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The OTEC Liaison

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Conference and Congress Propel OTEC Ahead

ATTENDANCE UP 68% \$20 MILLION BUDGET ADDITION ANTICIPATED

"Everything is go!" This was the phrase heard more than once from key researchers, corporate principals, and government personnel after the Fifth Annual OTEC Conference held in Miami in February. Their enthusiasm was well founded, based not only on the tremendous increase in attendance compared to the Fourth Annual Conference held in New Orleans only eleven months earlier (455 to 330), but

to the conferees that only two years ago all of the six basic technical problems (bio-fouling, resources, heat exchangers, cold-water pipe, cable, and corrosion) were beclouded, while today most either are solved or have solutions closely in sight. With the OTEC-1 platform about to become a reality in September, one top government official said it is likely that 1978 will be "the year to make OTEC happen".

ADDITIONAL OTEC FUNDING REQUESTED IN CONGRESS

(The following remarks by the Honorable Walter Flowers of Alabama were delivered in the House of Representatives on February 15th, 1978. Sections dealing with the potential locations of OTEC plants, OTEC history and principles, and OTEC's potential for providing non-electric products have been deleted in the interest of brevity.)

Mr. Speaker, yesterday, before the Advanced Energy Technologies and Energy Conservation Research, Development, and Demonstration Subcommittee's hearing on the Department of Energy Fiscal Year 1979, Congressman Lou Frey Jr. testified on behalf of ocean thermal-energy conversion (OTEC).

Mr. Frey has been working for the last 10 years to point out the potential of OTEC as a renewable energy source. He is our chief proponent for this program, and I would like to share his remarks with my colleagues.

Ocean Thermal-Energy Conversion

Mr. Chairman: To respond to the pros-
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also on two other important factors: (1) research has advanced many OTEC concepts from problems to solutions; and (2) Congressional support indicates additional budgeting of \$20 million to further OTEC work, for an expected total for FYE 1979 of almost \$55 million.

FOREIGN GOVERNMENTS INVESTIGATE OTEC

Fifteen foreign nations were represented in Miami, making it the first OTEC meeting anywhere of true international composition. Canada, The Congo, France, Germany, Guadeloupe, India, Israel, Italy, Japan, Monaco, The Netherlands, The Philippines, Syria, Taiwan, and Turkey had representatives, with many countries sending teams of individuals to survey current OTEC development. Increased exposure of what OTEC is and its current status has many viewers rating OTEC as "the most likely solar-energy program of all to succeed". Unfortunately, not only does the man in the street know little about OTEC, let alone understand it, but many policy makers in Congress and elsewhere are only now beginning to grasp its potential significance. This will be aided in the next six months by publicity to the general public via feature articles in consumer publications as well as television exposure, and to government officials through increased focus on alternative energy proposals such as OTEC—amplified by the current dollar crisis brought about largely by heavy imports of oil.

Both Europe and Japan are proceeding rapidly with OTEC development, as detailed in the January issue of *The OTEC Liaison*. James Madewell, who runs DOE's OTEC program, made clear in his address

TWO VIEWS ON PILOT-PLANT SIZE

Madewell confirmed earlier conjecture that DOE had "dropped off the chart" their plans to have a 100MWe plant opera-

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James F. Madewell (left), Assistant Director of Biomass, Ocean, and Wind Systems of DOE, addresses the Miami conference as (left to right) Howard P. Harrenstien and Harold J. Plass Jr., both of the University of Miami, and T. Nejat Veziroglu, Director of the University's Clean Energy Research Institute, look on.

The OTEC Liaison

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ENERGY CONVERSION

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Please Subscribe!

The OTEC Liaison will provide continued liaison [from the French: *an instance or means of communication between bodies, groups, or units*] to the community of ocean thermal-energy conversion, with response to your expressed needs. Your comments and criticisms are welcomed,

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tional in the mid-1980s and had shifted to modular experiments in the 5-to-15-megawatt range. This was done, he explained, to point up the government's plan to fund OTEC only until it becomes operational. At that point, it is anticipated, private industry and public utilities would take it from there. However Representative Mike McCormack (D-WA), Chairman of the House Advanced Energy Technologies and Energy Conservation Research, Development, and Demonstration Subcommittee, has budgeted the additional \$20 million to augment other monies as follows: proposed new totals of \$10.7 million for OTEC-1, \$10 million for engineering and design work on the tropical ocean-grazing concept, \$5.1 million for heat-exchanger research, \$2 million for the cold-water pipe, and \$1 million for cable—all designated for culmination in the 100 MWe plant during the next five to eight years. These differing options will be resolved, it is expected, before this summer.

