SOST Interagency Working Group on Facilities and Infrastructure – Subcommittee on Unmanned Systems

11 April 2013
Consortium for Ocean Leadership
1201 New York Avenue, NW
Washington, DC

INTERAGENCY WORKING GROUP ON FACILITIES and INFRASTRUCTURE
SUBCOMMITTEE ON UNMANNED SYSTEMS*

Consortium for Ocean Leadership

Fourth Floor, 1201 New York Avenue, Washington, DC

Conference Call Details: (888) 407-5039 Conference ID: 07668008

AGENDA

Thursday, 11 April 2013
1400-1600

0. Gather (1330-1400)

1. Introductions and Remarks by Co-Chairs (1400-1410, J. Adler, S. Lingsch)

2. Review of 12-14-12 Actions and Minutes (1410-1420, Co-Chairs J. Adler, S. Lingsch)

3. Updates (1420-1530)
   a) Update on *Status, Issues, and Recommendations* Whitepaper and Implementation Plan (J. Adler, J. Coffey, S. Lingsch, P. Kenul)
   b) Geospatial Metadata Standards Presentation (L.Wayne, GeoMaxim)
   c) Election of a New Co-Chair

4. Around the Room / Open Forum (1530-1550, All)

5. Summary Remarks / Actions (1550-1600)
   - Scheduling of Next Meeting
   - Reminder: SOST Wiki Space

6. Adjourn (1600)

SUS Meeting Materials can be found on the NSF/SOST Wiki Site.

* Unmanned Systems include: Unmanned Aircraft Systems (UAS), Unmanned Surface Vessels (USV), Gliders, Autonomous Underwater Vehicles (AUV), Lagrangian Platforms and Animals.

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Federal Unmanned Systems:
Status, Issues, and Recommendations

Written by:

The Subcommittee on Unmanned Systems

Submitted to:

National Science and Technology Council

The Subcommittee on Ocean Science and Technology

Interagency Working Group on Facilities and Infrastructure

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EXECUTIVE SUMMARY

The Interagency Working Group on Facilities and Infrastructure (IWG-FI) established the Subcommittee on Unmanned Systems (SUS), formerly the Task Force on Unmanned Systems (TFUS), to advise, assist and make recommendations to the IWG-FI on policies, procedures and plans relating to unmanned systems uses, upgrades and investments. The goal of this whitepaper is to develop a coordinated Federal effort and approach to maximize the efficiency and capabilities of unmanned systems across the government. Individual agencies strategies, roadmaps and visions were leveraged to identify challenges that might stand in the way of maturing those visions to a shared collaborated vision. The whitepaper does not identify specific requirements, as the individual agencies will continue to identify requirements gaps and utilize internal processes to determine which requirements to fund. Instead, core areas are identified that are challenges to further growth in unmanned systems and chart out science, technology, and policy paths that will enable unmanned systems to fulfill an expanding role in supporting the users. Based on reference documents from multiple agencies and challenges/issues identified by the SUS, the following recommendations were developed as potential solutions to those challenges:

- **Establish an overarching Inter-Agency Agreement (IAA) between Federal agencies.** An IAA between agencies for unmanned systems would improve agency inter-relationships, work load sharing and allow for the transfer of unmanned systems and technology. The IAA will enhance inter-agency program transparency, coordinate the definition and efficiency of utilization rates across communities, decrease duplicative Federal resource expenditures, and coordinate acquisition, operations, training and life-cycle maintenance.
- **Establish consolidated operations centers for Federal unmanned systems.** In order to harness the full potential of unmanned systems and strengthen mission effectiveness, Federal agencies should establish consolidated operations centers, where applicable. Standards and interface specifications need to be established to achieve modularity, commonality and interchangeability across payloads, control systems, telecommunications interfaces, data and communication links.

- **Define common capability descriptions, metadata standards, data models and architectures.** The enterprise-wide adoption and execution of proper data management practices, with emphasis on accepted metadata standardization, fosters improved operating efficiencies in Federal and partner programs and reporting that supports government transparency. This model improves the single agency stovepipe model by applying consistent policy, improved organization, better governance, and understanding of the electorate to deliver outstanding results.
- **Establish asset pools for Federal unmanned systems.** Federal organizations should share unmanned systems, personnel, technologies and information, strategic and operating plans, observing and performance requirements, technology assessments, impact studies, system and business case analyses and lessons learned. A successful "asset pool" will generate an inventory of unmanned systems, data requirements, sensors and operating facilities.

Success in each of these areas is critical to achieve a Federal Government shared vision and realize the full potential of unmanned systems at an affordable cost, with improved efficiency and assured safety of operations. Implementation of these specific recommendations will go far to assuring that success is achieved. Development of an implementation plan is recommended by the SUS and will address communications, affordability, interoperability, centralized coordination, and data gathering and management. The SUS recognizes the distinction between research and operational activities as these two appropriations and the policy for transfers of funds as well as the logistics are different and pose a significant challenge. Specific timelines, milestone decision points, and agency coordination junctures and goals will also be included.

As the Federal Agencies, such as NOAA, NASA, DOI and DoD, continue to develop their strategic plans and roadmaps, there is a clear need for convergence to enable sharing of assets, operators, sensors, logistics, etc, across the agencies. A Federally coordinated effort applied now would significantly improve the overall efficiency, effectiveness, and safety of Federal government unmanned system operations.

1.0 INTRODUCTION AND BACKGROUND

The use of unmanned systems has become more prevalent across the government in recent years due to the unique capabilities they possess. Unmanned systems traverse terrain, oceans and the atmosphere thru various means, including gliders, autonomous underwater vehicles (AUV), unmanned aircraft systems (UAS), and unmanned surface vessels (USV). Characteristics such as long range and endurance, very low or very high altitude flight capability, and internal programmability give unmanned systems a unique means to fill gaps in surveillance and reconnaissance capability as well as provide a significant enhancement to environmental science observations.

Unmanned systems operated by agencies other than the Department of Defense (DoD) are typically used to make measurements and observations that are *mission efficient*, requiring *enhanced endurance*, and *cost effectiveness*. Other missions too risky for manned systems are also important; examples are operating in and around volcanoes or forest fires, deep sea observations, and taking samples of a radiation, chemical, or biological incident.

Surveying missions highlight the enhanced endurance category, where time and/or distance can be carried out well beyond the scope of manned crafts. Mission examples are Arctic sea ice characterization or mapping the deep ocean floor. Along with enhanced endurance, unmanned systems have other potential advantages over manned platforms. They may provide more detailed observational information because they can incorporate diverse sensor packages dedicated to specific mission requirements, while operating in a broader environment. It may be only through the use of coordinated manned and unmanned observation platforms that a truly volumetric "holistic" sampling of an environment could be obtained, as depicted in Figure 1.

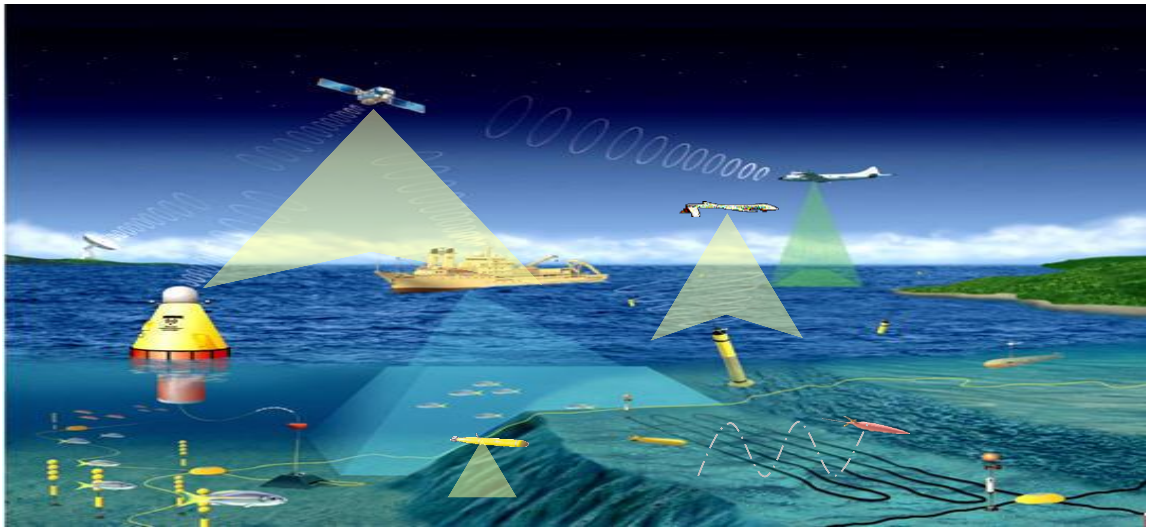

Figure 1. How unmanned systems can be used as part of the overall Earth Observing System.

