

# *UNOLS SCOAR: Scientific Committee for Oceanographic Aircraft Research*

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and  
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SCOAR Website: Briefs from past annual meetings, currently undergoing update to include more resources to users

<https://www.unols.org/committee/scientific-committee-oceanographic-aircraft-research-scoar>

## Current Membership:

Name	Institution	Role	Rep Of	Term Start	Term End
Dr. Christopher Zappa	LDEO	Chair		9/1/2021	Sep-24
Dr. Armin Sorooshian	UA	Member		10/1/2021	Oct-24
Dr. Michael Starek	TAMU	Member		9/1/2017	Sep-23
Dr. Britton Stephens	NCAR	Member		4/1/2019	Apr-22
Dr. Hanumat Singh	NEU	Member		2/1/2017	Feb-23
Dr. Roni Avissar	Miami	Member		11/1/2020	Nov-26
Andrew Woogen	OSU	Committee-Rep	RVTEC	11/1/2020	Nov-23
Dr. Debbie Bronk	Bigelow	Ex-Officio		11/1/2020	Nov-22
Dr. Dennis Hansell	RSMAS	Ex-Officio		10/1/2020	Oct-22
Dr. Anthony Bucholtz	NPS	Ex-Officio		3/1/2019	



Annual meeting: 4–5 October 2022, 1 ½ days, Boulder CO, **IN PERSON.**

New Research Aviation Facility and Mesa Lab at NCAR

Host: Britt Stephens, included Gulfstream V tour

Also, we've held virtual meetings quarterly.

We will have turnover next year on the Committee (2 members)

- To inform broader community on the use of airborne assets in support of ocean sciences, in particular in coordination with Academic Research Vessels.
- **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.**
- SCOAR is available as a resource to those PIs, RVTECs, etc. who are interested adding such capability to future field programs.
- Receive community input and feedback on implementation? Follow-up discussions about all UAS are welcome.
- On-going SCOAR activity:
  - Review of the UAS Guidance document; Original Published: July 2021 – Version 2.0.
  - Antarctic Research Vessel - Opportunity to provide input
  - Operator/User input is needed!

Please contact us if you are interested!

## Promote the use of Uncrewed/Unoccupied and piloted aircraft in support of atmospheric and oceanographic research

- Inform the scientific community on the benefit of airborne remote sensing capabilities
  - AGU Ocean Sciences Town Halls in 2022: *Expanding the Reach of the Research Fleet: Autonomous (and Piloted) Airborne Systems in Support of Ocean Sciences*
    - Lightning talks (8)... which led to invitees to recent and future SCOAR meetings
    - 50 Participants... mailing list for future attendance and participation in SCOAR meetings
- Developed the Uncrewed/Unoccupied Aerial Systems (UAS) Operations from the U.S. Academic Research Fleet: Operator's Handbook: *A roadmap to using Uncrewed Aerial Vehicles on Academic Research vessels.*
- Explore various approaches to make UAS a standard capability of the Academic research fleet.
- White Paper for a Phased Vision for a UAS facility as part of an Implementation Plan
  - Interest from science community and R/V Techs
  - Immediate steps:
    - Workshop planning
    - Continue to Facilitate on ships (R/V Sikuliaq example)

## Motivation is to develop UAS Policy and guidance documents for Shipboard Operations on UNOLS ships

**UNOLS**  
**Uncrewed Aerial Systems (UAS) Operations from the U.S. Academic Research Fleet: Operator's Handbook**  
 A publication from the UNOLS Scientific Committee for Oceanographic Aircraft Research



