Acquisition Directorate

Research & Development Center

Automatic Transfer of SAR Patterns for AUXSAR

Report No. CG-D-04-16

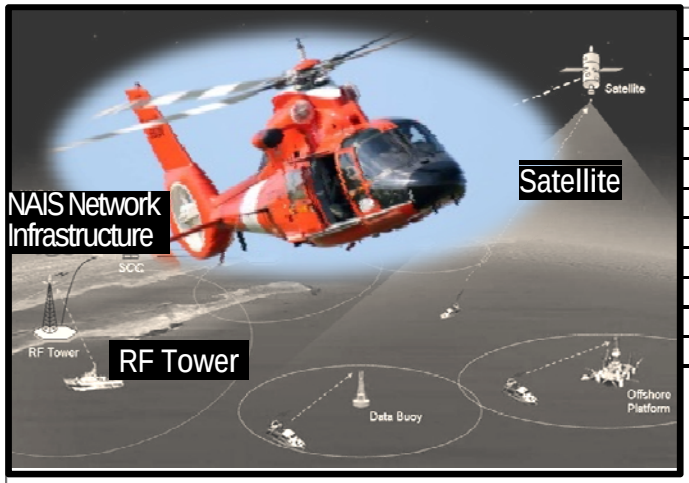
Distribution Statement A: Approved for public release. Distribution is unlimited.

Automatic Transport of SAR Patterns

Mission Need: Near real-time Search and Rescue (SAR) patterns for forward assets to effectively execute mission.

Project Objectives:

- Demonstrate and evaluate the near real-time transport of Search and Rescue Patterns to forward assets.
- Define required capabilities for deployment/transition.
- Provide system architecture(s), System Dataflow Diagram(s), and Concept of Operations (CONOP) documentation necessary for deployment/transition of the system.
- Inform planned Enterprise Transmit solution being coordinated by CG-761.



POSITION
36:50.190N / 076:17.907W
36:50.190N / 076:17.907W
42:21.310N / 071:03:046W
42:80.872N / 069:35.504W
42:22.062N / 071:03:169W
41:16.185N / 072:54.112W
41:20.635N / 072:05.745W
36:52.915N / 076:21.528W
36:52.915N / 076:21.528W

Key Milestone / Deliverable Schedule:

Project Start	12 Nov 14 ✓
Auxiliary Search and Rescue (AUXSAR) Test	10 Sep 15 ✓
★ Sponsor Brief AUXSAR Test	Oct 15
Cutter Test	Dec 15
★ Sponsor Brief Cutter Test	Feb 16
Fixed Wing Test	Nov 16
★ Sponsor Brief Fixed Wing/ KDP for Rotary Wing	Jan 17
Rotary Wing Test	Jun 17
★ Rotary Wing Brief	Jul 17
★ Final Summary Report	Sep 17
Project End	Oct 17

★ Indicates RDC product.

Sponsor: CG-761

Stakeholder(s): CG-711, CG-731, CG-751, C3CEN, CG-SAR, CG-5P

Project #:	RDC POC:	CG-926 Domain Lead:
8113	Mr. Sean Lester (860) 271-2800	Mr. Jaurin Joseph (202) 475-3493

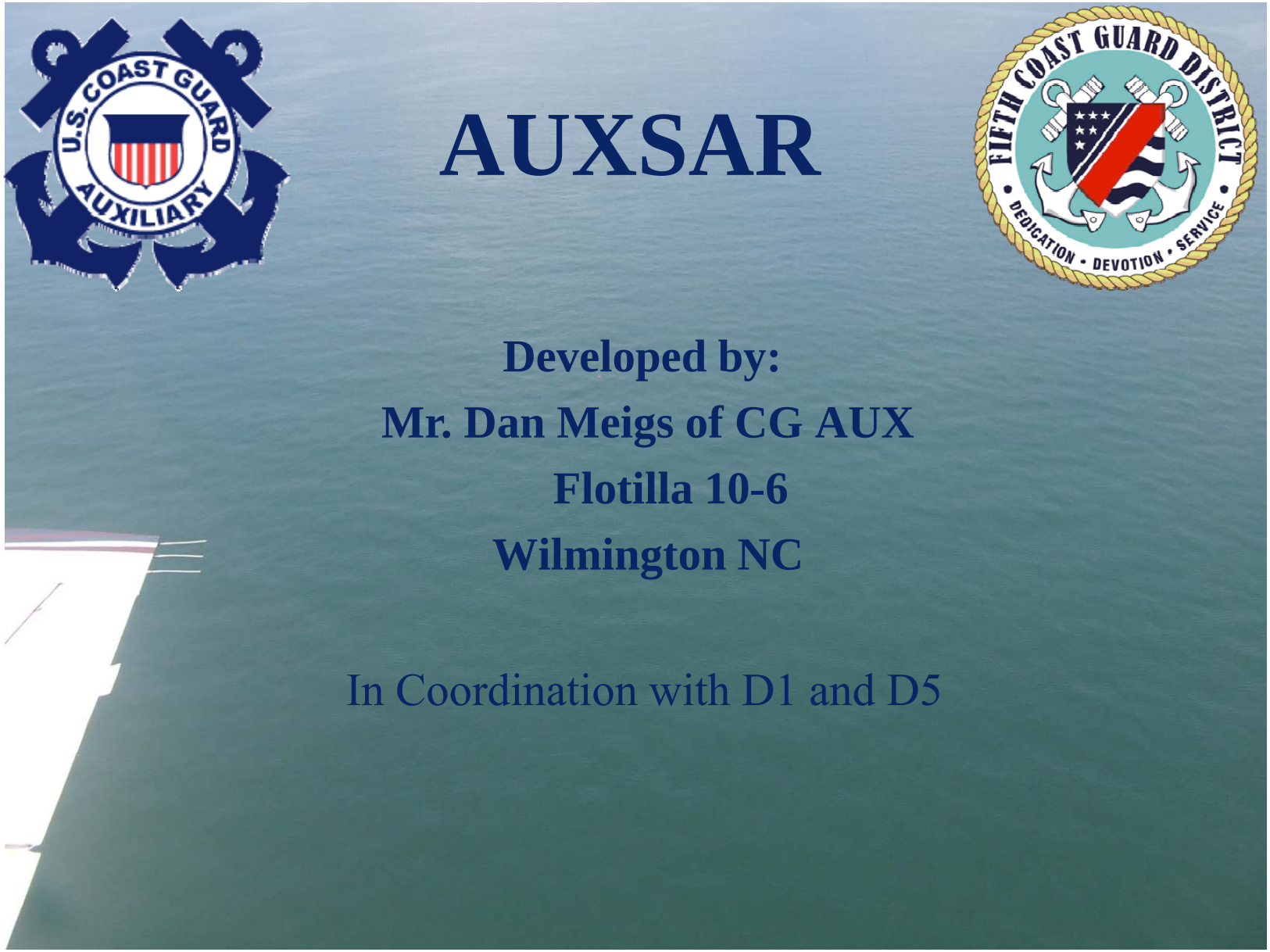
Expected Benefit:

Improve operational performance/efficiency/mission execution/resiliency

Notes:

Response Boat testing cancelled due to SINS II Acquisition

Introduction



Overview

- **Overview of AUXSAR/System Design**
- **AUXSAR Field Test**
- **Potential CONOPS**
- **Path Forward to Transition**

Overview of AUXSAR/System Design

Overview of AUXSAR/System Design

- **Reads Search and Rescue Optimal Planning System (SAROPS) pattern summary Falcon View (FV) format**
  - Recently added the ability to read text search pattern summaries
- **Creates boat and aircraft navigation system input**
  - CG SINS (RB-M, RB-S)
  - CG HC-130J, MH-65, MH-60T (PFPS)
  - CG GCCS .ovl for Mission Suite/Pallet (HU-144/130J)
  - Cutter VEGA (ECS/ECDIS)
  - Garmin Flight Plan (GNS-400, 500, and 600 series, G1000 etc)
  - ForeFlight with FlightSream technology
- **Reads & writes GoogleEarth/CG EGIS .kml**

Overview of AUXSAR/System Design – Generated AUXSAR File Types

- Response Boat – Small (RB-S) (grp, rte, wpt)
- Response Boat – Medium (RB-M) (.rou, .rat from GPSU)
- GoogleEarth /eGIS .kml (pattern name)
- .xml (PFPS: Large CG Aircraft)
- .fpl (Garmin Flight Plan: G1000 etc)
- .txt (ForeFlight)
- .sar (GPSU: to create RB-M files)

Overview of AUXSAR/System Design – General Operation

- Search planners create search action
- AUXSAR reads exported SAROPS pattern file
- AUXSAR creates Navigation (NAV) system files
- MS Outlook macro creates email with attached NAV files
- NAV files are emailed to Station/ SAR Resource Unit (SRU)
- Station/SRU uploads to NAV system
- Pattern run as Global Positioning System (GPS) route

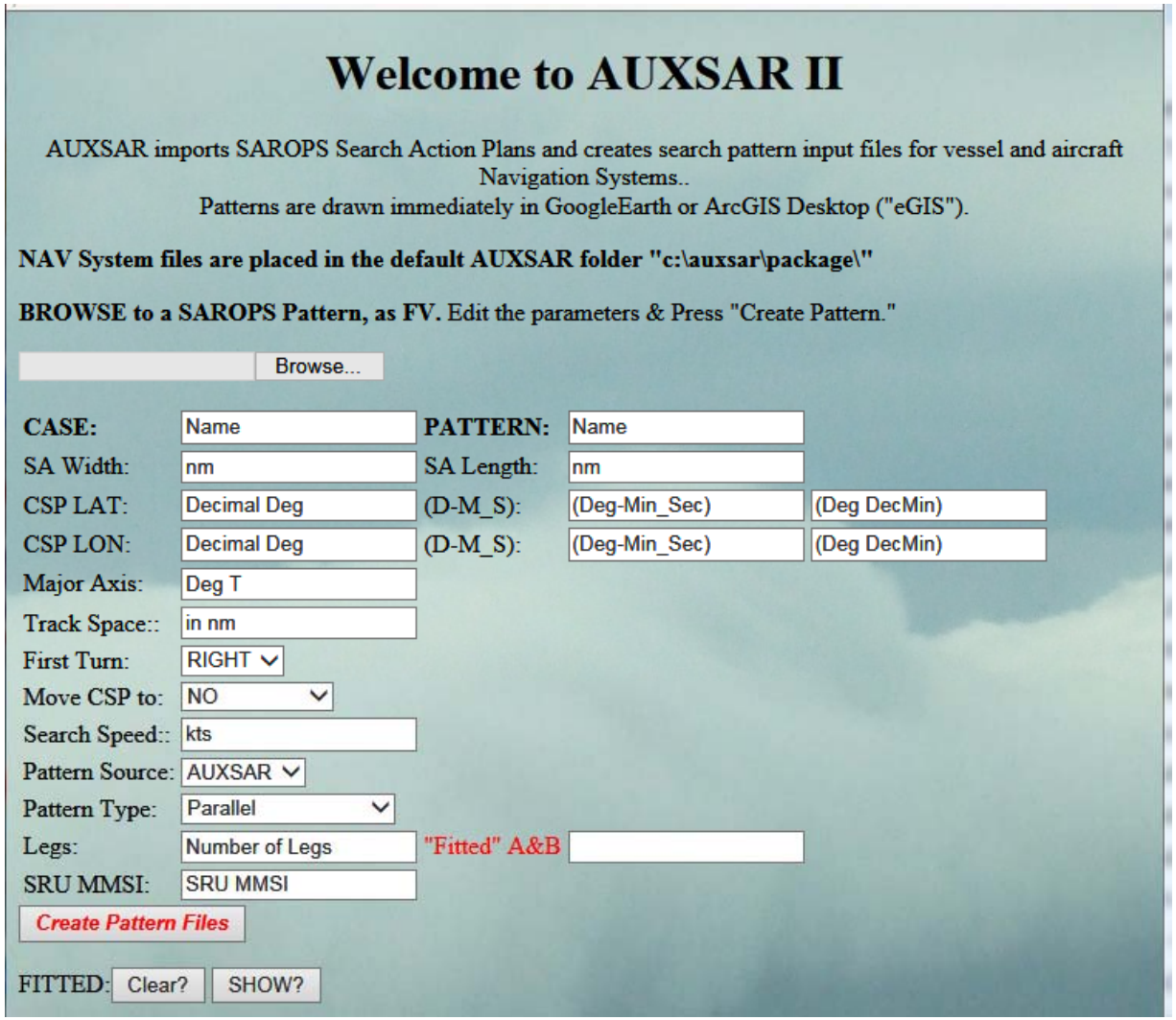
Overview of AUXSAR/System Design – Prototype Installations

- Standard Workstation III (SWIII)
- Sector Command Centers (SCC)
- Stations in CGOne Network
- Mission Suite (130J, 144A)
- SBU notebook (Air Stations)
- Standalone notebooks

