Scientific Committee for Oceanographic Aircraft Research (SCOAR)
June 23 and 24, 2011
CIRPAS Facility, Marina, CA

Meeting Minutes

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Day 1, 23 June 2011

Welcome and Introduction – Daniel Schwartz, SCOAR Chair, called the meeting to order at 8:30 am on June 23, 2011. The meeting was held at the CIRPAS facility in Marina, CA. Dan opened the meeting by stating that in these challenging times, it is important to consider economic operations of facilities. Meeting participants introduced themselves.

The meeting agenda is included as ***Appendix I*** and the participant list is included as ***Appendix II***.

Bob Bluth, CIRPAS Director, welcomed SCOAR to CIRPAS.

Agency Representatives, UNOLS, and CIRPAS Reports:

UNOLS Report – Annette DeSilva provided the UNOLS report. Her slides are included as ***Appendix III*** and cover the following topics:

- UNOLS Fleet Utilization – Projected fleet utilization for 2012 is significantly lower than 2011 by almost 1000 days.
- BP Research Funding for the Gulf of Mexico Research Initiative (GRI) and UNOLS related activities – The UNOLS Chair sent a letter asking GRI investigators to consider UNOLS facilities in their proposed GRI operations.
- Fleet Renewal Activities:
  - Ocean Class research vessel (OCRV) - Two design/build team for the OCRVs Phase I awards were made in Jan 2010. The OCRV operator selections were made in May 2010 and are WHOI for the first ship and SIO for the second ship. The ships will be deliveries in 2014/2015.
  - Regional Class Research Vessel (RCRV) - The RCRV project is under NSF review.
  - R/V *Sikuliaq* - The R/V *SIKULIAQ* hull fabrication is well underway. The ship is scheduled to begin science operations in CY 2014.
- UNOLS has formed a new standing committee, the Ocean Observing Science Committee (OOSC). The OOSC will be an essential in the process of communicating the observatory science user perspective to the NSF and to the project teams involved in developing, deploying and operating ocean observatories. The OOSC membership list is included in the slides.
- A 2010 UNOLS Goal was to explore how to make the present and future fleet more environmentally sustainable. In response, a Greening the Research Fleet Workshop is planned for January 2012 at Duke University. The workshop is supported by NSF and ONR.
- UNOLS is evaluating of decline in ship time requests. An on-line survey was announced in February 2011 and over 300 responses have been received. The results will be presented at the UNOLS Annual Meeting in the fall.
- There are a variety of UNOLS outreach, training and education activities underway or planned:
  - Chief Scientist Training Cruise coordinated by Clare Reimers, FIC Chair. There will be two *Wecoma* cruise opportunities with 14 students on each cruise.
  - A early career scientist/student workshop is planned as part of the winter 2011 DESSC meeting.
  - A 2011 UNOLS Goal is to explore a lectureship program to reach non-UNOLS scientists and under represented students.

Office of Naval Research (ONR) – Tim Schnoor joined the meeting via phone conference and reported that an Unmanned Aircraft System (UAS) Scientific Demonstration project is planned from a Navy AGOR vessel. SCOAR member, Luc Lenain, is involved with the project and will provide a report later in the meeting.

Mike Prince reported on the status of the Ocean Class Research Vessels that Navy is acquiring. The ship names should be announced by the time of the keel laying. The ships should be able to support ROV and UAS operations, but there is nothing specifically in the specs on how to do this.

Discussion:

- Tim Schnoor said that suggestions from the SCOAR on how to carryout the UAS operations from an OCRV would be helpful.

- Luc Lenain said that the ship launch and recovery equipment for UAS is very portable. Space is needed at critical locations for communications. The directional antenna requires space. Phil McGillivary added that the ship must have a good communication system.
- Mike Prince said that the communications/science information system network on the OCRVs would be installed post delivery. Mike suggested that Luc provide feedback to Zoltan Kelety and Bruce Appelgate (SIO) regarding UAS requirements.
- There is a lot of competition for antennae space on our ships. Phil McGillivary added that he is also dealing with this same issue on the *Healy*.
- The systems should be compatible with R2R.

United States Coast Guard (USCG) – Phil McGillivary provided the USCG report. His slides and additional presentation material is included as ***Appendix IV***.

The Coast Guard manned aircraft research includes continuation of the CG C130 Arctic Domain Awareness (ADA) biweekly flights from Kodiak to Barrow and Prudhoe Bay. They are continuing the NOAA gas sampling for CO2, Methane, and 18 other gases. The USCG has a joint program with NASA Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE) effort to map methane fluxes from melting tundra. CARVE is an EV-1 investigation. Final CG HQ approval for the FLIR tube lidar from Jim Maslanik is expected in 2011, but not in time for deployment this year.

