14TH Annual Systems Engineering Conference

Data Fusing Maritime Sensors from National, Tactical, and Unmanned Aerial Systems

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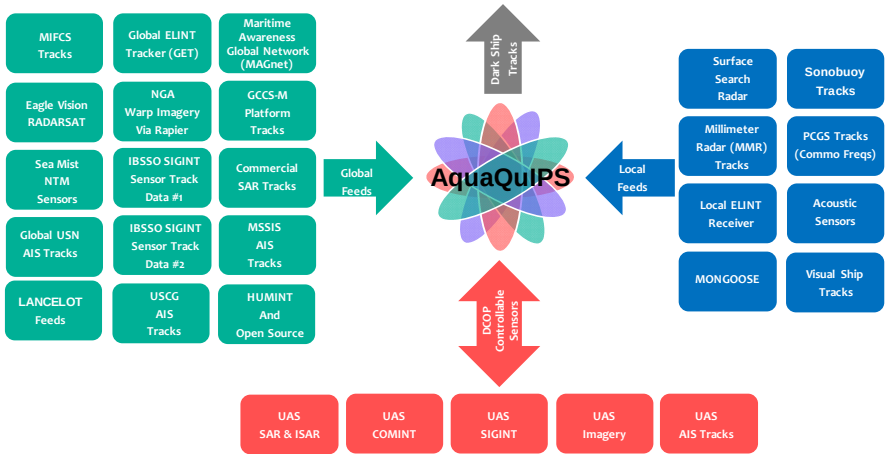
Fly on Top Operation (FoTO)

SPAWAR HQ 5.1

- *Tech Description: Utilize In-Organic (National Assets, etc…) to queue organic (tactical assets) to improve fused composite operational picture. Queuing is based upon proven data fusion engine equipped with netcentric interfaces that are used by existing deployed systems(STANAG 4586, NCCT, JAUS, CoT).*



- *TW 11 Objective: Demonstrate the ability to queue unmanned asset using information from national assets. Use NSW Group 10 sensor, EO/IR, and potentially Sea Search Radar on UAS (or surrogate) to find dark emcon silent ship and transmit image back to NQA center and post image on SIPRNET.*

- *Special Requirements:*
  - *Sensors*
    - *NSW Group 10 UAS sensor (initial discussion are underway)*
    - *Sea Search Radar (Artemis SLIMSAR loan dependent on next round SBIR funding)*
  - *Netcentric AQ fusion center at SPAWAR HQ (installation started)*

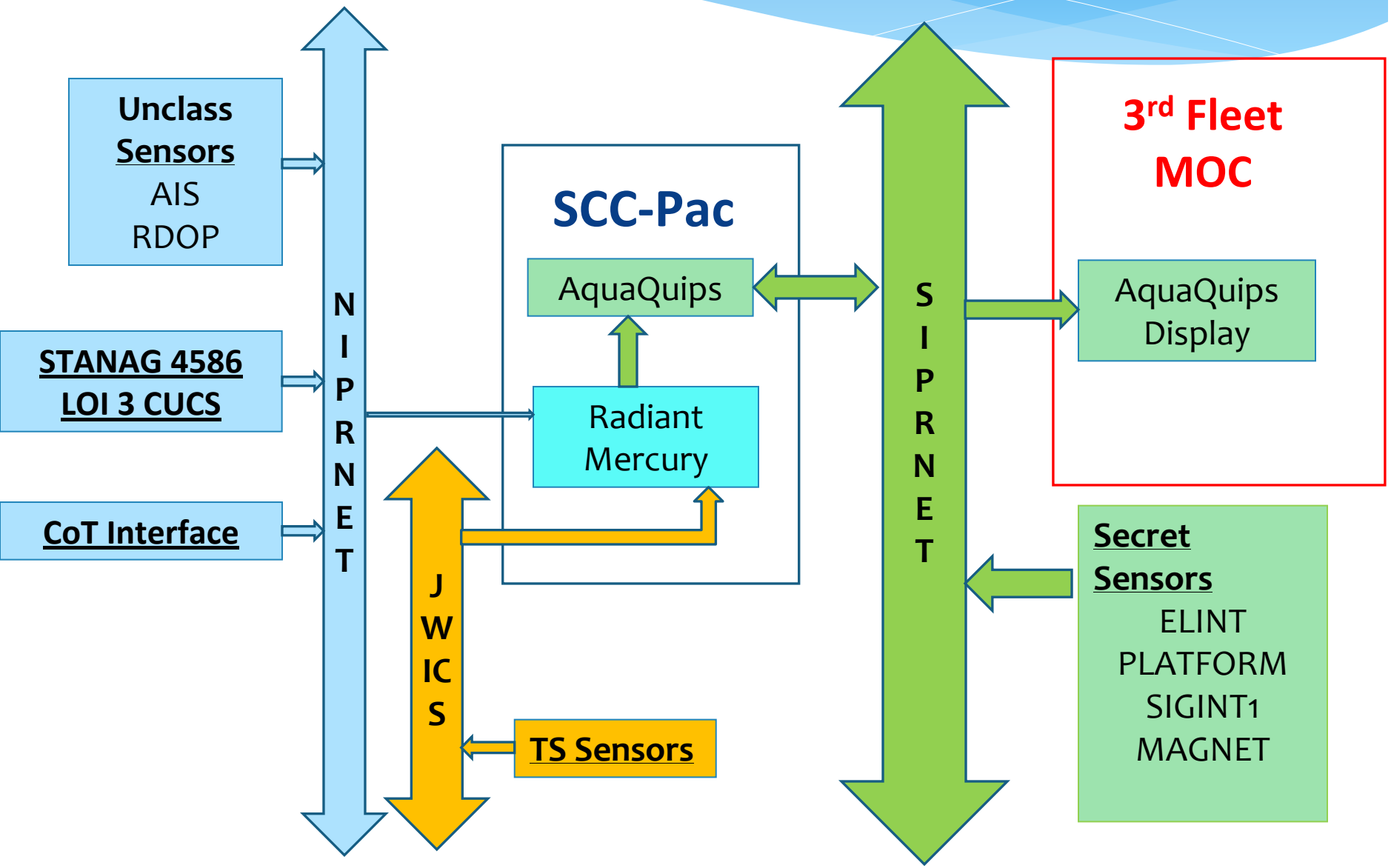
AquaQuIPS (AQ)/TrackSim Data Fusion With PACOM Funded UAS Sensors

