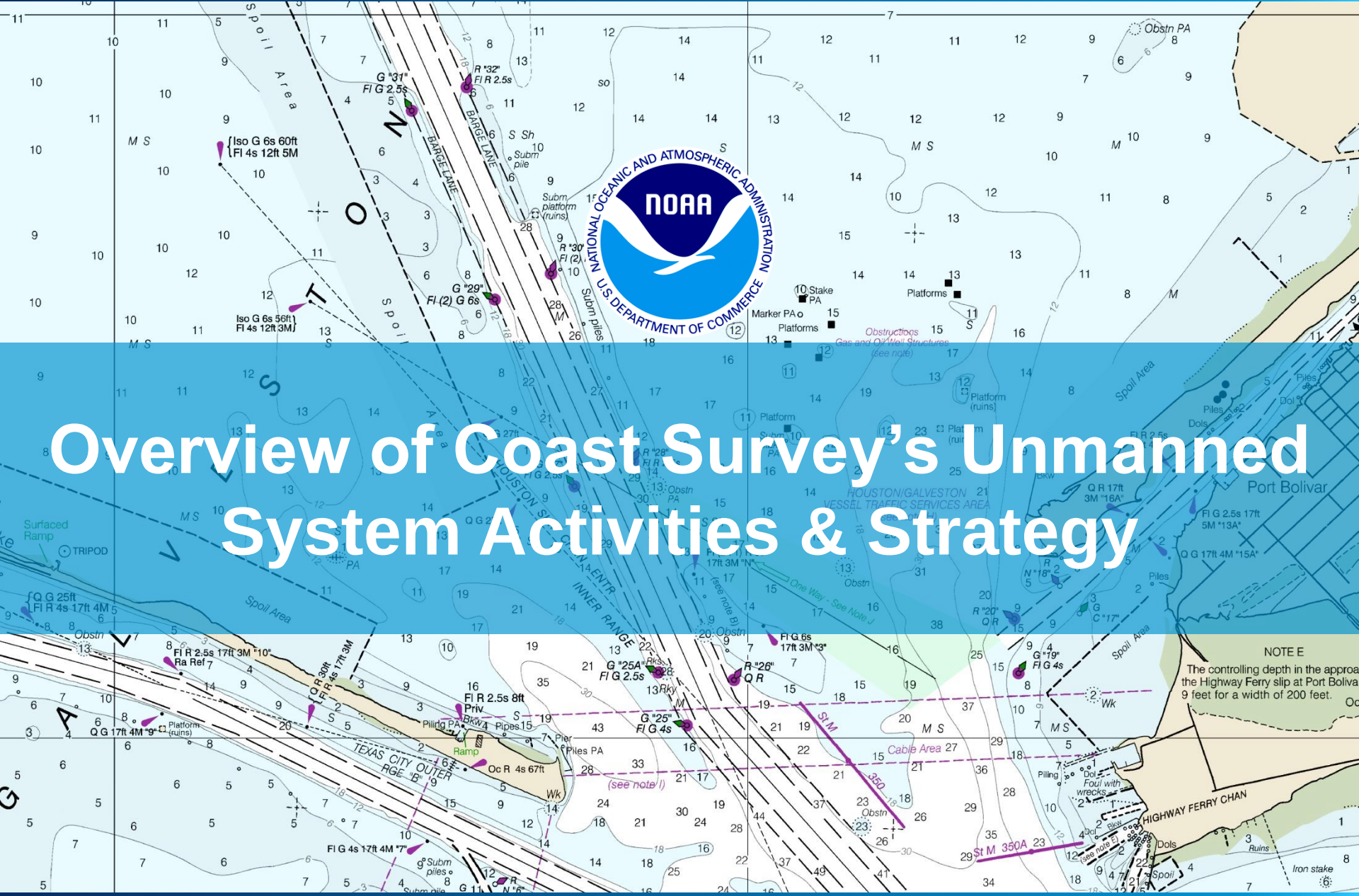
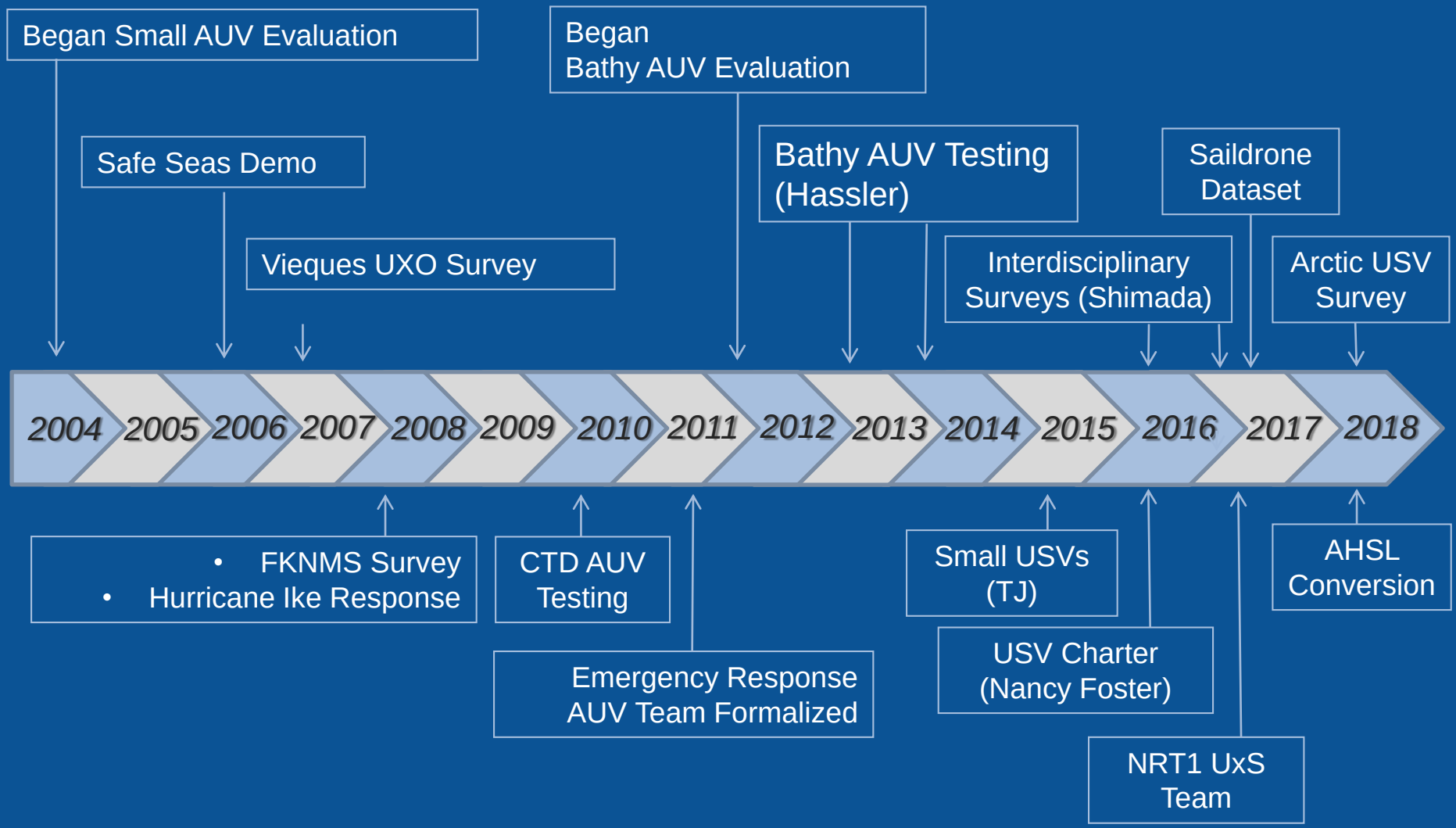