Phil reported on the Alaska Coast Guard (ACG) Aircraft Site activities. The U.S. Coast Guard conducts regular flights across Alaska for Arctic Domain Awareness (ADA); for search and rescue operations as sea ice melts. NOAA and USCG collaborate with flights of opportunity. The ACG Aircraft Site is a test bed for instrumentation for commercial aircraft. Scientific opportunities at the Site include monitoring Arctic response to warming and sea ice melting, establishing baseline and monitoring inter-annual variability, and stratospheric/tropospheric exchange. Photos of the ACG Aircraft Site are included in the slides.

Next Phil discussed the USCG Unmanned Aircraft operations. The UAS general operations plan focuses on FireScout. There are ongoing discussions regarding small UAS. There is approval in principle for ScanEagle ops from *Healy* during the summer 2012 by Greg Walker (UAF) as part of the DHS S&T UH CIMES program (Center for Island, Maritime & Extreme Environment Security). There are plans for USAF/NORTHCOM test of hand-launch/retrieval of RAVEN UAS from *Healy* during the summer 2011 from ship or ice, TBD.

USCG Unmanned Aircraft Operations, partnered with DHS (Customs & Border Patrol), DoD to use the FireScout VTUAS to extend ship surveillance from a USCG Cutter. FireScout is a civilian vehicle.

Phil reported on the DARPA Arctic UAS VULTURE program (see slides). This is a solar powered vehicle.

In summer 2010, there was a *Healy*/ScanEagle program with G. Walker, UAF as the PI. Sensors on the ScanEagle include a visible camera; long-wave IR camera; Short-wave IR camera; X-band SAR; and ice-roughness lidar. The goals of the program are to improve/validate satellite imagery, resolve the issue of cloud/fog obscuration of non-SAR satellite imagery, and provide data on ice ridging. The UAS allow improved assessment of ice conditions suitable for helo landings. See the slides for images of this operation. RADM Vince Edwards, CG HQ, has

provided a letter supporting the ScanEagle concept, but noted the NAVAIR ship certification requirement, and the requirement for 'further discussion of risks and costs.' A meeting is planned with G. Walker and CG HQ personnel later in the summer 2011. Bob Bluth added that NAVAIR is moving in a direction for compliance similar to manned aircraft.

Phil reported on the status of a USAF / Nat. Def. Intel. Univ. RAVEN operations plan for *Healy*. The proposed plan is to "Demonstrate value added of Full Motion Video (FMV) streaming from Small Unmanned Aerial System (SUAS) during Arctic Ops." The goals include:

- Demonstrate SUAS ops can be done safely on/off ships
- Demonstrate Intel, Surveillance, Reconnaissance (ISR) capabilities of SUAS
- Stream Full Motion Video from RAVEN SUAS on to ROVER for:
  - Sea ice ridge detection/monitoring
  - Marine mammal detection
  - Assistance in emergency exercises
  - Detection/monitoring oil spills from ship or oil exploration
- Integrate lessons learned/ops concept into NDIC thesis research for Masters of Science in Strategic Intelligence

The RAVEN has been employed since 2002. It is hand launch/recovered and battery powered with a 60 to 90 minute endurance. Line-of-sight command and control is required. The RAVEN can accommodate full color and IR capable payloads. The system fits into a large backpack. The system is constructed to break apart upon impact with land/obstacles to minimize kinetic damage.

The RAVEN system can be launched and recovered by one person (2 is preferred). The system can be set up/broken down in under five minutes. While windward launch is preferred; there is no need to turn ship to launch (assuming 180 degrees of free range to launch and recover). Operations are not preferred in winds over 20knts and/or precipitation over ½" per hour. Launch can be done anywhere on deck.

Phil reported on some of the non-USCG UAS Operations underway or planned. In the summer 2010 there was UAS testing with subs, UAVs, ASVs, ships and manned aircraft of DTN (Delay/Disruption Tolerant Wireless Comms). The systems it worked on all platforms.

In summer 2011 a repeat exercise is planned in the Portuguese coastal Marine Protected Area to determine bandwidth capabilities/limits of DTN. In fall 2011 the exercise will be repeated with multiple UAS. Summer 2012 call for a repeat exercise in open the ocean MPA (Azores) and/or Mediterranean (TBD).

