carrier could. Analysis has suggested, however, that in most situations the nuclear ship's advantage would be measurable in hours, not days.

To many naval officers, the fact that the nuclear carrier has now received the blessing of favorable cost-effectiveness studies must seem of quite academic interest. The Navy reports that the *Enterprise*, operating off Vietnam in the South China Sea, has been launching 20 percent more attack sorties than the conventional carriers have been launching. The very circumstances which, 2 years ago, McNamara felt would be "quite exceptional" have become routine since the raids on North Vietnamese and Viet Cong targets began in February 1965. Carriers of the U.S. Seventh Fleet have been engaged in sustained combat operations and have required frequent replenishment. The Navy's analysis of the nuclear carrier's value—heavily influenced by the intuitive judgment of experienced naval officers—appears to have been better than the early judgments by McNamara and his analysts.

In any event, the question of nuclear propulsion for carriers has been settled. The question which remains is whether other major new combatant ships shall be nuclear-powered, as the Navy has proposed. A nuclear-powered guided missile frigate costs about 50 percent more than a conventional frigate, or about $150 million, compared to $100 million. Only modest reductions in this differential are foreseen.

McNamara has made it plain that, at the current price, he regards the nuclear frigate as a bad bargain. So far he has withheld the $20 million appropriated by Congress last year for purchase of "long lead-time" equipment for such a frigate. The only nuclear ship that has been built under the McNamara regime is the frigate *Truxton*, which was included in the fiscal 1962 defense program on the initiative of the House Armed Services Committee.

Although their cost is admittedly great, nuclear ships may offer operating advantages as yet unsuspected. Harold Brown, former director of defense research and engineering, expressed concern a few years ago that cost-effectiveness studies tend to evaluate the effectiveness of nuclear ships in terms of deployment concepts developed through years of experience with conventional ships. "I think this prejudices the case against the all-nuclear Navy and prejudices it unfairly," Brown said. "It is quite possible that entirely different concepts and tactics will evolve."

As Brown's remarks suggest, the next real breakthrough in the use of nuclear ships may come from collaboration between naval forces afloat and systems analysts ashore—all working to develop and test new concepts which can exploit to the full the advantages peculiar to nuclear propulsion.

—LUTHER J. CARTER

Announcements

The Commerce Department's Environmental Science Services Administration has created a committee to coordinate government research efforts on **turbulence in clear air**. Such turbulence, which appears without visible warning, presents problems in aircraft operations. The committee is composed of representatives of the Defense Department, Federal Aviation Agency, NASA, NSF, the Agriculture Department, the State Department, and ESSA. Jack J. Catton, director of operational requirements and development plans for the Air Force, is chairman.

The departments of chemistry and physics at the University of Tennessee have combined efforts to offer a graduate program leading to the Ph.D. in **chemical physics**. Students may participate in theoretical or experimental research. The program is open to people with a bachelor's degree in either physics or chemistry. Additional information is available from the Department of Physics or the Department of Chemistry, University of Tennessee, Knoxville.

Grants, Fellowships, and Awards

The University of Miami will provide grants for up to 50 U.S. and foreign undergraduate students to participate in a course on fundamental concepts in **environmental and planetary sciences**, 17 June to 22 July. The awards will include tuition and fees, round-trip travel to Miami, and $60 a week for subsistence. Applicants need a background equivalent to 3 years of college training in physical sciences and in mathematics through advanced calculus. Advanced courses in theoretical mechanics, electricity, and modern physics are desirable. The course will emphasize fluid dynamics in the context of geophysics and planetary physics. Application deadline: *1 May*. (S. Fred Singer, School of Enviromental and Planetary Sciences, University of Miami, Coral Gables, Florida 33124)

The University of Virginia will offer eight graduate courses in field **biology** between 17 June and 25 August at the Mountain Lake Biological Station. A limited number of NSF fellowships are available: postdoctoral, for research, stipend $1300; predoctoral, for supervised research, stipend $500; postgraduate, for field biology training, stipend $400. Deadline for applications: *1 May*. (J. J. Murray, Jr., Department of Biology, University of Virginia, Charlottesville)

Courses

The University of Texas Institute of **Marine Science** will offer courses 9 June to 6 August on marine microbiology, geology, and chemistry; ecology of fishes; estuarine ecology; and adaptive mechanisms in marine animals. Applications should be made by letter and should include an official transcript and letters of recommendation from two faculty members. Applicants should state their career objectives and their housing requirements. Deadline: *1 April*. (Director, Institute of Marine Science, Port Aransas, Texas 78373)

McGill University and the National Research Council of Canada will sponsor a course on molecular and cellular aspects of **immunobiology** 4–15 July. Attendance will be limited to 80 to 100 pre- and postdoctoral participants. The fee is $75 for people from universities and government, $300 for those in industry; room and board will cost $15.50 a day. Stipends are available for graduate students. Application deadline: *15 April*. (A. Sehon, Department of Chemistry, McGill University, Montreal, Quebec)