Unmanned systems are not without their challenges, however. From a government-wide perspective many agencies are making proprietary acquisitions. Often these acquisitions are on a one or two systems-at-a-time rate, and often for a one-time use or project. As a result, the overall utilization rates of the systems are very low. Other agencies have mission requirements for unmanned systems, but are not acquiring systems because of the costs of the infrastructure required to sustain operations. With the demand for such systems becoming higher, and resources becoming more limited, a more careful government-wide approach to the acquisition and utilization of unmanned systems is required.

The Subcommittee on Unmanned Systems (SUS) was chartered by the National Science and Technology Council's Subcommittee on Ocean Science and Technology (SOST) Interagency Working Group on Facilities and Infrastructure (IWG-FI) as a sustained working group to get a better understanding for how unmanned systems are currently being used by the different agencies, and to understand the infrastructure requirements for operating such systems. The low utilization rates, the high costs of operations due to infrastructure, and the limited coordination and communication between agencies brought about the realization that an overall, high-level government strategy for unmanned systems is needed.

2.0 CURRENT UTILIZATION

It is misleading to assume that "Unmanned Systems" are truly "Unmanned." In fact, the requirements for ground crew for both operations and maintenance equal that or can exceed that of most manned platforms. As the need for unmanned systems becomes increasingly more important, multiple Federal organizations have embarked on programs to incorporate unmanned technology. Programs range from complex operational fleets of platforms to single platforms devoted to specific projects.

2.1 Agency Missions

The missions of the US government agencies are various and complex. For example, the Department of Defense (DoD) continues the goal of persistent and pervasive intelligence, surveillance, and reconnaissance. The rest of the government realizes the importance of this goal and desires similar objectives for unmanned systems to contribute to their missions and efforts. Following is a more detailed look at specific agency missions and their current use of unmanned systems

NOAA - Within its broad mission, NOAA has temporal and spatial sampling observing requirements of expansive ocean and atmospheric regions, air-sea boundaries, rapidly changing weather and climate events, ecosystems, mapping and hydrography. Currently, traditional observing technologies and available resources cannot provide for sufficient temporal or spatial resolution of critical atmospheric and oceanic conditions necessary to meet these observing requirements. The technical maturity of marine and aviation unmanned systems now offer feasible solutions to fulfill NOAA's observing gaps, which include the need to improve understanding, predictability and warnings of high impact oceanic weather, Arctic climate and ecosystems changes, marine health and sustainability, monitoring of inland flooding, fire weather, tsunamis, El Nino/La Nina and coastal circulation including harmful algal blooms and hypoxia events. Unmanned observing systems provide capabilities in distant regions such as the deep ocean, Arctic, or mid-Pacific that cannot be adequately satisfied by current space-borne, manned, or surface observing platforms.

NASA – NASA's Science Mission Directorate (SMD) has the mission to engage the nation's science community, sponsor scientific research, and develop and deploy satellites and probes in collaboration with NASA's partners around the world to answer fundamental research questions requiring both orbital and suborbital views. NASA SMD has recognized the potential for UAS to fill gaps within their existing suborbital measurement capability, and through its Airborne Science Program has invested in UAS technology since 2000. Some of the earlier investments included several flight demonstration missions using a variety of different platforms and involved many of NASA's partner agencies. In support of growing interest from the science community in the potential of UAS, SMD acquired the SIERRA UAS, three pre-production model Global Hawks, and four Block 10 model Global Hawks. SMD has since flown multiple UAS missions nationally and internationally (350+ flight hours), and has a vast amount of experience in defining the current and future mission characteristics required to obtain essential science data within the international science community. NASA also owns and operates many other types of UAS for Aeronautics and Space related research.

Department of Defense – "Adaptive Sampling" of the battle space environment presupposes known metrics that meet specific war fighter requirements. Battle space environment includes weapons, sensors and platforms as well as the natural surroundings affecting the force. Notwithstanding the military/security requirements, the roles and missions inherent within the DoD for unmanned systems are similar to other agencies with respect to mission efficiency, cost effectiveness and extended endurance. Environmental support specific to unmanned systems whether underwater, on the surface or in the atmosphere, has two distinct roles: (1) enhancement of the immediate operational efficiencies of the unmanned platform and (2) provision of mission critical information to further enhance the force capabilities.

The Naval Oceanographic Office (NAVOCEANO) has been operating Autonomous Underwater Vehicles (AUVs) from the TAGS-60 Pathfinder Class ships since 2000 to satisfy its' hydrographic and oceanographic mission. To satisfy its' persistent ocean sensing mission supporting the Navy's operational global ocean modeling, NAVOCEANO has been operating buoyancy gliders since 2005. The Littoral Battlespace Sensing Fusion and Integration (LBSF&I) Program of Record (PoR) will deliver 140 buoyancy gliders by 2015 and 5 AUV's by 2014. A complete Analysis of Alternatives (AoA) were performed for the AUV's (ref [1]) primarily for the bathymetric, hydrographic and Q-Route survey missions and buoyancy gliders (ref[2]) for their role supporting operational ocean modeling supporting the Anti-Submarine Warfare (ASW) mission. NAVOCEANO has also deployed Unmanned Surface Vehicles (USVs) or wave gliders supporting its' mission, with a current inventory of 7 vehicles. The Glider Operation Center (GOC) is a 24X7 operation providing Command and Control for long dwell AUVs (buoyancy gliders) and USVs (wave gliders) located at Stennis Space Center, MS.

Department of Homeland Security/Customs and Border Protection - The U.S. Customs and Border Protection (CBP), Office of Air and Marine (OAM) became a pioneer in the use of UAS for homeland security when it first employed the Predator B UAS at the Southwest border in 2005. Since then, CBP has continued to leverage the Predator B to unprecedented success in homeland security, law enforcement and in support of disaster relief efforts. The flexibility of the Predator B also makes it a force multiplier whenever OAM is called to support the national security and disaster relief efforts of its Department of Homeland Security (DHS) partners, including the Federal Emergency Management Agency (FEMA), U.S. Immigration and Customs Enforcement (ICE), and the U.S. Coast Guard. OAM selected the Predator B for a unique combination of cost, operational capabilities, payload capacity, pilot-in-the-loop mission flexibility, potential to accommodate new sensor packages, and importantly, for its proven safety and performance record with other Federal entities.

Department of Interior/United States Geological Survey – A fundamental objective of the United States Geological Survey (USGS) and the Department of the Interior (DOI) Aviation Management Directorate is the development of cost effective UAS technology that does not compromise the risk to the public's safety. The United States Geological Survey UAS Project Office supports informed decision-making by creating the opportunity, via UAS technology, to gain access to an increased level of persistent monitoring of earth surface processes (forest health conditions, wildfires, earthquake zones, invasive species, etc.) in areas that have been difficult or impossible to obtain information. Additionally, UAS technology offers the potential for cost savings and increased timeliness over traditional field sampling methods. Much like the use of internet technology and global positioning systems, unmanned aircraft systems have the potential of enabling DOI to be better stewards of the land by:

- Improving natural hazard forecasting and the analysis of the impacts,
- Improving the understanding of climate change to better plan for the likely impacts,
- Developing precipitation and evaporation forecasting to better manage water resources,
- Monitoring Arctic ice change and its impacts on ecosystems, coasts, and transportation,
- Increasing safety and effectiveness of wild land fire management,
- Broadening DOI's ability to monitor and enforcing land use regulations,
- Better understanding and protecting ecosystems.

2.2 Current Known Inventory of Federal Unmanned Systems

SUS, as part of its charter, is maintaining an inventory of unmanned systems owned and operated by the different government agencies. The inventory is split into 2 major categories: research and operations. Some agencies, such as the Office of Naval Research (ONR), NASA, and the National Science Foundation (NSF), use unmanned systems to conduct scientific research to support their specific agency missions. Other agencies like NOAA, DoD, CBP, and USGS have operational requirements per their specific agency mission and use unmanned systems to support these operational requirements. Table 1 provides the current inventory of unmanned systems currently used for research missions, and Table 2 provides the current inventory of unmanned systems used for operational missions. The inventory is not complete, as many of the agencies are still trying to understand what systems exist internally (see next section); however, the information provided in the tables is accurate to the extent possible.

