2004-10

UNOLS now oversees research aircraft facilities for ocean science

Bane, John M.

Section News, Eos, Vol. 85, No. 41, 12, October 2004.
http://hdl.handle.net/10945/42322

SECTION NEWS

OCEAN SCIENCES

Editor: *Keith Alverson, PAGES International Project Office, Barenplatz 2, CH-3011 Bern, Switzerland; Tel: +41-31-312-3133; Fax: +41-31-312-3168;* **Section President**, *Ellen R. M. Druffel;* **Section Secretaries**, *Christopher R. Sherwood, Deborah K. Steinberg, Kathleen C. Ruttenberg and Molly O. Baringer*

Fig. 1. The CIRPAS UV-18A Twin Otter turboprop research aircraft. This twin turboprop Short Takeoff and Landing (STOL) aircraft can cruise at low speeds for long durations over the ocean with a maximum endurance of 8 hours, maximum altitude of 7600 m, 35–80 m/s operational speed range, 200 amps of payload power, and an approximately 2400 kg useful load. Original color image appears at back of this volume.

UNOLS Now Oversees Research Aircraft Facilities for Ocean Science

PAGES 402, 405

In recognition of the increasing importance and value of aircraft as observational platforms in oceanographic research, the University National Oceanographic Laboratory System (UNOLS) has established the Scientific Committee for Oceanographic Aircraft Research (SCOAR). SCOAR aims to establish procedures for research aircraft that follow the present UNOLS practices for research vessel use, with the goal of making it understandable, and easy, and thus desirable, for oceanographic scientists to utilize research aircraft more.

For consistency with the operation of UNOLS ships, this will require UNOLS to designate appropriate research aircraft operating organizations to be National Oceanographic Aircraft Facilities (NOAFs), essentially like institutions that operate one or more UNOLS ships. UNOLS presently has one designated NOAF, the Center for Interdisciplinary Remotely Piloted Aircraft Studies (CIRPAS) at the Naval Postgraduate School, in Monterey, California.

SCOAR also will develop and disseminate knowledge about aircraft platforms, unpiloted aerial vehicles (UAVs), and airborne instruments that are presently in use in ocean science. It will also attempt to stimulate the development of new instrumentation that exploits airborne capabilities. For example, a synergistic evolution of UAVs and small, lightweight, low-power instrumentation is expected.

Motivation for the establishment of SCOAR came in part from the recognition that, at present, research aircraft in the United States are operated by a range of agencies, universities, and public corporations. The federal fleet includes some 40 aircraft operated by or for the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the National Science Foundation (NSF), the Department of Energy (DOE), the Office of Naval Research (ONR), and the U.S. Coast Guard (USCG).

Most of these aircraft are used for specialized research and development, but several are available for oceanic or atmospheric research. An interagency committee, the Interagency Coordinating Committee for Airborne Geosciences Research and Applications (ICCAGRA), is charged with facilitating inter-agency cooperation and being a resource to senior-level management on airborne geosciences issues. The university research aircraft fleet is much smaller; however, information about these aircraft and how a new potential user might gain access to them has been neither centralized nor uniform across institutions.

SCOAR Activities and Goals

The four principal activities and goals for SCOAR are as follows:

- Provide recommendations and advice to the operators and funding agencies of the UNOLS-designated National Oceanographic Aircraft Facilities regarding operations, sensor development, fleet composition, fleet utilization, and data services.
- Inform and advise the ocean science user community about research aircraft facilities, including experiment design, facility usage, scheduling, and platform and instrumentation capabilities.
- Promote collaboration and cooperation among facility operators, funding agencies, and the scientific community to improve the

Table 1. Standard Instrumentation List for UNOLS Aircraft

Aircraft flight parameters
Position and time: GPS and inertial navigation system; attitude, pressure altitude, climb rate, heading, air speed, ground speed, and track; distance above surface

Flight level atmospheric parameters
Temperature; pressure; humidity; 3-D wind velocity; turbulence; liquid water

Remote sensing
Solar radiation; sea surface temperature; visible imaging, digital video, frame grabbing

Deployable sensors
Dropwindsondes, AXBT, AXCTD, AXCP, AXKT, sonobuoys; surface drifters and floats

Instrumentation integration facility
Downward looking port; data and power bus, including time and/or position stamp

availability, capabilities, and quality of research aircraft facilities.