Photos courtesy of Luc Ienwin, Chris Zappa and NSR/USAF



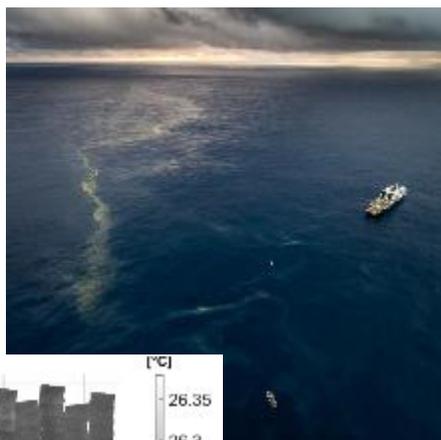
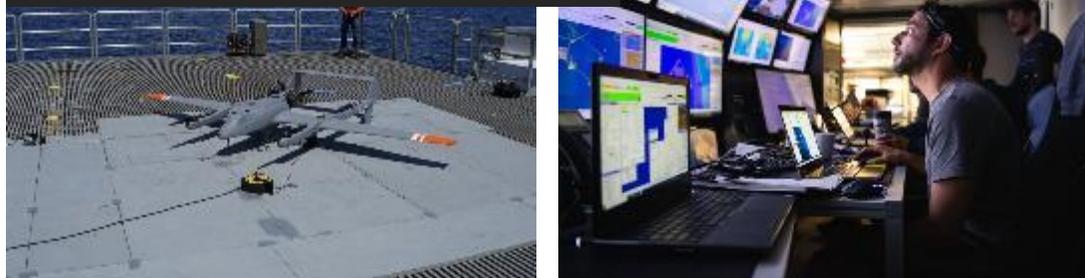
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The handbook is designed to provide detailed guidance on how to operate UAS from the Academic Research Fleet (ARF)

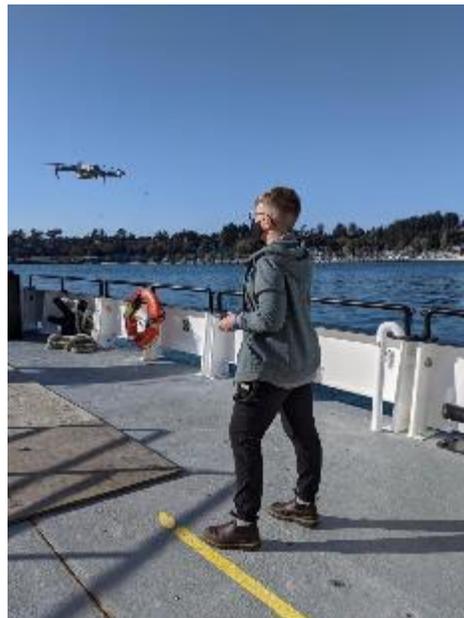
Status: Handbook endorsed by UNOLS council, available on the UNOLS website

Andrew Woogen (OSU) and Zappa (LDEO) invited RVTECs to work more closely with SCOAR and to engage PIs to facilitate the use of UAVs on ships as more the “norm” or routine