Table 1. Unmanned systems inventory used for Research missions and applications, June, 2012

Agency	AUV		Gliders		UAS		USV		Total
	#	Usage Rate	#	Usage Rate	#	Usage Rate	#	Usage Rate	
BOEM[1]	2		0		2		-		4
EPA[2]	1		1		-		-		2
NASA	-		9		7		1		17
NSF	6		48		-		-		54
NOAA	1		0		6		0		7

ONR	19		30	~15%	7		4		60
Total	29	-	88	-	22	-	1	-	144

[1] Bureau of Ocean Energy Management

[2] Environmental Protection Agency

Other data being collected by the inventory effort includes usage rates of the different types of unmanned systems. As shown in both Tables 1 and 2, very little of this information has been obtained. Utilization rates are defined differently by different agencies, and it is thus difficult to assimilate. Operational missions are most likely to have utilization rates. Research activities, on the other hand, rely on grant funding and there is rarely more than 10% of grant funding available to keep platforms fielded at any sort of operational tempo. Depending on how the utilization rate is defined, a longer endurance platform will have a higher utilization rate. Generally speaking, if there are fewer Launch & Recovery (L&R) requirements (for short endurance), the utilization rate will be higher. The SUS expects to continue to update these inventories as agency information is provided.

Table 2. Unmanned systems inventory used for Operational missions & applications, June 2012.

Agency	AUV		Gliders		UAS		USV		Total
	#	Usage Rate	#	Usage Rate	#	Usage Rate	#	Usage Rate	
CBP	-		-		12		-		12
EPA	1		1		-		-		2
NOAA	7		67		0		20	50%	94
Navy	5[1]	30%	140[2]	33-50%	-		7	~20%	152
USGS	-		-		38		0		38
Total	13	-	208	-	50	-	27	-	298

1 Full inventory achieved in FY14

2 Full inventory achieved in FY15

2.3 Current Procurement Methods and Use Approach

For purposes of discussing inventories, unmanned systems assets are separated into two categories by ownership status: Federally owned or non-Federally owned. Most granting institutions (NSF, ONR, NOAA, NASA) purchase smaller unmanned systems in response to openly competed grant awards, and the awarded institution is the owner. Systems purchased for operations by the Federal government (DoD, CBP, NASA, NOAA) are considered Federally owned assets. Federal ownership is typically associated with more robust, or more costly assets or those required for specialized missions (e.g., law enforcement) or to fulfill rapid response requirements. All procurements follow Federal Acquisition Regulations (FARS) or Defense Federal Acquisition Regulation Supplements (DFARS), except in the case of transfers, e.g., transfers from military use to civilian agency use. Purchase of Federally owned assets are usually planned for in future fiscal years, whereas non-Federally owned assets are generally in response to grant opportunities and are not usually planned in advance.

Some scientists and researchers operate small unmanned aircraft purchased and flown without knowledge of what is required from an airspace perspective, or of what the agency aircraft safety requirements are. These "one-off" purchases are often inexpensive and viewed as replaceable assets, which makes it difficult to account for the entire inventory of unmanned systems within the agencies. It also makes it challenging to understand the true utilization rates of the systems. Many times these acquisitions result in a one-season use, and the system is then shelved and forgotten.

Current inter-agency coordination – Many of the agencies utilizing unmanned systems today are beginning communication and coordination efforts. For example, NASA, NOAA, and DOE have an interagency memorandum of agreement in place for collaboration on UAS operations and missions. A recent roadmap, developed by the Next Generation Air Transportation System (NextGen) Joint Program Development Office (JPDO) in collaboration with NASA, NOAA, DoD, and FAA, addresses planned, required, and/or ongoing research activities that will improve access to the national airspace systems for unmanned aircraft. Congress recently passed the 2012 FAA Modernization and Reauthorization Act in which the full integration of UAS into the NAS is mandated to occur by 2015.

SUS is a unique body in that it covers unmanned systems in air, land, and water domains. Other groups such as the Interagency Coordinating Committee for Airborne Geoscience Research Applications (ICCAGRA) focus in one domain exclusively. Additionally, the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) provides a forum to discuss planning and utilization of UAS for meteorological applications through their standing interagency coordinating infrastructure that spans the Federal meteorological community. Successful synchronization of each agency's current and future operations with others is critical to achieving the Federal government's shared strategic vision and realizing the full potential of unmanned systems at an affordable cost.

3.0 CURRENT ISSUES AND CHALLENGES

3.1 Infrastructure requirements

While unmanned systems can be autonomous, most are remotely monitored or piloted. In all cases, they require significant manning to maintain common lifecycle infrastructure. Common lifecycle infrastructure includes activities, hardware and facilities necessary for:

- Launch and recovery systems,
- Command, control and communications (C3) & Interoperability,
- Data quality control, quality assurance, distribution, archiving and stewardship,
- Storage, maintenance, upgrades, repair and shipping (including permits),
- Sensor integration and calibration,
- Operator training and certification.

To support all these activities, hardware and facilities are necessary whether an institution or agency has one, ten, or one hundred unmanned systems. As the diversity of vehicle systems increases, these activities must be duplicated for each unique platform, further raising the level of required manning, Command, control and communications considerations, maintenance facilities, and additional operator training and certification.

The DoD has extensive experience with unmanned systems and has shown that economies of scale can be realized, as more systems are operated from centralized command centers. From another perspective, lessons learned from commercial aviation show that the fewer the types of aircraft flown, the easier the resulting maintenance, training, etc. The DoD is coalescing on fewer, more capable unmanned aircraft to simplify and standardize unmanned systems common lifecycle infrastructure. On the oceans side, fleets of Navy Gliders and Autonomous Undersea

Vehicles (AUV's) will be maintained and operated at one central location, minimizing personnel and infrastructure requirements. These lessons-learned have been translated to civilian applications by CBP, which operates one type of aircraft, off five runways, from two command centers, yet can reach anywhere in the country within two hours. Flying variants of a DoD unmanned system, CBP has calculated that the cost per flight hour of flying is roughly half that of flying a manned aircraft. Other civilian science agencies have yet to implement these DoD practices at anywhere near the level implemented by CBP. This results in considerable duplication of effort and, ultimately, low utilization rates, as common lifecycle infrastructure requirements and costs overwhelm the situation, often leaving assets 'grounded,' in a non-deployed state.

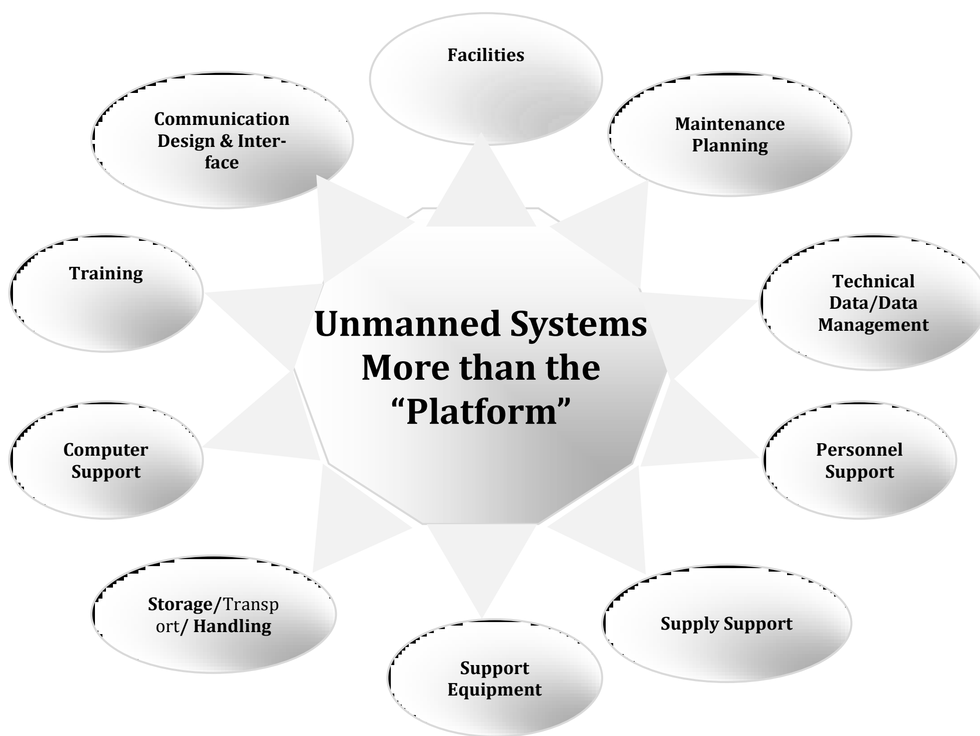

Figure 2. Unmanned systems require significant infrastructure and are more than just the platform.