Phil reported on other unmanned systems and their respective specifications and operations including:

- Gavia Defence (2) – PO Navy
- NAUV (1) – Porto University
- Seacon AUV (3) – Porto University
- Swordfish (1) – Porto University
- Manta Gateway (4) – Porto University
- Mini-UAV (Level 0): to be ship launched, recovered
- Antex-X02 (Level 1): Multi-UAS, multi-altitude ops
- Operations BLOS
- UK Shoreline Mapping w Quadrotor, staring 2011

- NOAA PMEL UAS, Ny-Alesund, Norway, 2011
- Norwegian UAS, Ny-Alesund, Norway, 2011
- Use of "Hyperblimps" by US Scientists to Study South Atlantic Right Whales off Argentina
- Sentient (Australia) life-jacket detection software for UAS w Kestrel Maritime software
- Northrup Grumman Army Long Endurance Multi-Intelligence Vehicle (LEMV), w 21 day endurance ($500+M contract)

Phil presented additional material:

- USCG UAS – AUVSI
- Guardian IDGA UAV Summit Brief 13 April 2011
- STORMFLUX UAS-ship proposal summary
- McGillivary, P.A. 2010. Design Considerations for Launch & Recovery of Autonomous Systems from Ships, including Coast Guard Icebreakers. Procs. Launch & Recovery 2010, Dec.8, 9, Arlington, VA.

National Science Foundation (NSF) - Peter Milne and Bernard Grant joined the meeting via teleconference and provided the NSF report. Their slides are included as ***Appendix V***.

The NSF is continually assessing its airborne facility needs. Enhance interagency and international collaboration is a strategic thrust. CIRPAS has become a major component in the mix of airborne assets. Airborne assets are typically oversubscribed and therefore priorities have to be made for their use.

Some examples of NSF aircraft operations are provided in the slides along with images. Many improvements were made possible to the aircrafts with ARRA funds. The photos include:

- NSF C-130Q on a mission over Christmas Island
- NSF C-130Q during Inspection - Cascade Aerospace in Canada
- NSF's Office of Polar Programs operates 4 LC-130s
- An LC-130 has been equipped with 8 Bladed-Props. This offers less vibration and fuel savings.
- NRL P-3 with ELDORA - NSF and NRL are under an MOA through 2013 for supporting the ELDORA radar.
- University of Wyoming King Air - Cooperative Agreement between NSF and University of Wyoming. This aircraft is one of the most requested NSF atmospheric facilities.
- NSF GV flying HIPPO mission (complex operation and pole-to-pole). This system will be used in modeling. It is very useful for ground-truthing. Getting clearances has been a challenge.
- CIRPAS Twin Otter is available to NSF investigators (NSF-NPS MOA)
- A-10 SPA will replace the T-28. Its last mission was in 2003. The A-10 will be operational as a NSF facility in late 2012 or early 2013.

A slide showing the flight path of the UAS Aerosonde in the Antarctica was presented. The Aerosonde is seeing increased use by NSF scientists. They have been successfully used for operations that could not be done on traditional platforms. Launch and recovery is from a truck. Airspace issues limit their use in National Airspace due to Certificate of Authorization (COA) requirements. Operations are easier in selected international airspace.

Discussion:

- Dan – When will the A-10 arrive? Bernard – NSF is working with on an interagency agreement. They will know that status by July 2011.
- Phil McGillivary – Are any of these aircraft operations coordinated with ship operations? Peter Milne - The twin otter is coordinated with ship operations. Aerosondes might be a challenge. It is really up to the science requirements.
- Luc – Will there be follow-up operations with the Aerosonde? Peter – Yes, they are starting to do profiling. UAS offers a useful strategy.
- Mike Prince – In the early days of SCOAR there were discussions on CIRPAS aircraft access with NSF. Now that NSF is finalizing the MOU with CIRPAS, have you had discussions with Bob Houtman and the science program managers? Peter Milne – Yes. Jim Hunning has been involved with this. If science comes up with a good proposal, NSF can make it happen. There are some cultural differences between UNOLS and UCAR. Mike – Science would have to include the aircraft costs in their proposals. Peter –The different NSF programs talk to each other.
- Peter – There is interagency partnering and they hope that SCOAR can help spread the word to the community.
- Phil McGillivary – There was an NSF RAPID program for the Gulf of Mexico oil response. Did any of the NSF aircraft get involved? Peter – Not that he knows of, but there were no obstacles that he knows of.
- Dan Schwartz – An on-going piece of work for SCOAR is outreach. We need to inform the community about the aircraft tools that are available.
- Peter M– On the other side, the Atmospheric scientists don't often consider ships as tools for their research.
- Peter suggested that SCOAR look at the RCN process.
- Dan thanked NSF for participating in the SCOAR meeting.

