Report to the UNOLS Annual Meeting
Scientific Committee for Oceanographic Aircraft Research (SCOAR)

October 24, 2012

Daniel Schwartz, Chair and Annette DeSilva, UNOLS Office

UNOLS SCOAR Meeting – August 2012: Agenda Topics

- **UNOLS and Agency Reports: ONR** (Tim Schnoor), **NSF Division of Atmospheric and Geospace Sciences** (Linnea Avallone), N**OAA's UAS Program** (John Coffey), I**WG-FI SUS Activities** (Brenda Mulac), A**ircraft Measurements of Greenhouse Gases by NOAA Global Monitoring Division (**Colm Sweeney)
- **CIRPAS Report and A10 Update - UNOLS National Oceanographic Aircraft Facility**
- **Update on the AGOR / UAS Scientific Demonstration Integration for Project DYNAMO and Manta Operations**– Luc Lenain
- **University of Tennessee Space Institute - Aircraft facilities and Research Operations -** Dr. Peter Solies
- **USGS Report and an Update on Raven and ScanEagle Operations —** Phil McGillivary
- **WHOI Unmanned Aircraft Vehicle Operations —** David Fisichella
- **Flow-field Visualization and Incorporating unique capabilities into UAS which are ideal for take-off and landing on ships** - Srini Srinivasan (U. Queensland)
- **UAF UAV Operations and Future Plans -** Greg Walker
- **Poker Flat Research Range Tour**
- **SCOAR Outreach Activities**
-

Development of Instrumented UAS for Air Sea Interaction Research & Ship-Based UAS Measurements of Air-Sea Interaction and Marine Atmospheric Boundary Layer Processes in the Equatorial Pacific

Update on the AGOR / UAS Scientific Demonstration Integration

Luc Lenain, Ken Melville, Ben Reineman

Scripps Institution of Oceanography
San Diego, CA
llenain@ucsd.edu

Mission is at sea, October 2012!

http://airsea.ucsd.edu/index.php?option=com_content&task=view&id=86&Itemid=115

CURRENTLY AT SEA, OCTOBER 2012

R/V Revelle

EquatorMix experiment
October 2012

N25°
Tropic-of-Cancer
N15°
N5°
Equator
S5°
S15°
Tropic-of-Capricorn
S25°
E175°
Antimeridian
W165°
W155°
W145°
W135°
W125°
W115°
W105°
W95°
W75°

lat -2.223183° lon -141.060071° elev -4323 m

Eye alt 9

Google

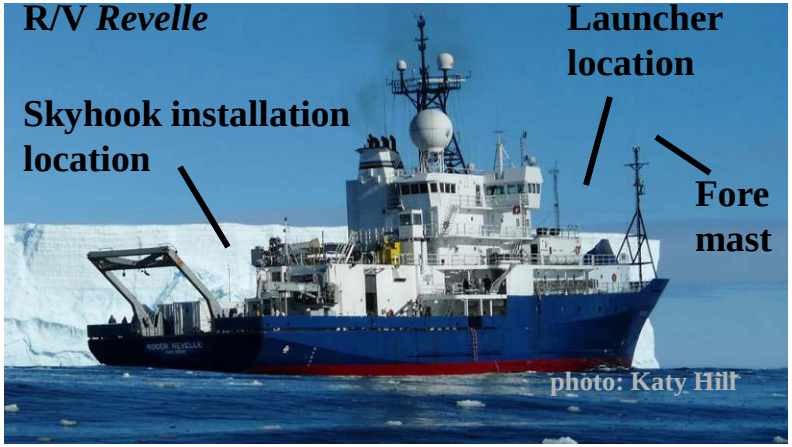
llenain@ucsd.edu

SIO ScanEagle UAS for air-sea interaction research

Ship-Based UAS Measurements of Air-Sea Interaction and Marine Atmospheric Boundary Layer Processes in the Equatorial Pacific

Deployment of instrumented ScanEagle UAVs from the R/V *Revelle* during the Papeete to Nuku Hiva, Tahiti cruise (4 - 22 Oct., 2012; Jerome Smith - SIO , Chief Scientist) EquatorMix experiment (NSF PO funded)

•ScanEagles will extend the capabilities of the research vessel by measuring air-sea fluxes, marine atmospheric boundary layer (MABL) variables, and surface signatures of ocean boundary layer (OBL) processes.
• Low level flight and stacked flight using two GCS.
•>12 hrs endurance, 2 – 3 kg payload



