Synoptic Engineering Overview

**Experience**
- Small business of five researchers with decades of experience as PM/PI on >$100M in funded R&D work
- Primary customers have been DARPA, DoD service labs, and IC
- Rich history of demonstrating new technologies in the field

**Recent Research Areas**
- Distributed RF arrays for communications, EW, and radar
- Centimeter-scale ranging and picosecond-scale clock sync. between radios
- GPS-free navigation
- Overwater RF propagation
- Linguistics processing and machine learning

**Societal Missions**
- To make the scientific knowledge and enabling technologies we develop broadly applicable and publicly available
- To eliminate financial and social barriers to education and vocations in the sciences and engineering
**SINTRA concepts leveraging Synoptic experience**

**Coherent Ka-Band Distributed Radar**
Coherent transmission and reception across distributed ground radar array enables very low RCS debris to be detected and tracked.

**Microtag-Enabled Debris Soliton Detection and Localization**
Distributed field of in-situ acoustic field microsensors in LEO detect debris soliton in ionosphere, use radar responsive microtags for localization & tracking.

### RCS (conducting sphere)

<table>
<thead>
<tr>
<th>Diameter</th>
<th>S-Band</th>
<th>Ka-Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>10cm</td>
<td>-21dBsm</td>
<td>-21dBsm</td>
</tr>
<tr>
<td>1cm</td>
<td>-53dBsm</td>
<td>-41dBsm</td>
</tr>
<tr>
<td>0.1cm</td>
<td>-113dBsm</td>
<td>-73dBsm</td>
</tr>
</tbody>
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**SNR $\propto N^3$ enables detection of tiny objects**

Synoptic researchers have led multiple large DARPA efforts demonstrating distributed transmit beamforming.

Synoptic researchers have demonstrated a radar responsive microtag detectable at >2000km.