Athenoxat-1, Night Vision Experiments in LEO

POPSAT-HIP1: Russia 19th June 2014
first 3 axis micropropulsion Cubesat

ATHENOXAT-1: India 16th Dec. 2015
first day and night multi-resolution imaging Cubesat
MICROSPACE
Nanosatellites R&D
Athenoxat-1

- 3U cubesat of 4.8kg
- ADS sensors: coarse sun sensors, magnetometer & gyroscopes
- ACS air-coil magnetorquers primarily for stabilization
- Made in-house ACS reaction wheels for imaging pointing
- Made in-house main payload optics
- Main in-house payloads boost converters
- Made in-house deployable solar panels
- Made in-house deployable antennas
- Made in-house frame structure including deployment system for solar panels & antennas
- Made in-house payloads interfaces
- Made in-house CDH & ADCS software including Nadir vector determination & payloads drivers
Developing Athenoxat...
Environmental Testing
Ready to launch
Athenoxat-1 Launch
On PSLV C29, 16th December 2015
Power and Batteries

Athenoxat - 1 Solar Panels Power Harness & Battery Voltage Profile
(Available Data from 16/12/15 - 07/08/16)

- Total power harness > 20W
Stabilization

Athenoxat-1 gyroscopes reading (161215 20:52 SGT - 6 hours)

- Stabilized after 3 orbits with B-dot controller
Temperatures

- Temperatures within expectation
- Healthy satellite 😊
5 view points in One Satellite
Fisheye Imaging (Bow)
Fisheye Imaging (Port)
Fisheye Imaging (Starboard)
Fisheye Imaging – Nadir Determination

Nadir Vector [-0.1069, 0.0724, 0.9916]

ATHENOXAT-1
2016-02-01 04:24:20
Wide Angle Imaging – Resolution

ATHENOXAT-1
2016-03-14 14:45:49
Wide Angle Imaging
Sumatra – Singapore – Malaysia

- Analysis based on RGB channel values
- Land-use monitoring
- Water pollution study
- Weather nowcast
Wide Angle Imaging
North Australia
Wide Angle Real-time Imaging

- Scouting in formation flight
- Avoiding imaging of cloudy areas
Wide Angle Imaging – Haze

HOT SPOTS and HAZE PLUMES

ATHENOXAT-1
2016-03-31 02:13:37

- Environmental warning
- Forest fires alert, mitigation and fighting support

<table>
<thead>
<tr>
<th>Hot Spot</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>3°26'22.11&quot;N</td>
<td>98°55'34.05&quot;E</td>
</tr>
<tr>
<td>2</td>
<td>3°3'4.91&quot;N</td>
<td>99°0'9.69&quot;E</td>
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</tbody>
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Night Vision Imaging – Olongapo, Philippines

- Rizal Hwy bridge: 50m
- Land protrusion at Causeway Road: <50m
- Pier at Quezon Street: 25m
- Subic dock: 100 to 200m
Night Vision Imaging – K. Selangor, Malaysia
Night Vision Imaging – Ayer Baloi, Malaysia
Night Vision Imaging – Moon Pointing Accuracy < 1°
Night Vision Imaging – Stars
Pointing Accuracy < 1°
Night Vision Imaging – Singapore & Johor

Pointing Stability $3\sigma = \sim 0.27^\circ$

√ ADS based on only coarse sun sensors and magnetometer
Summary

3x Fisheyes
GSD ~4km minimum
D=1800km

Wide Angle
GSD 300m
D=550km
Wide Angle
GSD 300m
D=550km
Summary

Wide Angle
GSD 300m
D=550km

Night Vision
GSD 25m
D=21km
Summary

Night Vision
GSD 25m
D=21km
Thanks !