Overview of AUXSAR/System Design – Computer Environment

- **Javascript in html wrapper (Web Page)**
- **Not installed as a "registered" program**
- **No changes to registry**
- **Interpreted by Internet Explorer (IE) 11 (already approved for Image 7)**
- **Program files stored locally, executed locally**
- **File I/O is all intranet/local**
- **Makes no calls to Internet**
  - Launches Google Earth (or kml associated application) automatically through associated programs in Windows to display patterns

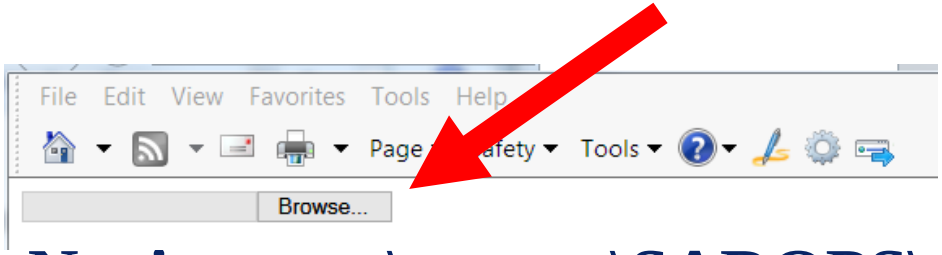
Overview of AUXSAR/System Design – AUXSAR Interface



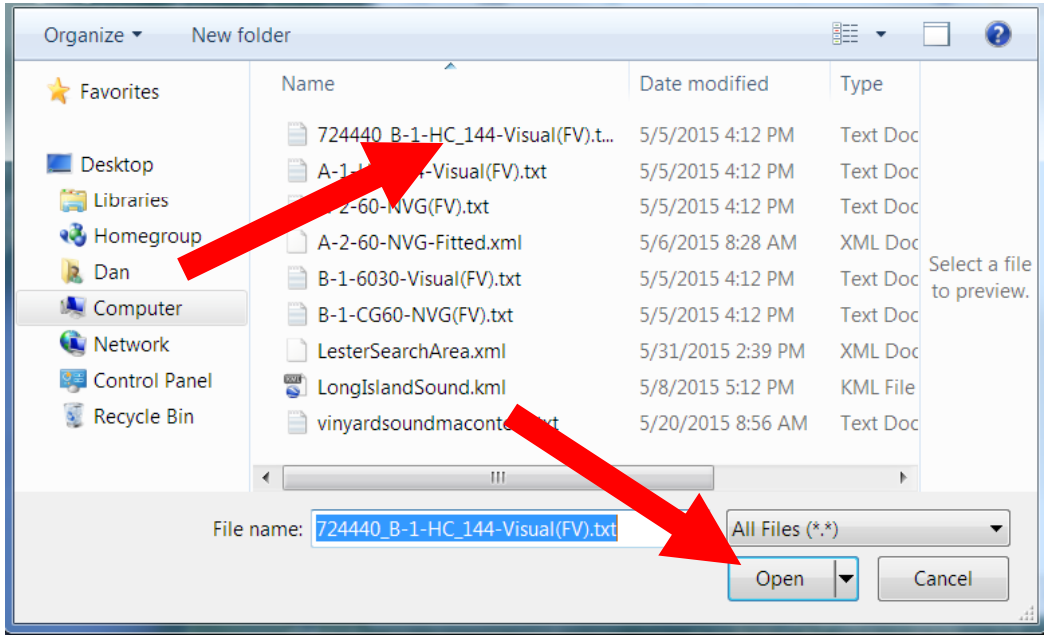
1. Browse to SAR file
2. Select the file
3. Fields are imported
4. Add missing data and/or modify search
5. Create patterns

Overview of AUXSAR/System Design – Pattern Upload

- Select pattern to upload
- Select “Browse”



- Navigate to \auxsar\SAROPS\ (or any location)
- Select a file

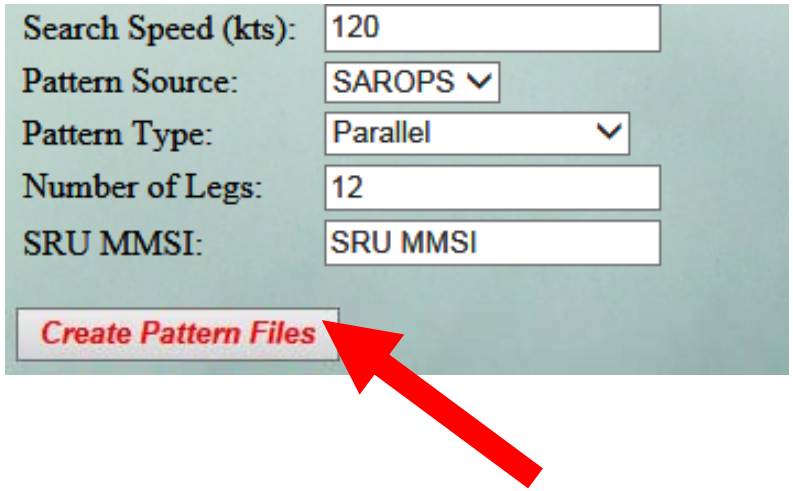


Overview of AUXSAR/System Design – CASE/Pattern/CSP

CASE:	A-1-1501-Visual	**PATTERN:**	A-1-1501-Visual	
SA Width:	37.7	SA Length:	21.8	
CSP LAT:	35.05	(D-M_S):	35-2' 59.999" N	35-3'
CSP LON:	-75.419	(D-M_S):	75-25' 8.3999" W	75-25.14'

