Solutions Contributing to the Outer Space Sustainability

May 10th, 2016
Washington, D.C.
Agenda

1. About us
2. Our Focus
3. Our Solutions
4. Next Steps
ASTROSCALE’s mission is to develop cutting-edge technologies to help maintaining a sustainable space environment.
Presence

KEY MILESTONES

2013  Incorporation

2015  Series A – USD 7.7M
       Manufacturing Facility Inauguration

2016  Series B – USD 35M

2017  IDEA OSG 1 - In-Situ Environment Monitoring

2018  ADRAS 1 – Satellite Deorbiting Demonstration
Space is becoming congested...
Our Activities

- **Debris Removal**: Remove large spacecraft threatening the safety of future space missions.
- **Debris Monitoring**: Monitor submillimeter size debris and fragmentation events.
- **Spacecraft Servicing**: Spacecraft EOL operations and in-orbit services.
- **Debris Mitigation**: Make Spacecraft easier to track, approach, capture & service.

Make Spacecraft easier to track, approach, capture & service.
# IDEA OSG 1

<table>
<thead>
<tr>
<th><strong>SIZE</strong></th>
<th>380mm x 580mm x 600mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MASS</strong></td>
<td>20 kg</td>
</tr>
<tr>
<td><strong>INSERTION ORBIT</strong></td>
<td>End 2016 – Early 2017</td>
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<tr>
<td></td>
<td>Apollo Altitude (800km)</td>
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<tr>
<td></td>
<td>Perigee Altitude (540km)</td>
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<td></td>
<td>Polar Orbital Plane</td>
</tr>
<tr>
<td><strong>MISSION MODULES</strong></td>
<td>Space Debris Monitor</td>
</tr>
<tr>
<td></td>
<td>350mm x 350mm x 2sheets</td>
</tr>
<tr>
<td><strong>ATTITUDE CONTROL &amp; DETERMINATION SYSTEM</strong></td>
<td>Sun Sensor, Magnetometer, MEMS Gyro, 3 axis-control Magnetorquer</td>
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<tr>
<td><strong>ON BOARD COMPUTER</strong></td>
<td>Bus OBC (SH4 BeoCHAN-1)</td>
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<tr>
<td></td>
<td>Mission OBC (FPISA)</td>
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<tr>
<td></td>
<td>Watch Dog Controller (PIC)</td>
</tr>
<tr>
<td><strong>POWER SUPPLY</strong></td>
<td>GaAS Solar Cell (30W)</td>
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<tr>
<td></td>
<td>NiMH Battery (10Ah)</td>
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<tr>
<td><strong>TIME &amp; ORBIT DETERMINATION</strong></td>
<td>GPS Sensor</td>
</tr>
<tr>
<td><strong>COMMUNICATION</strong></td>
<td>S-band (Downlink / Uplink)</td>
</tr>
<tr>
<td><strong>GROUND STATION</strong></td>
<td>Japan</td>
</tr>
<tr>
<td><strong>DE-ORBIT MECHANISM</strong></td>
<td>Expandable / Fold-controllable Deorbit sail</td>
</tr>
<tr>
<td><strong>SEPARATION MECHANISM</strong></td>
<td>Single Pyro Lock System</td>
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</tbody>
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Mission Overview
# ADRAS 1

**Mother**

- **Size**: 600mm x 600mm x 1000mm
- **Mass**: 90kg
- **Attitude Control System**: GPS, Star Tracker
- **Communication**: S-band, X-band
- **Power Supply**: 2 Solar Array Peddles And Body Mounted Solar Array Panels At 6 Dimensions
- **Propulsion System**: Electric Propulsion Thrusters, H2O2 Propellant Thrusters
- **Mission Modules**: Optical Cameras, Stellar Compass, Infrared Camera, Laser Range Radar, Chaser Separation System

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**Boy**

- **Size**: 380mm (Length) And 500mm (Height)
- **Mass**: 10kg
- **Attitude Control System**: GPS, Sun Sensor
- **Communication**: S-band
- **Power Supply**: Body Mounted Solar Array Panels At Outer Peripheral Side
- **Mission Module**: Adhesive Unit, Gimbal Unit, Cluttered Solid Rocket Boosters, Small Optical Camera
Mission Overview

Phase 1
Mother initial operation

Phase 2
Non-collaborative approach to target debris

Phase 3
Diagnosis

Phase 4
Capture

Phase 5
Detumbling

Phase 6
Deorbit with ion engine

Phase 7
Release Boy & debris

Phase 8
CG/inertial tensor estimation & gimbaling

Phase 9
Deorbit with solid rocket booster

Phase 10
Reentry
What’s needed?

- Admit that space is getting congested and increase awareness
- Improve environmental data accuracy and access to all
- Remove legal and political barriers
- Define rules of road and develop best practices for spaceflight safety