NOAA OMAO Aircraft Facilities and Operations – Phil Hall provided the NOAA report. He reviewed the NOAA facilities then the NOAA organizational structure. His slides are included as Appendix VI.

Their Twin Otter missions include marine mammal research, fisheries assessment, remote sensing, and air chemistry. The King Air is a new asset and is a very good imaging platform. The Turbo Commander missions include phogrammetry, obstruction charting, coastal mapping, and snow/moisture surveys. Missions for Shrike, WP-3D, Gulfstream IV, and Third P-3 (N44RF) are all outlined in the slides. Details about the missions are also included in the slides.

Providing Deepwater Horizon Support was a huge effort for NOAA.

Discussion:
- Phil McGillivary – How has the Coyote UAS performance been? Phil H – NOAA carried out an experiment last year.
- JC – NOAA will use a different vehicle instead of Coyote in the future because Coyote was expensive.

NOAA's UAS Program – CDR Phil Hall presented the NOAA/OAR Unmanned Aircraft Program slides for John 'JC' Coffey and Robbie Hood. The slides are included as ***Appendix VII***.

Phil Hall reviewed NOAA's tools for building an UAS capacity. They plan to utilize UAS for improved situational awareness and scientific understanding in addition to the manned aircraft. The Arctic is a good area for UAS operations.

NOAA is using a Quadrotor system for Antarctic wildlife assessment. The amount of area that they can cover has gone up exponentially. A manta system has been used for Polar monitoring of the Greenland Glacier and Ice Seal. They operated off of the *Oscar Dyson* and the *MacArthur*. There were challenges in getting air clearances. Air space and frequencies is the biggest issue.

Phil Hall reported on the Global Hawk Pacific (GloPac) Experiment. It was a partnership between NASA, NOAA, and Nothrup Grumman. The aircraft can fly at an altitude of 65,000 ft. The system has a large payload capability. The accomplishments of the experiment are highlighted in the slides.

The Winter Storm and Pacific Atmospheric Rivers (WISPAR) experiment was discussed. The first Dropsonde was released from a Global Hawke. Phil showed a video of the GH 872 Dripstone deployment (***Appendix VIIA***).

There is a wide range of innovative UAS observing solutions. The ultimate goal is that these become regular use tools.

Phil reviewed the Gale UAS specifications. The Gale can be deployed through an Aerosonde and is expendable. JC added that the Gale UAS has a Dropsonde on it.

As next step, NOAA is:

Optimizing UAS observing strategies for:

- Sea ice information
- Wildlife assessments
- Air quality and atmospheric chemistry process studies
- Oceanic meteorological information
- Real-time data delivery
- Fast, effective image processing

Identifying promising UAS technologies for:

- Methane impact studies
- Gravity and elevation information
- Coastal mapping
- Inland flooding and meteorological information.

Lunch Break – During the break the Puma testing video clip was presented by Ro Bailey. The clip is included as ***Appendix VIII***.

The United States Interagency Coordinating Committee for Airborne Geosciences Research and Applications (ICCAGRA) – Jason Tomlinson, ICCAGRA Chair, provided the ICCAGRA report. His presentation is included as ***Appendix IX***.

The goals of ICCAGRA are to improve cooperation amongst US Agencies, foster awareness,

facilitate communication, and provide a resource for senior level management. They have no binding authority.

Members are actively involved in standardizing US and international airborne datasets and instrumentation. Each US Agency has developed their own specialties with slight overlaps.

There is an on-line resource for facilities and instruments used by the atmospheric and earth system research communities. It is the Facilities for Atmospheric and Earth Science Research (FAESR), http://faesr.ucar.edu.

The ICCAGRA Working Group, IWGADTS, is working towards establishment of commonality in data streams, commonality in DAQ systems, instrument integration and commonality in data formats. They hope to achieve 85% commonality. Bob Bluth added that ICCAGRA wanted to organize a group modeled after UNOLS and this is how IWGADTS came to be.

The International Society for Photogrammetry and Remote Sensing work to promote the standardization of instrument interfaces, data formats, and aircraft accommodations. They work to facilitate more efficient, flexible, and cost-effective international science flight operations.