Receiving increased emphasis at the February conference were the commercialization and legal and political aspects of OTEC plants, and the industrial capabilities of the construction and deployment of the cold-water pipe (CWP). These subjects will be expanded on in the April issue of *The OTEC Liaison*.

All in all, the Fifth Annual OTEC Conference was a resounding success. From practically every viewpoint OTEC proponents left Miami highly enthusiastic, with the phrase "Everything is go!" an apt summation.



Dr. Abraham Lavi of DOE addresses the Miami conference.

HARM SEEN IN RIFT BETWEEN UNIVERSITIES AND GOVERNMENT

Research universities and the federal agencies that provide funding for much of their research are becoming more and more mistrustful of one another, and the results of this growing rift could be harmful to both science and education in the US.

Such is the viewpoint of Professor Sanford Lakoff, Chairman of the Political Science Department of the University of California at San Diego, as expressed in an article prepared for publication by Change Magazine Press in a forthcoming book: *The State of Academic Science, Volume II*.

According to Lakoff, university administrators feel that they should be free to chart their own research course without being restricted by politically-determined priorities, while government officials contend that public functions paid for partly or fully by tax revenue should be subject to publicly-established standards and objectives.

In addition, universities are upset over the growing number and complexity of regulations attached to federal funding, while the government is increasingly concerned about slipshod accounting procedures by research universities.

Lakoff indicates that a large part of the solution to this conflict between academic freedom and public accountability lies in running a tighter ship.

For example, universities could streamline management and accounting procedures and develop innovative programs to diversify sources of support and respond to vital public needs, perhaps in part by co-operating with private industry and creating multidisciplinary policy centers.

While government agencies could curb their tendency to gather reams of useless data by carefully analyzing the value of such data before researchers spend untold hours in gathering them, and could develop uniform procedures and share certain types of information to avoid wasteful duplication of effort.

Lakoff warned that unless the government and the universities co-operate to resolve their conflicts, the future of science, education, and the many social applications that depend on them would be seriously impaired.

CONTRIBUTIONS INVITED

To add to THE OTEC LIAISON's function as an informative and useful instrument of communication, the editor invites readers to contribute. This may take the form of informally written reviews of research underway or planned, letters to the editor, or collect telephone calls. Inquiries of any form are also invited, as we are generally well-informed of OTEC progress as well as projected planning by researchers, government and private industry.

INTERNATIONAL NEWS

BRITISH ANALYZE UK'S ENERGY STRATEGY

Collecting the analyses and forecasts of a group of British engineers, scientists, and economists has resulted in the publication in England of *An Alternative Energy Strategy for the United Kingdom*. Astronomer Sir Royal Martin warns in the preface that "the timetable is so short that no viable nuclear program can avoid the energy problem". A varied program was proposed using wind (18 million mWh), solar heating (45 million mWh), biofuels (111 million mWh), and wave energy (50 million mWh), all in combination with waste-heat recovery, energy conservation, improved efficiency of existing facilities, and adequate matching of energy needs to energy supplies.

US AND FRANCE TO JOIN IN OCEANOGRAPHIC RESEARCH

Plans for co-operative research in the oceans by the US and France have been drafted by Yves La Prairie, president of the National Center for the Exploitation of the Oceans, and David Wallace, acting assistant administrator of the National Oceanic and Atmospheric Administration (NOAA). The various projects over the next 18 months will include marine geology and geophysics, incorporating studies of manganese nodules using the Deep Tow and Bottom Ocean Monitor under development by the Scripps Institute of Oceanography. Also included will be work on marine pollution, man in the sea, instrumentation, buoy technology, and air-sea interaction, among others.

WORLD OCEAN POLICY SOUGHT DURING JAPANESE CONFERENCE

Speaking in Tokyo to the Third Ocean Policy Seminar, Representative John Murphy (D-NY) called for a "co-operative ocean policy" throughout the world requiring "that we define world ocean objectives, move ahead vigorously to achieve them, and seek to make multiple uses of the oceans . . ." He promised that the US would propose the development of worldwide ocean-buoy systems and satellites, and improve efforts "to mathematically simulate ocean phenomena". The conference was attended by representatives from over 34 countries, and stressed environmental safeguards, establishment of exchange of research through data banks, and development of ocean resources.