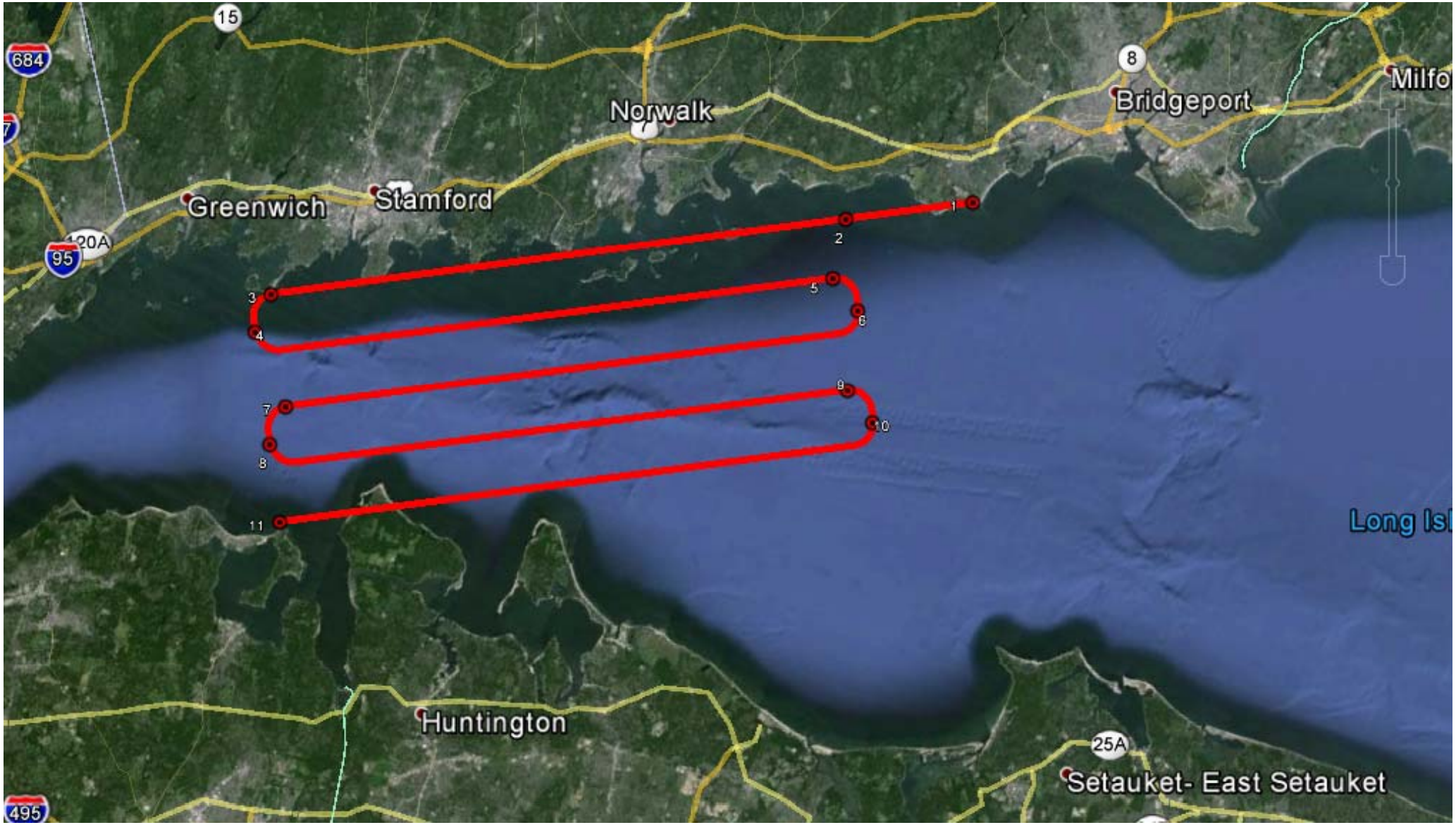
- **A CASE may have many PATTERNS**
  - PATTERN name becomes file name
  - CSP LAT/LON in decimal degrees
  - LAT/LON convention for sign ("-" West LON)
  - CSP LAT and LON shown in additional formats
    - Deg-Minutes_Decimal Seconds
    - Deg-Decimal Minutes

Overview of AUXSAR/System Design – Create Pattern Files

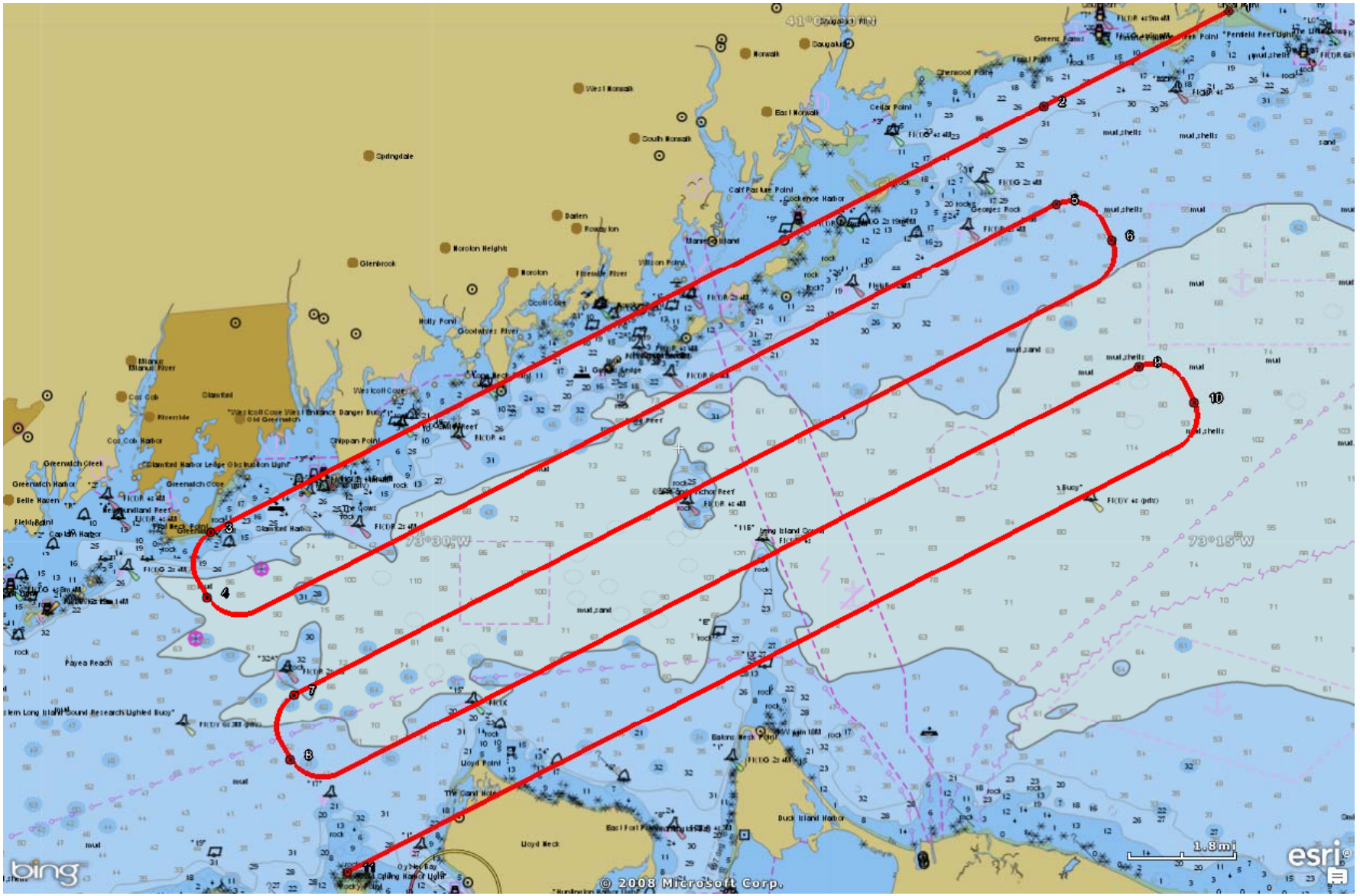


- Press "*Create Pattern Files*"

