Update on use of ship-launched airborne vehicles from UNOLS research vessels

Report to FIC
July 9 2018

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Objective

To provide guidance on how to integrate unmanned airborne systems of various sizes and performances in at-sea experiments, operating from UNOLS research vessels in a safe manner and within the bounds of the relevant aviation authorities (e.g. FAA, CASA etc.)

<55lbs UAS VLOS

A broad range of platforms!

VTOL long endurance BLOS

Increase in UAS ops from research vessels

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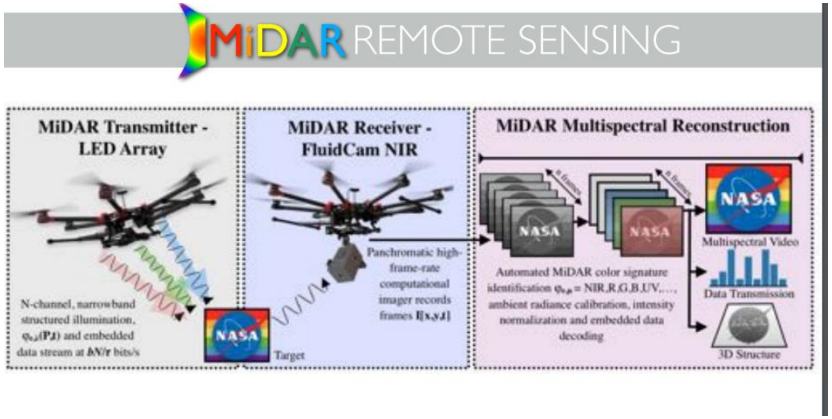
Primary areas:

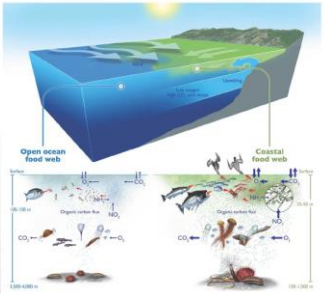
- Physical Oceanography
- Atmospheric Studies / EM propagation
- Sea-Ice studies
- Operational purpose (Ice reconnaissance / navigation and ice station planning)
- Biological Studies/Sampling
- Coral reef mapping
- Outreach



Recent increase use of small UASs for science (not only outreach)

MBARI's CANON Experiment

2017's interdisciplinary field experiment used UAVs for the first time to attempt collection of surface temperature data in collaboration with a the Flightwave VTOL system.



NSF Antarctic program

Case study: NSF/USAP Antarctic program (Tim McGovern)

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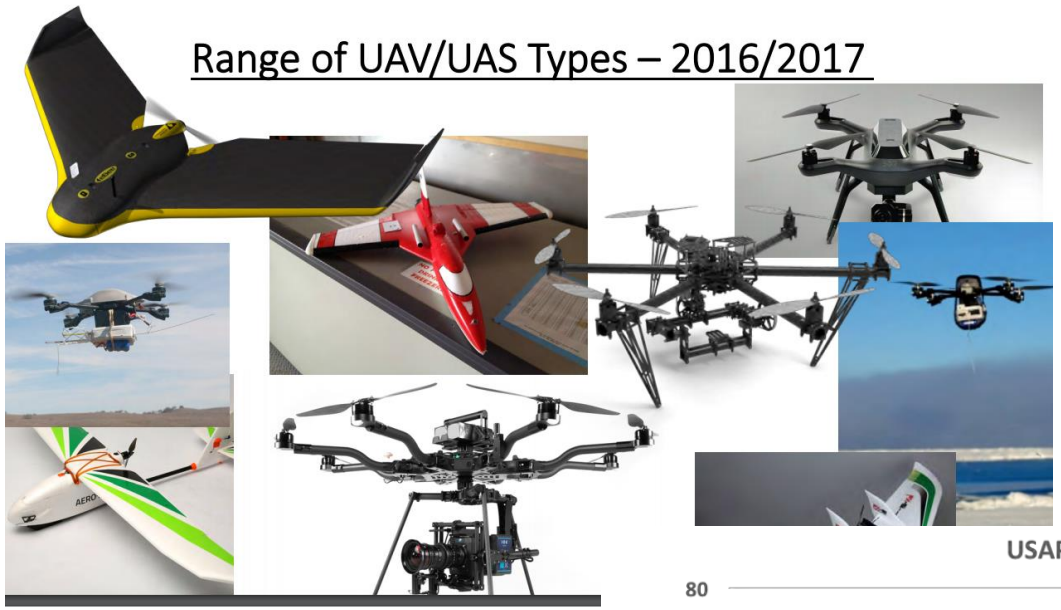
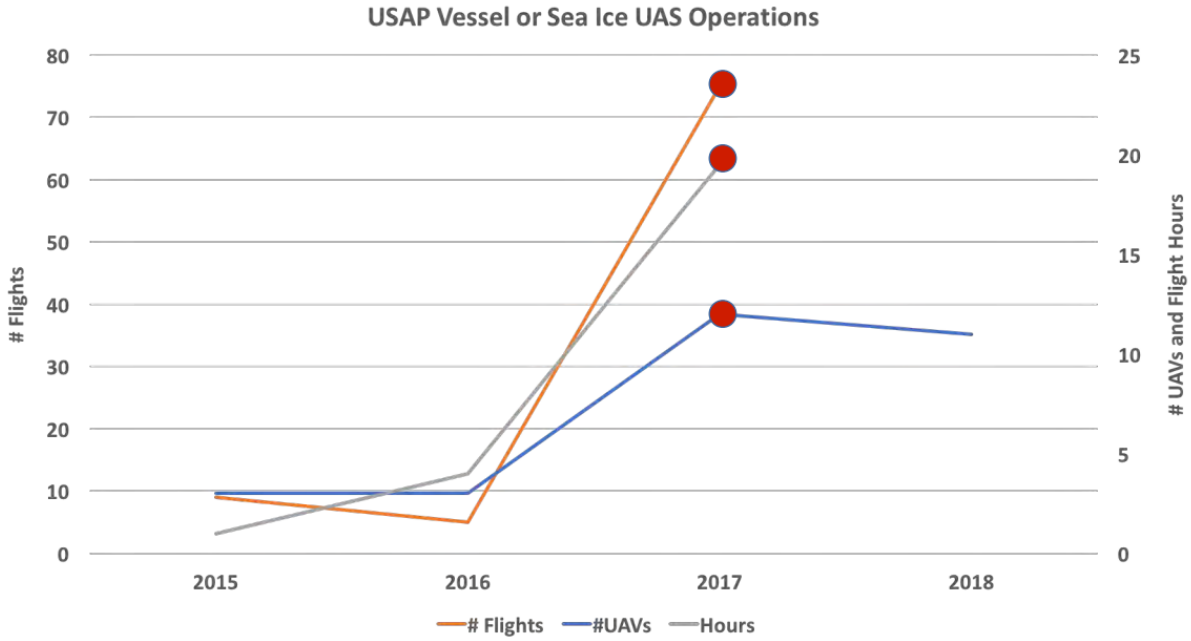


