2]			0.31
Total Mission Cost	**132.82**	**32.49**	**156.31**

[1]Includes $1.1M to cover cost of Items deferred to Step-2

[2]Not required to meet mission / science objectives

Schedule Summary



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