Overview of Coast Survey's Unmanned System Activities & Strategy

Coast Survey's Unmanned Systems Experience



Coast Survey's Unmanned Systems In Operation or Evaluated

Currently Owned Systems (Located with NRT1 – Stennis, MS)

Hydroid REMUS-100

Hydroid REMUS-600

Teledyne Oceanscience Z-Boat (2)

Seafloor Systems Echoboat (2)

Previously Owned Systems

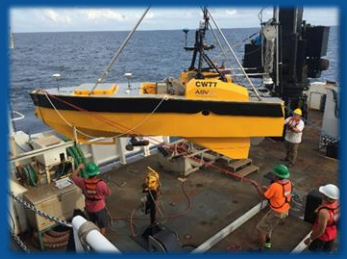
VCT Harborscan (Retired)

OceanServer Iver (Transferred)

REMUS-600 (Lost)

Collaborative Systems

ASV C-Worker 4
(UNH CCOM/JHC)



ASV C-Worker 5
(USM)

Multi-Use Systems

Optionally-manned Survey Launch
(NOAA Ship *Rainier*)

Shipboard USV Demonstrations

Habitat Mapping on *Nancy Foster* – 2016

- Chartered ASV Global C-Worker 5
- Collaboration with NCCOS
- Coordinated surveys with the ship to explore operational concepts and shipboard requirements

Artic USV Survey – July 2018

- UNH's ASV C-Worker 4
- Collaboration with UNH CCOM/JHC, NOAA Ship *Fairweather*
- Tested new operational models, identified and solved technical short-comings, and provided experience to the ship's crew in the operations and support of unmanned systems.