* Three Efforts Proposed that Address the Critical Technology Gap of Data Fusion of UAS sensors:
  1. Integration of UAS sensors with the numerous tactical and national sensors currently data fused by AQ/TrackSim:
  2. Demonstration of UAS sensors with AQ/TrackSim data fusion in WESTPAC with PACOM and Singapore Navy participation:
  3. Integration of AQ/TrackSim with the Air Force's Network Centric Collaborative Targeting (NCCT) and the Navy's CEC sensor inputs:

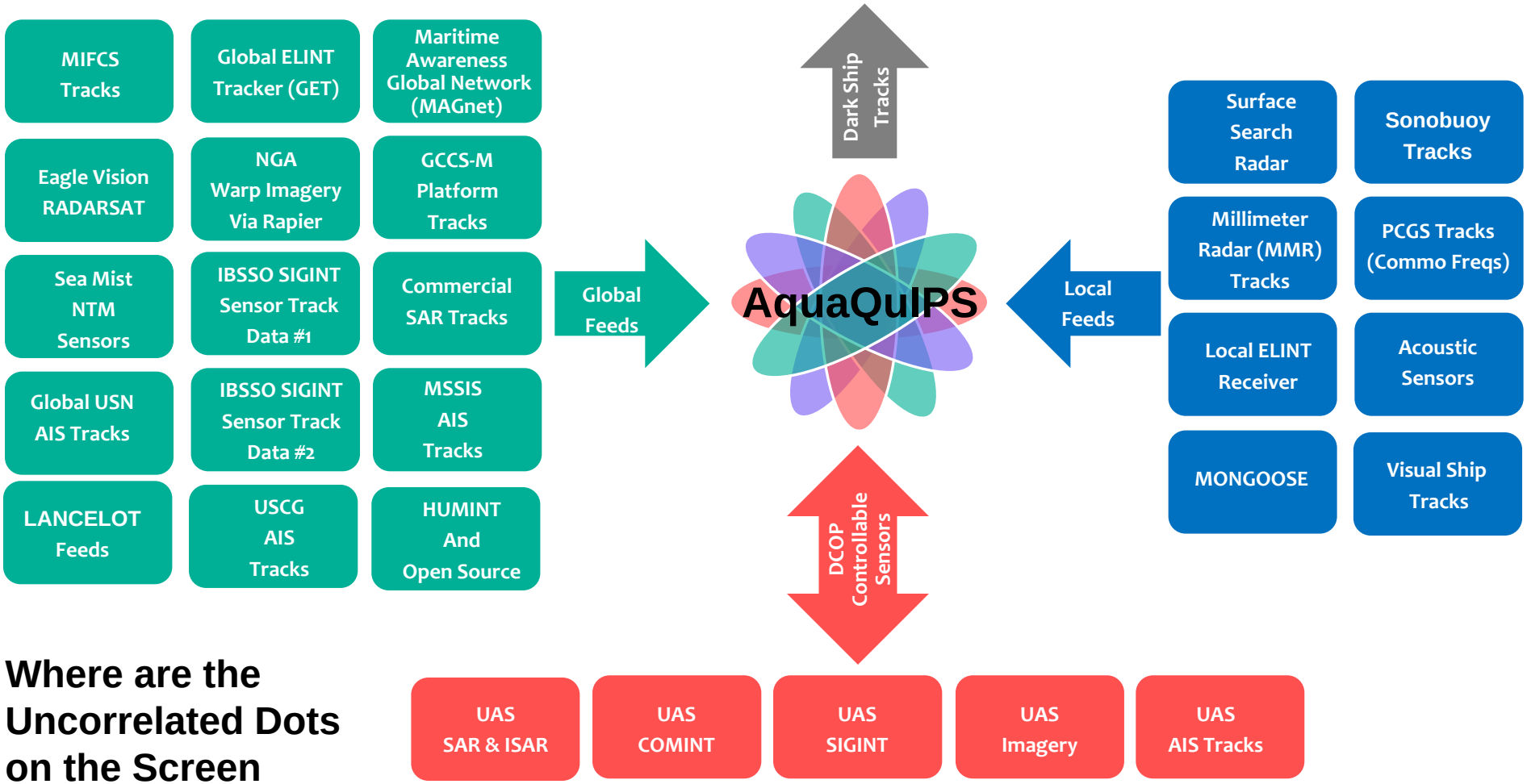
Integration of FURY 1500 sensors with the numerous tactical and national sensors currently data fused by AQ/TrackSim

- **Three Years of Trident Warrior Tests Provided More Difficult Detection and Tracking Problems Each Year**
  - TW-08 – detect large, dark, uncooperative vessels in the open ocean
    - awarded a Military Utility Assessment (MUA) for Top Ten performance rating out of 141 technologies tested
  - TW-09 – detect large, dark, uncooperative, vessel in crowded coastal shipping
    - Navy performance assessment made strongest recommendation to transition AQ to the Fleet ASAP
  - TW-10 – detect small, dark uncooperative vessel using imagery and other special sensors
    - AQ performance was excellent, but official Navy performance assessment not yet published
- **AQ won performance bakeoff and has been integrated into NAVSEA Program of Record (Undersea Warfare Decision Support System) since 2007**
- **SPAWAR HQ SBIR Phase II will partially fund adding TrackSim in the Loop with AQ, inputting FURY 1500 sensors to AQ and testing in Fleet Experimentation (FLEX)/Trident Warrior 12**

AquaQuips in FLEX 12 OV-1



AquaQuIPS at SPAWAR HQ Can Enhance Detecting and Tracking Surface Ship Threats



Where are the Uncorrelated Dots on the Screen (UDOTS)?

