Scientific Committee for Oceanographic Aircraft Research UNOLS SCOAR

Report to the UNOLS Council
May 7-8 2015

CIRPAS Twin Otter flying at 30m AMSL in close proximity of R/P FLIP during the HIRES2010 experiment

Purpose (taken from Terms of Reference)

"This Committee shall provide advice and recommendations to the National Oceanographic Aircraft Facility managers and supporting federal agencies on aspects of operations, sensor development, fleet composition, utilization and data services as appropriate.
In addition, SCOAR and the UNOLS Office shall provide the ocean science user community with valuable information and advice concerning experiment design, facility usage, scheduling and capabilities.
The Committee shall also promote collaborations and cooperation between facility operators, funding agencies and the scientific community to improve the availability, capabilities and quality of aircraft facilities supporting the ocean sciences. By promoting collaboration between the ocean science community, the atmospheric science community and other science communities using aircraft in support of their research, the Committee shall work to improve utilization and capabilities for all of these communities.

The SCOAR shall also recommend the designation of aircraft facilities as National Oceanographic Facilities to the UNOLS Council and membership as described in paragraph 4 below."

SCOAR members

NAME	AFFILIATION	TERM
Bailey, Ro	UAF	02/13 to 02/16
Bluth, Bob | (ex-officio)	NPS	01/03
Fisichella, David	WHOI	07/14 to 07/17
Hartz, Steve | (RVTEC Rep, ex-officio)	UAF	05/07
Jonsson, Haflidi | (ex-officio)	NPS	01/03
Kudela, Raphael *	UCSC	10/11 to 10/15
Lenain, Luc | (Chair, SCOAR)	SIO	04/15 to 04/18
McGillivary, Phillip	USCG	04/10 to 04/16
Woods, Roy | (ex-officio)	NPS	03/09

- New Chair elected at the last SCOAR meeting in April 2015
- Call for new SCOAR member

THANK YOU DAN!!!

2015 Meeting at the Rosenstiel School of Marine & Atmospheric Science (RSMAS), University of Miami

- Meeting hosted by Roni Avissar (Thank you!)
- Coincided with the Commissioning of a new Airbus AS-350 helicopter configured and instrumented for marine and atmospheric science**: the University of Miami's Helicopter Observation Platform (HOP)**

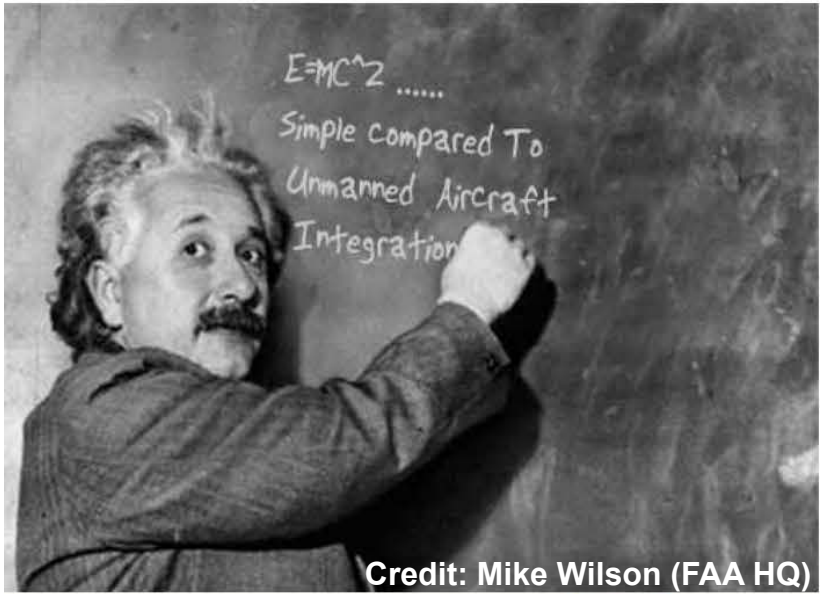
- Scripps Institution of Oceanography
- University of Alaska
- CIRPAS / Naval Postgraduate School
- NOAA
- WHOI
- University of Miami RSMAS
- NSF
- ONR
- Texas A & M University
- NASA
- Florida Atlantic University
- USCG
- Airbus Industries
- FAA HQ
- Schmidt Ocean Institute

