# MITRE-TRITON

## *- April 2013 TRB #4*

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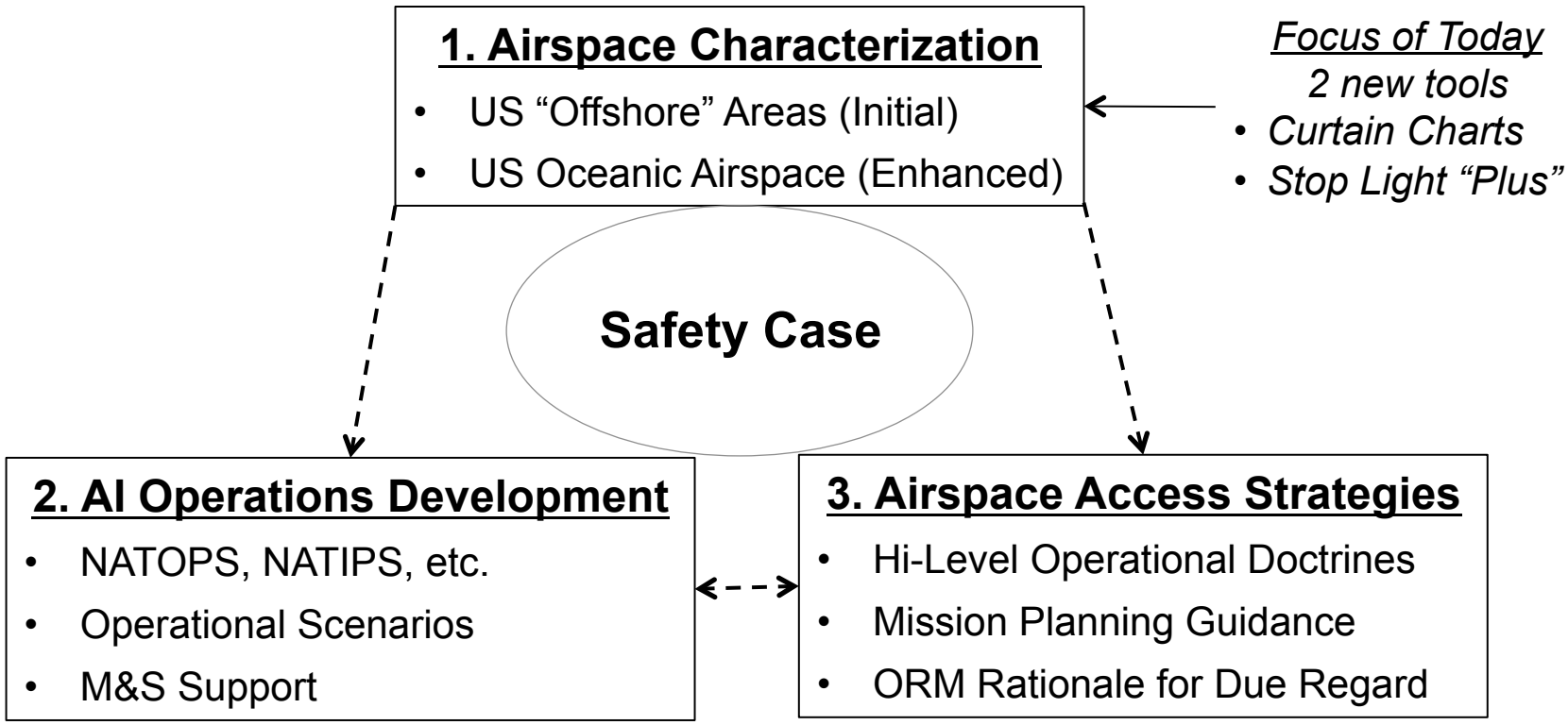
# Three Main MITRE Work Areas for FY13





