STRATEGIC INITIATIVE

OFFICE OF COAST SURVEY UNMANNED SYSTEMS ROADMAP

I. LONG-TERM VISION

THE OFFICE OF COAST SURVEY WILL AGGRESSIVELY DEVELOP AND UTILIZE UNMANNED SYSTEMS FOR MORE EFFICIENT AND EFFECTIVE ACQUISITION OF ENVIRONMENTAL DATA TO SUPPORT NOAA'S NAVIGATION PRODUCTS AND SERVICES.

II. MAJOR MILESTONES TO ACCOMPLISH OVER 5 YEARS RECOMMENDATION

In order to achieve the vision, what are the major milestones that must be accomplished over the next 5 years?

FY	MAJOR MILESTONES
18	• CONVERT TWO HSLS TO OPTIONALLY MANNED CONFIGURATION AND DEPLOY IN AN OPERATIONAL TEST ENVIRONMENT • AWARD OPTION FOR CONVERSION OF ADDITIONAL LAUNCHES AND CONTINUE TO ADVANCE THE STATE OF TECHNOLOGY • BEGIN TO TEST AND DEVELOP VESSEL-TO-VESSEL DATA TELEMETRY PROTOCOLS BY DEPLOYING TECHNOLOGY IN AN OPERATIONAL ENVIRONMENT • COMMISSION THE NSD ASV FOR USE • DEFINE THE MISSION PROFILE AND REQUIRED RESOURCES FOR OCS UXS OPERATIONAL TEAM • TRAIN AND QUALIFY UXS OPERATIONAL TEAM ON CURRENTLY OWNED SYSTEMS (REMUS 100, REMUS 600, ECHOBOAT) • COLLABORATE WITH JHC/CCOM ON ARCTIC ASV MISSION • COLLABORATE WITH RSD IN UTILIZATION OF SHIP-BASED UAS FOR SHORELINE MAPPING MISSION.
19	• DEVELOP A RISK MANAGEMENT STRATEGY TO MINIMIZE THE POTENTIAL LOSS OR DAMAGE OF UNMANNED SYSTEMS AND INJURY TO PERSONNEL • OCS UXS OPERATIONAL TEAM FULLY RESOURCED AND OPERATIONAL CONDUCTING OCS AND INTERDISCIPLINARY MISSIONS (SET A TARGET # OF MISSIONS?) ○ LARGE MULTIBEAM AUV UTILIZED FOR EEZ / SEABED 2030 MISSIONS • OPERATIONAL USE OF HSL IN UNMANNED CONFIGURATION - I.E. TRANSITIONED TO OPERATIONS.

	• Continue conversion of HSL to optionally manned configuration - consider conversion on an east-coast vessel • Reduce shipboard data processing man-hours per acquisition hour by 50% from 2017 level.
20	• Complete initial set of HSL conversions (6) and transition to operations • Decide on the next the next generation of unmanned vessel acquisitions and conversions • Improve remote data transfer (platform to shore) and implement cloud based autonomous processing and product generation. • Start developing a recapitalization plan for HSLs, considering appropriate use of ASVs • Incorporate the requirements for UxS into fleet recapitalization (e.g. LARS, Lab space, etc) • Operationally test capabilities of autonomous navigation, collision avoidance, and COLREGs compliance • Reduce shipboard data processing man-hours per acquisition hour by 75% from 2017 level
21	• Test and develop collaborative operations and adaptive mission planning between autonomous vehicles • Expand Coast Survey UxS team to manage multiple simultaneously deployed ASVs on survey missions, ship-based or shore based. • Expand the use of UxS to gain efficiencies in the complex,shallow, nearshore regions. • Begin development of persistent autonomous systems for rapid resurvey requirements in critical underkeel clearance ports

22	• The use of unmanned systems is fully institutionalized in NOAA for sea floor mapping requirements
	  ○ A well-qualified and robust workforce exists to operate, maintain, and further the capabilities of UxS
	  ○ NOAA owns a mature operational suite of unmanned systems fully suited to mission
	• Reduce shipboard data processing man-hours per acquisition hour by 90% from 2017 level

III. CRITICAL DEPENDENCIES FOR SUCCESS

What are the critical dependencies for this initiative's success in priority order? (e.g. staffing, technology, tools, contracts, partnerships, etc.)