Meeting Notes

Papers are invited for a conference on **nuclear and particle physics**, scheduled for 21–23 September at the University of Glasgow, Glasgow, Scotland. Outlines: 300 words; deadline: *30 June*. [N. MacDonald (nuclear physics) or I. S. Hughes (particle physics), Department of Natural Philosophy, The University, Glasgow, W.2]

Advance registration for the meet-

ing is required. Application forms are available from the Meetings Officer, Institute of Physics and the Physical Society, 47 Belgrave Square, London S.W.1, England.

The Society for **Cryobiology** will hold its annual meeting 8–10 August in Boston, Massachusetts. Papers on all areas of the field are invited. Abstracts: 200 words; deadline: *15 May*. (C. Huggins, Department of Surgery, Massachusetts General Hospital, Boston 02115)

Evaporites and related rocks will be the topic of an **earth science** conference in Banff, Alberta, 8–13 May. The purpose of the meeting is to provide practicing geologists with an opportunity to keep up to date with new advances in their field. Fee: $100; deadline: *21 April*. (Phyllis Laking, Extension Department, University of Alberta, Edmonton, Canada)

Scientists in the News

The University of Missouri has appointed **James O. Davis** professor and chairman of the physiology department, effective 1 July. He is now a heart research specialist and chief of the section on experimental cardiovascular diseases at the National Heart Institute.

J. Harry DuBois, president of Molecular Dielectrics, Inc., has received the highest award of the Society of Plastics Engineers, the international award in plastics science and engineering. He received a $1000 honorarium for "continuing efforts and success in expanding and disseminating the technology of plastics engineering."

John B. Stanbury, director of the thyroid research unit and associate clinical professor of medicine at Harvard, will become professor of experimental medicine and director of the MIT clinical research center on 1 April.

Hamish N. Munro, former professor of biochemistry at the University of Glasgow (Scotland) has become professor of physiological chemistry at MIT.

Walter S. Owen, professor of metallurgy and dean of the faculty of engineering science at the University of Liverpool, has become the T. R. Briggs Professor of engineering and director of the department of materials science and engineering at Cornell University.

Robert C. Horton, mining engineer with the Nevada Bureau of Mines, University of Nevada, has been named administrative head of the bureau, with the rank of associate director.

The new director of the Smithsonian Institution's museum of natural history, is **Richard S. Cowan**, formerly assistant director. He succeeds **T. Dale Stewart**, who has become senior scientist in the Smithsonian's division of physical anthropology.

Hunter Rouse, director of the Institute of Hydraulic Research and a professor of mechanics and hydraulics at the University of Iowa, has been named dean of the university's college of engineering.

Recent Deaths

Laurence M. Ames, 65; research professor of microbiology at American University; 2 February.

Ralph C. Corley, 64; professor of chemistry at Purdue University; 24 January.

Robert Fries, 89; director of the Bergius Institute and botanical garden of the Royal Swedish Academy of Sciences from 1915 to 1944; 29 January.

Gilbert Grosvenor, 90; editor for more than 50 years of *National Geographic* magazine and chairman of the Society's board of trustees since 1954; 4 February.

Ernest Scott, 88; retired associate professor of physiology at Columbia University's College of Physicians and Surgeons; 19 January.

REPORT FROM EUROPE

Decision Time Approaches for European Rocket Programs

London, 16 February. The managers of the six-nation European rocket development organization ELDO are preparing to ask for commitment to a second-generation program that will probably cost about twice as much as the present one.

But as they do so, the ground seems to be slipping underneath even the first program. It became known today that the British government has "serious doubts" about financial, commercial, and technological aspects of the present ELDO program, which it estimates will cost a total of $420 million, not $200 million as agreed 5 years ago, or even $300 million as estimated last year.

Under the leadership of Britain's new minister of aviation, Fred Mulley, the British will express these doubts at a meeting of ministers from ELDO countries to be held in Paris from 29 to 31 March. Such doubts could be crucial to the initial ELDO program, for Britain contributes not only the largest share of ELDO's cost (about $165 million) but the Blue Streak first stage of the planned three-stage Europa or ELDO-A rocket now being developed.

There is a distinct possibility that Britain will withdraw from ELDO before the ELDO-A rocket is used to launch even one satellite (an event now scheduled for 1968), and long before it could be used in projected tests, planned for 1969, of communications satellite equipment which might be sold to the world system. The withdrawal might occur at the end of this year.

Informed sources were saying, naturally, that the doubts about ELDO had no effect on Britain's generally friendly attitude toward international scientific and engineering collaboration (for example, activities of ELDO's sci-