SBIR Phase II Base and Option Tasks

* **SBIR Phase II Base Task:**
  * Develop AQ Best Fit Algorithm to reduce multiple tracks from multiple sensors that "belong" to the same ship track.
  * Develop TrackSim "in the Loop" with AQ for data fusion engine testing and as a Tactical Decision Aid
  * Input sensors from UAS sensors to AQ in real time for testing during FLEX 12 in June 2012
  * **SBIR Phase II Option Task 1 – Automation of Abnormal Behavior (AB) detection of potential surface ships**

* **SBIR Phase II Option Task II – Develop Platform Interface Module from NCCT to AQ/TrackSim to input Air Force and CEC sensors**

SBIR Phase I Base Task and RIP SBIR II.5 Requested Support are Focused on Developing the UAS Sensor Platform as a "Core" Data Fusion Capability

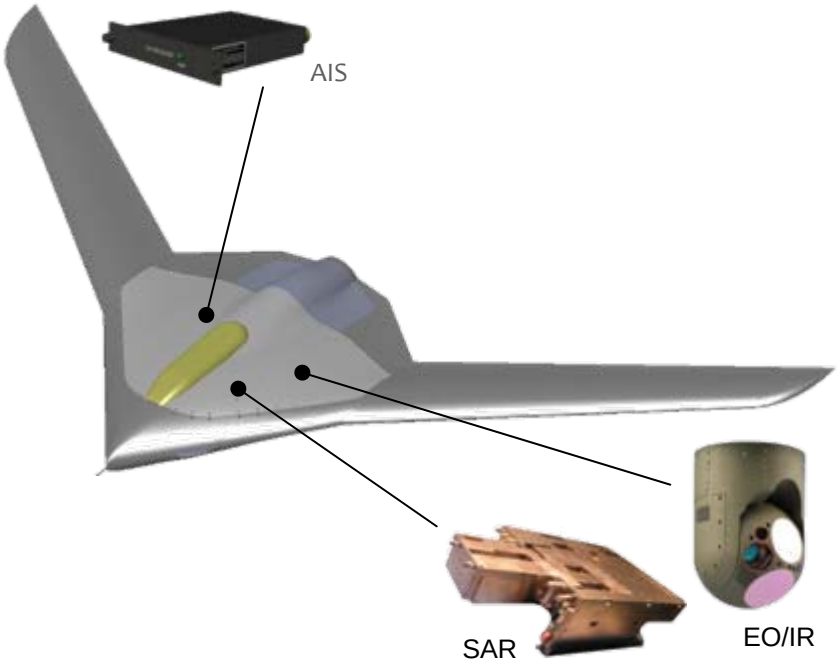
The Netcentric AQ and FURY UAS Data Fusion Advantage

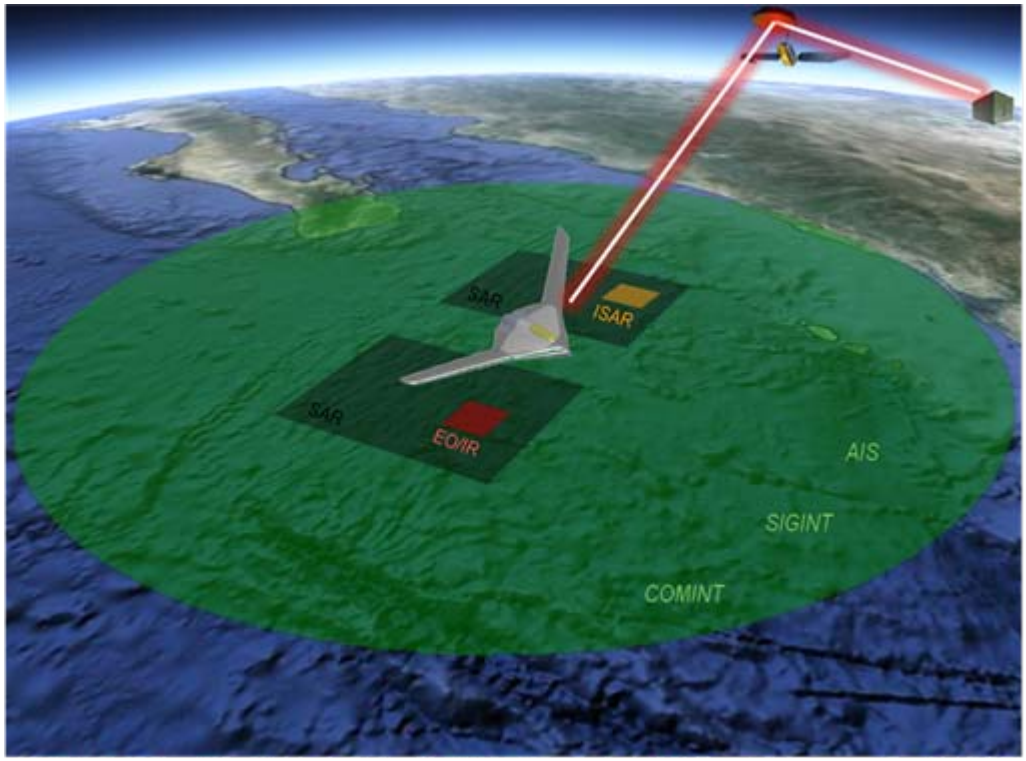
- **AQ/FURY 1500 Sensor Packages**
  - SLIM SAR (white paper available)
  - EO/IR and Streaming Video with STANAG standards
  - SIGINT