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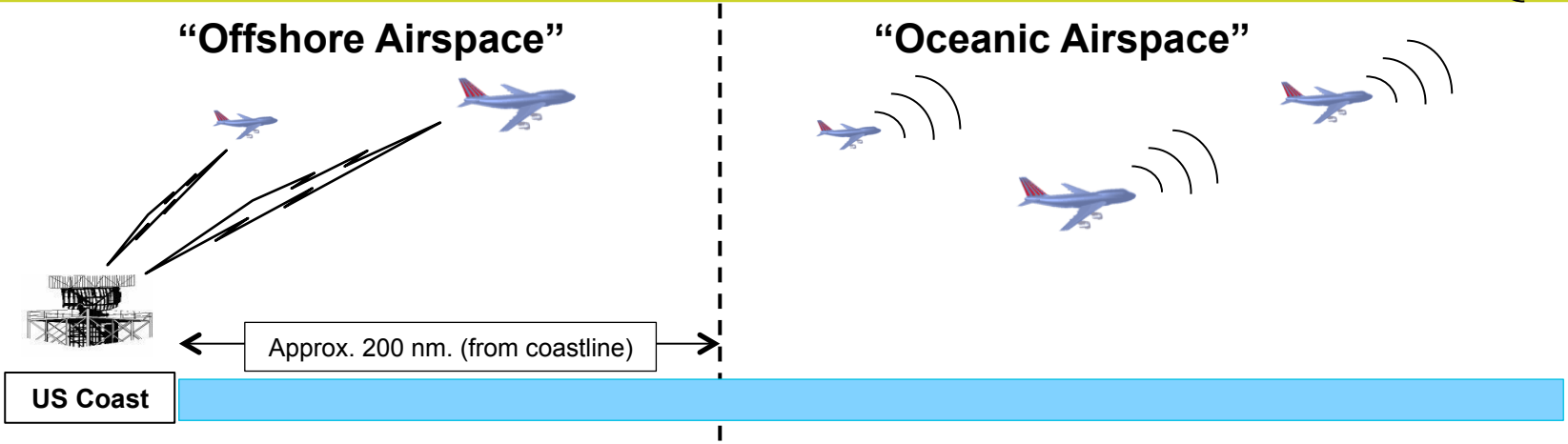
# Overview of FY13 Airspace Characterization




**Objectives:**

- Locate "breakpoints" between random domestic traffic patterns and well-behaved oceanic
- Identify offshore airspace where Triton can more easily operate due regard
- Correlate airspace features with actual usage (for Access Strategy)

**Data Sources - Terminal & En Route Radars**

- Radar Position Data with Flight Info Tags

**Objectives:**

- Identify Oceanic airspace where Triton can more easily operate due regard
- Provide objective, data-driven outputs for
  - Safety Case
  - Access Strategies
  - M&S support

**Data Sources – ATOP-Based Oceanic Centers**

- Position Report, CPDLC, and Flight Plan Messages



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# Offshore Characterization (1)