SOVIET-AMERICAN PROJECT SEEKS OCEAN-CURRENT DATA

OTEC researchers will want to observe carefully the results of a joint research project of the US and USSR called *Polymode*, underway to learn more about the role of complex ocean circulation that will undoubtedly affect the siting and operation of future OTEC plants. Winter storms and cold mix with and cool water just east of the Gulf Stream in a way that L. V. Worthington of Woods Hole Oceanographic Institution thinks builds an energy supply that helps drive the current.

Severe weather last winter provided support for this theory, since data gathered by the oceanographic ship *Researcher* of the US National Oceanic and Atmospheric Administration (NOAA) show an unusually strong pool of energy left behind in the western North Atlantic last spring. Worthington says it seems likely that both the Gulf Stream and the Kuroshio currents—the world's greatest ocean-current systems—derive much of their energy from this winter recharging process.

How these systems actually tap the energy that winter brings is unknown and is part of the mystery as to how ocean circulation operates. It is becoming apparent that ocean currents are not as simple as previously thought, borne out by the research of joint teams of US, European, and Russian oceanographers which have discovered eddies several hundred miles across in the North Atlantic that may be as important as the main currents, with water flowing as much as 10 times faster than the Gulf Stream. Their effect on the world's weather is certain, but full understanding is incomplete. As Soviet oceanographer Konstantin N. Fedorov has observed: "...because the ocean's 'work' affects our everyday life so much...we cannot afford to ignore the niceties of its behavior."

These circulating water masses—intermediate in size between the great ocean currents and strictly-local circulations—are called mesoscale eddies, and often persist for years carrying their own assemblage of marine organisms. In this way northern water and organisms inhabiting it may be carried to warmer regions, and vice-versa. The two-year project will end in 1978, hopefully resulting in definitive knowledge of these variable currents. Fedorov had called the eddies "the discovery that posed a thousand new questions". Answers should be forthcoming toward the end of this year and are expected to ultimately have great significance in the determination of OTEC siting.

MEXICO AND ISRAEL TO RESEARCH SOLAR ENERGY

In a mid-March Israel Radio communique, Mexico and Israel announced that they had reached agreement in Mexico City talks between Israel Minister of Energy Yitzrak Modai and Mexican officials on two major points: (1) that Mexico will supply Israel with all its oil requirements, and (2) that the two countries will carry out long-term joint research projects in energy supplies, stressing various forms of solar energy, including various aspects of OTEC. *The OTEC Liaison* will publish more details of these agreements in a future issue.

THIRD WORLD MAY LEAD IN SOLAR-ENERGY USE

The industrialized world may easily be outdistanced by Africa, Asia, and Latin America in the full exploitation of solar energy, a Washington DC research institute said in mid-December. A study by Denis Hayes of the World Watch Institute, a private non-profit organization, said these less-developed countries will be forced to make the switch to solar energy sources, since they have little choice. Mr. Hayes points out that, faced with little capital and inadequate fuel reserves, these countries now realize that they cannot afford to copy industrialized nations in making a major commitment to petroleum when world oil production is expected to peak around 1990. By switching to solar energy, they will escape the agonies of developed countries as they reach the end of the oil era.

US AND SAUDI ARABIA TO CONDUCT \$100 MILLION SOLAR-ENERGY PROGRAM

Responsibility for developing a five-year plan for the recently signed solar-energy agreement between Saudi Arabia and the US has been assigned to the Solar Energy Research Institute (SERI) of Golden CO. SERI, which is a part of DOE, will initially co-ordinate the efforts of the two countries under the direction of Dr. Lloyd O. Herwig, Science Advisor, Division of Solar Technology (DOE). Joint first-year funding of about \$500,000 is projected, with Congressional appropriations being sought for the remaining four years.

The agreement covers development of solar-energy applications, advancement of solar technologies, transfer of information, and improvement of solar-research capabilities in both nations.

(continued from Page 1)

pect of energy shortages, researchers on campuses, industry and government, federal energy officials, and the Congress are looking with a sense of urgency at alternative energy sources. In this regard I should like to commend the outstanding efforts of Mr. McCormack and Mr. Flowers, the chairmen of our two energy subcommittees, who, through their leadership and dedication, have stimulated a well-balanced effort in research, development, and demonstration of new energy sources as well as in the development of additional supplies of proven, conventional energy sources. And I want to take special note of the leadership of Chairman Teague in directing this committee's actions in developing new energy sources for the nation.

Until recently, Mr. Chairman, many people throughout the world believed that fossil-fuel resources were in endless supply. The dramatic impact of the oil embargo of 1973 and the effect of continuously escalating costs of oil, natural gas, and the nuclear option have altered that misconception.