Across the agencies, it is quite likely that common or similar vehicle mission, and operational requirements and system functional requirements will arise. To avoid redundancy of design and development effort and to leverage ongoing efforts across the agencies, it is imperative that participating agencies share unclassified future-looking mission and operational requirements, technology development, and design information to the highest degree possible. Such information could pertain to mid-term (e.g., 5 to 10 years) strategic planning for future mission or operational requirements as well as near-term technology development, design and engineering of unmanned systems, as well as sensors and on-board analysis systems, power/energy systems, propulsion systems, and control systems.

3.2 Interagency Coordination and Asset Sharing

In addition to the DoD, numerous U.S. civil government agencies operate unmanned system programs and issue unmanned system roadmaps. However, agencies do not always share information on their operations, making it difficult to assess the U.S. government's overall unmanned system operational capability. One major challenge identified between collaborators is the mechanism to transfer funding between partners. Greater coordination among U.S. government agencies would improve unmanned system operations and help to meet the safety challenges of allowing routine access, thereby enhancing both research and operations. For example, the creation of an intergovernmental unmanned system annual report to document the number of missions performed, hours operated, types of missions, and different agencies' unmanned system operations could help coordinate the diverse efforts of multiple programs.

It is acknowledged that the true import of an unmanned systems program does not lie within the operation of the platform; rather it is the data and information these platforms provide. While each agency will possess its own specific mission requirements (at least in the physical environment), the vast majority of supporting data are universally applicable. Moving towards an earth-system or eco-system approach to analysis and prediction capabilities, basic science, applied research, and actual operations demand a synergistic approach to unmanned system use. The challenges come from proprietary development, acquisition, operations and life cycle maintenance programs within separate organizations. This non-unified methodology results in duplicative effort and significantly less efficient use of our nation's resources. A coordinated Federal approach is seen as a conduit to mitigating risk and accelerating utilization.

One potential challenge is that restrictive regulations may be required to ensure safety of navigation, especially in the near coastal regions and within high-density shipping lanes which may result in restrictive regulations. Other identified challenges include combined costs of acquisition and maintenance of both manned and unmanned platforms, and unmanned system data sharing and assimilation standards and protocols. The importance of procuring common platforms with core command and control systems cannot be overstated, as it will yield enormous collective benefits by reducing training costs, reducing supply chain diversity, improving availability, and offering a cost-effective procurement path by exploiting the benefits of scale and software and technology reuse. Improved efficiencies of operations and cost reduction could be realized by formulating an interagency commonality.

3.3 Data Management

By definition the human operator is not on the unmanned platform, hence the feedback mechanisms available to the operators and payload managers are in the form of data and lack the personal observation often critical to operational decisions. Therefore data management is an extremely critical function for the safe operations of unmanned systems. According to OMB Circular A-16, "Data management and particularly geospatial data management is one of the essential components for addressing the management of the business of government and for supporting the effective and economical use of tax dollars." To support mission-critical functions, the Federal Government makes large investments in acquiring and developing geospatial data. Historically these investments were largely uncoordinated and often lacked transparency, sometimes resulting in data deficiencies, lack of standardization, inefficient use of resources, lack of interoperability, or inability to share data. Of particular note, unmanned systems will significantly increase the amount of data received, but lack the personal feedback provided by manned platforms because the scientist/technician on board understands the conditions in which the data were collected. The enterprise-wide adoption and execution of proper data management practices, with emphasis on accepted metadata standardization, not only fosters improved operating efficiencies in Federal and partner programs but also includes reporting that supports government transparency. This model cures the single agency stovepipe mechanism by applying consistent policy, improved organization, better governance and understanding of the requirements to deliver outstanding results.

The DoD's UAS Control Segment (UCS) Working Group is tasked to develop and demonstrate a common, open, and scalable UAS architecture supporting most sizes and types of UAS. The

UCS Working Group comprises government and industry representatives and operates using a technical society model where all participants are encouraged to contribute in any area of interest. This effort incorporates the best practices of current Army, Air Force, and Navy developments that include, but are not limited to, the following:

- Definition of a common functional architecture, interface standards, and business rules,
- Use of open-source and Government-owned software as appropriate,
- Competitive acquisition options,
- Refinement of message sets to support all operational requirements of the systems previously defined.

To ensure quality and usability of datasets by a broad range of agencies and programs, the data must be: 1) Discoverable – published and available; 2) Reliable – coordinated by a recognized national standard; 3) Consistent – supported by defined schema, standards and understood content definitions to ensure their integrity; 4) Current and applicable – maintained regularly and adaptable to current needs; and 5) Resourced – established and recognized as an enterprise investment.

4.0 RECOMMENDATIONS

The preceding sections have outlined the current issues and challenges facing unmanned systems, including interagency agreements and coordination, asset sharing, and data management. The recommendations that follow are intended to address these challenges and to meet the goals of coordinating Federal efforts to maximize the affordability, efficiency and capabilities of unmanned systems.

- **Establish an Overarching Interagency Agreement (IAA) Between Federal Agencies.** To simplify and speed the utilization of unmanned systems for Federal personnel and assets, an overarching IAA should be established which would define the parties involved, work performed and the transfer of systems, technologies and funds. The Department of the Treasury's IAA (FMS 7600C) is the current government standard; however, it is applied differently across Federal agencies. An overarching pre-existing IAA to share and pool systems, sensors, operators, facilities and funding would facilitate the efficient utilization of unmanned systems in a timely fashion. Specifically, the IAA will: 1) Enhance inter-agency program transparency, 2) Coordinate the definition and efficiency of utilization rates across communities, 3) Decrease the duplicative Federal resource expenditures, and 4) Coordinate acquisition, operations, training and life-cycle maintenance.

- **Establish Consolidated Operations Centers for Federal Unmanned Systems.** To encourage interagency expertise and improve multi-mission platform/sensor utilization rates, consolidated operational centers (COC) should be considered to harness the potential of unmanned systems and strengthen mission effectiveness while maintaining fiscal responsibility. Each COC will also work to establish a complementary relationship between manned and unmanned capabilities while optimizing commonality and interoperability across space, air, ground, and maritime domains. Open architecture and open interfaces will need to be leveraged to address problems with proprietary robotic system architectures. Standards and interface specifications need to be established to achieve modularity, commonality, and interchangeability across payloads, control systems, video/audio interfaces, data, and communication links. This openness will enhance competition, lower life-cycle costs, and provide users with enhanced unmanned systems capabilities that enable commonality and interoperability. Prudently developing, procuring, integrating, and fielding unmanned systems, COCs will ensure skillful use of limited resources and access to emerging capabilities. NASA and DOI have successfully demonstrated this concept through their air operations centers with the Global Hawk and Raven UAS respectively. Additionally, Navy and NOAA are discussing coordination efforts between the Naval Oceanographic Office's Glider Operations Center and the National Ocean Data Buoy Center Operations Center at Stennis Space Center in Mississippi.

- **Define Common Capability Description, Metadata Standards, Data Models, and Architectures.** In addition to defining of common capability descriptions, metadata standards, data models, and architectures, the Federal Government must continue to promote the development of open architecture tools to aid in the acquisition and development of open architecture systems. These efforts extend across the technology and unmanned vehicle spectrum, from software development kits, to complete architectures, addressing unmanned systems, across all agencies. Examples of such tools include:

1. The Joint Architecture for Unmanned Systems (JAUS) Tool Set (JTS) is a tool to help developers build JAUS-compliant software components without having to be intimately familiar with the details of JAUS.
2. The Standardization Agreement (STANAG) 4586 Compliance Toolkit (4586CT) is an integrated set of software tools that provides passive, interactive, and automated test capability.
3. International Organization for Standardization (ISO) 19115 is an international standard for metadata management and is endorsed by the Federal Geographic Data Committee (FGDC).