Selection of presentations available on the SCOAR website:
https://www.unols.org/committee/scientific-committee-oceanographic-aircraft-research-scoar

- Agency and UNOLS Reports
- CIRPAS report (UNOLS National Aircraft Facility)
- Report from Subcommittee on Unmanned Systems (SUS)
- Guest presentations (SOI, FAA HQ, UAF, WHOI, Lone Star UASS test site, U of M. HOP) - selected examples to follow

Very exciting times for airborne research – New manned and unmanned systems becoming accessible to scientists, including in support of sea-going projects.

But still a lot of challenges ahead,
In particular with UAS!



Credit: Mike Wilson (FAA HQ)

Manned and Unmanned Air Platform capabilities

	Unmanned System	Manned System
Portability/Ship-Launch	Yes	Limited to Helo/VTOL
Access Remote Location	Yes	Requires runway or helipad
Long Endurance Capable	Yes	Varies/platform-specific
Range	Varies depending on comms: LOS vs SAT	Varies/platform-specific usually better than UAS
Airspace/Flight Clearance	Very Challenging	Straightforward
Low Level Flight Capable	Yes	Helo or special trained crew (as per CIRPAS)
Multi-Platform Ops	Yes	Challenging/do-able
Platform Cost	Broad Range	Expensive
Payload Capability	Quite limited	Significant >200 Lbs.
Operation Cost	Varies depends on ops.	Varies depends on ops.

University of Miami's Helicopter Observation Platform (HOP)

POC: Ronni Avissar (RSMAS)

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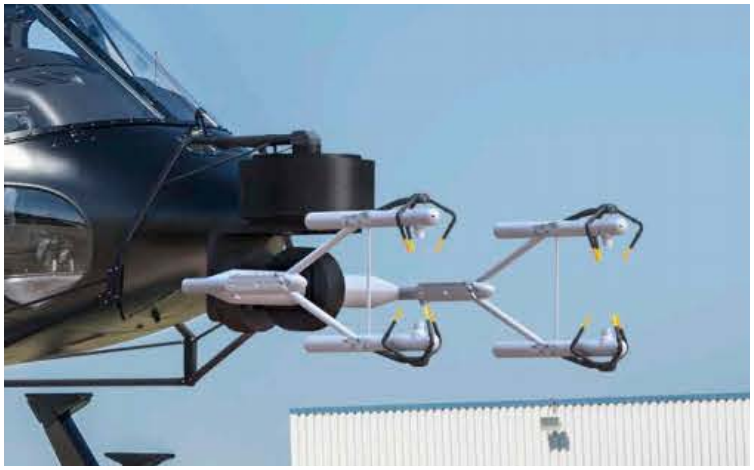


Why a helicopter?

1. Various environmental observations require low altitude, very-high frequency of sampling, and/or slow speed of sampling (e.g., aerosols, which have a key impact on climate and health; fluxes – water, carbon, others)
2. Maneuverability (complex terrain, urban areas, quick turns for flight tracks)
3. Time at station (with a fuel truck on the ground, no need to commute to an airport)
4. Remote location (e.g., operation from a ship)

Cost of Operation…

Rate is $1,995/hr (including ALL costs: insurance, hangar, maintenance and inspections, operation, pilot, fuel, parts and labors). A typical intensive field campaign lasts about 10-12 days. Flying 5 hr/day on average results in 50-60 hours of data collection (plus transportation to the site) and costs about $150K. Typical field campaign budgets are in millions of $ and, therefore, the cost of the HOP is typically minor, especially given the uniqueness that it brings to the table…

University of Miami's Helicopter Observation Platform (HOP)

POC: Ronni Avissar (RSMAS)

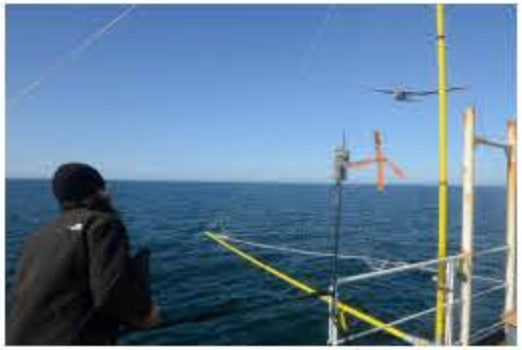
Airbus Helicopter H125 - Performance at Max. GROSS WEIGHT, ISA, SL