Jason reviewed activities of specific agencies:

- Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Aerial Facility (AAF). They have conducted many field campaigns focused around DOE ARM mobile and fixed facilities. This includes the AMF2 which can be installed on a ship. DOE ACRF procured 18 new instruments under the 2009 Recovery Act that can be installed on a multitude of aircraft.
- National Aeronautics and Space Administration (NASA) provide aircraft systems that further science and advance the use of satellite data. They maintain a catalog of research aircraft.
- National Suborbital Education and Research Center (NSERC) is a joint venture between NASA and the University of North Dakota (UND). They have a Student Airborne Research Program (SARP) that allows students hands-on training in airborne science using earth-observing instruments aboard the NASA DC-8.
- National Science Foundation/National Center for Atmospheric Research (NAS/NCAR) – The
- NCAR Research Aviation Facility operates a C-130Q and G-V supported by NSF. NSF supports other platforms (NRL P-3 and the Wyoming King Air)
- Naval Research Lab (NRL) has mostly military related deployments but can be deployed for other USA agency related research. Primary focus is on remote sensing. They have a variety of aircraft.
- National Oceanic and Atmospheric Administration (NOAA) - NOAA's mission is to describe and predict changes in the Earth's environment and to conserve and manage the nation's coastal and marine resource. They operate the hurricane hunters and also conduct flights for marine and atmospheric research.
- Office of Naval Research (ONR) operates the Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) facility - which SCOAR is familiar with.
- U.S. Forest Service (USFS) owns and operates 27 aircraft and helicopters. They have contracts with over 800 aircraft and helicopters annually. Missions include fire surveillance, aerial reconnaissance, air attack, delivery of smokejumpers, firefighter and cargo transport, aerial delivery of retardant and water, Natural Resource Management, and research.
- U.S. Geological Survey (USGS) operates an Experimental Advanced Airborne Research Lidar (EAARL). They conduct remote sensing of vegetation canopy structure and

submerged topography for use in ecological models and environmental stewardship.

ICCAGRA is fostering cooperation and communication amongst US agencies and international counterparts. Each agency has unique capabilities. Member agencies are pushing forward with the use of UAS for scientific research.

UNOLS National Oceanographic Aircraft Facility - Bob Bluth, Director of CIRPAS, provided the CIRPAS report. His slides are included as ***Appendix X***.

The Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) provides manned and unmanned air vehicle flight services to the scientific and engineering communities. The Twin Otter is now an NSF National Facility available to NSF-sponsored researchers. The current CIRPAS fleet includes the UV 18-A Twin Otter, two Pelicans, and three Predators. The CIRPAS facility in Marina, CA has a 3500 ft runway for manned operations and a 30,000 sq ft maintenance hangar. There is an Instrumentation and Calibration Laboratory and maintenance and payload integration shops and offices. CIRPAS also includes a Camp Roberts facility that provides airspace for UAV testing and training. It is located about 100 miles from Marina.

Details about the research aircraft, Twin Otter, specifications are included in the slides including the payload capabilities for the nose, wings, and cabin. Payloads can be changed out quickly. Examples of CIRPAS scientific instrumentation were presented including:

- 95 GHz Cloud Radar
- Wind Lidar
- Smart Towed Vehicle
- Stabilized Radiometer Platform
- Micro-sized air-launched expendable meteorological sensor & chaff

There are plans for CIRPAS to get a Storm Penetrating A-10 Mid-Size NSF Aircraft. Once it arrives, they will start fitting it out for severe storm research. It will have a lot of power.

- Jason – How will you harden the science equipment?
- Bob - The modifications will be done by the Air Force and then Navy will operate the aircraft. The pilot will be civilian.

CIRPAS has a new UAV, the *Sentry*.

Bob reported on the two Pelicans which are modified Cessna 337/02. They are ideal training platforms due to FAA restrictions on UAVs. They are less expensive than the Predators and they provide realistic capabilities.

The three Predators are un-usable because their documentation is out of date. They are also expensive to operate. Without the documentation, the Navy won't allow flying. It will cost about $900K each to upgrade to bring the documents into date.

Discussion:

- Annette – Will there be increased staff for operation of the CIRPAS facilities? Bob – There will be additional staff support with the A-10, but not with the Twin Otter.
- Luc and Jason had high praise for the support provided by Haf Jonsson. The operational support provided last year for the *Sproul, FLIP*, and Twin Otter was excellent.

The SCOAR Meeting participants toured the CIRPAS Facilities.