Overview of AUXSAR/System Design – Pattern Viewed in Google Earth



Overview of AUXSAR/System Design – Pattern Viewed in CG EGIS



Overview of AUXSAR/System Design – Pattern Converted to ForeFlight

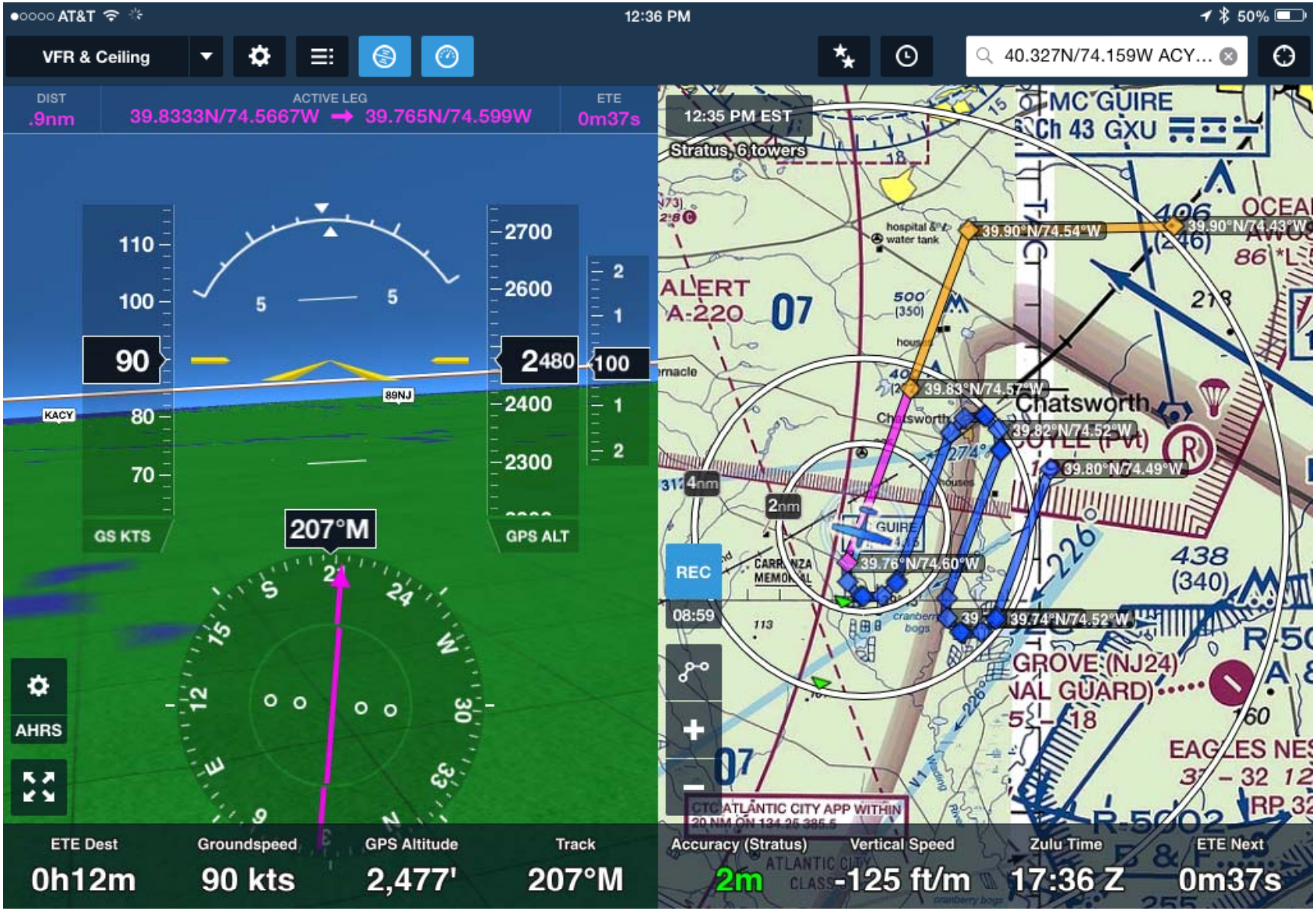
AUXSAR Field Test

AUXSAR Field Test – Garmin GPSmap 496 In Flight

AUXSAR Field Test – Garmin GNS 530W Autopilot In Flight

AUXSAR Field Test – Garmin G1000 / Autopilot Mar 2014

AUXSAR Field Test – ForeFlight Received In Flight Jan 2015



AUXSAR Field Test – HC-130J 0.1 TS PS, 180 kts

A/S Elizabeth City In Flight

"It flew fine without incident or issues."

".. images of the SAP I flew today. Everything worked well. I played around ..with waypoint sequencing and found that Point to Point worked best for total coverage."