Concurrently, there is an increased demand for unmanned systems to provide greater resolution, more persistent coverage, and continuous information flow. Technical strategies need to be developed to deal more efficiently with the extremely large data sets derived from unmanned system operation. In managing this data, better data compression, encryption and processing algorithms need to be employed in preprocessing, transmission and data fusion. These strategies also need to mandate efficient use of the spectrum, reduce frequency use overhead, allow for data security and ensure improved clarity of the available frequency spectrum. To support user goals, communication systems need to support multiple frequency bands, limited bandwidth, variable modulation schemes, error correction, data encryption, and compression. These support improvements must also avoid electromagnetic interference caused within those systems or within other nearby spectrum-dependent systems.

- **Establish Asset Pools for Federal Unmanned Systems.** Across Federal agencies there are reports of under-utilization of unmanned assets. Organizations should share unmanned systems, personnel, technologies and information, strategic and operating plans, observing and performance requirements, technology assessments, impact studies, system and business case analyses, and lessons learned with other Federal agencies and interagency UAS working groups. Taking advantage of economies of scale, avoiding duplication of effort, and sharing national air space are in the best interest of the Government and non-governmental groups. The keys to this successful collaboration are generating an inventory of unmanned systems, an inventory of data requirements, an inventory of sensors, and an over-arching Federal Interagency Agreement to share systems, sensors, operators, facilities and funding.

It is recommended that the Federal agencies possessing an unmanned system program work towards a closer partnership in which diverse assets (atmosphere, ocean and surface) are procured, maintained and operated. This approach could include a national “pool” of available unmanned platforms and appropriately qualified operators that could be shared by agencies, a closer-knit acquisition architecture, and a consolidation of operational centers, thereby reducing the “manpower” for unmanned system operations.

4.1 Implementation of Recommendations

Implementation of the recommendations will require central coordination to ensure affordability, effectiveness, and efficiency of the Federal effort. To ensure the best mission solutions at the best value across the Federal government, a disciplined approach will be required. The approach will need to include conducting an analysis of alternatives and market research, using systems engineering processes, and accurately cataloging research assets (platforms and sensors) and data. SUS recommends the development of an Implementation Plan that will outline the approach required.

A coordinated Implementation Plan will need to include details concerning communications, data bandwidth and link security; ensuring affordability and interoperability of assets across the government; identifying mechanisms for centralized coordination of programs and assets; and review data gathering methods and management. Specific timelines, milestone decision points, agency coordination junctures and goals will also be identified within the Implementation Plan.

5.0 SUMMARY

Many of the Federal agencies have identified unmanned systems as a key technology that provides a capability beyond current tools and assets used to acquire the data needed to fulfill mission requirements. There are many challenges related to these systems, however, that could be addressed with a coordinated Federal Government approach. Infrastructure requirements for many systems are substantial, as are the related costs. Many of the unmanned systems already in use and owned by different agencies are under utilized because acquisitions are often made on a one or two system-at-a-time rate and often for a one-time use or project. Data management is becoming more critical as the amount of data obtained by unmanned systems is tremendous and requires standards for quality control and format in order for the data to be usable. While the challenges are considerable, establishing better mechanisms for interagency coordination, asset pools, and consolidated operations centers would provide viable solutions to many of the challenges.

As the Federal Agencies, such as NOAA, NASA, DOI and DoD, continue to develop their strategic plans and roadmaps, there is a clear need for convergence to enable sharing of assets, operators, sensors, logistics, etc, across the agencies. A Federally coordinated effort applied now would significantly improve the overall efficiency, effectiveness, and safety of government unmanned systems.

6.0 REFERENCES

[1] AUV Analysis of Alternatives (AOA) Report for Littoral Battlespace Sensing, Fusion and Integration (LBSF&I), Version 3.0, PEO C4I, PMW-120, 5 April, 2007.

[2] Glider Analysis of Alternatives (AoA) Addendum for Littoral Battlespace Sensing Fusion and Integration (LBSF&I), version 4.1, PEO C4I, PMW-120, 16 February, 2007.

[3] The Unmanned Systems Integrated Roadmap FY2011-2036, U.S. Department of Defense.

[4] U.S. Integrated Ocean Observing System (IOOS) Development Plan: A Report Of The National Ocean Research Leadership Council and the Interagency Committee on Ocean Science and Resource, 2006.

[5] Joint Planning and Development Office (JPDO) Draft Report: UAS R&D Prioritization, 2012.

[6] Joint Planning and Development Office (JPDO), NextGen Research, Development and Demonstration (RD&D) Roadmap, 2012.

[7] Office of Naval Research, Naval S&T Strategic Plan, 2011.

[8] United States Air Force Chief Scientist, Technology Horizons: A Vision for Air Force Science & Technology During 2010-2030, May 2010.

Acknowledgements

Thank you to the SUS Strategy Working Group co-authors, Brenda Mulac (Team Lead), Kim Curry, Reggie Beach, John Adler, and John "JC" Coffey for their attention to and support of SUS, and for their input to and review of this document.

INTERAGENCY WORKING GROUP ON FACILITIES and INFRASTRUCTURE
SUBCOMMITTEE ON UNMANNED SYSTEMS*

Actions and Summary from the Meeting on the SUS Implementation Plan

Tuesday, 5 February 2013, 1300-1430

ACTIONS:

Description	Who / By When	Status
Develop a straw man outline of the four Implementation Plan phases, based on this meetings discussion points	P. Kenul, J. Coffey	
Investigate the software requirements for the IOOS asset inventory and data sharing with IOOS contractor to share with the group for consideration	B. Baltes	
Compile the notes from the meeting into minutes and them provide to the group	NOPPO	Completed

Introduction

This inaugural meeting of the working group assigned to draft the SUS Implementation Plan, a document intended to accompany the SUS' Status, Issues, and Recommendations, was called to begin discussing ways forward for developing an initial outline. The group will be led by P. Kenul. At this time, the group included participation by P. Kenul of NOAA's UAS Program Office, B. Baltes from the IOOS Program Office, J. Adler, Co-chair of the SUS, J. Coffey, NOAA Affiliate to the UAS Program Office, and J. Eiler from the National Marine Fisheries Service in Alaska. In the future, the group will be looking to expand interagency efforts on the document.

Four Phases

Four focus areas were determined based on the recommendations set forth in the Status, Issues, and Recommendations document. Phase 1 will focus on administration, including development of an overarching Interagency Agreement (IAA), Phase 2 will work on developing asset pools and data standardization, Phase 3 will investigate acquisition strategies, and Phase 4 will be full implementation of a National Unmanned Systems Center (NUSC). From previous discussions held by the SUS Co-chairs, it was determined that an appropriate way forward to illustrate these phases in the Implementation Plan would be to provide already existing examples of success stories for each of these focus areas. The Implementation Plan could then pull together lessons learned and additional details based on these success stories, to help provide clear examples of how implementation could occur. For example, in ultimately implementing a fully-operable

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Center of Excellence or NUSC, already existing facilities such as Stennis that are successful in coordinating resources, personnel, etc. could provide an appropriate baseline for suggesting recommendations to implementing a NUSC.

Phase 1

For the administrative phase, determining exactly what the IAA will include will be crucial. This document will need to be developed in coordination with all of the other phases, as it will ultimately list what each of the participating agencies will be agreeing to. J. Coffey said a communications plan to educate the community on what the IAA7600 is and aims to do will be key, to assist in receiving buy-in from the agencies. The group agreed that the IAA should include elements of the following:

- Dollars, funding, in-kind services, membership, and exit strategies for those who have committed funds but back out early;
- Personnel exchanges and training standards;
- Scheduling, prioritization, performance risk, cross-scheduling performance;
- International procedures;
- Description of the nature of the work being done - so as to not exclude activities even if the other agencies do not want to buy into a particular study.

J. Coffey said the ICCAGRA IAA is a great example of a timeless, broad, and high-level IAA that has been extremely effective for many years. The group was in agreement that the SUS IAA should be broad like ICCAGRA's to simply outline the agencies' agreements to share resources, funding, etc., but that MOU's should also be developed to list the details of specific cases or projects. Additionally, J. Coffey suggested that the NUSC itself could be virtual, with a small group of personnel operating a command and control center at a location like Stennis which the participating agencies could help financially support. The idea of a virtual NUSC will probably be a lot easier to sell to the agencies.

Phase 2

B. Baltes said IOOS currently has a data catalogue that they are using to help in developing asset pools. They also have an automated asset inventory system; she offered to contact the contractor working on the software to help the group better understand how it works. Identifying data standards is going to be much more challenging. J. Coffey suggested a good first step might be to have a listing of available data sets in a central location and then work towards converging on commonality in the standards over time.