Additional documents, images, and video clips were presented by Bob and are included in the meeting appendices:

- UAV Images
- Neptune II UAS (7 MB)
- Neptune Payload Deployment Video (18.4 MB)
- Neptune UAV
- Piranha Handout

Update on the AGOR / UAS Scientific Demonstration Integration for Project DYNAMO - Luc Lenain provided the update. His slides are included as ***Appendix XI*** and provide updates on two projects: the Development of Instrumented Unmanned Airborne Systems (UAS) for Air-Sea Interaction Research and the Ship-Based UAS Measurements of Air-Sea Interaction and Marine Atmospheric Boundary Layer Processes in the Equatorial Indian Ocean. The presentation was prepared by Ken Melville, Luc Lenain, and Ben Reineman of Scripps Institution of Oceanography (SIO).

The UAS instrumentation development for Air-Sea Interaction Research experiment uses two UAS in stacked formation. The goal is to correlate wave breaking with bursts of turbulences. Two Mantas were used and were equipped with turbulence probes. The upper Manta flew at 400 meters altitude and the lower Manta flew at 20-30 meters altitude. The Manta wingspan is 2.6 meters. To determine net radiative heat flux, surface temperature, the UAS was equipped with a met. package (P, T, RH) with large field of view video radiometers DGPS. There was point lidar (for autopilot and wavefield measurements). The RF linked to the base station.

Experiments were run at Camp Roberts in January 2011. Sample flight paths from the lower Manta are shown in the slide. There was 18 hours of flight time for the two UAS. Images of the Mantas and instruments are shown in the slides. The data is also provided including:

- Water vapor and turbulence probe calibration
- Sample vertical profiles of Wind, water vapor, Temperature
- Sample spectra of vertical wind, temperature, water vapor
- Evolution of vertical profile of T, virtual potential temperature

Luc showed a video clip of the Manta operations (***Appendix XIa***).

Next Luc reported on the DYNAMO project: Dynamic of the Madden Julian Oscillation (MJO) - DYNAMO (NSF) and the Air-Sea Coupling in the Indian Ocean ONR DRI.

MJO effort includes deployment of ScanEagle UAVs from the R/V *Revelle* during the Tuticorin-to-Tuticorin cruise in the Indian Ocean (12/2011- 01/2012, Rob Pinkel/Jerome Smith, Chief Scientists) as part of the joint field program with NOAA/NSF (DYNAMO). The use of the UAVs are to enhance the capabilities of research vessels in the Coupled Air-Sea Processes DRI. These capabilities include the measurement of air-sea fluxes, marine atmospheric boundary layer (MABL) variables, and surface signatures of ocean boundary layer (OBL) processes.

The areas of study include the following:

- Air-sea Fluxes and the Marine Atmospheric Boundary Layer
- Atmospheric Convection & Precipitation

- The Diurnal Surface Layer
- Surface Wave Processes and Mixing

The UAV will be recovered using Boeing InSitu's SkyHook system, in which ScanEagle catches a cable hanging from a 50ft-high pole. Preferred launch and recovery areas on the ship are shown in the slides.

Luc provided the program status. The original plan was to use the NPS ScanEagles (managed by Bob Bluth) and operated by Evergreen, but the NPS ScanEagles are no longer available for this effort. Evergreen, now VT group, is no longer interested in supporting this effort. Two options have been identified: 1) ISR group, UAS operator could provide flight support, launch and recovery equipment for three ScanEagles or 2) The Naval Surface Warfare Center Dahlgren Division (NSWCDD) is able to provide flight support, launch and recovery equipment for 5-6 ScanEagles for the DYNAMO AGOR/UAS scientific demonstration. Their statement of work and schedule is due on 06/24/2011.

Discussion:
- Ro Bailey offered to assist Luc if needed with a payload bay.
- Dan Schwartz – Will you have to ship the ScanEagles to India? Luc – Export licenses (ITAR) will be needed. They are also looking at back-up plans. If they are not ready for operations in 2011, Rob Pinkel has another DYNAMO cruise in August 2012.
- Tim Schnoor – It would be great if UAF could provide the payloads. A temporary loan would be greatly appreciated.
- Phil McGillivary – What is the size of the ScanEagle support team? Luc – Six people for 24-hour/day operations.

Tim said that he appreciates Luc's participation in SCOAR and on this project.

FLIR Sensors – Dan Schwartz discussed possible synergistic operations between aircraft and the UNOLS seismic research ship *Marcus Langseth*, utilizing FLIR to recon project areas for marine mammals. Dan explained that the FLIR sensor is very small now. There are others using FLIR for monitoring. The FLIR detects very slight differences in temp/absorption and it can even monitor logs. Steve Hartz added that FLIR has been used for wildlife management in Alaska.

SCOAR Membership – The Committee reviewed the current SCOAR membership and discussed future openings. It was suggested that an individual with ocean observatory experience.