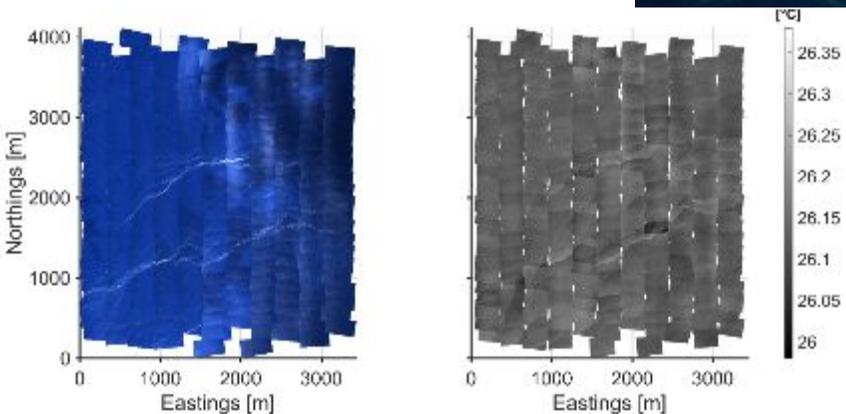
### High-Endurance UAVs



### Quad-Copter UAVs

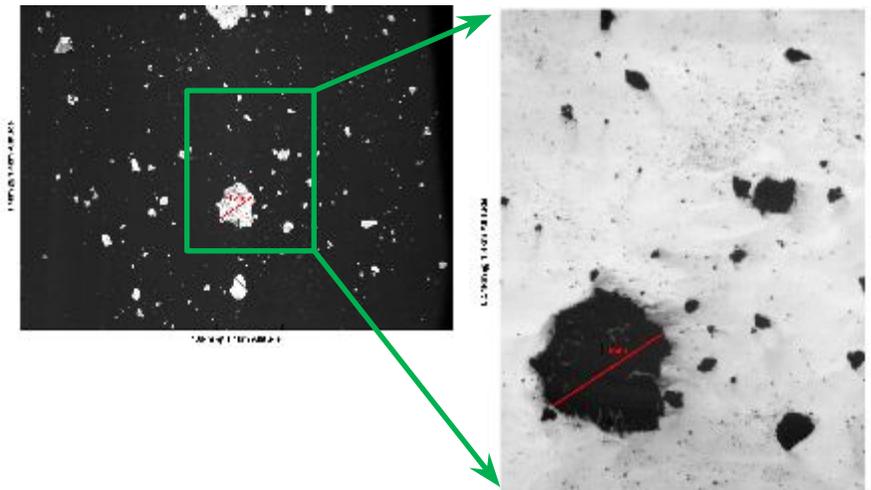


NOAA/NMFS research permit #21678

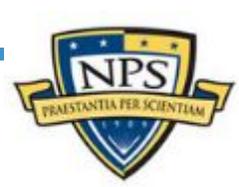


- Ethan Roth (Science Operations Manager, R/V *Sikuliaq*) contacted Andrew Woogen (OSU; UNOLS SCOAR)
- Interest in utilizing a fixed wing UAS for ice surveys on UAF R/V *Sikuliaq*
- SCOAR provided guidance on UAS options, on how to operate UAS from the Academic Research Fleet (ARF), on EEZ logistics, etc.
- Working together moving forward to facilitate this activity. Just starting to get this going... more to come.
- Goal is to become part of the Marine Tech toolbox, which is a step in the right direction for SCOAR's interests

## Intermediate Fixed-Wing UAVs



Visible (Left): 1.4 km x 1.8 km  
Infrared (Right): 0.54 km x 0.41km



# Naval Postgraduate School (NPS) CIRPAS Airborne Research Facility Twin Otter DH-6

Twin Otter-primary research aircraft



## In-house Instrumentation



**Wings:** CAPS, FSSP, PCASP, CIP, PIP ...  
Hard points and pods for 'research' or 'guest' instruments

- **Research Capacity:** 1500 lbs
- **Research Power (DC):** 7000W at 28VDC
- **Research Power (AC):** 4000W 110VAC/60Hz
- **Speed:** 100-140 kts
- **Practical Ceiling:** 18,000 ft
- **Floor:** 100 ft over ocean  
(weather dependent)
- **Duration:** 3-5 hours  
(6-8 hrs w extra fuel tanks)
- **Base of Operation:** Marina, CA
- **Deployable:** CONUS, OCONUS
- **Recent Field Studies:** CO, FLA, Iceland

**Cabin:** Nephelometer, Sootphotometer, CPCs, UFCPC, Data System Racks for 'Research' and 'Guest' Instruments. Satcom system

**Dropsonde:** standard/AXBT

**Fuselage:** Solar/IR radiometers

**Nose:** Temperature, Dew Point, Pressure (Static, Dynamic Sideslip Attack angle), GPS/INS, IR Temperature, Liquid Water Content, Aerosol Inlet

