Intelligent Space Assembly Robot (ISAR)

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United States Naval Academy
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SmallSat 2017
International Space Station
Current Space Robotics
Robotic Servicing of Geosynchronous Satellites (RSGS)
Canadarm
Curiosity
Comparison

- Basic orbital assembly:
  - Overly capable, specialized, expensive solution?
  - Sufficiently capable, versatile, inexpensive solution?

  OR

Labor, Cost, Availability
USNA Solution

Demonstrating necessary orbital assembly techniques using a CubeSat platform
ISAR Mission Objectives

- Technology Demonstration/Development
- Semi-autonomous On-Orbit Assembly
- Advanced Sensor Integration
  - Visual (2D and 3D Cameras)
  - Tactile (Contact Sensors)
  - Proximity (Proximity Sensors)
- Provide the ability for the robotic arms to sense, plan and react to a dynamic environment
ISAR and RSat
RSat Heritage
AMODS
Modular Spacecraft Assembly

AMODS

RSat

BRICSat
RSat Current Status
RSat Current Status
RSat Current Status
ISAR System Overview
# 3D Camera Selection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Intel R200</th>
<th>DUO M</th>
<th>Tara</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Range</strong></td>
<td>10 m</td>
<td>2 m</td>
<td>8.5 m</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>640x480</td>
<td>752x480</td>
<td>752x480</td>
</tr>
<tr>
<td><strong>Frame Rate</strong></td>
<td>30 fps</td>
<td>45 fps</td>
<td>60 fps</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>130 x 20 x 7 mm</td>
<td>52 x 25.4 x 11.6 mm</td>
<td>100 x 30 x 35 mm</td>
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</tbody>
</table>
• Long Range
• Powerful
• Large Form Factor
DUO M

- Limited Range
- Integrated LED
- Small Form Factor
Tara

- Moderate Range
- High Frame Rate
- Labor Intensive
Test Feature Spacecraft
DUO M Results
Using Cloud Compare
On Orbit Demonstration
Initial Deployment
Maneuvering
Object Assembly
Project Timeline

Fall 2017
- Component Testing
- Robotic Manipulator Construction and Testing

Spring 2018
- Software Integration
- Standards Testing
- Ground Testing of Robotic Arm

Summer 2018
- Final Purchases

Fall 2018
- Hardware Integration
- Final Assembly
- Final Testing
- Delivery for Launch: Dec 2019
ISAR Team

Systems Engineer
T.T. Marshall

Program Lead
D.L. Wenberg

Aerospace Engineer
I.A. Hardy

B. Rubio
K. Guo
C. Wellins
T. Lai
C. Tingler
Questions