Adjourn Day-1

<u>SCOAR Meeting, Day 2 - 24 June 2011</u>

Day-2 Opening Remarks – Dan Schwartz opened Day-2 of the meeting and welcomed everyone back.

Haf Jonnson of CIRPAS joined the meeting.

Future Business and Direction for SCOAR: Brainstorming session – The first part of Day-2 was an open discussion on action items and future SCOAR activities.

Discussion:

- Phil McGillivary – SCOAR should interact with OOSC for consideration of aircraft at ocean observatories.
- Dan Schwartz –SCOAR should continue a dialog with NOAA for application of UAS for marine sanctuary surveys. Phil added that UAVs are used for surveys at the Marianna's for law enforcement of illegal fisheries.
- Dan Schwartz encouraged a Twin Otter demo using FLIR for marine mammal observations. This would require IHA permits and Bob Houtman and Holly Smith could be contacted along with the NSF aircraft group.
- Mike Prince – There is now an MOA between NSF and CIRPAS. The pathway for making aircraft available to the NSF ocean sciences community is now in place via the MOA. This opportunity could be broadly announced.
- Future forums that could be appropriate for SCOAR outreach include:
  - UNOLS Annual Meeting – display videos of aircraft and UAV operations.
  - MLSOC Community Meeting – December: highlight potential use of FLIR sensors for marine mammal monitoring
  - Ocean Sciences Meeting – flyers, hands on tools, videos, etc.

Workshop on Utilization of Unmanned Aircraft Systems for Environmental Monitoring – Michael Bonadonna, Senior Staff Meteorologist, Office of the Federal Coordinator for Meteorology, NOAA provided the report (via teleconference). His slides are included as ***Appendix XII***.

The Exploratory Mini-Workshop Utilization of Unmanned Aircraft Systems for Environmental Monitoring was held on February 4, 2011. There were three sessions:

- Session 1: Unmanned Aircraft System Applications for Environmental Research and Monitoring
- Session 2: Challenges to the Development and Use of UASs for Environmental Monitoring
- Session 3: Interagency Coordination and Strategic Planning for the Use of UASs to Support Environmental Monitoring

The key take-away messages from the workshop were:

- Technology has progressed to the point where UAS should be considered a viable approach to accomplish a wide variety of environmental monitoring missions.
- UASs are particularly appropriate for those "dull, dirty, denied, or dangerous" applications not well suited for manned aircraft.
- The development of UAS capabilities and programs within agencies should be approached from a "Program of Record" point of view and consider full life cycle costs. The majority of life-cycle costs are incurred during the operation and maintenance phase of the program.
- UAS technologies are adaptable for a wide variety of missions and transferable between organizations. There's no need to reinvent a system when you can leverage the investment already made by other agencies. The DOD can be a particularly useful partner for leveraging technology, systems, procedures, etc.
- The need for interagency communication and transparency is paramount. Numerous UAS

activities that have taken place, are in-progress, or are planned can benefit other organizations.
- The Federal agencies must present a coherent, coordinated approach to the development and utilization of UASs in order to mutually support UAS initiatives and programs.
- This must fit within an overall construct of all unmanned systems (including ground, sea surface, and undersea systems) for environmental monitoring.

A number of challenges to the implementation of UAS solutions for environmental monitoring exist including:
- Routine access to the National Airspace System (NAS)
- UAS infrastructure and support
- Interagency/international coordination
- Data and system standards.

Potential Government Actions in respect to UAS are:
- Coordinate the efforts of organizations interested in UAS development and utilization for environmental monitoring and related missions.
- Find or establish a data/metadata clearinghouse for UAS missions so that information can be shared across agencies. NOAA's National Data Centers may be the best organizations to consider.
- Cross-feed information about miniaturized sensor development for UAS platforms amongst the community as much as possible.
- Cross-feed information about the Joint Center for Satellite Data Assimilation (JCSDA) to the UAS community to serve as a model for interagency development and exploitation of UAS capabilities.
- Establish data standards to maximize use of data obtained from UAS missions.
- Establish instrument and sensor calibration standards. The UAS community could leverage examples from other systems (radar, balloon, surface observation, etc.)

IWGF - TFUS – Reggie Beach provided the Interagency Working Group on Facilities Task Force on Unmanned Systems Update. He co-chairs the TFUS with Kim Curry (Oceanographer of the Navy). Reggie's slides are included as ***Appendix XIII***.