Very detailed process and policies in place to integrate UAS in Antarctic program projects.

Similar approach is being implemented for UNOLS research vessels



Key Challenges

- Extreme Temperatures
  - Impact on touch screens/iPad controllers
- High Wind
  - >20 knots grounds UAVs
- Wildlife Avoidance
- Multi-unit Operations
  - Establishment of "Air Boss"
- Navigational Interference
  - Ship's hull
  - Compass interference

Unmanned Aerial Systems (UAS) Operations from UNOLS Ships: Operator's Handbook

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Status: Draft undergoing revisions to include recent inputs; new version will be sent this next week (July 18 target date) to the SCOAR Subcommittee on UAS Shipboard Operations and SCOAR group for review.

In the interim, operator institutions and science investigators are encouraged to contact SCOAR for guidance on proposed UAS ship based operations (multiple requests handled this year).

Primary objectives:

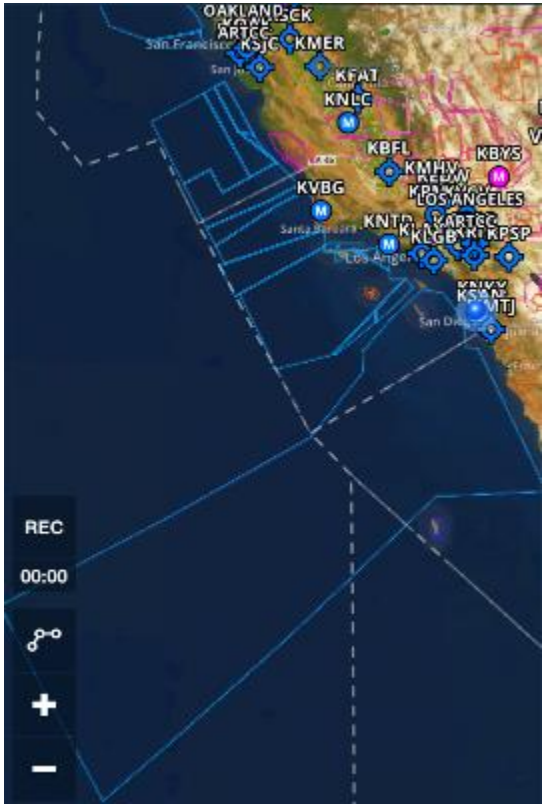
1 - Develop guidelines on how to implement UAS policies based primarily on NSF/USAP current procedures and policies.

This includes the creation of a ship operator/PI handbook, to identify and manage risks associated with ship-based UAS operations and to develop guidelines to mitigate those risks. The document itself is a living document, as UAS technology and regulations evolve.

Important aspects included in the handbook

2 – Educate operators and scientists about regulatory restrictions (e.g. Section 333, Part 107 exemptions, pilot certification)

3 - Identify institutional approval processes (e.g. UC now requires internal approval, to demonstrate FAA rule compliance and requiring to file a flight plan prior to each event for all UC operators and UC owned platforms)



4 –Importance of flight clearance for the planned operation area.