This great global effort to find and develop new sources of energy not only encompasses the 30% of the Earth's surface covered by land, but also extends to the greater part covered by water—the world ocean. Interest has heightened in the renewable-energy-resource potential of the world ocean, and ocean temperature differences are one such renewable energy source that could play a significant role in easing the strain on US energy resources.

.... While the technology required for ocean thermal-energy conversion is available, and although OTEC operating principles are well documented, we know that both closed-cycle and open-cycle systems do pose complex engineering and cost problems. DOE officials point out that refinement, optimization, and further engineering development within the existing body of technology are being pursued in several key areas in order to adapt the technology for economically competitive applications. In addition, certain potential environmental, political, and institutional questions need to be addressed before an OTEC power plant could be operated at sea.

Early calculations of both the initial capital cost and the cost per kilowatt hour imply a favorable economic future for OTEC technology. Although the first units built will cost considerably more per kilowatt than fossil-fueled or nuclear-powered plants, expected savings due to technological improvements, assembly-line production, lower operating and maintenance costs, no fuel expense, and long-life operation may allow OTEC power plants to become economically competitive with more conventional energy sources by the 1990s. With identical assumptions, the capital costs projected by the various OTEC researchers for closed-cycle baseline state-of-the-practice plant designs fall within a reasonably narrow range of \$1650

to \$1990 per kilowatt. Use costs are projected to be in a range of 42 to 51 mills per kilowatt hour by 1985, 21 to 31 mills per kilowatt hour by the turn of the century,⁸ and 15 to 25 mills per kilowatt hour by 2020.

.... Proponents charge that the ocean thermal-energy conversion option is receiving too little priority, funding, and manpower. Supporters urge rapid movement toward testing of systems and demonstration plants. Critics view ocean thermal energy as a high-cost, high-risk, and uncertain energy option with perhaps relatively small payoff compared with other energy options under consideration and development. They question whether R&D will bring breakthroughs on costs and raise doubts about resource accessibility, energy transmission ashore, vulnerability to attack by nature or man, and environmental, legal, and political implications.

The issue of transcendent importance is not the fact that one energy option must inevitably emerge as being superior to another or favored at the expense of another, but rather that the nation needs all the energy it can muster—coal, oil, natural gas, nuclear, synfuels, renewable environmental energy sources. Renewable energy options appear particularly attractive from the standpoint of serving in a supplementary role to nuclear and coal programs and, attendant, extending the life of non-renewable fossil and nuclear fuel resources. The ocean thermal-energy resource capacity could provide electricity directly to mainland distribution grids—even possibly providing baseload power to utilities and process industries or replacement electricity when incremental expansions of energy-intensive processes come to be located at sea or on island sites. Mainland electricity is thus freed for other consumption.

Fiscal Year 1977 was a productive year for the OTEC program as a whole, Mr. Chairman. Information concerning most of the critical questions is now in hand, and it is generally encouraging. This past December, the OTEC program reached a critical decision point in the Department of Energy. DOE officials feel that enough information is now available to accurately assess the technical viability and potential contribution of this new technology. An in-depth review of the program is now being carried out by the DOE management. In general, it appears that it will be possible to resolve the technical issues, and that OTEC can make a substantial contribution to electric power in certain geographic areas.

During FY '79, the heat-exchanger bio-fouling, corrosion, and cleaning tests will be continued on larger-scale assemblies. The plan includes initiation of the conversion of the Hughes mining barge to the OTEC-1 early ocean test platform. This process is planned to be completed in Fiscal Year 1980. Fabrication of two shell-and-tube heat exchangers for testing on the OTEC-1 will begin next year. A paral-

lel effort in plate heat exchangers will also be conducted. Large-scale cold-water pipe segments will be constructed of concrete and fiberglass for testing purposes, and electric-cable development activities will commence.

I am concerned, Mr. Chairman, in the matter of what amounts to an \$18.6 million decrease in the Division's request of \$51.1 million, to a level in the President's budget submission to Congress of \$32.5 million. In investigating the matter, I have learned that approximately \$10 million of this \$18.6 million could have been used to ensure completion of the outfitting of OTEC-1 by the end of Fiscal Year 1979 so that ocean performance evaluations of the 1-megawatt power-cycle system could then commence with the beginning of Fiscal Year 1980, rather than toward the end of that year. The remaining \$8.6 million was meant to hasten the development of hardware for (1) the cold-water pipe (\$2 million) and (2) OTEC heat exchangers (\$5 million). These procurements, along with associated funding in support of program management (\$1.6 million), could have advanced the Fiscal Year 1980 program in modular experiments (pilot plants).