***How Close To Shoreline Can Triton Operate Under Due Regard?***

- ***Examine coastal radar data for Pacific, Atlantic***


***Radar-Derived IFR Tracks Of US West Coast - 21 August 2012***





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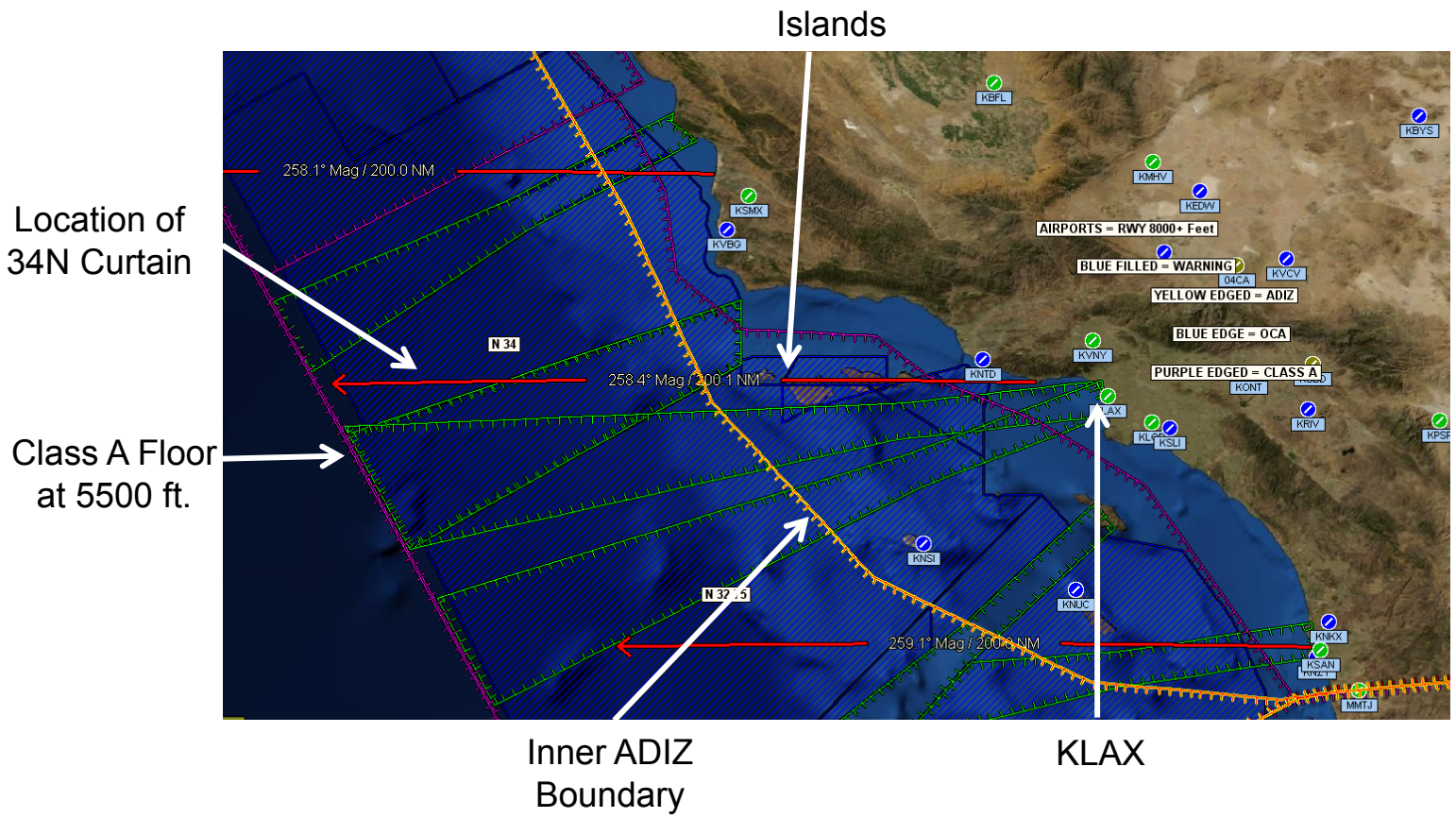
# Offshore Characterization (3)

