

MICRO WAVE NEWS

Vol. I No. 7

A Monthly Report on Non-Ionizing Radiation

July/August 1981

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With this issue, we begin a new column on medical applications in order to keep our readers up-to-date on developments on RF and microwave hyperthermia, bone healing, NMR imaging, microwave thermography and other topics.

ERMACHEARS AGENCY UPDATES, OWN FUTURE IN DOUBT

The Electromagnetic Radiation Management Advisory Council (ERMACH) met July 15-16 under the new chairmanship of Donald Jansky, an associate administrator of the National Telecommunications and Information Administration (NTIA). Sixty people crowded into the Washington, DC meeting room for a review of the Environmental Protection Agency's (EPA) present and future programs and the US-USSR cooperation agreement.

News on an array of topics cropped up during the meeting, including:

- Funds for NTIA's side effects program, which includes ERMACH, have been deleted from the FY83 NTIA budget.
- EPA's forthcoming population exposure standard may be frequency independent. The criteria document for the standard will be submitted to the agency's Scientific Advisory Board in September.
- The NIOSH RF/MW criteria document will be seriously delayed if the Institute is moved to Atlanta and Cincinnati as proposed. (See related story below.)
- EPA's non-ionizing radiation programs in Las Vegas will move to Silver Spring, MD.
- The Soviet Union has raised its occupational exposure standard to 25 $\mu\text{W}/\text{cm}^2$ from 10 $\mu\text{W}/\text{cm}^2$.

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NIOSH RF/MW CRITERIA DOCUMENT IN TROUBLE AGAIN

The much delayed National Institute for Occupational Safety and Health (NIOSH) criteria document on radiofrequency and microwave (RF/MW) radiation is in trouble again. The new setback came as the Reagan administration proposed to move the institute out of the nation's capital to Atlanta and Cincinnati. A source within the criteria documents branch said, "Work has come to a virtual standstill as the staff tries to deal with the shock of the move." Many employees are known to be looking for other jobs, and none of the three staffers writing the documents has made a commitment to move with NIOSH. As of last May, the criteria document was scheduled for external review in December.

According to the administration's plan announced this June, most of NIOSH will move to Atlanta from Rockville, MD, and thus be in the firm control of its administrative parent, the Center for Disease Control (CDC). The approximately 50 members of the criteria documents branch would be transferred to Cincinnati. Dr. J. Donald Millar, director of CDC's Center for Environmental Health, has been selected to replace the past director, Dr. Tony Robbins, who was fired earlier this year.

The proposed move drew immediate criticism from a number of congressmen and labor leaders. Sheldon Samuels of the AFL-CIO's Industrial Union Department, a long-time follower of the progress on the RF/MW docu-

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- The World Health Organization criteria document on RF and microwave radiation health effects will soon be available.
- Soviet over-the-horizon radar is causing serious interference problems.
- An evaluation of prospective populations for future RF/MW epidemiologies will be released this September.

ERMAC Budget Cut

Confronted by the loss of program funds, Jansky pledged to "do whatever I can" to carry out ERMAC's responsibilities. He said he had appealed to restore the bioeffects research program in NTIA's FY83 budget, and will use discretionary funds, if necessary, to support the program. (Funding for FY82 will remain at the same level as this year's budget.) He cautioned, however, that the future was still too uncertain to allow guarantees. Underscoring his point, Jansky warned that the new administration will ask ERMAC "to justify its existence" and suggested the council do just that.

Lobbying efforts began almost immediately. ERMAC, responsible for tracking and evaluating work on the side effects and control of non-ionizing radiation, drafted a letter to the Secretary of Commerce stressing the importance of EPA's RF/MW public health standard and of the agency's research programs.

In a June 23 letter, Howard Johnson of RCA sent a related message to the secretary: ERMAC's work warrants greater support. ERMAC "has not been properly aided or utilized" since its move from the White House, Johnson wrote. He urged that the council be reconstituted with a new charter and that it receive a fair share of the FY82 budget.