Fury-1500 UAS for Example SPSS DT&C Mission

Payloads

- SAR: SAR Maps for Wide Area Search, ISAR for Classification, MTI for Target Tracking
- AIS: Wide Area Search
- SIGINT/COMINT: Wide Area Search and Geolocation
- EO/IR: Target ID and Tactical Situational Awareness

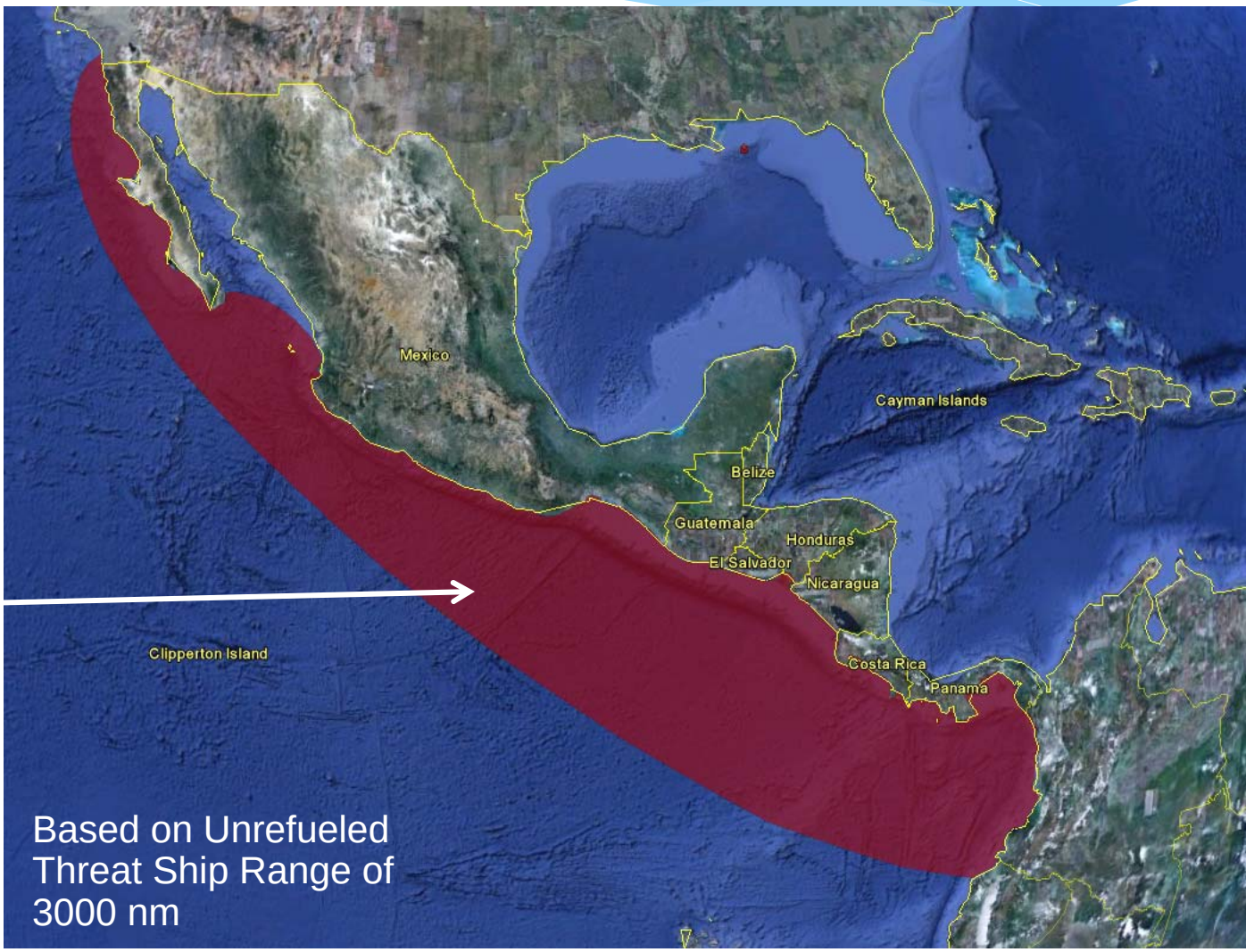




Candidate Search Area