Maximum speed (Vne)	155 kts / 287 km/hr
Fast cruise speed	140 kts / 259 km/hr
Range (@127 kts)	345 nm / 638 km
Max Endurance	4'23" (no reserve) – 4 hrs for science mission
Rate of climb	1,959 ft per min / 10 m/s
Service ceiling	16,550 ft / 5,044 m
Hover ceiling IGE	13,200 ft / 4,023 m
Hover ceiling OGE	11,100 ft / 3,383 m
Maximum Altitude	23,000 ft / 7,010 m (landed on Mt Everest!)
Maximum takeoff weight	5,225 lb / 2,370 kg
Maximum with external load	6,172 lb / 2,800 kg (+950 lb for Payload)
Maximum cargo-swing load	3,086 lb / 1,400 kg
Maximum Scientific Payload	1,000/3000 lb (fully fueled with 2 pilots)

UAS Operations

APH-22 Hexacopter – NMFS/OMAO

Sensintel Coyote – OAR/UASPO/OMAO



AeroVironment Puma AE
NOS/UASPO/OMAO

USCG Arctic Shield

Insitu Scan Eagle
2015 Marine Mammal Arctic Study
NMFS/OMAO/ONR/UASPO/BOEM

Killer Whale Survey

NASA Global Hawk Partnership
Sensing Hazards with Operational
Unmanned Technology (SHOUT)

CIRPAS update
Presenter: Bob Bluth (NPS)

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- The Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) was established by the Office of Naval Research (ONR) in the spring of 1996
- CIRPAS provides Manned and Unmanned Air Vehicle flight services to the scientific and engineering communities.
- CIRPAS became an University National Oceanographic Laboratory System (UNOLS) National Facility in 2002 and NSF National Facility in 2010

UV 18-A Twin Otter (2)

Pelican

Sentry BK 30
UAV (5)

SPA-10

NAVAL POSTGRADUATE SCHOOL

2015 Science Missions

- Aerosol and Cloud Interaction Experiment: July 2015 - Monterey Area

Objective: Understand the complicated interplay between aerosol particles, cloud droplets, and dynamics in governing the physical and chemical nature of the marine boundary layer clouds and precipitation. The participating teams are from Caltech, U. of Arizona, and Georgia tech., and are led by Professor John Seinfeld of Caltech.

- Effects of organized flow-structure within the MBL on air/sea exchange rates: Aug 2015 – Monterey Area

Objective: Study the possible effects of organized structures in the boundary layer flow patterns on flux rates with the Twin Otter Doppler Wind Lidar. PI, Dr. David Emmitt of Simpson Weather Associates.

- CTV Engineering and Test flights: April 2015 – Monterey Area

Test Controlled Towed Vehicle (CTV) improved video and altitude hold stability for improved flux measurements over the sea.

- CASPER: Oct 2015 – Duck, NC

Objective: Study the influence of the atmospheric and oceanic environment on electromagnetic wave propagation. Ocean conditions will be characterized by use of buoys and ships, while the CIRPAS Twin Otter aircraft characterizes the conditions in the atmosphere. The many participating teams led by Qing Wang of the Naval Postgraduate school.