**Airspace usage and traffic behavior can be associated with airspace, route, and surface features**





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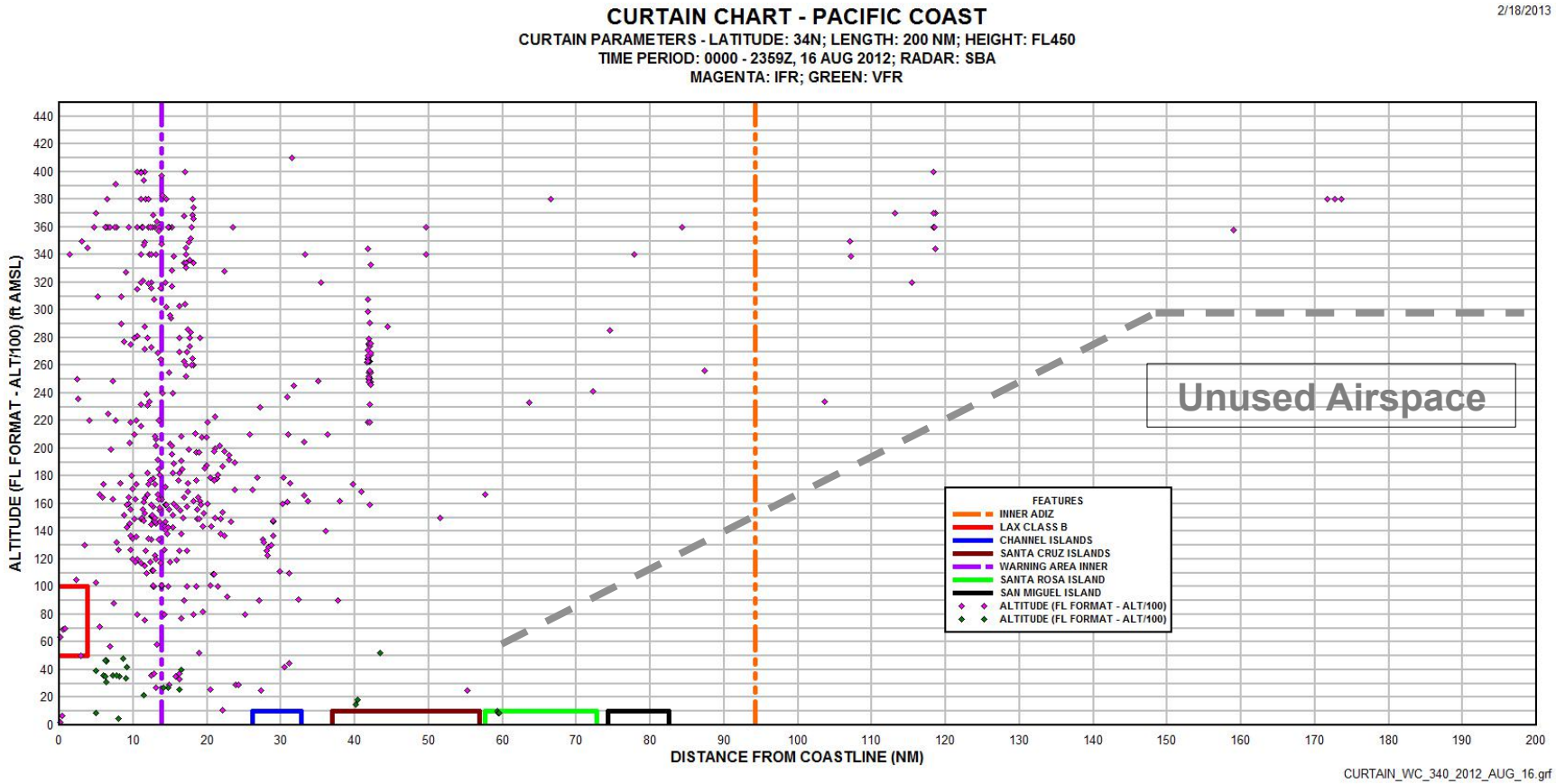
# Offshore Characterization (4)

# Offshore Characterization (5)

## Curtain Charts Provide A Way To Look At The Vertical Airspace Picture





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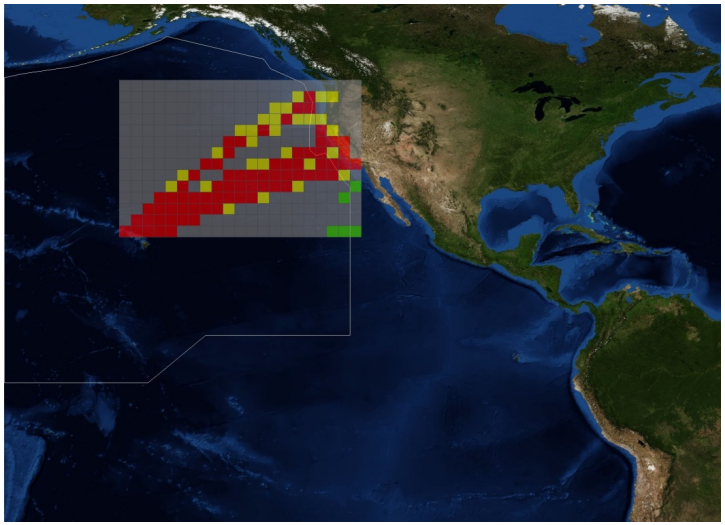
# Motivations for Enhancing Stop Light Charts