**Towed Platform:** High rate T/RH/winds, SST



**Inlet**



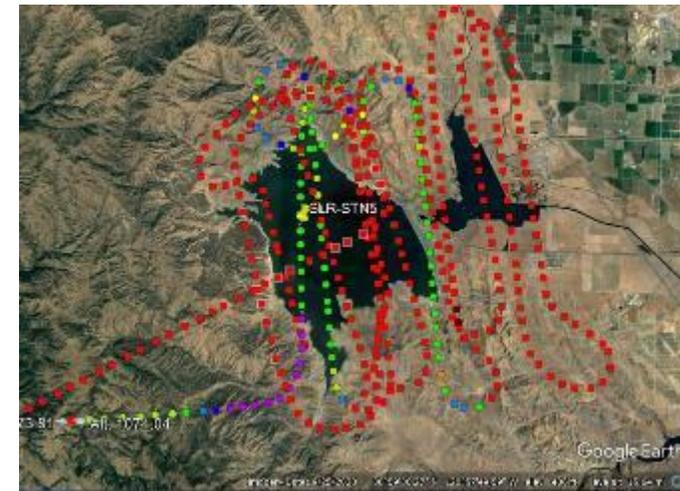
# FY22 Twin Otter Missions

## C-HARRIER

- **C-HARRIER:** (October 2021 - 1 week)
  - **PI:** Liane Guild, NASA Ames
  - **Location:** Marina, CA
  - **Goal:** Measure coastal and inland water radiance for satellite validation over relevant aquatic targets – supports coastal and inland water quality science
  - **Sponsor:** NASA
  - **Sensors:** C-AIR, 19-channel radiometers
  - **Collaborators:** DART Boston Whaler, UCSC
- **3 Science Flights:**
  - **27Oct 2021:** Pinto Lake, Elkhorn Slough, Monterey Bay
  - **28Oct 2021:** Elkhorn Slough, Monterey Bay, coordinated with S-MODE project
  - **29Oct 2021:** San Luis Reservoir
- **Highlights:**
  - Captured first flush rain event (atmospheric river) for watersheds out to Monterey Bay
  - Drought stricken San Luis Reservoir with a cyanobacteria bloom



Nominal flight patterns – Monterey Bay



Flight pattern over San Luis Reservoir



# FY22 Twin Otter Missions

## CALICO (California Investigation of Convection over Ocean)

- **CALICO:** (14 Feb – 23 Mar 2022 - 6 weeks)
  - **PI:** Scott Powell, Naval Postgraduate School
  - **Location:** Marina, CA
  - **Goal:** Study of post-frontal convection and interactions with the boundary layer
  - **Sponsor:** ONR
  - **Sensors:** Twin Otter facility sensors: meteorology and cloud/aerosol probes
  - **Collaborators:** SJSU and NRL cloud radars
- **6 Science Flights:**
  - **21 Feb 2022:** Test flight, calibration maneuvers, Monterey Bay
  - **22 Feb and 5 Mar 2022:** Two science flights each day, morning and afternoon over Monterey Bay
  - **19 Mar 2022:** Off the coast of northern CA between Crescent City and Santa Rosa
- **Highlights:**
  - Captured met (T, P, RH, winds) and cloud properties of numerous post-frontal convective cells.



Forward camera image of typical post frontal convection sampled



Sampling near the bottom of a convective cell with rain appearing on windshield.