University of Alaska update (ACUASI/PPUTRC Research)
Presenter: Ro Bailey

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ACUASI

Unmanned Aircraft Systems and the Arctic

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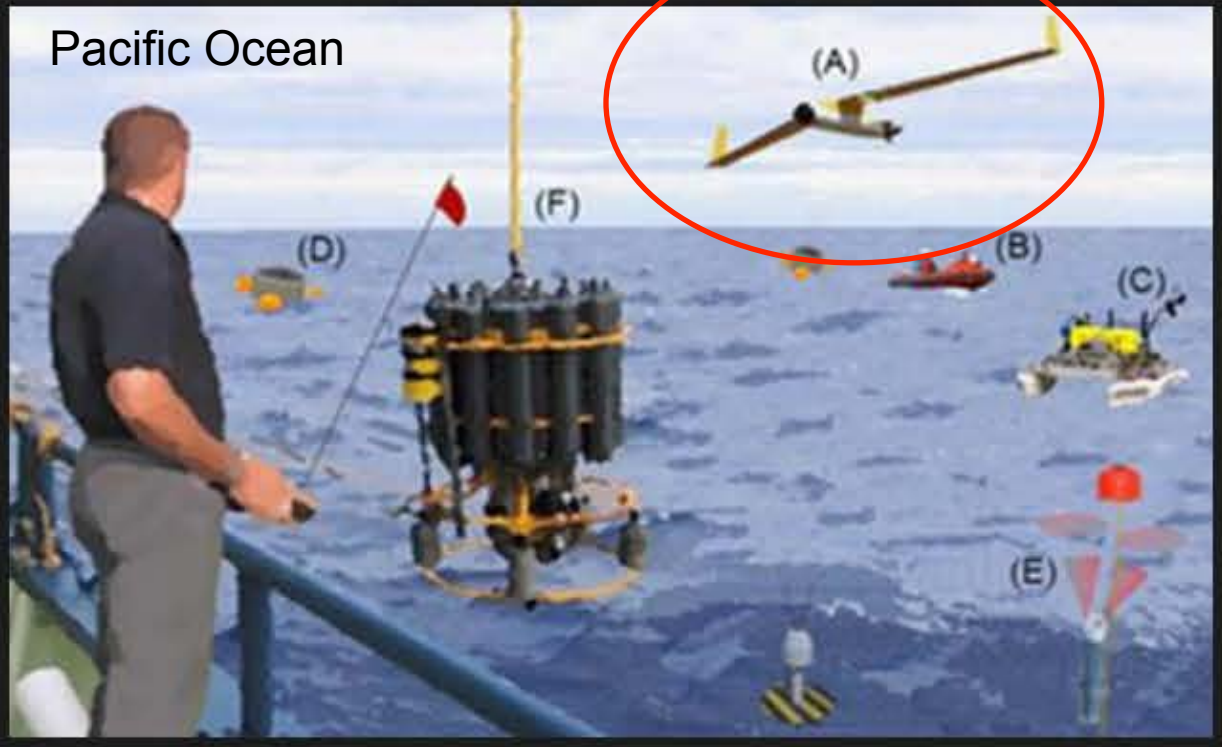
Summing It Up...

- Activity level is increasing—but stymied by untimely COA approvals
  - Research opportunities abound, but approval of novel COAs a challenge
  - 'and funding—but money is out there, if we can offer something
- Developing joint proposal to beta test NPRM (but not limit to that)
  - And strongly support platform agnostic COAs
    - Big interest from industry, agencies (NASA)
- Meanwhile recasting fleet, very active operational year ahead

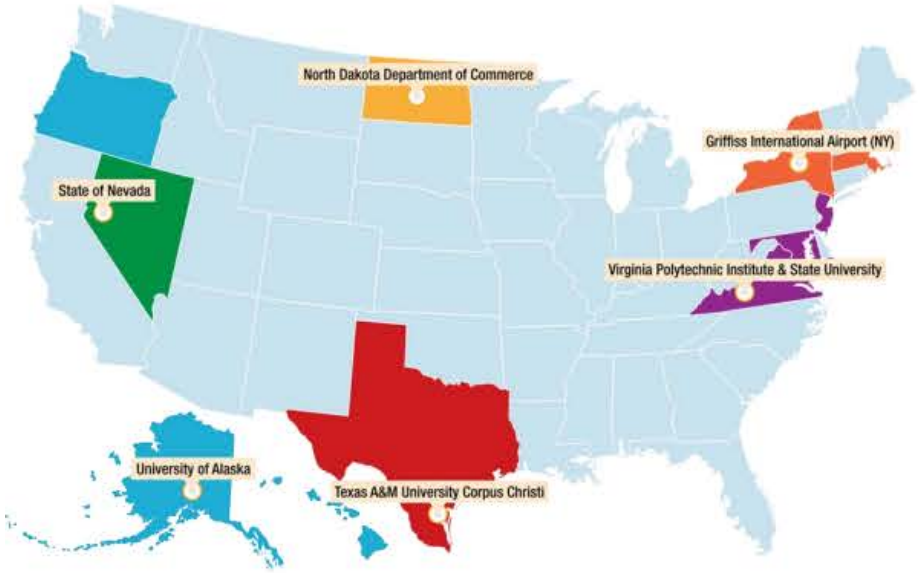
NPRM: FAA UAS Notice of Proposed Rule-Making

