# UAS Debris Detection: *Goals, Current and Future Efforts*

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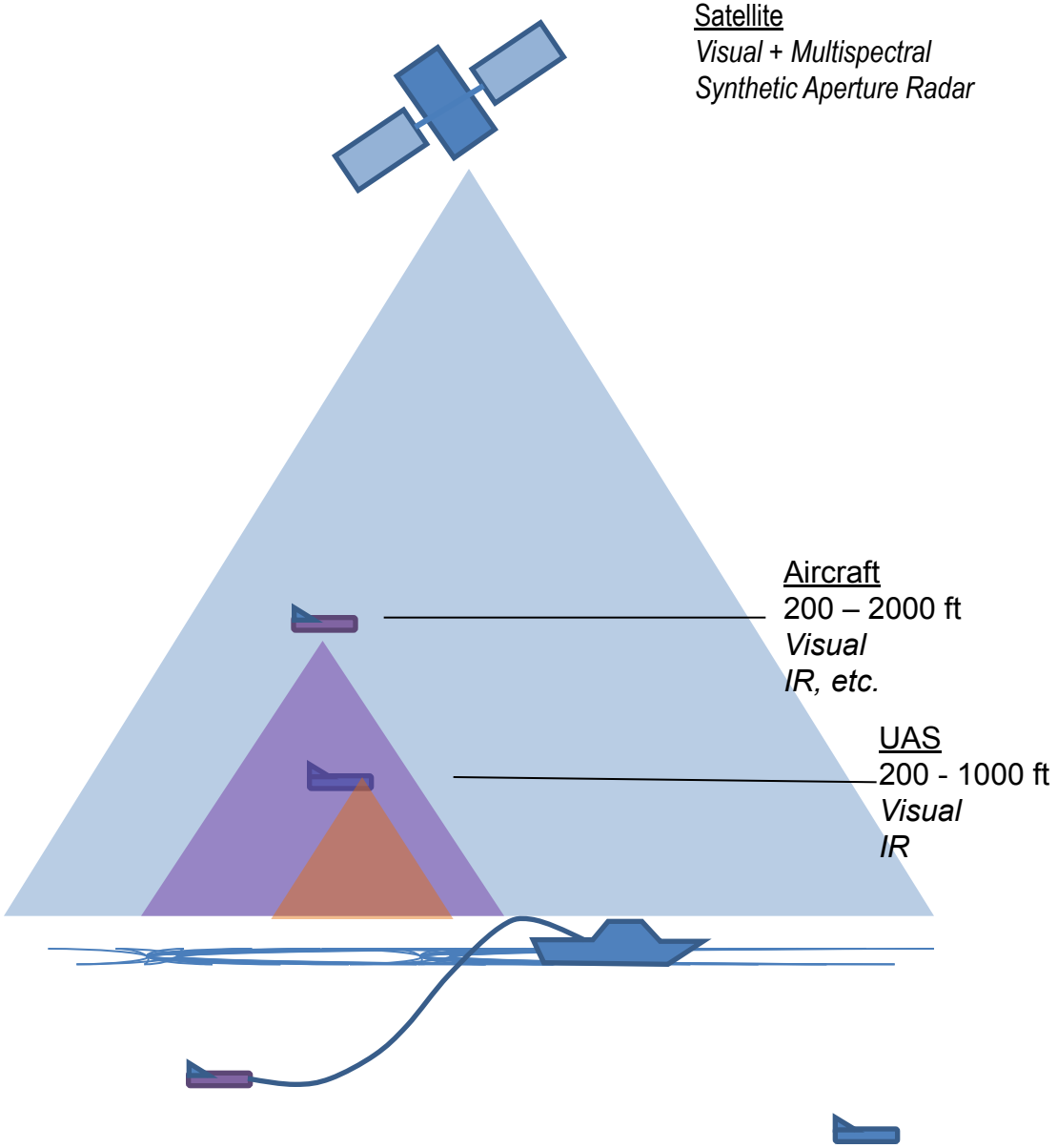
# Debris Detection Efforts

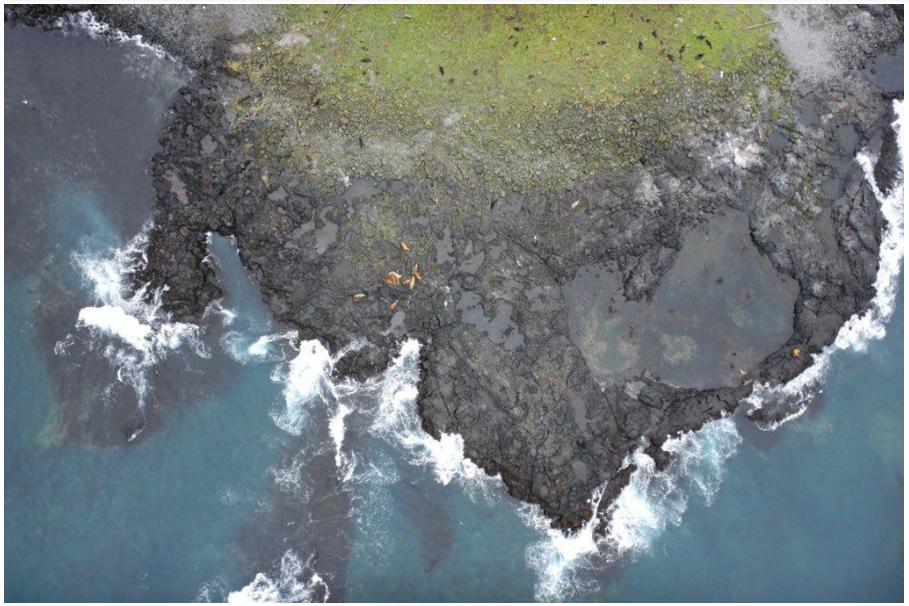
Altitude

- Satellite Surveys
- Aerial Surveys
- UAS Surveys
- Surface Surveys
  - Vessel
  - Shoreline
- Vessel-Towed
  - Sonar
  - Video
  - Diver
- AUV