- **Earlier Stop Light Charts were strictly "proof-of-concept" visualization aids**
  - Collapsed a lot of data onto 2-D picture
    - Altitudes
    - Time Windows
  - 1deg x 1deg squares
  - Involved some subjective weighting of encounter exposure
  - Not readily extensible to other analyses
  - *"Airspace Volume" Perspective*

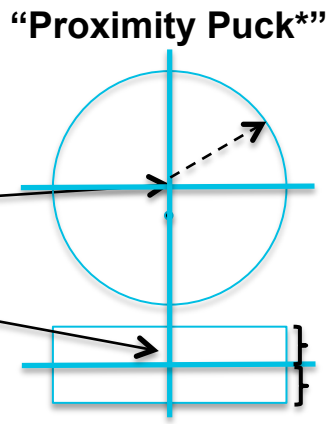


- **Needed enhanced analytical tool (Stop Light Plus – "SLP")**
  - Characterize airspace from *UAV-in-airspace perspective*
  - Extensible to other analyses and purposes (e.g. Access Strategy)

# Overall Approach in "Stop Light Plus"

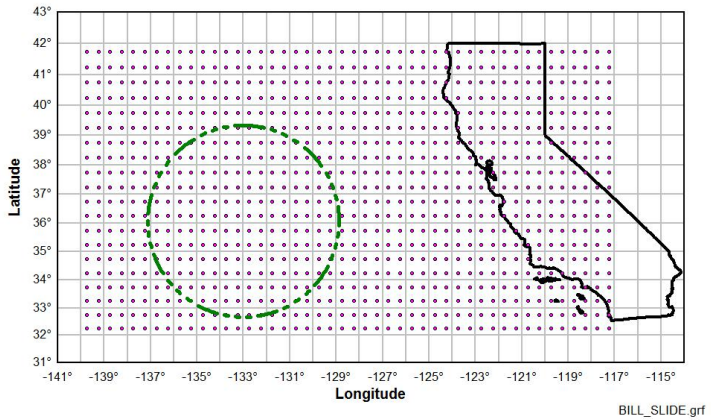
**Focus on "UAV-in-airspace" perspective**

- Examine how "proximate" air traffic would appear to (UAV) observer at a location in the airspace
  - Within specified range of a lat/lon
  - Within specified distance from an altitude
  - **Not to be confused with NMAC volume*
    - *Substantially larger than NMAC volume (and even TCAS or ADS-B volumes)*