- By promoting collaboration among the ocean science, atmospheric science, and other science communities using research aircraft, strive to improve utilization and capabilities for all of these communities.

ONR established CIRPAS as a research center at the Naval Postgraduate School in 1996 to operate a variety of manned aircraft and UAVs. CIRPAS provides measurements using an array of airborne and ground-based meteorological, aerosol, cloud particle, radiation, and remote sensors. It also conducts payload integration, reviews flight safety issues, and provides logistical planning and support around the world. In addition, CIRPAS assists in developing new airborne instrumentation. The CIRPAS Twin Otter has been widely used in oceanographic projects for the past 8 years (Figure 1).

SCOAR has established a standard instrumentation package for UNOLS aircraft. Specialized sensor/data packages can be accommodated as well, depending upon the specific mission. Table 1 presents the Standard Instrumentation List, which will evolve as UNOLS and SCOAR gain experience with the needs of the user community.

Rapid developments in ocean observing systems have prompted SCOAR to consider the utility of airborne observations within these activities. Aircraft will be useful in three principal ways: (1) routine observations in areas that do not have fixed in situ instrumentation (e.g., to obtain data for the initialization or verification of oceanic and atmospheric models); (2) observations surrounding observatory sites to provide more complete, 3-D views of the environment; and (3) intense observations for short-term events, e.g., algal blooms, high runoff episodes, atmospheric storms, Gulf Stream intrusions, or ocean eddy events.

Long-range aircraft operated by agencies such as NOAA, NCAR, and NASA are presently available for deep-ocean observatory needs far from a land base. In order to best serve the nation's growing coastal observing systems, SCOAR foresees the need for regional research aircraft centers. These should operate shorter-range single- or twin-engine aircraft for coastal research programs. CIRPAS is already filling this role on the west coast. A strong case can be made for centers on the east coast, in Alaska, on the Gulf of Mexico coast, and in Hawaii.

SCOAR held its inaugural meeting in February 2003 with five charter members attending, along with aircraft program managers from NSF, ONR, NOAA, and NASA. SCOAR committee members will typically be ocean scientists, but those from allied fields such as marine meteorology and environmental cryology will be welcomed. UNOLS is currently interested in expanding the committee by one member, preferably in either remote-sensing biology or marine meteorology. Readers are invited to visit the SCOAR and CIRPAS Web sites at: http://www.diu.unols.org/committees/scoar/index.html and http://www.cirpas.net/public/home.cfm.

The SCOAR Web site now serves as a first stop for ocean scientists interested in obtaining an aircraft for their research. Online application forms for the CIRPAS facilities and connections to other aircraft operating agencies are provided there.

—JOHN M. BANE, University of North Carolina, Chapel Hill; ROBERT BLUTH, Center for Interdisciplinary Remotely-Piloted Aircraft Studies, Naval Postgraduate School, Monterey, Calif.; CHARLES FLAGG, Marine Science Research Center, State University of New York at Stony Brook; HAFLIDI JONSSON, Center for Interdisciplinary Remotely-Piloted Aircraft Studies, Naval Postgraduate School, Monterey, Calif.; W. KENDALL MELVILLE, Scripps Institution of Oceanography, University of California at San Diego, La Jolla; MIKE PRINCE, University National Oceanographic Laboratory System, Moss Landing Marine Laboratories, Calif.; and DANIEL RIEMER, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Fla.