Additional shipboard instrumentation

A. Fore mast:
   - Eddy covariance station (wind, atmospheric temperature, humidity, short-/longwave, up-/ downwelling radiation, momentum and heat fluxes)
   - Scanning lidar (surface wavefield measurements)

B. Wind doppler profiler (Leosphere WindCube; up to 450 m, 20 bins)

CURRENTLY AT SEA: R/V REVELLE

http://airsea.ucsd.edu/index.php?option=com_content&task=view&id=85&Itemid=115

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

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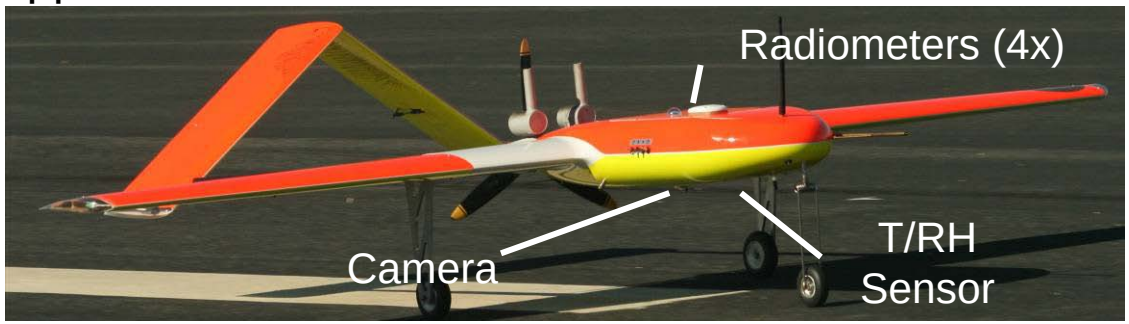
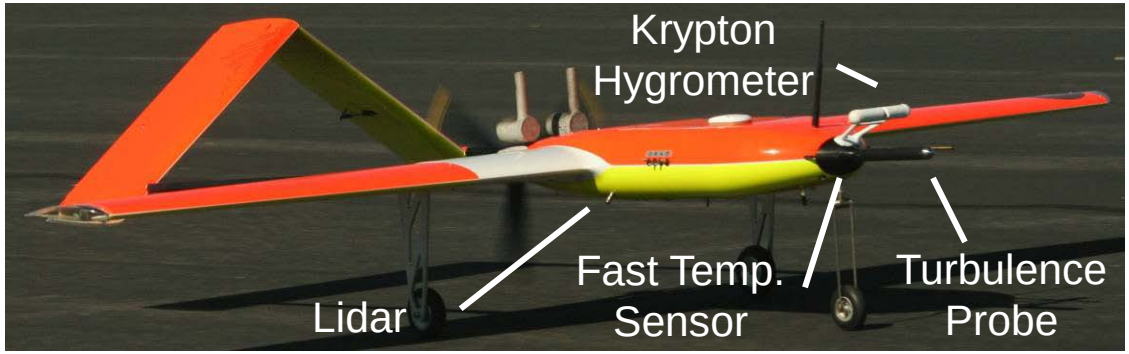
SIO Manta UAS for Air-Sea Interaction Research

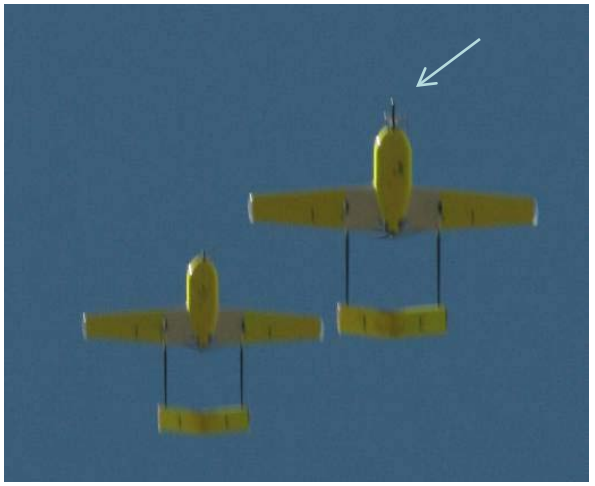
Upper Manta



Lower Manta



Automated
Stacked flight)