Recent Activities – Optionally Manned Survey Launch

Purpose

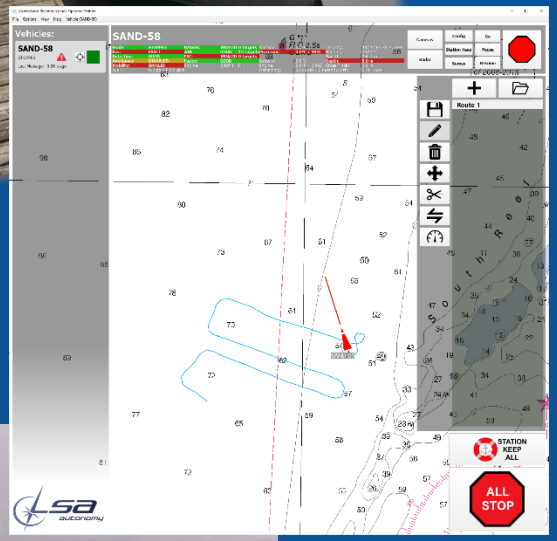
- Maximize current infrastructure and expertise
- Allow for expedited, moderately priced, and scalable means to integrate unmanned systems

Expected Benefits

- Platform to develop and test enabling technologies & operational concepts
- More effective use of survey personnel
- Increased survey efficiency

Status

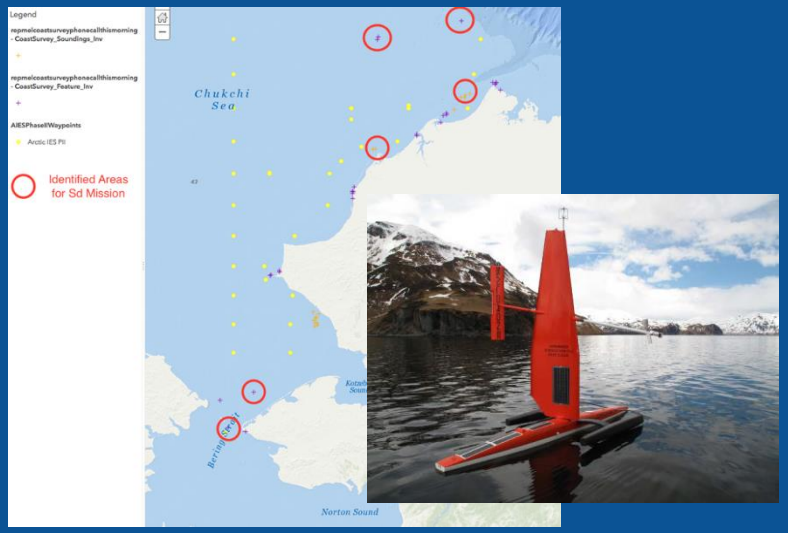
- Feb 2019 – Technical Acceptance of 1st launch conversion on NOAA Ship RAINIER
- Mar 2019 – Installation & Acceptance of 2nd launch conversion
- Spring/Summer 2019 – At-sea operational testing



Collaborative Activities

SailDrone

- Collaboration with NOAA PMEL
- Opportunistic mapping to support charting efforts
- Potential Missions – Reconnaissance, chart assessment, and investigation of chart discrepancies



UNH iXBlue DriX ASV

- Testing and evaluation of the long endurance iXBlue DriX ASV through UNH's industrial partners program

USM Saildrone Research

- Testing and evaluation along the Gulf Coast to identify benefits to charting mission (cooperative agreement/grant)

Key Lessons Learned

- Unmanned systems require the development of **enabling technologies**, such as automated data processing and high-bandwidth communications, that can also benefit manned operations.

- Unmanned systems should provide **new capabilities**; one-for-one replacement of manned platforms in existing mission profiles is not effective.

- Unmanned systems require skilled **personnel** to operate and maintain, and do not necessarily reduce staffing requirements, but can allow for the more effective use of personnel.

Key Lessons Learned

- Unmanned systems do not diminish the need for **ships**, which may be necessary to deliver systems to remote locations and provide operational control and logistical support.

- Unmanned systems require unique shipboard and land-based **infrastructure**, including launch and recovery systems (LARS), maintenance facilities, and communications, for their safe and effective operation.

- Unmanned systems require **supervision** on a spectrum ranging from remote-controlled to fully autonomous depending on the environment and system capabilities.

Coast Survey UxS Vision

Develop and utilize unmanned systems for more efficient and effective acquisition of environmental data to support NOAA's navigation products and services.

Strategy

Develop Enabling Technologies - Support the development and adoption enabling technologies to advance unmanned systems and benefit conventional manned operations.

Maintain Operational Expertise - Develop and maintain operational expertise with unmanned systems.

Operational Innovation - Support the development and transfer-to-operations of unmanned systems that benefit Coast Survey and NOAA missions.

Collaborate - Collaborate with government, academic, and industry partners to share expertise and resources and to direct and expedite system development.

Strategy

Develop Enabling Technologies

- **Activities** - Software Development (Charlene, TensorScan), Data Radio Evaluation
- **2019 Goal** - Reduce shipboard data processing effort 50% from 2017 level

Maintain Operational Expertise

- **Activities** – UxS Operational Team in Stennis
- **2019 Goal** – Team fully staffed and resourced to conduct Coast Survey and inter-disciplinary missions

Operational Innovation

- **Activities** – Optionally-manned Launch Conversions
- **2019 Goal** – Operational use of launch in unmanned configuration

Collaborate

- **Activities** – SailDrone CRADA, USM and UNH partnerships
- **2019 Goal** – Integration and operation of seafloor mapping sonar on SailDrone.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