BOOK REVIEWS

Turbulence and Magnetic Fields in Astrophysics

E. FALGARONE AND T. PASSOT (EDITORS)

Springer, Berlin; ISBN: 3-540-00274-X; xi + 463 pp; 2003; $113.30.

PAGE 406

The juxtaposition of "magnetic fields" and "turbulence" arises in plasma dynamics in various contexts—such as the solar corona, the magnetosphere, space physics in general, cosmic ray propagation, and laboratory plasmas of both fusion and nonfusion types. In astrophysics, the impact of turbulence has arrived relatively recently but is rapidly finding importance. The present volume is a written record of topics presented at a conference, Simulations of Magnetohydrodynamic Turbulence in Astrophysics: Recent Achievements and Perspectives, held at the Institut Henri Poincare, in Paris, in July 2001.

The international audience that attended this meeting heard talks on a broad range of astrophysical, space physics, and purely theoretical subjects. A wide range of physical scenarios was discussed, with many different observational data presented. However, true to the conference banner, the emphasis was on the physics of low-frequency plasma turbulence, described by magnetohydrodyamics (MHD), and investigated using numerical simulation.

The conference organizers and editors, Edith Falgarone and Thierry Passot, made an important decision that greatly enhances the pedagogical value of the subject volume. Rather than assembling a true "conference proceedings," they solicited slightly longer articles on the principal physical topics covered at the conference. They did not shy away from topics that can engender "vivid controversies," but instead solicited articles that portrayed the status and breadth of some of these lively but unsettled research topics. This volume is much closer to being a coherent monograph than a typical conference proceedings would be.

The selection of topics, accurately reflecting the spectrum of conference talks, shows a diverse astrophysical interest in plasma turbulence. Five articles are devoted to the hot topic of molecular clouds, three to dynamo theory, and three to general numerical studies of turbulence. For good measure, there are also articles on adaptive mesh refinement, techniques for remote observation of magnetic fields, magneto-rotational-driven turbulence in accretion disks, magnetic reconnection in astrophysics, and turbulence models of heating of the solar corona. The span of topics is wide, but there is just enough overlap to feel some reinforcement across chapters.

There are big questions raised but not answered: Turbulence can account for a number of features "needed" in molecular clouds, but what drives the turbulence? How do kinetic processes affect turbulence and changes of large-scale magnetic topology? What is the timescale for generation of the largest-scale magnetic fields in helicity-driven dynamo activity? Can the present generation of numerical results on MHD turbulence be successfully extrapolated to astrophysical parameter regimes? These and other fundamental questions are well motivated and presented in this collection. A curious reader can here satisfy a healthy appetite for background on such issues, and get some up-to-date status reports as well.

As with any admirable effort to elucidate an entire field, limitations become evident. The lack of a full treatment of turbulence in the solar wind is unfortunate, in that it is probably the most completely studied example of cosmic MHD turbulence. There is some, but thankfully not a great deal of, preoccupation with fine details of steady state power law indices (for example, 5/3 versus 3/2), which can be a disservice to the importance of the underlying physics. Cosmic ray scattering is given only passing mention, although it is a well-studied application of turbulence ideas, perhaps somewhat better known to heliospheric physicists than it is to astrophysicists.

One is also reminded that turbulence physics is new to astrophysicists: Cascade "imbalance" is largely a rediscovery of two- or three-decade-old work on cross helicity. The "GS" spectral model is viewed frequently here as central, but actually has a rather close relationship to the low-frequency reduced MHD model, long used in laboratory plasma physics, but incomplete in that it ignores higher-frequency turbulence components. There is also some slippage into relatively loose discussion of "wave modes" when the difficult subject of compressible

Fig. 1. The CIRPAS UV-18A Twin Otter turboprop research aircraft. This twin turboprop Short Takeoff and Landing (STOL) aircraft can cruise at low speeds for long durations over the ocean with a maximum endurance of 8 hours, maximum altitude of 7600 m, 35–80 m/s operational speed range, 200 amps of payload power, and an approximately 2400 kg useful load.