- Partnerships:
  - OMAO
  - OAR
  - AGO
  - UNH JHC/CCOM
  - USM
  - US NAVY / NAVO
  - Hydrographic survey contractors
  - Commercial vendors and suppliers
- Staffing:
  - Staffing for Coast Survey UxS team
  - Training for Coast Survey UxS team
  - Staffing for transition to operations
  - Training for shipboard personnel
  - Staffing model for UxS - shipboard capability vs. deploying teams - Who owns the systems?
  - Transition of required knowledge, skills, and abilities
  - Impact on collective bargaining units
- Technology:
  - High-bandwidth shore- and long-range communications
  - Dependable data acquisition systems
  - Automated data acquisition (e.g. sonar operation)
  - Automated data processing
  - Increased data management requirements
  - Navigation and collision avoidance systems
- Infrastructure
  - Shipboard infrastructure:
    - Launch and recovery systems
    - Mission / lab space
  - IT:
    - Data communications

        - Data storage
- Contracts
    - Unmanned Launch Conversion contract has two remaining option years
        - [2] launch conversions at $150,000k per launch for each option year
- Policy
    - IT policy requirements
    - IT security
    - COLREGS development
    - OMAO policy for UxS on ships, safe manning
    - OMAO small boat policies
    - Deemed Export requirements

IV. REQUIRED PROGRAM/ACTIVITY INTEGRATION POINTS

With which organizations do you need to integrate and for what? (other OCS divisions, NOS, NOAA, other agencies or external partners)

ORGANIZATION	INTEGRATION REQUIREMENT
OCS/NSD	• **Resourcing and managing UxS operational team**
OCS/HSD	• **Integration of unmanned systems testing and development into hydrographic survey projects** • **Assistance with developing the best use cases of UxS**
OMAO	• **Equal partner participation in launch conversions** • **Full lifecycle support for optionally manned launches** • **Maintain staffing of hydro platforms**
NOAA	• **Support model where OCS provides mapping services through direct budget allocation or cost+ reimbursable model.**
Academic (UNH, USM)	• **Need to ensure research goals are consistent with operational needs**

V. BIGGEST CHALLENGES AND THE WAY FORWARD

What are top 3 -5 challenges to overcome to successfully implement the strategic initiative as envisioned? How will you address the challenge?

CHALLENGE/HURDLE	STRATEGY TO ADDRESS CHALLENGE
Unrealistic expectations: popular perception of current state of technology and operational impact is wildy optimistic.	Continue proactive communications to keep stakeholders informed and to calibrate expectations. Carefully calibrate 'successes' of funded research partners. Communicate both successes and failures as informing the approach.
Matching mission to capabilities: unmanned systems will be most effective when they provide new capabilities for new missions- things we just couldn't (or didn't) do before. But imagining these new missions- and providing support for them, will be difficult.	This may tie in with efforts to revise/ expand metrics from square nautical miles; e.g. hydro health. If we are expanding our mission profile through the use of UxS, we may need new metrics to measure our effectiveness.
Building a new workforce: far from replacing workers, unmanned systems will generally replace lower skilled general workers for highly skilled specialists. Additionally, the operational transition of the technology will require increased personnel levels to support the transition.	Unmanned systems group should start to provide nucleus of operational experience and practical lessons in what skill sets are actually required.
Risk Tolerance: We are going to lose systems and have significant casualties. We need to have the stomach for this- or if the risk-benefit is not there, not proceed.	FY19 milestone: Develop a risk management strategy to minimize the possibility of loss or damage of vehicle and injury to personnel. Assess our own level of risk tolerance.
Funding: New technology is not cheap	Design the development strategy such that we can innovate incrementally (e.g. launch conversion project). Launch a budget initiative to seek more funding. Partner to drive innovation collaboratively.

We may not realize a return, in terms of efficiency, on our investment for many years.	Think about other returns. Is efficiency our only measure of success? We will potentially need to broaden our measures of success.
Infrastructure currently does not exist to support unmanned systems, both at sea and ashore.	Plan for infrastructure needs in the fleet recapitalization process. Creatively leverage existing infrastructure to the greatest extent possible (e.g. launch conversion project). Continue to build out needed shore-side infrastructure.
Policy and regulations on the operation of unmanned systems are yet to be fully developed. They will need to be crafted in a way which doesn't stifle innovation or the ability to conduct the mission. This includes internal policy and federal regulation.	Proactively develop our own SOPs and best practices, and collaborate with others to share and standardize these. Insist on a "seat at the table" at the relevant groups, committees, cross-governments boards, etc.