OTEC is a viable new energy source for the nation, Mr. Chairman, and to coin a phrase: "Energy is... when you need it!" The skepticism of some stems in large part from their hope that energy either will not be needed in the future or will come solely from systems based on highly-sophisticated physics, but certainly not from a system which at best could be called sophisticated plumbing! I urge the Subcommittee in its deliberations on the Fiscal Year 1979 budget to consider restoring \$18.6 million to the OTEC budget, so that DOE is able to move with all due haste and vigor to advance the time when OTEC achieves a competitive posture and assumes its place in the future mix of energy technologies.

SENATOR PERCY ENCOURAGES OTEC RESEARCH

In correspondence with the editor of *The OTEC Liaison*, Senator Charles H. Percy of Illinois stated: "As you may know I am a strong supporter of all solar-energy options. I believe that we should vigorously pursue ocean thermal research; we need all the insurance we can get against another oil embargo." The Senator is well-informed on OTEC, but questioned several points brought up by Metz in his *Science* article, namely cost, biofouling, and scaling up of pilot models. Respondents in the "Letters" section of *Science* were quoted, as well as other information provided the Senator as to where OTEC stands today.

Senator Percy also told *The OTEC Liaison*: "I cannot affect the Department of Energy budget until it clears the Energy Committee. Mark-up in that committee is not expected to be complete for another two months."

US GOVERNMENT
PROCUREMENT INVITATIONS
AND CONTRACT AWARDS

Listed below are procurement invitations and contract awards related to OTEC in particular and ocean resources in general culled from the *Commerce Business Daily*. This is not to be construed, however, as a complete list.

Feb 1: Additional Research in the Areas of Physical, Chemical, Biological, and Geological Oceanography; Environmental Acoustics; and Oceanographic Instrumentation: Contract N00014-74-C-0262, 9 Jan 78, \$70,693, to Woods Hole Oceanographic Institution, Woods Hole MA 02543.

Feb 2: NAVSTAR Global Positioning System: Phase I: Controllable reception pattern antenna (CRPA) program: General and manpack/vehicular are two parallel efforts to build, test, and document alternative versions of brassboard models of GPS user receiving antennas that can discriminate between signal sources, providing both gain and suppression. The general CRPA contract will address a solution that can be extended in principle to all host vehicle categories, i.e. airport and manpack/vehicular. The manpack/vehicular CRPA contract will address a solution for the manpack/vehicular user category only. The following qualifications must be met for offerors to be eligible for consideration: (1) Must have existing equipment (at least breadboard model) including software if applicable. (2) Must have actual test results and design data which show promise for meeting SS-US-200 requirements. (3) Must have working CRPA brassboard within 240 days after contract to support government testing. (4) Must support CRPA maintenance, operation, and field test at Yuma proving grounds. (5) Must produce final test report and final oral briefing 365 days after contract award. Brassboard is not deliverable. The government has allocated a maximum of \$350,000 for the general CRPA contract and a maximum of \$100,000 for the manpack/vehicular CRPA contract. The government will not award both contracts to the same source unless that source can demonstrate two technically different solutions to this problem. Offerors desiring to bid on either solicitation are required to host a demonstration of existing hardware/software to a team of government/aerospace corporation representatives. Appointments for the demonstration must be made within 10 days of publication of this announcement to the address below. Following the demonstration, those deemed fully qualified will be considered for receipt of a request for proposal. SS-US-200 and other GPS documentation is available on request. Headquarters, Space and Missile Systems Organization (AFSC) (PMN), PO Box 92960, Worldway Postal Center, Los Angeles CA 90009.

Feb 6: Perform Studies and Analyses to Maintain and Enhance the Base Line Ocean Surveillance Master Plan (OSMP) and to Assist in Planning for Future Systems: Negotiations will be conducted with Keron Inc., Arlington VA, under Contract N00039-77-C-0099, RFP N00039-78-R-0145(S).

Feb 6: Perform Studies and Analyses to Maintain and Enhance the Base Line Ocean Surveillance Master Plan: Negotiations will be conducted with Martin Marietta Aerospace, Denver Division, under Contract N00039-77-C-0270, RFP N00039-78-R-0146(S).

Feb 6: Technical Engineering Services for the Verification and Validation of Software Applicable to Operation Sea Nymph System: Selected source procurement from Computer Sciences Corporation, San Diego CA, which was instrumental in the design implementation and documentation of the Sea Nymph during its inception. Schedule 78-0585, CDB-41. OIC, Naval Regional Procurement Office, Long Beach CA 90822.