EPA Program

EPA's Dr. Daniel Cahill, David Janes and their staffs from the Offices of Research and Development and of Radiation Programs briefed ERMAC on the agency's extra- and intramural projects during the first day and a half of the meeting. Cahill said that EPA's criteria document for an exposure standard will go to the Scientific Advisory Board for review this September. Later, on questioning, Janes announced that the federal guideline emerging from this document may be flat. Unlike the ANSI and NIOSH proposals, Janes explained that EPA is considering a single non-frequency dependent standard to simplify enforcement. Both officials noted that the budget cuts would not significantly hamper their programs (See *MWN* April 1981).

Completion of an EPA project identifying potential populations for future epidemiologies was reported by Doreen Hill. Hill, a graduate student working at EPA on a follow-up study of workers at the MIT Radiation Laboratory, said the evaluation will be out this September.

EPA's research activities drew general praise from ERMAC, except for repeated calls from Dr. Sam Koslov of the Johns Hopkins Applied Physics Lab for experiments at power densities closer to present environmental levels.

In administrative news, Janes has been made the permanent director of the surveillance and emergency preparedness division in EPA's Office of Radiation Programs, while Richard

Tell remains the acting chief of the office's non-ionizing radiation surveillance branch. Plans are underway to bring Tell's operations east from Las Vegas sometime during the next fiscal year.

USSR Radar Interference

The update on the US-USSR Cooperation Agreement sparked a heated protest from Dr. Ross Adey. Adey, from the VA hospital in Loma Linda, CA, could not support the program as long as interference problems caused by Soviet over-the-horizon (OTH) radar continue. "I don't think anyone can be aware of what is going on in the microwave frequency spectrum from 6 to 30 MHz," Adey said, "and not know that the Russians deliberately, maliciously and willfully are destroying the ability of the western world to utilize that spectrum." He opposed all scientific exchange programs until this "grossly abusive misuse of the spectrum" stops.

(The US has its own plans for an OTH system. The Air Force has proposed Bangor, ME, for its defense radar. A July 1981 supplement to the project's 1975 Environmental Impact Statement details the effects of siting the system at Bangor International Airport and reviews the issue of biological effects of non-ionizing radiation.)

Dr. Clifford Mitchell, from the National Institute of Environmental Health Sciences, and several council members felt the benefits of exchange outweighed the shortcomings. Mitchell said Soviet scientific reporting has improved markedly since the program began and he supported renegotiation of the agreement, which expires May 1982. Jansky, acknowledging that the USSR has been "roundly criticized" for this radar interference, asked Adey for more information in writing but said the ERMAC was not the proper forum for his complaint.

USSR and WHO Standards

News of a rise in the Soviet occupational standard popped up on the heels of this exchange. Dr. Morris Shore of the Bureau of Radiological Health (BRH) said he learned of the shift to 25 $\mu\text{W}/\text{cm}^2$ from 10 $\mu\text{W}/\text{cm}^2$ during a workshop in Kiev earlier this year. No one else at the meeting had heard of the change, and Shore is still awaiting details on the standard from the Soviet Union.

Poland's Przemyslaw Czerski, presently visiting BRH, announced that the World Health Organization criteria document on non-ionizing radiation health effects will be available soon. The report (EHC No. 16, WHO 1981, Geneva) concludes that acceptable occupational exposures range between 0.1 and 1.0 mW/cm^2 , depending on the exposure time.

A suggestion was made to reconvene ERMAC in this fiscal year, but several council members doubted that another meeting could be scheduled by late September and no date was set. The minutes of the meeting are now in draft form and will be out before long. Meanwhile, the minutes of the August 1980 meeting are still available.

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ERMAC's statement on the risks to employees at the Moscow Embassy, not discussed at the meeting, is now out. See opposite page.

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ment, said: "The degrading of the agency will slow down the possibility of a forthright report from NIOSH." But, he went on, "there is increasing resistance to the move and this is providing the impetus for an amendment to the Public Health Service Act, which would take NIOSH out of CDC."