**Develop that perspective at frequent lat/long/altitude intervals**

- Considerable overlap of "proximity pucks" is desirable





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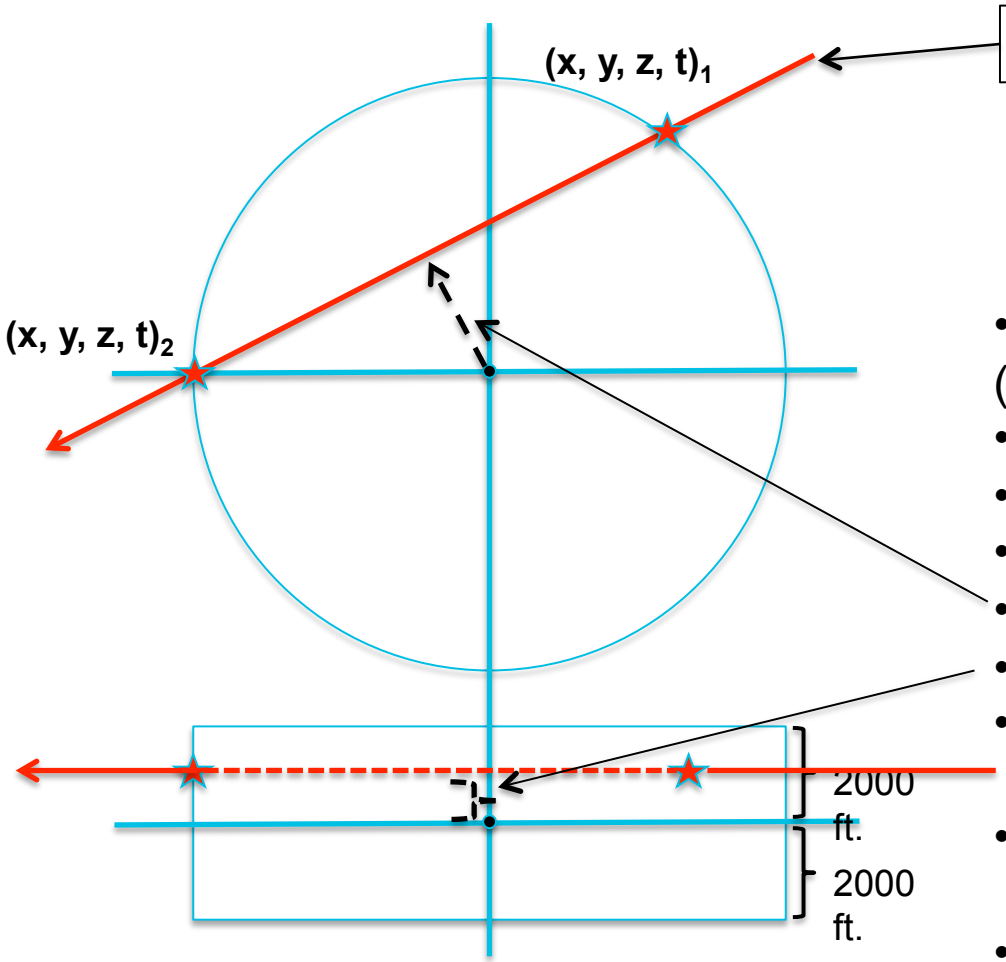
# Analysis of Each Intruder for Each Puck




**"Intruder"**

**(From traffic data)**

**Created Record**

- Aircraft Information (ID, Type, VFR/IFR, Equipage*)
- $(x,y,z,t)_1$, $(x,y,z,t)_2$
- (x,y,z)' avg. velocity vector
- Track angle
- Slant range at CPA
- Altitude separation at CPA
- Intruder speed, RCS, bearing, equipage
- Conditional/Cumulative reports
- Many more possibilities