Feb 6: Engineering Study in Support of the NAVSTAR Global Positioning System (GPS): The Joint Project Office for the NAVSTAR GPS intends to conduct negotiations with Stanford Telecommunications Inc., Sunnyvale CA. The contractor will be asked to perform selected studies in support of GPS and FAA requirements. Headquarters, Space and Missile Systems Organization (AFSC), PO Box 92960, Worldway Postal Center, Los Angeles CA 90009.

Feb 8: Analysis of Existing Data of Ocean Mixing Processes of Small Scales in the Setting of Large-Scale Flows: Contract N00014-78-C-0126, 24 Jan 78 (no RFP), \$98,879, to Science Applications Inc., 8400 Westpark Drive, McLean VA 22101.

Feb 8: Further Research on Toughness and Fatigue Behavior in Beta Titanium: Contract N00014-76-C-0409, 24 Jan 78 (no RFP), \$107,965, to Carnegie-Mellon University, Pittsburgh PA 15213.

Feb 10: Extend Study to Define and Develop a Temperature-Gradient Sub-Sea Model: Negotiations are being conducted with Locus Inc., State College PA. Supply Officer, Naval Research Laboratory, Washington DC 20375.

Feb 13: Study Analysis of Ocean Profile Effects on the Propagation of Internal Gravity Waves: Negotiations are being conducted with Science Applications Inc., McLean VA. See Note 46. Supply Officer, Naval Research Laboratory, Washington DC 20375.

Feb 14: Additional Research in Cable-Motion Engineering Sensors: Negotiations are to be conducted with the Charles Stark Draper Laboratory Inc., 68 Albany St., Cambridge MA 02139.

Feb 16: Biological Conversion of Biomass to Methane: Contract EY-76-S-02-2917.A002, \$235,430, to University of Illinois, Urbana IL 61801.

Feb 17: Conceptual Development of a Satellite Control Satellite System is being considered for approximately April 1978. The contemplated study will undertake a definition of military mission applications and concepts of using satellite-to-satellite links for both mission-data relay and command, control, and telemetry relay. The contemplated effort will develop and analyze a mission model and satellite support requirements, develop conceptual-level system configuration options, assess the options, and develop a program to achieve an operational system. One contractor will be selected to perform this nine-month firm-fixed price, minimum-hours contract. A draft Statement of Work and Data Requirements list are available for contractor information and comment. These may be picked up at SAMSO/YCPC, Building 125, Room 1570, or by sending a self-addressed stamped envelope to SAMSO/YCPC. Headquarters, Space and Missile Systems Organization (AFSC), PO Box 92960, Worldway Postal Center, Los Angeles CA 90009.

Feb 17: Deep-Water Stable Test Platform (YFN 1126) in the St. Croix, Virgin Islands Area: Contract N00019-77-C-0116-P00001, 27 Jan 78 (no formal RFQ), \$104,952, to Tracor Marine Inc., Port Everglades FL. Naval Air Systems Command, Washington DC 20361.

Feb 21: Seven-Month Study of Imaging Sensors for Ocean-Surface Waves: Negotiations are currently being conducted with Riverside Research Institute, 80 West End Ave., New York NY 10023. US Army Missile R&D Command, Attn: DRDMI-ICBB/Bowers, Redstone Arsenal AL 35809.

Feb 22: Additional Research on Capillary Waves, Wind Waves, and Wind-Wave Current Interaction: Contract N00014-75-C-0285, 1 Feb 78 (no RFP), \$72,000, to the University of Delaware, Newark DE 19711.

Feb 23: Provide Support to the Chairperson of the National Advisory Committee on Oceans and Atmosphere: This office is in the process of negotiating a contract (MO-78-4128SD) with the University of Washington at Seattle, Institute of Marine Studies, Seattle WA 98105.