# Debris Detection Goals

- Data
  - Abundance
  - Characterization / Composition
- Purpose
  - Operational prioritization
  - Scientific Evaluation
  - Policy Guidance
    - *"____ type of debris from _____ source is present and so…."*



# Debris Detection Challenges/ Nee

1. **Encounter Rate** – Debris concentration is often unpredictable and variable, particularly at-sea
2. **Debris Size –** Most debris is relatively small (<1m in long dimension, often <0.3m)
3. **Debris Composition –** Cannot "tune" approach to a single debris material, color, or shape.
4. **Debris Visibility** – Debris is often awash or partially obscured by water, sand or vegetation, reducing target size. Many platforms and sensors are weather dependent.
5. **Detection v. Identification –** Noting the presence of "something" versus identifying what the anomaly is
   - Challenge increases as resolution decreases
6. **Resolution v. Coverage –** Trade-off between detail of imagery versus coverage of imagery
   - Post-processing is often labor intensive

# UAS + MD – Example Projects

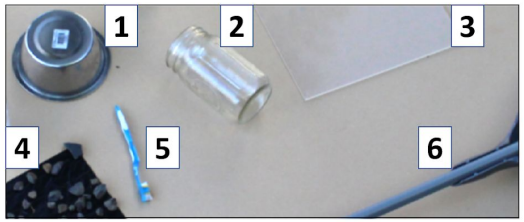
- **Rachel Carson Reserve (NC)**
  - *Duke + Rachel Carson Reserve*
  - Debris detection and prioritization in sensitive habitat
- **Northwestern Hawaiian Islands (HI)**
  - Debris detection for removal targeting and feasibility
- **Pribilof Islands (AK)**
  - Shoreline debris quantification
  - Detection & prioritization in sensitive habitat


# Oregon State + NCCOS + MDP Project

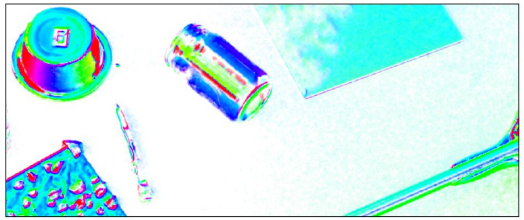
- **Question / Problem**
  - Detection v. Identification v. Quantification v. Classification
  - Diversity of object / target
- **Project Goals / Efforts**
  1. Payload evaluation / selection
  2. Define data acquisition parameters.
  3. Automate detection & material type classification.
  4. Develop and implement operationally-efficient workflows & <u>modularly deployable algorithms.</u>
     - **GOAL** = Platform agnostic tools and techniques

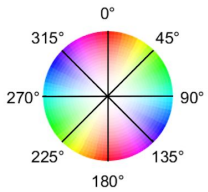
# Oregon State + NCCOS + MDP Project

- **Techniques**
  - **Polarimetric Imaging**- measurement and interpretation of the polarization state of transverse light waves reflected by object
  - **Machine Learning Processing** – Building on existing techniques to automate debris tagging and identification.

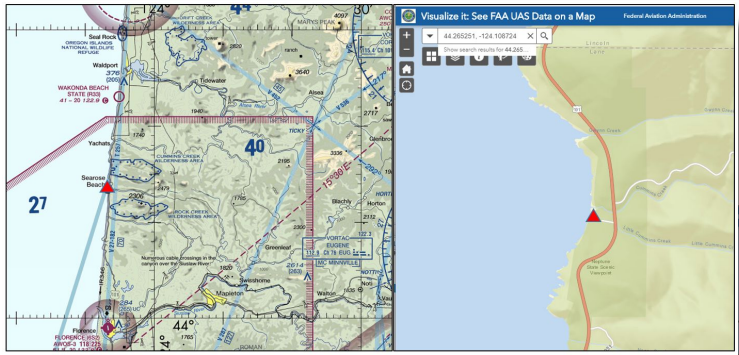



(1) Aluminum bowl
(2) Glass mason jar
(3) Acrylic panel
(4) Plastic trash bag
(5) Toothbrush
(6) Plastic broom handle

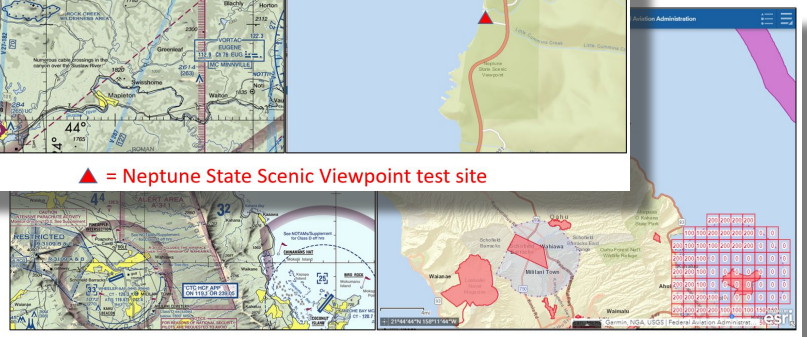





- **Phases / Actions**
  - **Data Testing** – protocols applied to test data sets, lab / controlled tests of sensors
  - **Controlled Field Tests –** Applying techniques to placed debris (Oregon)
  - **Validation Field Tests** – Applying techniques to in-situ debris (Hawaii)




▲ = Neptune State Scenic Viewpoint test site



▲ = Oahu validation site

# Thank You!

## *Any Questions?*

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