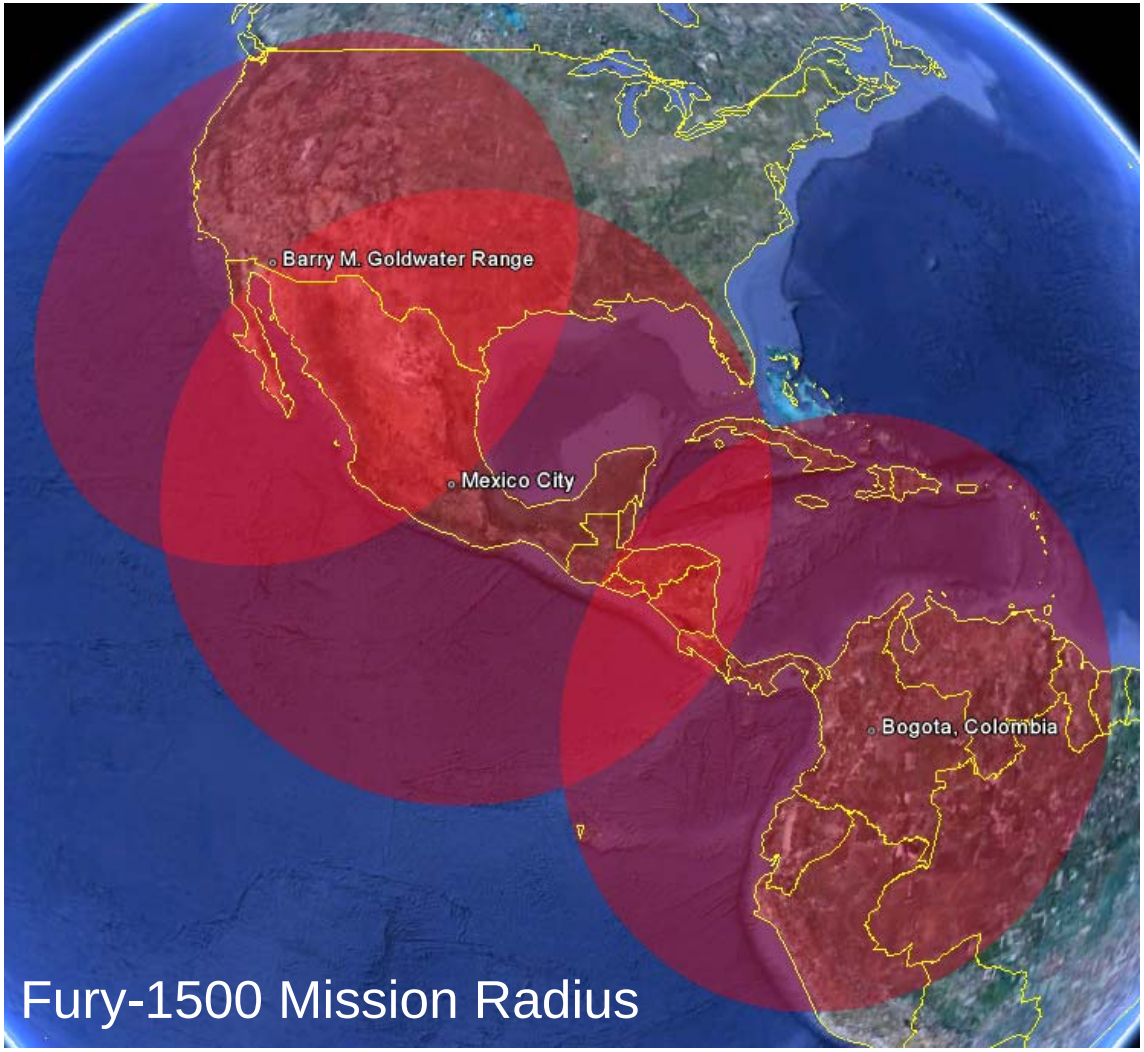
Threat Could Be Located Anywhere In This Region During

Distance From Coast Is 0 – 500 nm



UAS Spot Coverage

Fury-1500 Pacific Coast Coverage

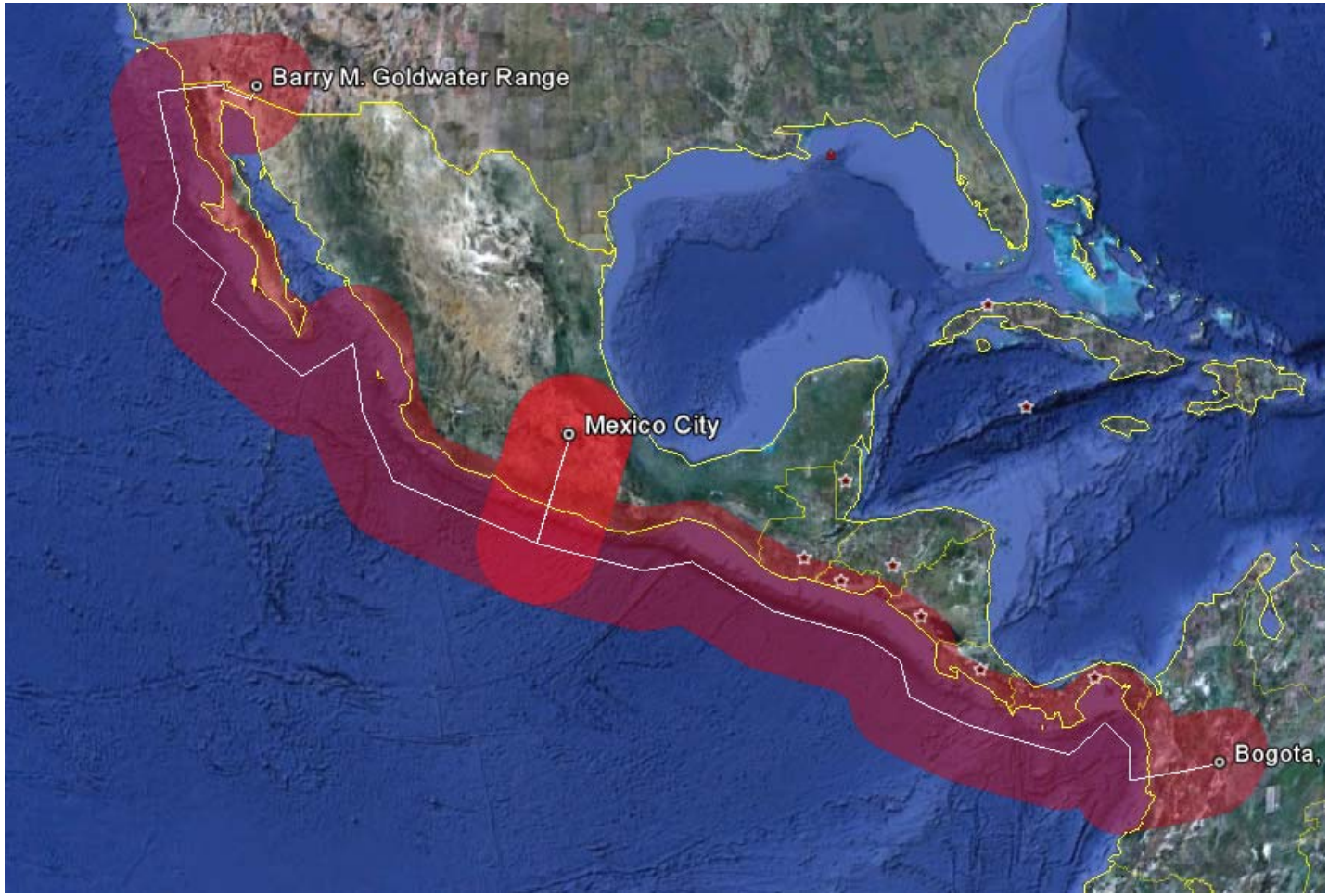


Fury-1500 Mission Radius

Complete Coverage of Pacific Coast from Colombia to Washington State from 3 Bases:

1. Barry M. Goldwater Range, Az
2. Mexico City, Mexico
3. Bogota, Colombia

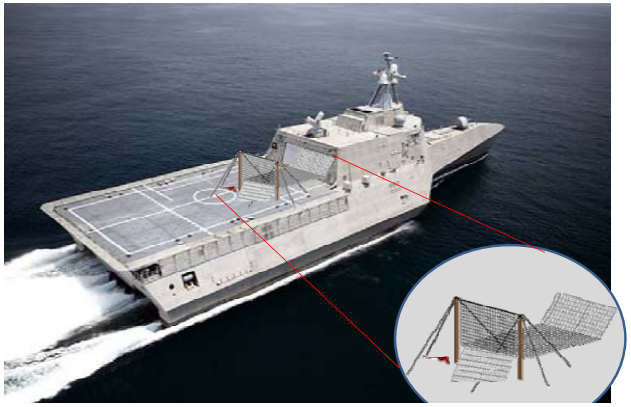
Pacific Coast Route Segments



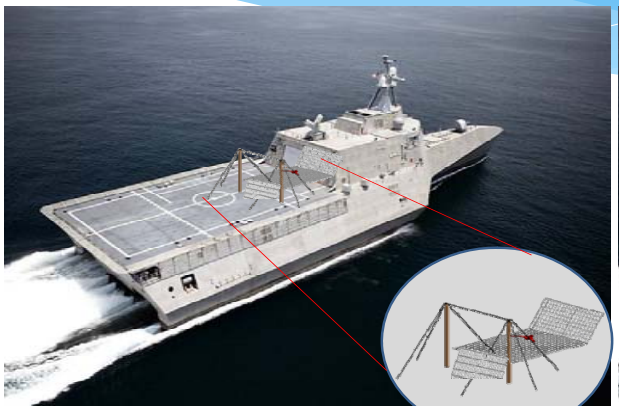
Expected Results

* Demonstration of the value of having a Track Simulator (TrackSim) in the same processing loop as the data fusion engine during TW-12.
  * TrackSim used to improve the AQ data fusion algorithm
  * TrackSim used as a near real time Tactical Decision Aid (TDA)
* Demonstrate the near real time data fusion of FURY sensors to Fly on Top of the uncooperative dark contact as vectored by AQ at the THIRD Fleet MOCC
* Initial steps taken to **Automate Abnormal Behavior Detection.**
* Data fusion of TS/SCI sensor data with normal AQ Secret and Unclassified sensor data using RADMER