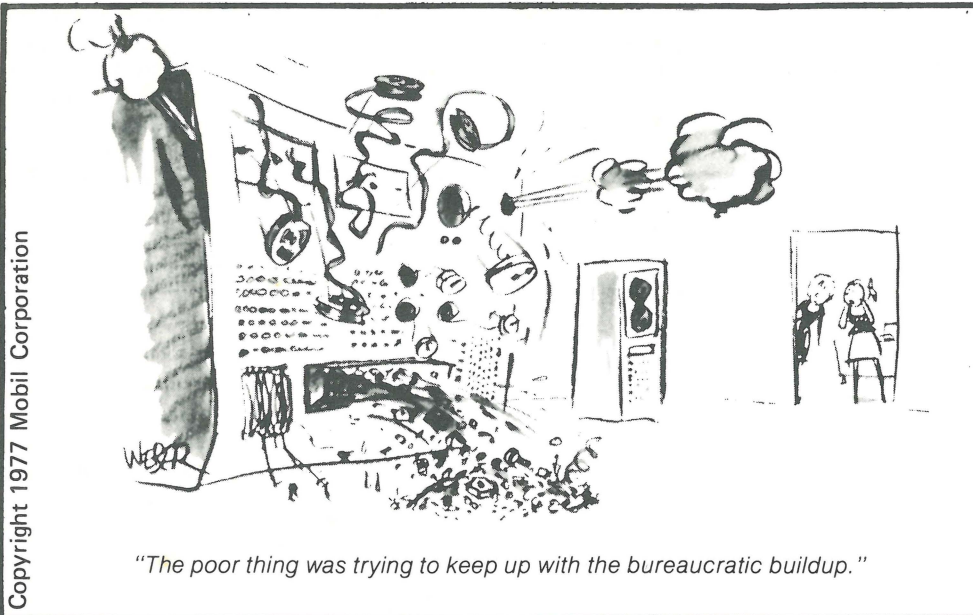
Feb 23: Development of Small Power Systems Using Solar Thermal Techniques: Contract ET-78-F-01-2892 (International Agreement), \$235,000, to International Energy Agency, Koeln, Federal Republic of Germany 90.

Feb 27: Naval Architect Support for Ocean Thermal-Energy Conversion: Contract ET-78-C-03-1830, estimated cost \$49,080, to Morris Guralnick Associates Inc., 550 Kearney St., San Francisco CA 94108.

Feb 28: Determine the Appropriate Number and Type of Government-Owned Vessels and the Role of Charter Ships to Effectively Support All NOAA Programs at Minimum Long-Term Cost to the Government: RFP NO-78-4123DM. Closing date 10 Apr 78. US Department of Commerce Procurement Research Division, Washington DC 20230.

Mar 1: Continued Research on Oceanographic Instrumentation Development, Profiling Sensor Technology, and a Buoyance Control System: Negotiations are to be conducted with C&M Systems Inc., Saybrook Industrial Park, Elm Street, PO Box 475, Old Saybrook CT 06475.

Mar 1: Cost Analysis of Algae Biomass System: Negotiations are being conducted with Dynatech R/D Co., Cambridge MA 02139, Contract EG-77-C-01-4000, Contract Specialist J. Scarpignato. Department of Energy, Office of Procurement Operations, Washington DC 20545.



"The poor thing was trying to keep up with the bureaucratic buildup."

Mar 2: Thermal Energy Storage Systems: The DOE/NASA is assessing the use of fluidized bed heat exchangers for low (less than 250 C) and high (250 C or more) temperature thermal-energy storage systems. This proposed effort will be (1) a definition of potential fluidized bed concepts and an identification of candidate thermal-energy storage applications, and (2) a technical analysis and economic evaluation of selected heat-exchanger storage systems. It is expected that bidders be familiar with fluidized bed math models as well as with the potential present/near-term thermal-energy storage applications. RFP 3-8545060 will be issued in the near future on a competitive basis. Inquiries concerning this procurement should be forwarded to Mail Stop 500-305 or by calling 216/433-4000, Ext 709.

Mar 3: Concurrent Studies of Enhanced Heat Transfer and Materials for Ocean Thermal Exchangers: Contract EY-76-S-02-2641.A0003, \$165,000, to Carnegie-Mellon University, 5000 Forbes Ave., Pittsburgh PA 15213.

Mar 3: Selective Solvent Extraction in Utilization of Stored Solar Energy in Belulosic Biomass: Contract ET-78-S-02-4658.A000, \$218,877, to Purdue Research Foundation, West Lafayette IN 47607.

Mar 3: Survey and Analysis of Solar Energy Procurement Activity for Small and Minority Business Participation: Contract ET-78-C-01-2869, \$26,610, to

Techmatics Corp., Silver Spring MD 20910.

Mar 8: Ocean Monitoring and Control: Contract DAAK40-78-C-0081, 15 Feb 78, \$99,188, to Tetra Tech Inc., Fort Myer Dr., Arlington VA 22209. US Army Missile Research and Development Command, Redstone Arsenal AL 35809.

Mar 10: Air Deployable Oceanographic Mooring (ADOM) Feasibility Study: Negotiations are to be conducted with EG&G Washington Analytical Services Center Inc., 2150 Fields Rd., Rockville MD 20850.