2010-2011 TFUS activities included:
- Creating an inventory on Unmanned Systems Assets
- Drafting a letter identifying challenges and opportunities to full utilization of UAS
- Holding a March 29-31, 2011 workshop on Unmanned Systems Common Lifecycle Infrastructure

Functions of the TFUS include:
- Review the operations, management methods, and capabilities of the growing federal usage of unmanned systems and, when appropriate, recommend common standards and approaches to assist federal oceanographic sponsors and facility managers
- Improve planning, coordination, and communication among federal sponsors and facility managers of unmanned systems
- Address interagency programmatic and operation questions of unmanned systems
- Provide a forum for the exchange of information on long-range plans regarding the construction, deactivation or usage of unmanned systems
- Monitor international oceanographic unmanned system activities for potential application to

the federal facility mix.

TFUS has identified challenges to utilization of UAS in a letter to IWG-FI. They recommend increased funding for the FAA Unmanned Aircraft Program Office with a streamlined COA process. A National database on UAS flight operations is recommended to expedite data analysis. They recommend increased federal funding for UAS training and equipment. Incorporation of DOD UAS command and control technology for civil uses to lower cost is also suggested.

A workshop on Unmanned Systems Common Lifecycle Infrastructure was held (see slides for details). Findings from the workshop discussions included:

- One-third of the costs of Unmanned Systems are in Command and Control.
- Data standards and parameters should be agreed upon to ensure interoperability and should flow in RT to national data facilities to be available the widest number of potential users, forecast centers and managers.
- UAS utilization levels were found to be low at about 100 hours per year.
- A virtual asset pool could be created (ownership retained by the institution, but the asset physically provided for use and maintenance in the pool) with day- rates established for asset usage, common lifecycle infrastructure and insurance.
- An interagency roadmap on unmanned systems should address vision/mission, Operations, Tests, Prototyping and Certification.

Specific 2011 TFUS activities are:

- Develop Interagency Unmanned Systems Roadmap
- Increase dialogue with the FAA representative
- Comment on FAA rulemaking proposal on 55 lb. UASs to be released this summer
- Update inventory, investigate utilization rates, and discuss national unmanned system asset pools and how they might be established.
- Consider visiting a UAS facility such as Pax River, Dryden or Dahlgren to further operational insight and discussion.

Discussion:

- Phil McGillivary– Does Homeland Security or USCG attend TFUS meetings? Reggie – Jon Berkson attends for USCG.
- Annette – Is the inventory available publically? Reggie – It does not. The inventory has been a challenge to create. Some agencies have many assets but they don't track them.
- Ro Bailey – Does DOI attend TFUS meetings? Reggie – Mike Hunt and Tom Cisaire attend for the Dept of Interior. No one from the Justice Dept attends.
- Mike Prince – Utilization would probably increase by leveraging autonomous systems. You get more effective utilization in using these assets with ships and manned aircraft. Reggie – There is that opportunity. A central finding is that there is a lot of duplicating the efforts among the operators of one system or multiple systems. For UAS operations to be economic, you need to operate with an asset pool model.
- Reggie – Research is being constrained by bureaucratic rules. TFUS would like to get these things sorted out.
- Jason Thompson – How is TFUS defining utilization? Reggie – Defining utilization has been a challenge and they don't know the answer. JC – As the platform sensor pairing matures, you will see the UAS utilization rates go up. The utilization is based on flight time; none of the staging time is accounted for. It is a tough subject. The utilization will increase as the maturity increases.

- Phil McGillivary – Some of the aspects of establishing UAS pools raise concern. The asset pool could take funds away from some of the smaller operations that play an important role. Reggie – this is very important and the intent is not to jeopardize the training or sensor testing facilities.
- Phil McGillivary – Is TFUS engaged with the Ocean Observing folks. Reggie – They are working with Sam Walker and he is providing input from IOOS.

Regulatory and Airspace Issues for UAS - Reggie Beach included this as an issue as part of his TFUS presentation (see slide 3 of Appendix XIII – Challenges to full utilization of UAS).

- JC Coffey reported that NOAA had a meeting on this issue just the other day. Department of Homeland Security might have the most success in addressing airspace issues.
- Bob Bluth – With increased utilization of UAS, FAA is looking at the entire system. They are looking at satellites, RF signals, etc. It is a complex situation. FAA is considering certifying UAVs in the same way as aircraft. This will add cost to operations.
- Phil McGillivary – In the Arctic, there is often more risk in manned operations as opposed to unmanned.
- Reggie – Randy Willis (FAA) is willing to work with the TFUS to address airspace issues.

Closing Remarks – Dan Schwartz thanked everyone for participating in the meeting.

The meeting adjourned at 12:00 pm