Many areas of the coastal waters are in Navy restricted areas where the airspace is controlled from the surface and up (Navy range clearance and coordination required)

On the left figure, all areas with the blue boundaries are controlled down to the surface.

Again, most academic institutions now have *in-house* expertise to provide guidance on flight clearance/approval requirements.

5 – Develop a list of Points of Contacts (POCs) of groups/people experienced in UAS operations from ships.

Flowchart for decision-making (under review)

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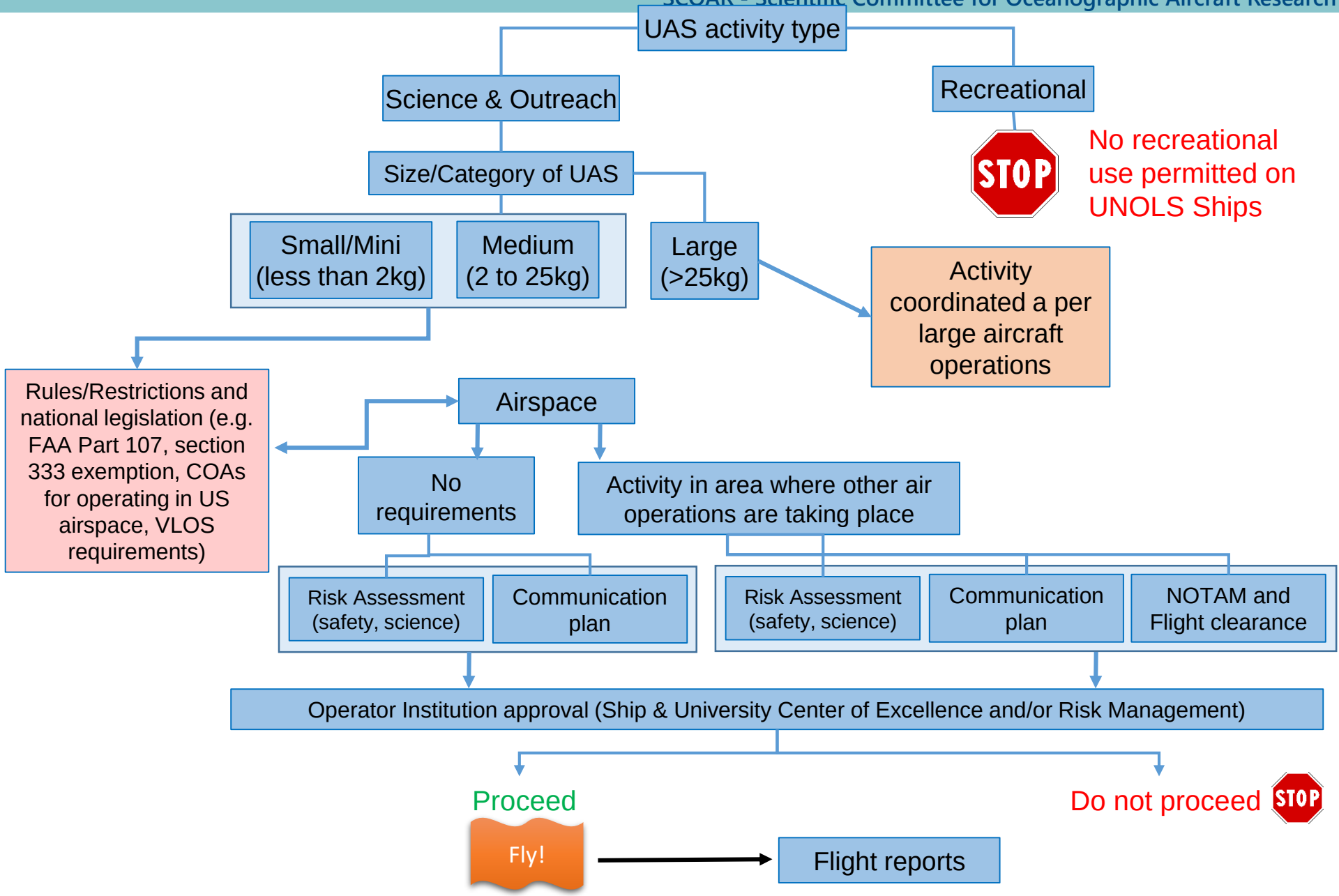

Ship-based UAS operations is anticipated to become a routine component of research operations conducted from UNOLS research vessels in the near future.

It is therefore essential that the design of the next generation of research vessels meets the basic needs of UAS shipboard requirements:

- Communication (air band radios)
- Sufficient "real-estate" to install system antennas (omni and directional)
- Sufficient physical clearance for take off and landing (though generally not an issue)
- Crew training on basic UAS ship based operations
- "Good" internet bandwidth to access remote sensing and aviation forecast products needed for flight planning.

New technologies such as smarter navigation and control systems, automatic take off and landing with sensing capability for obstacle avoidance (e.g. A-frame, ship super structure) are now mature enough to envision including UAS as a core component of the R/Vs, owned by the operator institution, operated by the ship crew or restechs, and requested by the PI at the scheduling stage:

- Operational purpose (ship inspection, obstacle avoidance …)
- Outreach
- Search and rescue operations
- Science support