LT Greg Rehlender
Ops Support Chief
LE/LMR Division Chief

AUXSAR Field Test – HH-65 0.1 nm TS PS, 90 kts

Aviation Training Center (ATC) Simulator

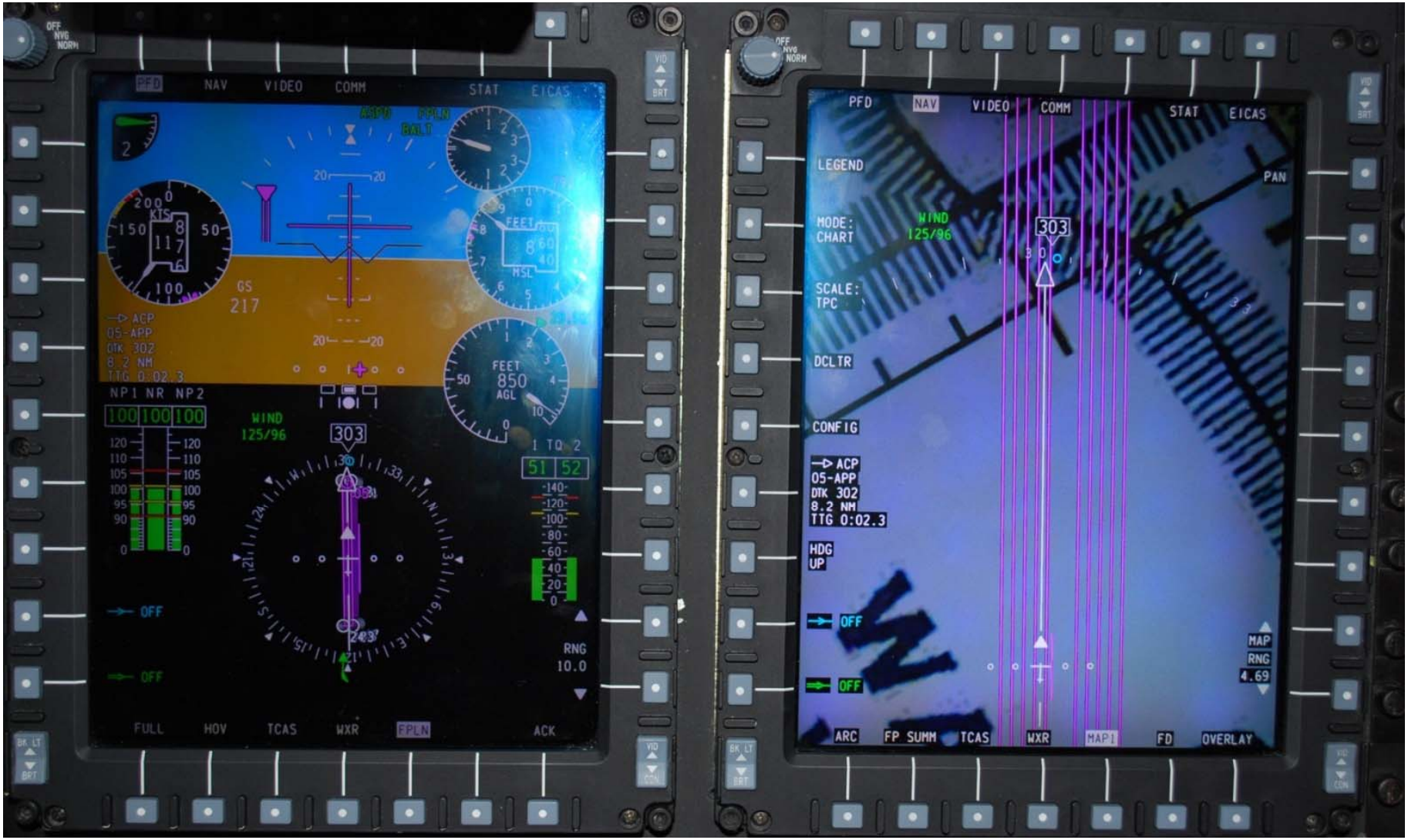
"Attached is the AUXSAR pattern on the MDL Card. The Flight Manager and Flight Director worked great; note the XTRK of 0.0 NM. This is key if the trackspace is 0.1 NM."

(Note: flown hands's off)

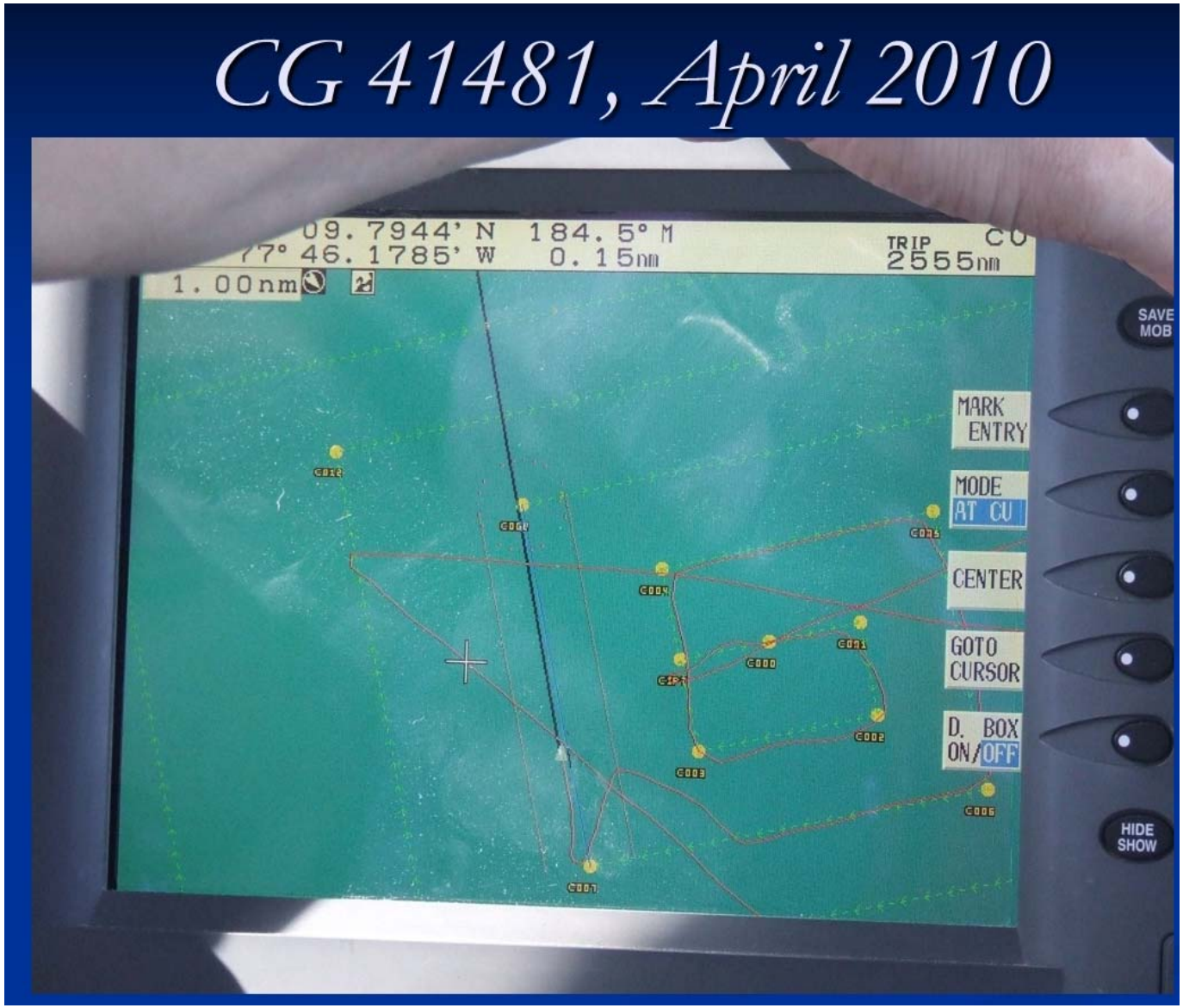
LT Ron Green
H-65 Stan Branch
ATC Mobile