- 5 hrs endurance, ~7 kg payload, 2.7-m wingspan
- Capable of stacked flight configuration
- Measures mean and turbulent wind (turbulence probe), surface topography, standard meteorological variables and air-sea fluxes

A-10 Storm Penetrating Aircraft Project

NSF Sponsored Mid-Size National Facility

A collaborative project between
CIRPAS/Naval Postgraduate School
And
South Dakota School of Mines & Technology

Haflidi H Jonsson, CIRPAS/Naval Postgraduate School
Robert T. Bluth, CIRPAS/Naval Postgraduate School
Andrew Detweiler, South Dakota School of Mines and Technology

Perspective

- 1985: Special Advisory Panel recognizes need for improved storm penetration capability.
- 2008: NSF Facilities assessment identifies a “gap in the fleet” for lack of an SPA.
- 2009: US Air Force agrees to provide an A-10 to US Navy/CIRPAS for storm research.
- 2010: NSF selects a proposal from CIRPAS with collaborative agreement with SDSM&T to operate an A-10 SPA as a Mid-Size National Facility.

A-10 has 11 hard points on wings and belly where 8000 lbs of instruments may be suspended.
It has a belly bay where 2200 lbs of stuff may be mounted.

A-10 is rugged and heavily armored, which minimizes needs of modification for storm penetration.

Development Plan

- USAF:
  - Removal of armament and weapons systems.
  - General Inspection and overhaul.
  - Delivery to Zivko Aeronautics in Sept. 2012.
- Zivko Aeronautics:
  - Ice-Cannon tests of wing sections (reinforcement if needed).
  - Deicing systems' installation.
  - Lightning protection installation.
  - Installation of research infrastructure (mounting fixtures, power and signal distribution network, baseline instrumentation).
  - Completion estimated mid-year 2013.

Commencement of Research Activities

- Engineering test flights are planned in mid-year 2013 (including tests of baseline instruments and communication).
- Progressive science flights are planned in latter half of 2013.

Airborne Science at the University of Tennessee Space Institute

Uwe Peter Solies, PhD
University of Tennessee Space Institute
Tullahoma, Tennessee
931-393-7289
psolies@utsi.edu
August 2012

Av Systems Facilities

- Faculty and Student Offices at UTSI Main Campus
- Flight Research Laboratory
  - Located on Tullahoma Regional Airport (KTHA)
  - 10,000 sq ft, 2-bay hangar
  - Offices, Flight Briefing room, Flight Simulator, and classroom
  - Instrumentation and Fabrication shops
- Flight Simulation Laboratory (at Main Campus)
  - High fidelity Engineering Research Flight Simulator
  - “Desktop” flight simulators
  - Dedicated CFD analysis computers
- Flight Systems Laboratory (at Main Campus)
  - Work benches and tools
  - Systems, instrumentation, avionics hardware and software

UT-FRL Airborne Research and Education Facilities

- Airborne Science
  - Piper Navajo
  - Cessna 210
  - Piper Super Cub
  - Extra 300
- Unmanned Aerial Systems (UAS)
  - Navion Surrogate UAV
- Flight Test Engineering Education
  - Piper Saratoga

Rotorcraft Expertise

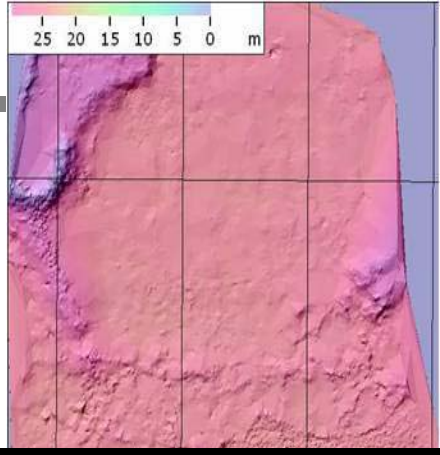
- UTSI previously maintained, modified, instrumented, and operated OH-58A+ rotorcraft
- Also, have experience with other rotorcraft that have been used for UTSI research
- Used for education (academic courses and short courses) and flight research