In terms of asset pools, a primary concern will be who is responsible for repairs if an asset is loaned out and it breaks. The group again brought up the need for case-specific MOUs that will outline details such as who pays in the case of an accident, etc. J. Eiler asked to group to consider how to make asset sharing user friendly. For example, cost sharing can be a concern if

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smaller groups can't fully cover the loss of a vehicle. Determining approaches that will make smaller field offices willing to participate will be important.

Phase 3

Discussing acquisition is difficult because it involves discussing dollars. Examples of effective joint acquisitions will be critical in this phase. The group suggested discussing acquisition in smaller parts, for example training, common contract buys, etc. J. Coffey said the Small UAS Army Program Office might be able to provide good examples of this. In the past, they have successfully offloaded platforms to other agencies, developed IEIQ contracts for services, etc. For example, NOAA can go to them for a specific requirement, the Army UAS Program Office can put out a competition for proposals, and select awards in a matter of weeks. The process is much more efficient and effective. The group agreed that treating acquisition is this way, leveraging acquisition elements rather than ultimately aiming for joint acquisitions for joint ownership, will be much easier to accomplish effectively.

Phase 4

Full implementation of a NUSC and recommendations on how to do so will be more easily fleshed out as the development of the other three phases proceeds. The IAA development will be dependent on all of the elements of the plan, including asset pools, data standards, acquisition, etc. Keeping the NUSC virtual is a good place to start and will make it easier for the agencies to agree to. P. Kenul and J. Coffey will put together a straw man outline with the keys points discussed today for presentation at the upcoming 4 March SUS meeting. The NOPP Office will compile the notes from the meeting and provide them to the group as soon as possible.

Meeting Participants:

	Name	Agency	E-mail
	Adler, J. Co-Chair	National Oceanic and Atmospheric Administration	john.adler@noaa.gov
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	Coffey, J.C.	National Oceanic and Atmospheric Administration	John.j.coffey@noaa.gov
	Eiler, J.	National Marine Fisheries Service (NOAA)	John.eiler@noaa.gov
	Kenul, P.	National Oceanic and Atmospheric	Philip.m.kenul@noaa.gov

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		Administration	
NOPPO			
	Horst, K.	Consortium for Ocean Leadership	khorst@oceanleadership.org

* Unmanned Systems include: Gliders, Autonomous Underwater Vehicles (AUV), Unmanned Aircraft Systems (UAS), Unmanned Surface Vessels (USV), Lagrangian Platforms and Animals.

GEOSPATIAL METADATA STANDARDS FOR UNMANNED SYSTEMS

Lynda Wayne
GeoMaxim / Federal Geographic Data Committee (FGDC)

Thursday
April 11, 2013

INTERAGENCY WORKING GROUP ON FACILITIES and INFRASTRUCTURE
Subcommittee on Unmanned Systems

TOPICS

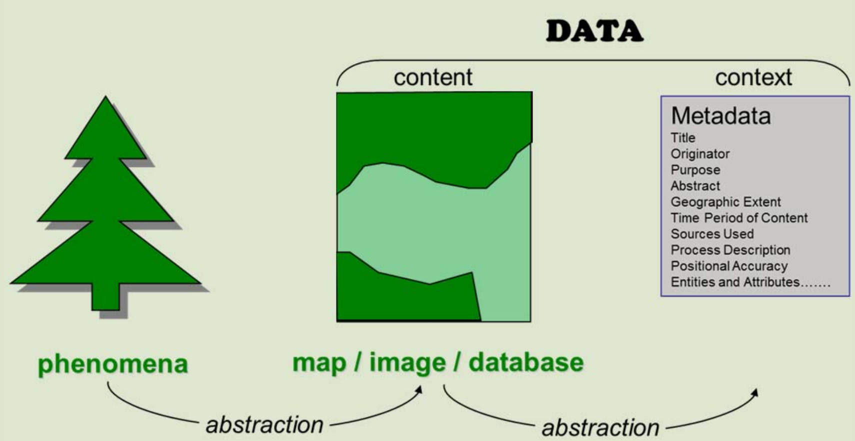
- Geospatial Metadata
- Value of Geospatial Metadata
- Metadata Support for Data Interchange
- Current Geospatial Metadata Standards
- Metadata Standards that Support Unmanned Systems
- Metadata Resources

GEOSPATIAL METADATA

Data Documentation

- **WHO** created the data?
- **WHAT** is the data content?
- **WHEN** was the data created for what time period?
- **WHERE** was the data acquired, where is it stored?
- **WHY** was the data acquired?
- **HOW** as the data acquired, how is the data stored, how can I access the data?

DATA COMPONENT

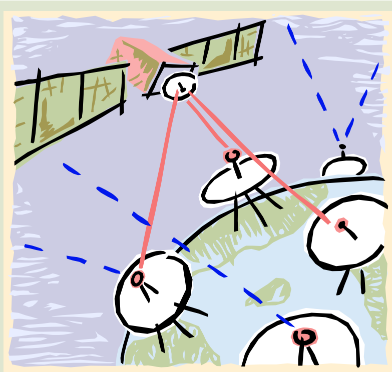


VALUE OF METADATA

Data Discovery & Use
- Locate
- Assess
- Access
- Apply

Data Management
- Maintain
- Re-use
- Accountability
- Liability

VALUE OF METADATA



System Component Information
Platform
Sensor
Objects

Mission Information
Purpose
Date
Location
Bands/Parameters
People

Data
Values
Resolution

Storage & Distribution
Location
Contact
Order Process
Price

Output Product
Processing
Media
Format
Scale
Attributes

Metadata Record

DATA INTERCHANGE SUPPORT

Describes, *does not specify*, data format & content

Information

- Platform / Instrument Type & Character
- Data Structure, Processing, Attributes
- Extent (geo, vertical, temporal)

References

- Contacts
- Source Data
- Geo-referencing system
- Data Models

CURRENT GEOSPATIAL METADATA STANDARDS

FGDC Content Standard for Digital Geospatial Metadata

- 1998
- GIS-centric
- flat file

ISO 19115 Geo Info: Metadata

- 2003
- GIS-centric
- UML - content

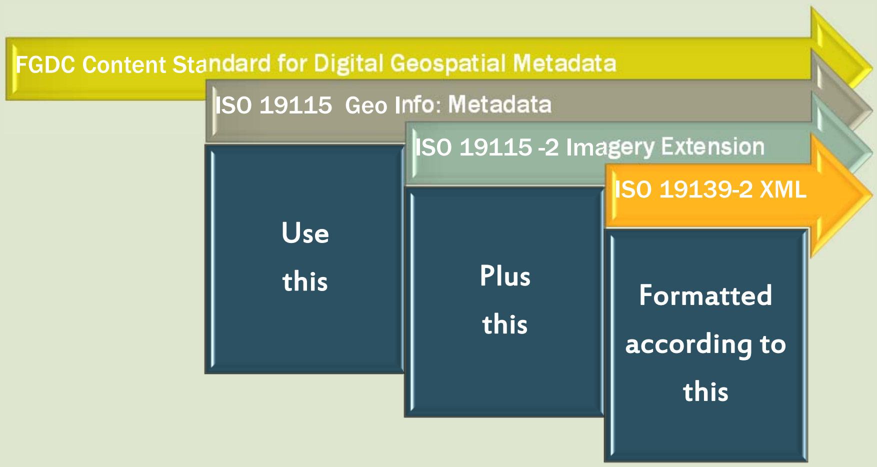
ISO 19115-2 Imagery Extension

- 2009
- instrumentation
- extends 19115
- UML - content

ISO 19139-2 XML

- 2013
- formats 19115-2
- XML - structure

BEST STANDARD FOR UNMANNED SYSTEMS



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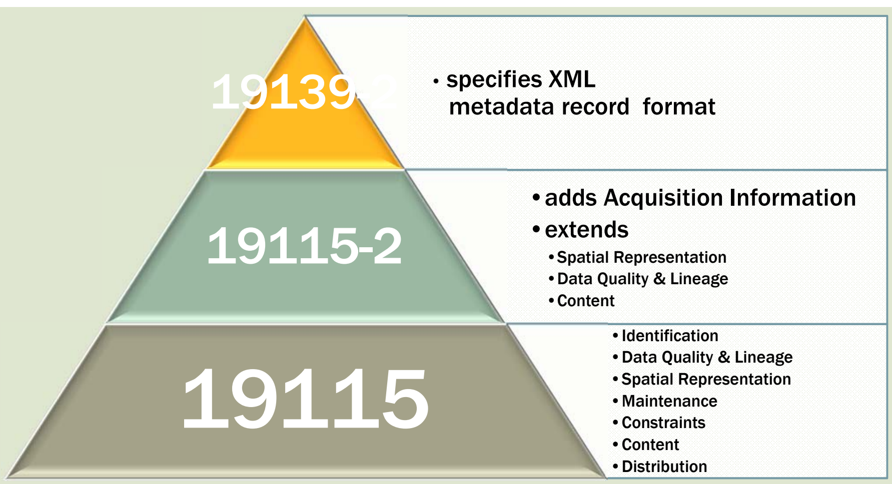
WHY ISO 19115/19115-2/19139-2?