Congressmen from at least three house subcommittees are examining the administration's plans for NIOSH. Representative Joseph Gaydos's (D-PA) health and safety subcommittee of the House Committee on Education and Labor held hearings on the proposal July 28. A number of witnesses argued that NIOSH should stay in Rockville because of the high costs of moving and of the importance of preserving the independence of the agency. Congressman Michael Barnes (D-MD), who urged Gaydos to call the hearings, made specific mention of the RF/MW document: "I myself know of one very important project that will likely go unfinished if NIOSH leaves this area. The long-awaited study of the impact of radiofrequency and microwave radiation will lose one and perhaps both of the scientists in charge of the project. Private industry and OSHA both want this study to appear. The study's suppression, whether intentional or unintentional, would be an unconscionable blow to thousands of American workers and consumers."

David Obey (D-WI) of the House Appropriation Committee's subcommittee on labor, health and human services and Toby Moffett (D-CT) of the House health and environment subcommittee of the Energy and Commerce Committee are also pursuing investigations.

While Congress is in summer recess, CDC is continuing with its reorganization of NIOSH. Whether any formal action will be taken to block the changes will not be known until Washington goes back to work after Labor Day. By then, a picture of who will be leaving NIOSH and of the resulting delay in the criteria document should emerge.

OSHA and ACGIH

Meanwhile, things have hardly been quiet at the Occupational Safety and Health Administration (OSHA). A move toward the development of a RF/MW standard was taken as officials were reported to be seriously considering setting up a standards committee—a step requested by labor representatives at last May's congressional hearings (see *MWN* June 1981). OSHA administrator Thorne Auchter, who has otherwise been busy withdrawing many occupational health standards,* is due to decide on the microwave issue soon.

Paralleling NIOSH's staff programs, the standard setting operation at OSHA has come to a virtual stop with the resignation of Dr. Bailus Walker and the firing of Dr. Peter Infante. Walker's departure leaves OSHA's health standards program without a permanent director. The upheaval caused by the dismissal of Infante over conflicting views on the carcinogenicity of formaldehyde has exacerbated the situation.

At its May meeting in Portland, OR, the American Congress of Governmental and Industrial Hygienists (ACGIH) approved a proposal for a new RF/MW standard. While similar to the NIOSH and ANSI proposals, the ACGIH standard, when formally accepted, would begin at 10 kHz—the first to apply to low frequency VDT radiation. A full text of the ACGIH standard will appear in *Microwave News* next month.

*See: R. Jeffrey Smith, "OSHA Shifts Direction on Health Standards," *Science*, 212, 1482, 26 June 1981.

The National Telecommunications Information Administration (NTIA) has released its report for the State Department on the beaming of microwaves at the US embassy in Moscow with the final assessment of the biological risks to those exposed. As previously reported (see *MWN* January 1981), members of the Electromagnetic Radiation Management Advisory Council (ERMAC) anticipated no adverse consequences from the Moscow signal. The full text of the ERMAC statement is presented below.

The bulk of the report, *Microwave Radiation at the US Embassy in Moscow and Its Biological Implications: An Assessment* (NTIA-SF-81-12) is made up of the previously released State Department and Johns Hopkins University's Applied Physics Lab analyses of the exposure of embassy employees to microwaves.

FULL TEXT

ERMAC Assessment of the Potential for Biological Effects from Microwave Illumination of the U.S. Embassy in Moscow

The Electromagnetic Radiation Management Advisory Council (ERMAC) met on August 26, 1980, to assess the biological implications of the microwave environment within the U.S. Embassy in Moscow, based on a retrospective analysis of that environment. This assessment was undertaken in response to a recommendation in the 1978 "Foreign Service Health Status Study" by The Johns Hopkins University School of Hygiene and Public Health, which reads as follows:

"There is a need for an authoritative biophysical analysis of the microwave field that has been illuminating the Moscow Embassy during the past 25 years with assessments based on theoretical considerations of the likelihood of any biological effects."