Sea-Surface Microlayer and Air-Sea Interaction Study



(A) unmanned airborne systems, (B) small boat operation for manual sampling and deployments, (C) a remote controlled catamaran for surface skimming and near-surface processes, (D) free-floating chambers for measurements of gas exchange, (E) sensor packages for near-surface measurements and (F) CTD profiles.

UAS Test Sites



- **University of Alaska**
  - Includes test ranges in Hawaii and Oregon
  - Operational May 5, 2014
- **State of Nevada**
  - Operational June 9, 2014
- **New York Griffiss International Airport**
  - Includes test ranges in Massachusetts
  - Operational August 7, 2014
- **North Dakota Department of Commerce**
  - Operational April 21, 2014
- **Texas A&M University – Corpus Christi**
  - Operational June 20, 2014
- **Virginia Polytechnic Institute and State University (Virginia Tech)**
  - Includes test ranges in New Jersey (partnered with Rutgers University) and Maryland
  - Operational August 13, 2014

http://www.faa.gov/uas/legislative_programs/test_sites/

And creation of centers of Excellence throughout the US

https://www.unols.org/sites/default/files/201504scoap12.pdf

What is Section 333 ?

"The Federal Aviation Administration has established an interim policy to speed up airspace authorizations for certain commercial unmanned aircraft (UAS) operators who obtain Section 333 exemptions. The new policy helps bridge the gap between the past process, which evaluated every UAS operation individually, and future operations after we publish a final version of the proposed small UAS rule.

Under the new policy, the FAA will grant a Certificate of Waiver or Authorization (COA) for flights at or below 200 feet to any UAS operator with a Section 333 exemption for aircraft that weigh less than 55 pounds, operate during daytime Visual Flight Rules (VFR) conditions, operate within visual line of sight (VLOS) of the pilots, and stay certain distances away from airports or heliports (…)

The "blanket" 200-foot COA allows flights anywhere in the country except restricted airspace and other areas, such as major cities, where the FAA prohibits UAS operations. Previously, an operator had to apply for and receive a COA for a particular block of airspace, a process that can take 60 days. The agency expects the new policy will allow companies and individuals who want to use UAS within these limitations to start flying much more quickly than before…" (from FAA website)

Would drastically simplify the current process in place to operate UASs from research vessels (e.g. COAs, military controlled airspace, or international airspace), especially for light UAS (quadcopters etc…) -> "UAS 101" article to be prepared for UNOLS Newsletter

Planned activities & relevant action items

- Start compiling a UAS information database to be posted on the SCOAR website. This includes:
  1. Regulatory aspects (sample COAs, list of approved Section 333 exemptions, FAA points of contact etc..) with regular updates.
  2. Example of past projects that made use of UASs on UNOLS ships.
  3. UAS operators with experience on UNOLS ships.

- Review SCOAR terms of reference, and UNOLS Safety Standards submitted for UAS operations by SCOAR last year in light of the new FAA regulations proposed.
- Appendix to the RVSS SCOAR submitted last year will be given another quick look-over for any needed edits before the Safety Committee submits a final version for approval by the Council and printing.

- SCOAR outreach:
  1. UAS Ocean Science 2016 session proposal submitted.
  2. UAS operation tutorial session submitted as well.
  3. Organize UAS ‘petting zoo’ for OSM UNOLS booth as in 2014.
  4. Possible participation in the Ocean Legislation Day.
  5. Discussing conducting SCOAR Community Survey within UNOLS to provide inputs about UAS training and/or other issues of interest SCOAR may wish feedback about.
  6. “UAS 101” article in UNOLS Newsletter

Thank you! Questions: Luc Lenain (llenain@ucsd.edu)

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Photo credit: Evan Walsh (SIO)