AUXSAR Field Test – MH-60T 0.1 nm TS PS, 90 kts

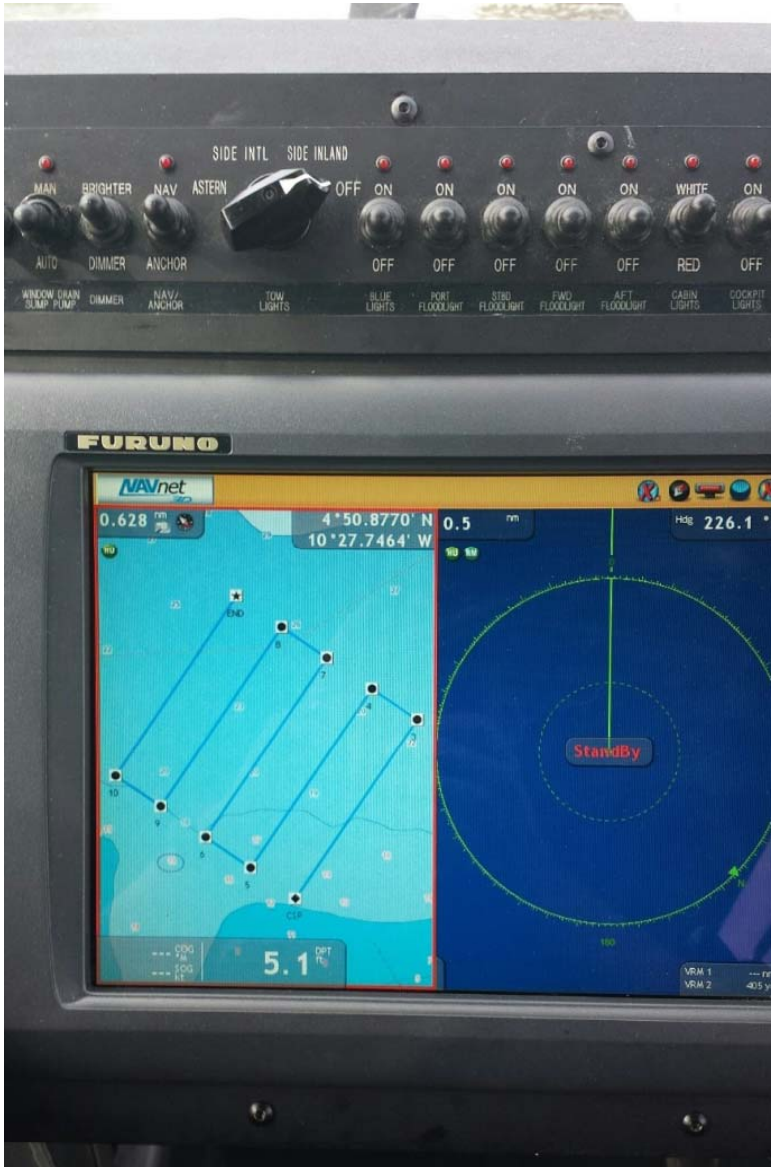
ATC SIM



AUXSAR Field Test – SINS

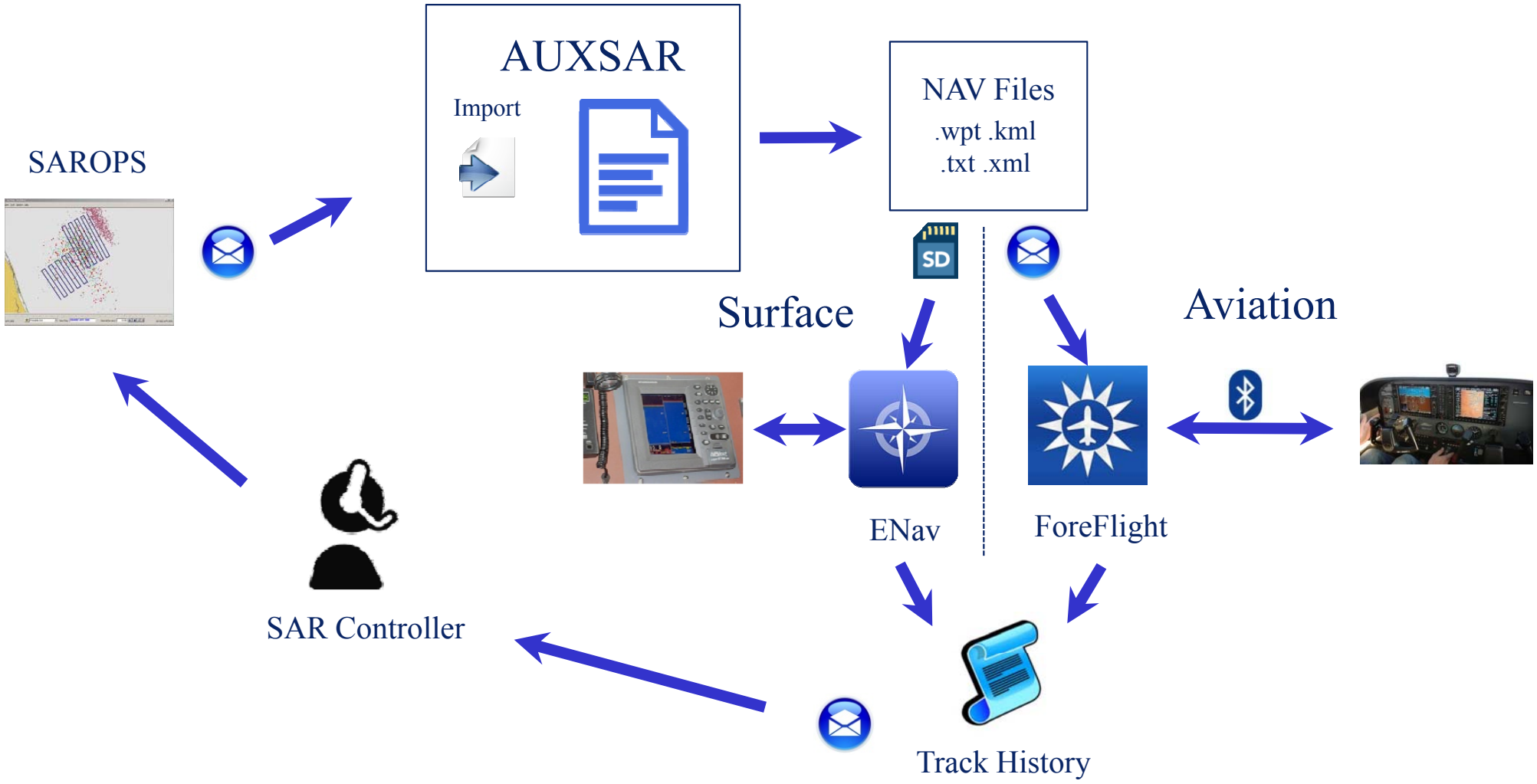


AUXSAR Field Test – RB-S, SOI June 2015



Potential CONOPS

Potential CONOPS – Basic Flow



Potential CONOPS – Benefits

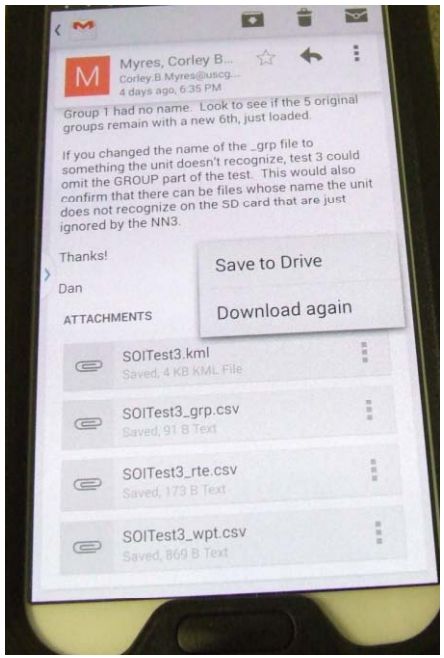
- **For an RB-S significantly less work inputting a SAR pattern**
  - Over 850 key strokes for an 11 leg pattern!
- **Ensures pattern accuracy**
  - Prevents data entry errors
  - Ensures the pattern requested is the pattern searched
- **Helps with pre voyage/per flight planning (Geographic Information System (GIS) overlays)**
  - Navigation hazards
  - Weather hazards
  - Restricted/controlled area situational awareness

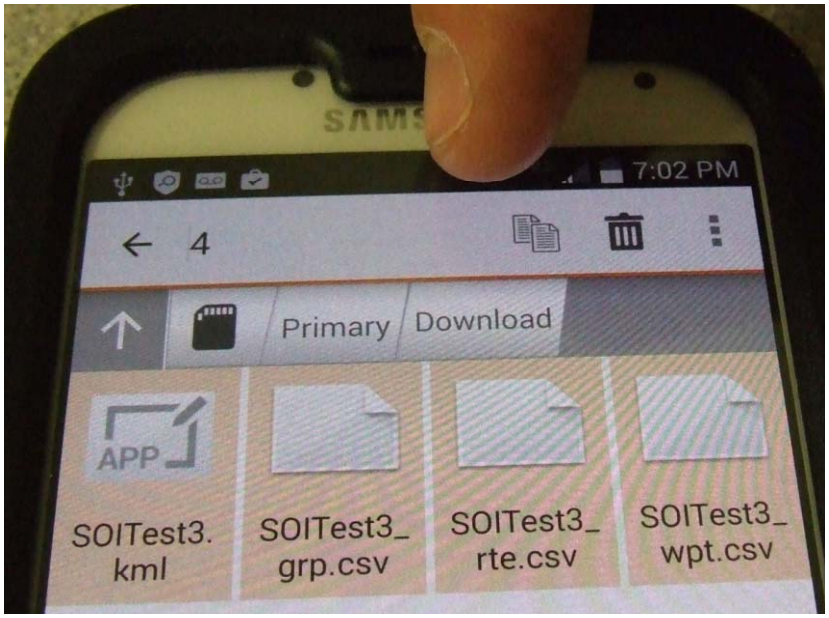
Potential CONOPS – Auxiliary Asset Notes

- **Many Auxiliary units are using AUXSAR**
- **Compatible eNavigation systems required**
- **Post sortie feedback loop**
  - Compatible eNavigation systems can download position history on the Secure Digital (SD) card
  - ForeFlight records flight history for AUX Air assets and exports the data via email in a KML format for post sortie analysis by the SAR Controller
- **Email required**
  - Units need to receive email underway/in flight for updates or new tasking

Potential CONOPS – Mobile Comm

- SD card writer to Android phone
- Used to transfer emailed pattern file





Potential CONOPS – Standard CG Asset Limitations

- **RB-S version of SINS clears the route list when importing a pattern**
  - Ensure SD card has routes backed up prior to pattern load
- **HH-60 and HH-65 upload limitations**
  - Only available upon initial startup