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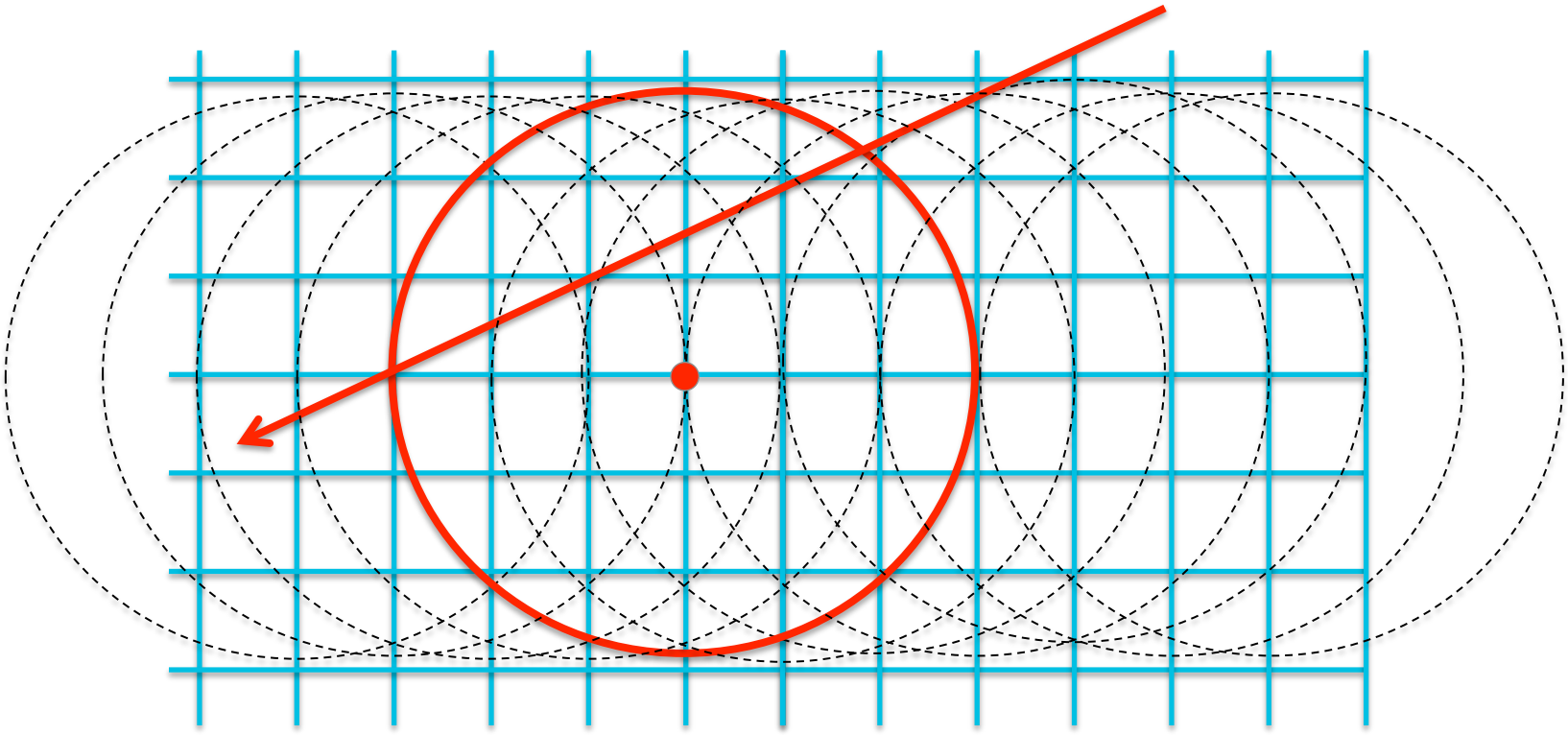
# Influence of Puck Overlap



- Intruder's influence on puck is unique to that puck
- Each puck (UA) traffic perspective is unique from all others
- Closer puck spacing provides finer granularity of results

# Advantages of SLP Approach

- **Allows for comprehensive statistical looks at the airspace**
  - Objective data describing UAV-in-airspace perspective
  - Easy identification of hot spots and cold spots
    - As input to M&S and Mission Planning/AVO tools
  - Easy examination ("windowing") of area & time of interest
    - Geographic area
    - Altitude slices
    - Time periods (e.g., by minute, hour, day, month, or year)
- **Enables estimation of encounter exposure *without* requiring**
  - Realistic, pre-determined UA scenarios
  - Full Monte Carlo encounter modeling simulation runs
- **Provides more-finely resolved data for better graphical depiction**
  - Indices can be used individually or in weighted combinations
  - Permits color-coded graphics (with animation) for visualizations

# Next Steps

- **Provide accelerated SLP example for Analysis Team (May 13)**
  - Atlantic “WATRS” Region (ATOP Data)
- **Provide analysis of offshore airspace for Atlantic and Pacific (Sep 13)**
  - Airspace usage w/in 200 nm of both coasts – two, one-week periods
  - Identify “low usage” offshore airspace using curtain chart graphics
  - Capture key relationships to airspace usage
- **Provide analysis of Atlantic/Central East Pacific Oceanic Areas (Sep 13)**
  - SLP analysis using one year’s worth of ATOP data
  - Statistical analysis & identification of hot spots and low usage volumes
  - Graphical depictions of pertinent parameters (e.g., density)
  - Incorporate observations into Access Strategy document

- **Issue: The need to obtain and analyze foreign air traffic data**
  - Focus on IOC mission areas if possible