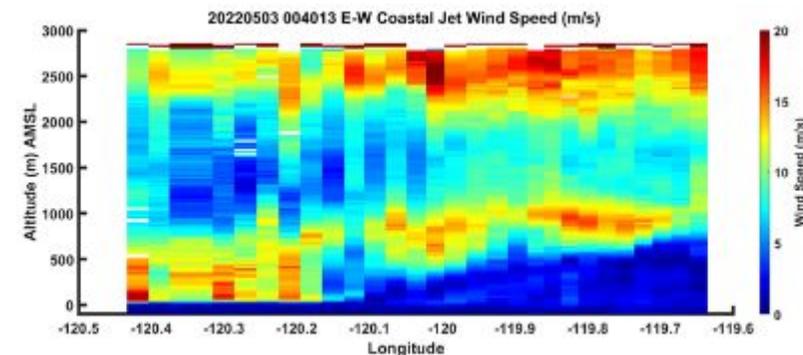
# FY22 Twin Otter Missions

## SWEX (Sundowner Winds Experiment)

- **SWEX:** (1 April – 15 May 2022 - 6 weeks)
  - **PI:** Leila M. V. Carvalho, UC-Santa Barbara
  - **Location:** Santa Barbara, CA
  - **Goal:** Study the downslope windstorms that frequently occur in the region in the spring that are a significant cause of wildfires in the area.
  - **Sponsor:** National Science Foundation
  - **Sensors:** Twin Otter Doppler Wind Lidar (TODWL), Wyoming Cloud Lidar (WCL), CU Compact Raman Lidar (CRL), NCAR AVAPS dropsonde system.
- **29 Science Flights (96 flight hours):**
  - **Two flights per day:** Afternoon flight before the start of a sundowner event, followed by a night flight after the start of a sundowner
- **Highlights:**
  - Captured the wind and thermodynamic profiles of numerous sundowner events and background conditions
  - Tested new TODWL observing techniques to measure winds near the surface



Nominal flight pattern – Santa Barbara area



TODWL wind measurements: Illustrates how the NE down slope flow from land to water is undercutting and lifting the low level jet over the Santa Barbara Channel (courtesy of D. Emmitt)



# Fire Incident

## Hangar Facility - Marina Airport, CA

- **4 Aug 2022 (early morning hours):**
  - Fire occurred on the **other side** of our hangar occupied by Joby Aviation, a private company
  - No injuries
  - No fire damage to the aircraft, or to our side of hangar
  - Fire set off our fire suppression deluge system flooding the hangar deck area and drenching the aircraft and equipment on the floor.
  - Smoke filled the entire building, covering everything with a layer of smoke and soot.
- **Water/Smoke Damage:**
  - Aircraft itself suffered little water damage – exterior covered by wet soot
  - Smoke infiltrated into the interior of the aircraft
- **Recovery Actions:**
  - Still assessing full extent of effects on aircraft
  - Working with aircraft, engines and avionics manufacturers, in coordination with NAVAIR, to determine needed tests, inspections, cleanings, etc
  - Exterior, and sections of the interior of the aircraft have been cleaned.
  - **Engines have checked out okay!**



- UNOLS Quarterly and Council meetings in 2022... Threads were:
  - Agreed on a Code of Conduct (modeled after others within UNOLS/NCAR)
  - Making Access Easier (How to access if funded)
  - Increase participation at all levels.
  - Inclusive environment
  - Broader participation (modeling StemSEAs programs geared towards Scientific or Technical side of Aircraft)
- Town Halls at Meetings (AGU Ocean Sciences)
  - Overview of what SCOAR is about
  - Lightning talks (8)... which led to invitees to recent and future SCOAR meetings
  - 50 Participants... mailing list for future attendance and participation in SCOAR meetings
- SCOAR version of STEMSEAS (e.g., STEMAir or STEMFlight)
  - Teacher in the Sky (provides basic principles from the field)
    - Basic principles of flight
    - Live Feed from Ships
  - STEMSEAS aims to provide ship-based, 6-10 day exploratory experiences for undergraduates from diverse backgrounds aboard NSF-funded research vessels. Students will sail with experienced faculty mentors and engage in geoscience and oceanography activities (while also having fun!)
  - <https://stemseas.wordpress.com/>
  - <https://mlp.ideo.columbia.edu/stemseas/>
- Road Show on SCOAR
  - Community Colleges, MSI (Minority Serving Institutions)...
  - Onboarding... specific set of slides for the Reps
    - Working to prepare 1-slide, 5-slide, 30-slide deck
- Summer Internship Program with immersive hands-on experience
  - Team up with existing programs
  - Engage Community Colleges
  - include undergrads in field programs- provide opportunities for them to participate as interns in various aspects of airborne science-planning, execution etc but with an emphasis on field work (not just sitting at the computer and data analysis although that can be a component)
  - MATE (Alice can provide information)
- Community Science Fellows Program similar to AGU Thriving Earth Exchange
  - <https://www.agu.org/Learn-About-AGU/About-AGU/About-AGU-Tabs/What-we-do/Thriving-Earth-Exchange>
  - <https://thrivingearthexchange.org/>

**Questions?**