  - No in flight load capability

Path Forward to Transition

Path Forward to Transition – Policy

- **Approval for AUXSAR to run on SWIII**
  - Only JavaScript run from IE in SWIII
  - No communications with web services. Html page is local and self contained.
  - Uses MS Outlook and the user's account to send email

- **Trim AUXSAR to function only as a pattern translation interface to various eNav systems**
  - Currently AUXSAR is capable of modifying and creating non standard patterns (Racetrack, Fast Mover, Fitted)

Path Forward to Transition – Verification & Validation

- **Verification and Validation (V&V) of AUXSAR pattern translation**
  - Ensure pattern imported is the pattern exported
  - Ensure pattern uploaded to various systems is the intended pattern
- **If AUXSAR's non standard patterns are desired, those must be V&V'd**
  - Not recommended

Recommendations

Recommendations – Standard CG Assets

- **STEDS solves all requirements listed previously**
  - Units can receive messages/patterns underway/in flight
  - SINS II will incorporate STEDS (all Boats)
  - Vega ECS/ECDIS is STEDS compliant (all Cutters)
  - Minotaur will be STEDS compliant for MPA assets
  - Automatic Identification System (AIS) offers track history through the Nationwide AIS (NAIS) Services through the ESB

- **Recommend STEDS verses AUXSAR for standard CG assets**

Recommendations – Auxiliary Assets

- Obtain approval for AUXSAR to run on SWIII
- Trim AUXSAR to function only as a pattern translation interface to various eNav systems
- V&V of AUXSAR pattern translation (trimmed version)
- Coordinate with CG-SAR to investigate SAROPS use of non-standard patterns