SCOAR 2012

U. Alaska, Fairbanks, Aug.14,15

US Coast Guard PACAREA Brief

P. McGillivary, USCG PACAREA Science



Clockwise: RAVEN UAS icebreaker launch, 88ºN, summer 2011; UAS Ice Ridge height map, Nome, AK, Jan. 2012; HEALY from RAVEN UAS, summer 2011; Ice Ridges in IR from RAVEN UAS, summer 2011; CG C130 Arctic Domain Awareness flight; UAF Quadrotor UAS, Nome

UAS Operation at Woods Hole Oceanographic Institution - David Fisichella

- Projects and Interest
  - Princeton Low Alt. Gas Analysis
  - Penguin Studies
  - Greenland Ice Sheet
  - Puerto Rico Reef Study
  - Martha's Vineyard Coastal Zone
  - Waquoit Bay National Estuarine Research Reserve Habitat/Vegetation Census

WHOI UAS Platforms

- Fixed wing

- Multi Rotor

What's Next for WHOI?

- Launch/Recovery From Ships
- WHOI Center for Marine Robotics
- Create Self-Sustaining Group
- Develop Operator Model – Shared-Use Pool
- Advanced Sustained Flight Experiments

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

qbi queensland brain institute

Insect-inspired vision guidance systems for UAVs - Mandyam Srinivasan

Queensland Brain Institute
and
School of Information Technology and Electrical Engineering
University of Queensland
and
ARC Centre of Excellence in Vision Science

Imaging properties

- *Removes perspective distortion*
- *Scales down image motion*
- *Defines a "collision free" cylinder*

Unmanned Aircraft Program Mission Objective

The technology exists -
We are researching how to use the tools.

A research center for small, unmanned aircraft systems providing integration of unique payloads and supporting pathfinder missions within government and science communities, with a special emphasis on the arctic region.

Ice Seal Survey – Bering Sea

Shoreline Clean-up Assessment Technique (SCAT) Evaluation

Nome Harbor Oil Delivery Ops, Jan. 2012
Photos from Greg Walker, UAF
Updates at:
http://dec.alaska.gov/Spar/renda/index.htm

Aeryon Scout Quadrotor UAS

Ice ridge imagery from Quadrotor with Nome dock

Navigating Sea Ice During The Nome Fuel Delivery

University Engagement and Decision Support

1. Identify potential safety concerns for those working on the ice
2. Document the site for mission response activity
3. Collect imagery for the USCG Public Affairs Officer
   - to help satisfy the press' interest
   - reduce the potential for independent activities on the ice

Launch of RAVEN from Canadian icebreaker LOUIS S ST LAURENT

HEALY from RAVEN (image degraded to abet transmission)

UAS Survey of Marine Debris Generated by 2011 Japanese Tsunami

PI: William Pichel – NOAA/NESDIS/Center for Satellite Applications and Research

2012 FAA Modernization and Reform Act

Unmanned Aircraft Language – Permanent Arctic

"***permanent area in the Arctic where small unmanned aircraft may operate 24 hours per day for research and commercial purposes below 2,000 feet in altitude***"

Calls for a process by August 14, 2012 to facilitate safe operations over water within all the areas identified, not a single geographical location

The University is helping the FAA UAS Integration Office develop this process

2012 FAA Modernization and Reform Act

Unmanned Aircraft Language – Six Test Ranges

"*… to integrate unmanned aircraft systems into the national airspace… to provide for verification of the safety of unmanned aircraft systems and related navigation procedures…In determining the location the Administrator shall (A) take into consideration* ***geographic and climatic diversity****; (B) take into consideration the location of ground infrastructure and* ***research needs***".

- Alaska will **compete** for one of the six FAA test ranges.
- The University of Alaska will **lead** the Alaska team
- Alaska is investigating **partnering** with Hawaii

University-National Oceanographic Laboratory System

Poker Flat Range Tour

UNOLS Booth – Feb 2012

UNOLS SCOAR Meeting – Future Activities

- Draft “Best Practices” document for operation of unmanned aircraft systems (UAS) from research vessel platforms.
- Continue to explore new sensors and technologies for optimizing research from aircraft (manned and unmanned)
- Continue Outreach Activities with focus on Early Career Scientists
- Draft an *Eos* article after completion of the AGOR/UAS Scientific Demonstration on R/V *Revelle*

We Thank our Hosts at the University of Alaska!

All presentations from the August 2012 SCOAR Meeting are available on the UNOLS Website at:

www.unols.org/meetings/2012/201207sco/201208scomi.html