CAPABILITIES FOR ORBITAL SPACE DEBRIS TRACKING

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Outline of Capabilities for Orbital Debris Tracking

1. L3Harris Overview

2. Novel concepts for orbital debris tracking modalities enabled by:
   • Libraries of custom wave propagation and interaction models that feed end to end mission performance models
   • First principal benchmarked models of RF Rydberg sensors, and state of art laboratories for testing

3. Translating debris field data to risk, damage, and mitigation assessments for specific spacecraft

4. Satellite payload design, construction, and testing

5. Mission integration
Novel Orbital Debris Detection Modalities Enabled By:

Proprietary modeling software for end to end mission performance models from custom components describing propagation of waves across custom channels

- Based on spatiotemporal wave propagation models, covering RF, optical, with plasma propagation components in development

- Extensive component libraries feed modularly built models for quickly assessing and optimizing trade spaces.

- Enables full field simulation of phenomena that COTS or custom lumped loss software can’t handle

\[
\begin{align*}
\text{At}, A_w, I_t, I_w &= \text{Coupler}(\text{At}, R_{at}, I_L) \\
\text{Assumes two-port output and one- or two-port input. To suppress 2nd output port, only call } E_t(:,1) \text{ on next component.}
\end{align*}
\]

Generic example of linking custom components together with the modeling architecture
Novel Orbital Debris Detection Modalities Enabled By:

**Benchmarked RF Rydberg sensing models**

- Promise for high sensitivity across extremely broad bandwidths (MHz – THz)
- Receiver minimum size not constrained by RF frequency
- Proprietary solutions for applying sensors for orbital debris detection

**State of art laboratories for receiver testing**

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Using sensor data to improve mission outcomes

Extract debris properties from sensor data

Damage assessments

Probability of critical failure

Mitigation Strategies - Shielding

htl.jsoc.nasa.gov: Exit hole of ISS crew module penetration test – performed to test repair techniques.
L3Harris provides payloads across every mission area

Depth and breadth has enabled us to become Responsive Prime market leader
Spacecraft and Payload Provider

Broad portfolio of spacecraft, antennas & reflectors to meet the most challenging mission needs

- **HIGH COMPACTION RATIO ANTENNA (HCR)**
  - 1m to 5m diameter apertures
  - Designed for S- to Ka-band frequencies
  - 100:1 compaction ratio is ideal for smallsats

- **CENTER-FED RADIAL RIB REFLECTOR**
  - Up to 9m+ diameter apertures
  - Offers up to Ka-band frequencies
  - Optimized for frequent re-point missions

- **RADIAL RIB REFLECTOR**
  - Up to 9m diameter apertures
  - UHF to Ka-band frequencies
  - Ideal for higher gain missions

- **FOLDED RIB REFLECTOR**
  - Up to 18m diameter apertures
  - UHF to Ka-band frequencies
  - Ideal for larger GEO Comm missions

- **PERIMETER TRUSS REFLECTOR (PT)**
  - Scales from 1m to 22m+, frequencies up to "Ka+
  - More compact, and lower mass
  - Ideal for LEO smallsats to GEO Comms
Mission Integrator: Exquisite and Responsive E2E Mission Solutions

Exquisite Solutions
60-year legacy of providing high performance mission payloads

Responsive Solutions
Augmenting Exquisite Systems with rapid delivery of end-to-end mission solutions

Exquisite Solutions
- PNT
- Missile Defense
- Weather
- Ground
- Space Objects & Debris
- Space Tracking
- Space Superiority
- Space Command & Control

Responsive Solutions
- SDA Tracking
- Hypersonic
- HBTSS
- SPACE WARFIGHTING

Keys to Success
- Mission knowledge
- Payload expertise
- Rapid delivery

Ground
Space tracking & space warfighting

Mission knowledge
Payload expertise
Rapid delivery
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