Mar 10: Development of Conceptual Designs for Lightweight, Rapidly Deployed

Mar 21: Study to Develop Preliminary Designs for Grazing Plant Mode and Stationary Electric-Cable Mode of Cold-Water Pipe Systems for the Ocean Thermal-Energy Conversion (OTEC) Program: RFP MO-78-4141 and 4142EM. Closing date 10 May 78. US Department of Commerce, Procurement Research Division, Washington DC 20230.

Mar 22: Technical Services to Division of Solar Energy in Areas of Program Alternatives, Development, and Impact Assessments: Contract ET-78-C-01-2854 (Sole Source), \$765,0444, to Mitre Corp., McLean VA 22101.

Mar 23: Inventory of Fuels from Biomass-Related Plant Sciences Programs Supported by Federal Agencies: Negotiations are being conducted with Ms. Sarah Sprague, Largo MD 20870: PO-ET-78-X-01-2840.

Mar 23: Technical Services to the NOAA Office of Ocean Engineering: Services to include the analysis of specific hydrodynamic shapes subject to ocean current shear forces, determining the effectiveness of dynamical positioning systems, and evaluating the effectiveness of sophisticated ocean-measurement sensors and the statistical analysis of such measurement data. The NDBO plans to negotiate only with the firm of Research Consultants, Framingham MA. (079) NOAA Data Buoy Office (NDBO), NSTL Station, MS 39529. Attn: Cashion (601) 688-2810.

Mar 24: Development of Dry-Ro Membranes for Desalination of Sea and Warm Brackish and Waste Stream Waters: Continuation of Contract 14-34-0001-7520, \$199,500, to Chemical Systems Inc., 1852 McGaw Ave., Irvine CA 92714. US Office of Water Research and Technology, 18th and C Streets NW, Washington DC 20240.

Mar 29: Corrosion Assessment Analysis As Part of the Overall Ocean Thermal-Energy Conversion (OTEC) Project: Contract 03-7-038-734, \$64,938, to University of Miami, RSMAS, 4500 Rickenbacker Causeway, Miami FL 33149.

Mar 29: Further Research on the Nature of Electromagnetic Field Interaction With Biological System Function: Contract N00014-78-C-0147, 15 Mar 78 (no RFP), \$72,535 to Randomline Inc., County Line and Mann Roads, Huntingdon Valley PA 19006.

Mar 29: Domestic and Export Markets for Underutilized Fish and Shellfish: Contract A01-78-4037, \$399,693, to Earl R. Combs Inc., Mercer Island WA 98040.

Mar 30: Research on the External Fluid Mechanics of Ocean Thermal Power Plants: Contract ET-78-S-4683.A000, \$97,892, to Massachusetts Institute of Technology, Cambridge MA 02139. US Department of Energy, Chicago Operations Office, Contracts Management Office, 9800 South Cass Ave., Argonne IL 60439.

Mar 31: Superplastic Forming/Diffusion Bombing of Titanium: One study, RFO, DAAG46-78-Q-0161, to Rockwell International, Los Angeles CA. Army Materials and Mechanics Research Center, Watertown MA 02172.

Undersea Suspended Cable Structures: Negotiations are to be conducted with EG&G Washington Analytical Services Center Inc., Hydrospace Challenger Group, 2150 Fields Rd., Rockville MD 20850. Office of Naval Research, 800 North Quincy St., Arlington VA 22217.

Mar 14: Study to Determine the Appropriate Number and Type of Government-Owned Vessels and the Role of Charter Ships to Effectively Support All NOAA Programs at Minimum Long-term cost to the Government is revised and set aside for small business. RFP 78-A01-4123BM. Closing date 17 Apr 78.

Mar 20: Wave Energy Resource Study to Provide an Analysis of the Resource Potential of Ocean Waves As an Alternate and Renewable Power Source: Specific attention will be focused on the Northeast Pacific Region, the Northwest Atlantic Region, and the Pacific Trade Winds Zone. The contractor will deliver all reports nine months from the effective date of the contract, ET-78-R-05-5697. It is anticipated that a CPFF contract will result from this solicitation. Write to obtain copies of RFP. US Department of Energy, Contract Division, Post Office Box E, Oak Ridge TN 37830. Attn: M. Williamson.

Mar 21: Ocean Thermal-Energy Conversion Engineering Development Program: System Support Contractor, RFP MO-78-4137PR. Closing date 24 Apr 78. Small businesses, size standard, \$9,000,000.