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ISO METADATA RESOURCES

Geospatial Metadata

- FGDC Metadata Website
  - http://www.fgdc.gov/metadata
- FGDC Online Training Materials
  - http://www.fgdc.gov/training/nsdi-training-program/online-lessons#lessons

ISO METADATA RESOURCES

ISO Metadata Standards

- FGDC endorsed ISO Metadata Standards
  - http://www.fgdc.gov/metadata/geospatial-metadata-standards#fgdcendorsedisostandards
- ISO metadata transition strategies: *Preparing for International Metadata*
  - http://www.fgdc.gov/metadata/documents/preparing-for-international-metadata-guidance.pdf
- NOAA CDDC ISO Metadata Webinar Training
  - http://www.ncddc.noaa.gov/metadata-standards/metadata-training/course-one/
- NOAA CDDC ISO 19115-2 Metadata Workbook
  - http://www.ncddc.noaa.gov/metadata-standards/

ISO METADATA RESOURCES

ISO Metadata Implementation

- Agency Metadata Coordinator ISO Implementation Webinar April 16 & 17, 2013, noon-4 (E) each day
  - Jennifer Carlino – Jcarlino@usgs.gov
  - USGS Reston, Denver Federal Center, NOAA CDDC Stennis
- ISO metadata quality assessment spirals and rubric scoring
  - https://geo-ide.noaa.gov/wiki/index.php?title=Documentation_Spirals*
- ISO metadata publication via geo.data.gov
  - http://www.data.gov/important-info-for-geodata-publishers

** geo-ide website will indicate security certificate out of date – self certified, select proceed*

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ISO METADATA RESOURCES

Join the Metadata Dialog

- FGDC Metadata Working Group
  - http://www.fgdc.gov/participation/working-groups-subcommittees/mwg/
- International Metadata Listserver
  - http://spatialnews.geocomm.com/community/lists/
- ISO metadata wiki workspace
  - https://geo-ide.noaa.gov/wiki/ *

** geo-ide website will indicate security certificate out of date – self certified, select proceed*

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QUESTIONS?

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Subcommittee on Unmanned Systems (SUS) SOST Wiki Space

A wiki space has been created for us by the SOST Secretaries to post meeting materials and other meeting documents online for the group to view. K. Horst from the NOPP Office will manage the site, but once you are registered and approved, you can access the documents on the site at any time.

Directions for Registration and Approval

- To register, first click on the below website and set up a username and password https://extwiki.nsf.gov/signup.action.
- Once you have created a username and password, email K. Horst at khorst@oceanleadership.org. She will contact the SOST Secretaries to approve your account.
- Once your account is approved, K. Horst will notify you that you are able to log in to the site.
- The log in for the SOST wiki space is https://extwiki.nsf.gov/x/5YDK.
- Each time you login, a link to the Subcommittee on Unmanned Systems should appear in the grey box on the left hand side. You can also search for it in the search bar.
- Please contact K. Horst (khorst@oceanleadership.org) if you have any material to add to the site, or if you have trouble.

INTERAGENCY WORKING GROUP ON FACILITIES and INFRASTRUCTURE
SUBCOMMITTEE ON UNMANNED SYSTEMS*

Actions and Summary from the Meeting
Friday, 14 December 2012, 0900-1100

All meeting materials, including those of past meetings, are available at:
NSF/SOST Wiki Site

ACTIONS:

Description	Who / By When	Status
Send ICAP and ICCAGRA minutes to group	B. Kearse, NOPPO will distribute to group	Completed
Submit JPDO National Plan distribution list for dissemination to group, especially DOD	B. Kearse	
Contact G. Walker and T. Barnes for lessons learned working on Arctic projects Sub-action: J. Coffey will put R. Petty and M. Jeffries in touch with T. Barnes	ALL, J. Coffey, R. Petty, M. Jeffries, NOPPO	Completed, email sent by J. Coffey 12/14
Contact R. Beach with any potential Army or Air Force POCs who might be interested in partnering on a research initiative on coastal fog	ALL	Ongoing
Incorporate SOST comments into draft Status, Issues, and Recommendations document	SUS Writing Team	Ongoing next two months
Identify groups or organizations working on UAS to encourage collaboration and engagement on Whitepaper recommendations	SUS Writing Team, ALL	
Provide tracking link for hurricane/severe storm NASA project	B. Mulac	
Provide slides for "RAPS"	R. Walker	
Create a subgroup to develop a more detailed IP outline Sub-action: Identify subject matter experts UPDATED: Please indicate your interest by 21 December, the NOPP Office will schedule an initial meeting for the small	ALL, P. Kenul, J. Coffey, R. Petty, J. Caskey, B. Baltes	First meeting 2-5-13

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group in January 2013 January SUS IP Doodle Poll: http://www.doodle.com/5q45x2fa95nmt48f		
Discuss options for a SUS IAA/MOU	J. Adler, B. Kearse, J. Coffey	Ongoing
Provide contact information/organize brief on data systems/communications	J. Adler	Ongoing
Next SUS Meeting: Please fill out doodle poll: http://www.doodle.com/q8fybr75xezmrw44	NOPPO	Completed

Introductions and Remarks by Co-Chairs
J. Adler called the meeting to order at 0900. Introductions were made around the room and on the phone.

Review of 9-12-12 Actions and Minutes
The 9-12-12 minutes were accepted as written.

J. Adler reviewed the action items from the 9-12-12 meeting. The co-chairs have created a matrix organizing the comments received from the SOST on the Status, Issues, and Recommendations document and are working on incorporating those into an updated draft. The IWG-FI co-chairs and J. Caskey met with OMB on 13 December to discuss the Fleet Status Report; once that milestone has been completed, additional milestones listed in the NOP will be addressed, including developing an inventory for all assets that are Arctic capable. More information is listed below in the NOP section. P. Kenul sent an email to the group asking for volunteers to assist in the drafting of the IP and has not yet received feedback. He will send another email to the group to follow up. If you are interested in working on the IP, please contact P. Kenul at Philip.m.kenul@noaa.gov. The SUS IAA will remain as an ongoing action item, as will the communications brief tasked to J. Adler.

Updates
a. ONR Arctic and Global Prediction Program Update (M. Jeffries)
M. Jeffries from ONR's Arctic and Global Prediction Program presented to the group on the many projects ONR has ongoing, working on research studies in the Arctic, many of them utilizing unmanned systems capabilities to observe and collect information on the Arctic environment. The goal of the Arctic program at ONR is to improve understanding and predication of sea ice from an operational perspective (about a year or so out). The program has three focus areas: to improve technologies and observing systems, to improve basic

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understanding of the physical environment, and to develop fully-integrated Arctic-system models. The program funds both awards and grants to the academic community, and also funds projects within the program itself.

There are two projects currently ongoing within the program, one on Emerging Dynamics of the Marginal Ice Zone and one on Sea State and Boundary Layer Physics of the Emerging Arctic Ocean, which primarily focuses on the waves and swells that develop in the open ocean and how the penetration of those waves impact ice cover. The first project will implement an experimental phase from March-October 2014 and will include deploying sensors, moorings, and buoys on, under, and in the ice, which will transmit data in near real time. An acoustic navigation array will be constructed under the ice, which will assist in the deploying and retrieving of profiling floats and gliders. The gliders will be deployed for three months and will communicate data through an acoustic communication array anchored into the ice that will transmit data via iridium. The second project will also utilize wave buoys, gliders, and other autonomous vehicles to monitor the boundary layer, including heat transfers across the surface. The main experiment will occur in 2015.