US Navy Integration Concepts

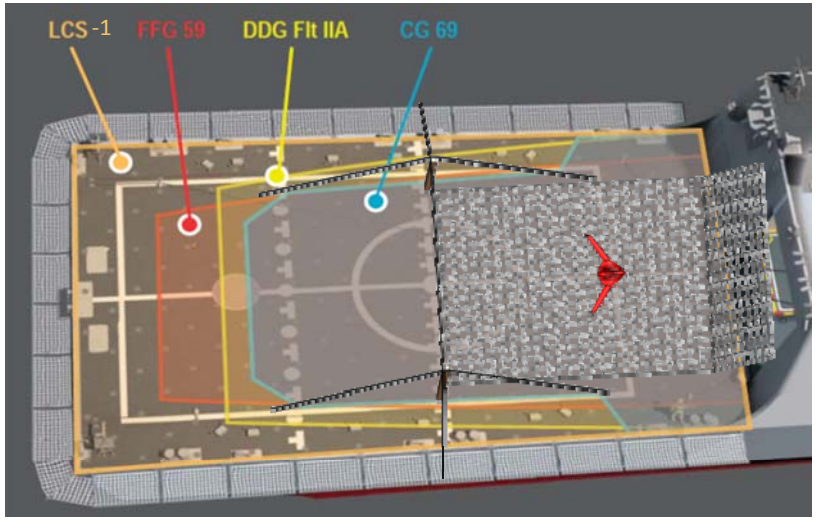


Net Deployed



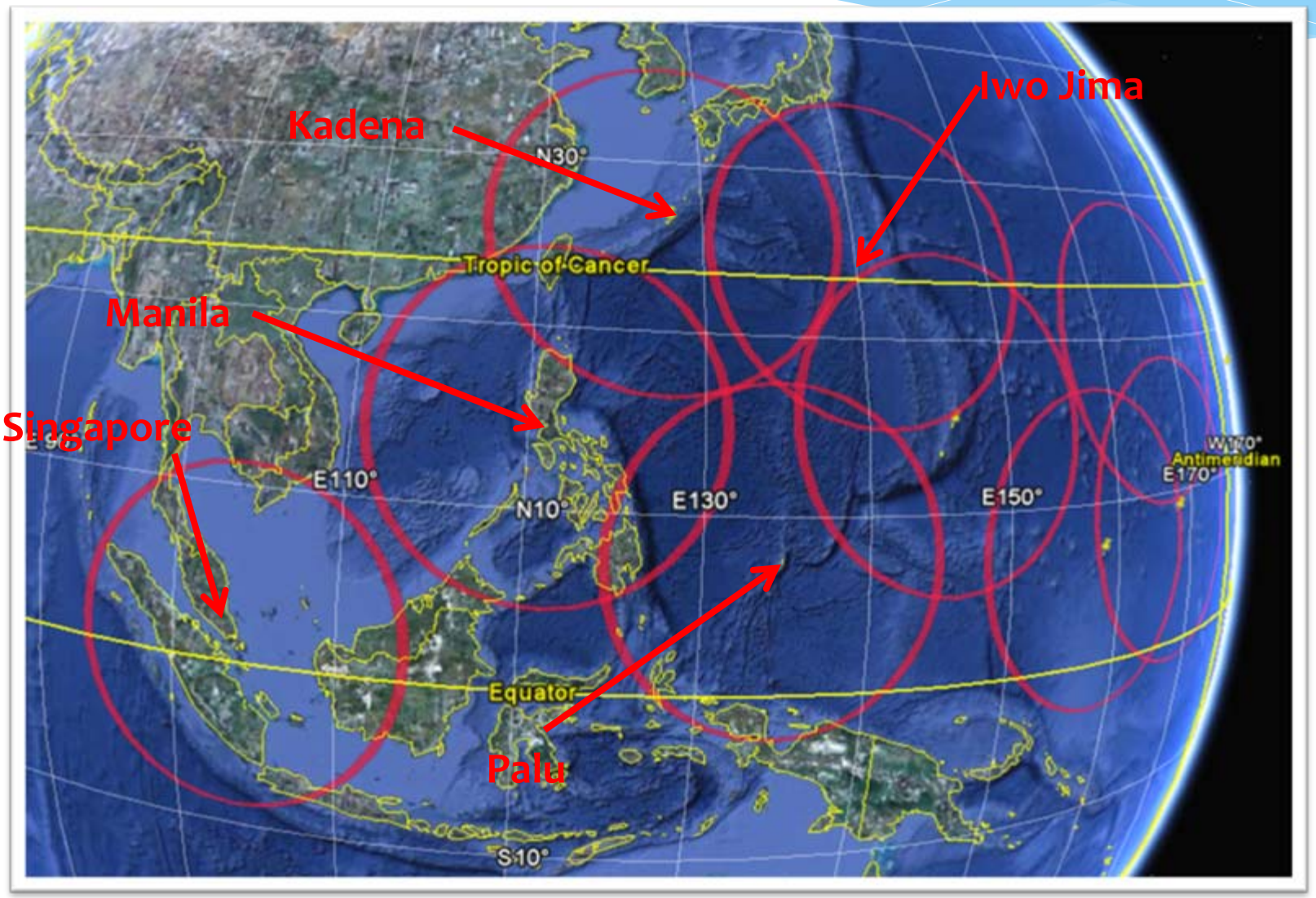
UAV Captured

Net Stowed

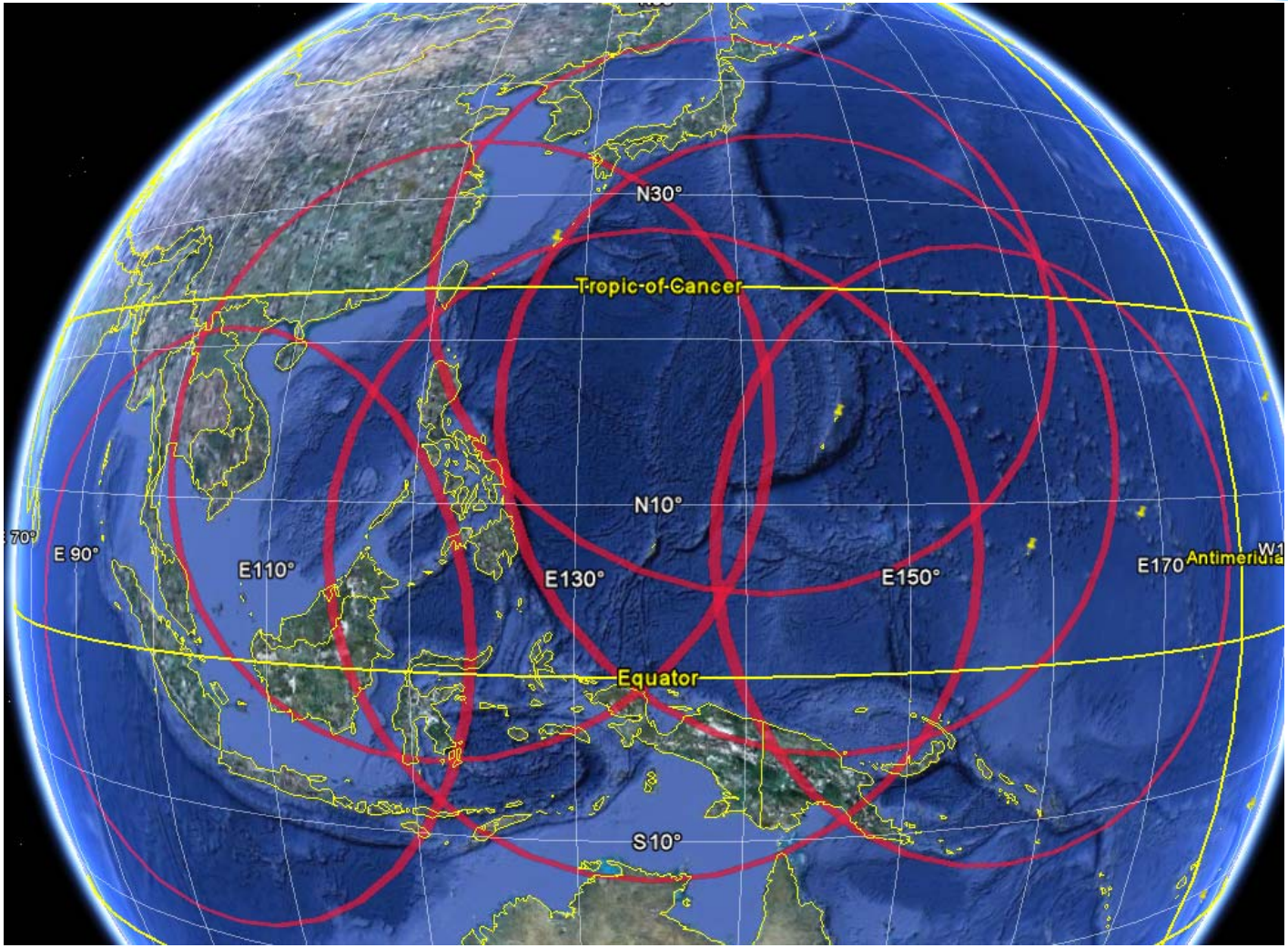


Fury 1500 Net Recovery System footprint on CG, DDG and LCS-1

600nm Combat Radius



1200nm One Way Radius



1200nm one way range circles. Uses

Singapore

Manila

Saipan

Palu

Kolonia

Iwo Jima

SBIR Phase II Option Task:

Integrate NCCT Air Force and Navy CEC Sensors into AQ/Track/Sim by Developing the NCCT to AQ Platform Interface Module (PIM)

Integration of AQ/TrackSim with the Air Force's Network Centric Collaborative Targeting (NCCT) and the Navy's CEC sensor inputs

* Specific Objectives:

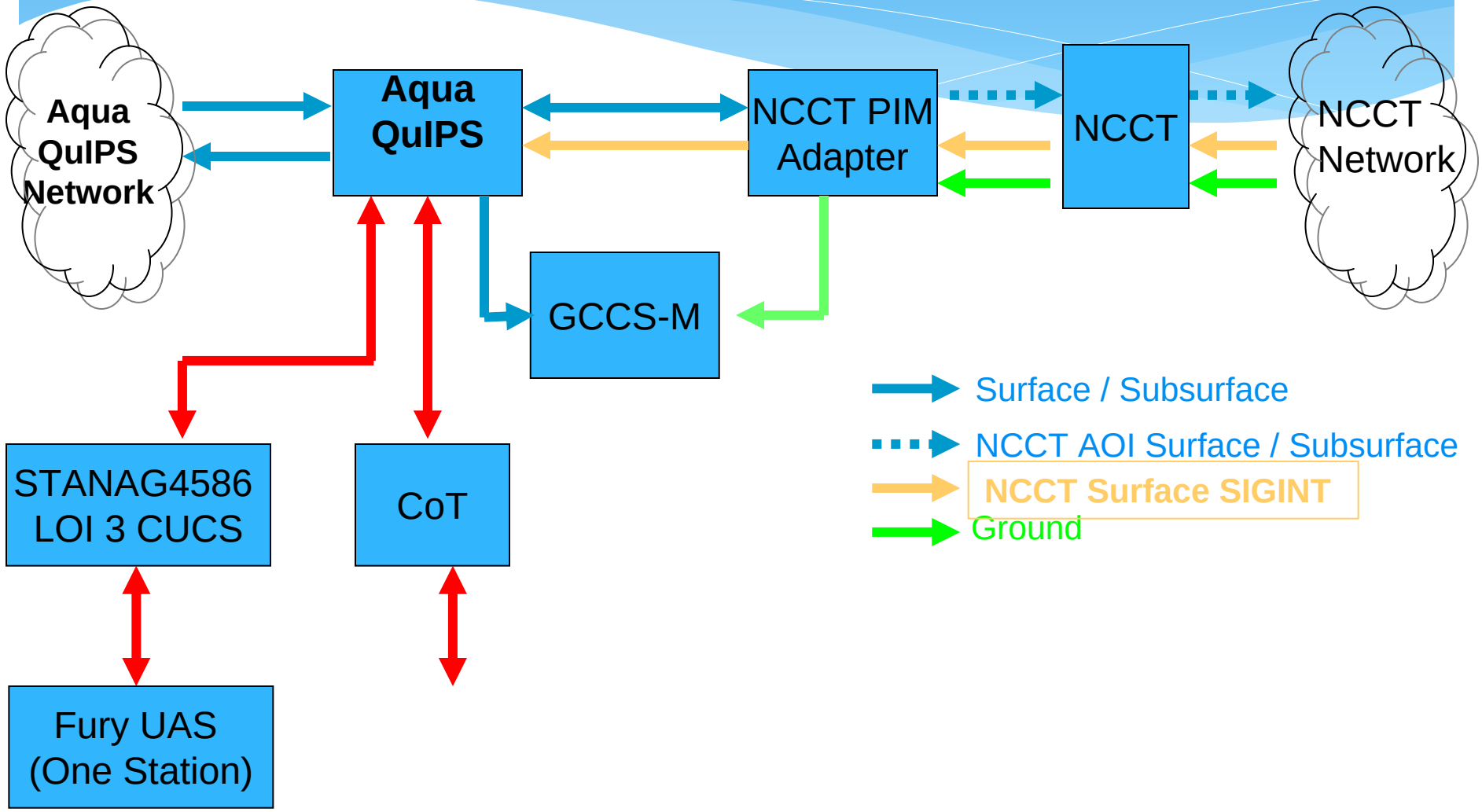
1. Process Line of bearing (LOB) vs time NCCT tracks from Air Force Mobile sensor platforms (e.g., JSTARS, Rivet Joint, etc.) via "forward" PIM. Possibly obtain Navy CEC surface ship tracks via an existing, but incomplete NCCT PIM

2. Develop AQ data fusion algorithm for LAT/LONG vs time tracks with LOB vs time tracks.

3. Develop data fusion CONOPS for utilizing both mobile Air Force sensor platforms and mobile and reroutable UAS platforms to Fly on Top of contacts of interest at low altitude

4. Obtain Air Force Big Safari and/or ONR funding to develop software for the "reverse" PIM to transmit AQ composite tracks (with NCCT data included) back to NCCT.

Netcentric AquaQuIPS-NCCT Integration Functional Flow



Conclusions

* UAS sensors need to be data fused with other national and tactical sensors to provide an accurate, timely MDA ship track picture.
* The UAS can be queued by other sensors providing "sniffs" of potential threats, and "Fly on Top" for positive classification
* Surface (and submerged) asymmetric threats are now capable of delivering nuclear weapons and other WMD to U. S. ports and world ports that host U. S. Naval assets