ONR's Arctic Program is also working on other projects, including Seasonal Ice Zone Reconnaissance Surveys (SIZRS), Determining the Impact of Sea Ice Thickness on the Arctic's Naturally Changing Environment (DISTANCE), and is also working through NOPP to develop an Arctic modeling and prediction multi-agency project. The slides from M. Jeffries presentation will be included in the post-meeting materials and also included on the SOST wiki site.

b. CG USV and AUV Operational Policies (J. Adler)

J. Adler said NOAA will be acquiring new USVs called "Emilys", so NOAA has been working with the Coast Guard on how to operate them, and to see if they can be coded as an unmanned systems vessel. Additionally, it is possible that this technology might be pushed forward into the international arena.

c. Update on SUS Whitepaper and Implementation Plan

The SOST comments on the whitepaper were incorporated into a matrix, which was included in the meeting materials. The writing team plans to take the next two months, leading up to the February meeting, to incorporate those changes into an updated draft. Some comments had to do with joint acquisition, which will be a primary area of focus.

d. ICAP and ICCAGRA Meeting Updates (B. Kearse)

B. Kearse updated the group on the ICAP and ICCAGRA meetings that occurred in the fall. The minutes from both meetings will be included in the post-meeting materials.

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ICAP formed in the 1980's to develop oversight of public aircraft operations. Since its inception, several subcommittees have been stood up, most recently a new unmanned aircraft systems subcommittee which held its second meeting to discuss training and standards, etc., this fall. The group is going to look into procurement and also do some data collection on who has assets in the federal arena. Additionally, they have offered to stand up a small group to look into developing a program to support voluntary audits, to ensure programs in the UAS realm are safe and to discuss what can be done to improve the UAS departments. B. Kearse will be working with B. Galloway at GSA going forward.

JPDO recently developed a national plan in coordination with DOD, DOC, NASA, FAA, and Homeland Security. It is still in draft form and under review by the member agencies. It is expected to go to OMB and Congress in the February timeframe. It is a comprehensive plan that includes many milestones and a roadmap developed by the FAA. Currently, the document is not available for dissemination, but when the document does become public, it will help provide more agency-wide, uniform policies and rules for operating UAS. The group expressed interest in the distribution list of those who are providing comments on the document, and B. Kearse said he would pass that on to the group.

ICCAGRA also met this fall and had a very productive meeting discussing the collection of atmospheric data, collaboration, and the sharing of pilots. Presentations were heard on interagency agreements, data standards, from JPDO on the national plan, from J. Caskey on the IWG structure, from Jim Weber on the European community, and from B. Mulac on the SUS' activities. The group will meet again in the spring and is hoping to have a joint meeting with SCOAR and AUVSI.

While the scopes of ICAP and also ICCAGRA do not necessarily align with the goals of SUS, it is important for all of these groups to have an understanding of the others to avoid duplication of effort and encourage collaboration where possible. An action item came out of the 10 December IWG-FI to put together a document listing the tasks and goals of the three groups, and J. Coffey and B. Kearse are working on that.

e. NOP Milestones Tasked to SUS

At the 10 December IWG-FI meeting, the group discussed in detail the additional milestones tasked to the IWG-FI through the National Ocean Policy. Three of those milestones fall under the unmanned systems prevue, and a spreadsheet highlighting those milestones was included in the meeting materials. Many include developing inventories of available assets, and both J. Adler and J. Coffey said NOAA has databases available with information that might provide a good start toward completing those tasks. J. Caskey is POC for two milestones, and J. Adler and B. Mulac are listed as lead on one milestone. Please send any applicable information or updates regarding these milestones to them.

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f. Environmental Global Hawk Update (M. Bonadonna)
A meeting was held on 8 November, as a follow up to the February 2011 meeting of this group, to discuss the use of UAS for environmental monitoring. The meeting consisted of learning what each agency is doing with their UAS assets for environmental monitoring, and included two breakout sessions to discuss the business/acquisition side and a whitepaper that is being drafted to highlight the benefits of using UAS for this type of monitoring. The group is also looking at hosting a few smaller meetings throughout the year instead of one large meeting once a year in order to make even more progress on these issues. Joint Action Groups (JAGS) were established to tackle a few specific actions, and the first JAG will meet next Tuesday. The group is co-chaired by NOAA, NASA, Air Force, and Navy.

Around the Room / Open Forum
U.S IOOS- B. Baltes the workshop held in August to discuss the National Glider Network Plan went well. The plan includes a format for glider data standards and a glider data assembly center. A first draft of the plan is circulating and a final draft is anticipated in the spring.

NOAA- L. Bernard said Stennis has a MOU with CINMOC and NBDC to collect data on the wet side and disseminate it on the web. Additionally, coordination with NOAA and Navy at Stennis is going well. The glider that was recently hit by a ship has been refurbished and will be re-deployed into the Gulf of Mexico with new tsunami monitoring capabilities.

P. Kenul reiterated J. Adler's update, that NOAA is taking possession of 10 Emily vehicles. Currently, there is one mission organized to use this new technology in a hurricane, and NOAA plans to use them for other environmental survey work in the future. He also reminded the group to contact him if anyone is interested in participating in a small group to work on the IP. He is hoping to have a kick-off meeting in January and will work with the NOPP Office to schedule that meeting.

J. Adler said NOAA has been working with Liquid Robotics. A wave glider recently made a 9000 mile journey across the Pacific which is a big deal. A glider will also be doing some work in the upcoming month to study penguin colonies.

DOE- R. Petty said flights of UAVs off the North Slope in Alaska occurred in the last week of October and first week in November. The UAVs came from New Mexico State University, and the flights took place in a small region of restricted area space owned by DOE. The flights went well, and DOE is looking to move forward to conduct additional missions in the future.

BOEM- G. Auad said BOEM has been working on creating a NOPP project to study the Arctic environment, a project which will include the use of gliders. The project is partnering with 6 other agencies and Shell, and includes an observation component and a modeling component. The RFP will be circulating among the agencies early next month.

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R. Lai said BOEM is also interested in using UAS along the Atlantic coast to collect environmental information in regions where wind energy is being developed.

University of Alaska- T. Barnes encouraged R. Petty and M. Jeffries to contact UA, as he would like to help them and their projects by providing lessons learned working in the Arctic environment. (J. Coffey sent an email and provided introductions electronically during the meeting on 12/14). He also said the Sikuliaq will be in the Seward/Anchorage area this time next year if M. Jeffries would like to get involved in the acquisition for time on that ship for his experiments.

ONR- D. Eleuterio said for anyone involved in the national network of gliders, ONR is starting to look at receiving velocity data from the wave gliders. Anyone interested in this work should contact ONR, as it should provide a good contribution to the network. Additionally, some work is being done using the scan eagles for eddy correlation; that data might become available to researchers once the studies are completed.

R. Beach said he will be working on a project in the spring that will be tagging comorants, a species of bird that dives many times per day all the way to the bottom. They can dive up to 900 times per days, and the project anticipates as many as 4000 soundings per day. The data will be used to gain a better understanding of bathymetry in both the marine and estuarine environment. Additionally, DOD is developing a five year, multidisciplinary research initiative focused on coastal fog. R. Beach is looking for some partners on that project, specifically from Army and Air Force. If anyone knows of any contacts, please let him know. R. Lai said BOEM is also interested in coastal fog from a wind energy perspective.

Navy- S. Lingsch said the Oceanographer of the Navy is working on a technology transfer agreement with ONR on a miniaturized lidar. If any other agencies are interested, please let him know.

CG- J. Berkson reminded the group to consider the gray area surrounding UAV collisions once they rise to the surface, and how to avoid those accidents.

USGS- B. Quirk introduced himself to the group. He said DOI has a number of UAS that have been used around the country for a variety of purposes. He said USGS' geologists have a keen interest in utilizing this equipment for their work.

Summary Remarks / Scheduling of Next Meeting

The next meeting will be scheduled in the late February, early March time frame. Additionally, P. Kenul would like to schedule a small group meeting on January to begin work on the IP. K. Horst will complete Doodle Polls with available dates and schedule those meeting accordingly.

* Unmanned Systems include: Gliders, Autonomous Underwater Vehicles (AUV), Unmanned Aircraft Systems (UAS), Unmanned Surface Vessels (USV), Lagrangian Platforms and Animals.

As a reminder, a wiki site has been created for the SUS members, to store meeting materials, documents, presentations, etc. Instructions on how to register for the site were included in the meeting materials. Please contact K. Horst to complete your registration, or if you have any questions.

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