To implement this recommendation, the Department of State requested the assistance of the National Telecommunications and Information Administration (NTIA). The Johns Hopkins University Applied Physics Laboratory was requested to develop as complete a physical description of the U.S. Embassy microwave environment as possible using all available data. Models were developed describing the microwave power density distribution within the Embassy during the period January 1966 to February 1977. Based on these models, the Department of State estimated personnel exposure as a function of location in the Embassy. After reviewing this information, the ERMAC was asked to assess the likelihood of any biological effects from the microwave environment and estimated exposures described.

The Council agreed that the models presented tend to overstate rather than understate the probable microwave levels and that there is no indication of any significant variations from the models over time.

The Council discussed the current state of knowledge and on-going research on biological effects of microwave radiation. A considerable number of scientific investigations have been conducted and biological effects have been reported from exposures to power densities higher than those under assessment and to specific modulation frequencies not found in the Moscow signals. It was agreed that there is no scientific evidence, nor are there any theoretical grounds to suggest that biological effects would be expected to occur from the type and low levels of exposure as presented in the models.

Consequently, the ERMAC concluded that no deleterious biological effects to personnel would be anticipated from the microwave exposures at the U.S. Embassy in Moscow as described in this assessment.

NBS Measurement Report

The National Bureau of Standards has found that: "The need to develop and improve instrumentation, measurement standards, calibration services and standardized measurement techniques [for non-ionizing radiation] far outweighs the need to establish regional calibration laboratories."

This conclusion together with some 84 specific requirements to upgrade the capability to monitor levels of non-ionizing radiation are contained in *Requirements for an Effective National Non-Ionizing Radiation Measurement System* by NBS's Howard Clark with the cooperation of the Conference of Radiation Control Program Directors (Special Publication No. 613). The report grew out of a recommendation by the Senate Committee on Commerce, Science and Transportation (See *Report on Radiation Health and Safety*, December 1978).

About half of the 84 requirements were deemed to be high priority, but Clark found that those important tasks either were already being implemented or are now being developed.

Clark notes that the Conference of Radiation Control Program Directors believes that "the principal barriers to its own efforts in assuring non-ionizing radiation safety are the lack of (a) general population exposure standard which its members can enforce, (b) enabling legislation at the state level which would give them authority to act, (c) inexpensive, commercially available field-survey instruments, and (d) adequately trained people."

The report is available from the Government Printing Office for \$2.75, stock no. 003-003-02335-3.

EMP News

The Defense Nuclear Agency's plans to deal with EMP radiation were reviewed in Lt. General Harry Griffith's testimony before a Senate defense appropriations subcommittee in early July.

Nuclear Regulatory Commission engineer Demetrios Basdekas believes that EMPs could cause a meltdown in nuclear reactors. His concerns are addressed in an Oak Ridge report, which concludes that a nuclear plant would shut down following EMP exposure. See Eric Lerner's "EMPs and Nuclear Power," *IEEE Spectrum*, June 1981; and *The Effects of Nuclear Electromagnetic Pulse on Nuclear Power Plants*, (ORNL-5029), available from the National Technical Information Service.

A number of technical papers on EMP were presented at the 18th annual conference on Nuclear and Space Radiation Effects, held at the University of Washington, Seattle, July 21-24.

William Broad's second and third articles on EMP, "Ensuring Delivery of the Doomsday Signal" and "Playing a Wild Card," appeared in the June 5 and 12 issues of *Science* respectively.

BRIEFS

The Federal Communications Commission (FCC) has proposed rules authorizing interim direct broadcast satellite (DBS) service in the 12 GHz band (46 FR 30124, June 5). If adopted, DBS priority will require frequency reassignment for terrestrial carriers currently operating in this band. . . . CBS, RCA and ten other companies have filed proposals for DBS service with the commission, which approved COMSAT's

Litigation . . . Ronald Karras, a former radar repairman, has won a \$200,000 mid-trial, out-of-court settlement of his suit against the General Electric Company and the Western Electric Company, according to a forthcoming article in the *National Law Journal* by Jill Jonnes. Karras, who worked on the Nike Hercules radar for 14 years, suffers from multiple injuries including deafness, bleeding eyes and systemic hemorrhaging. John Phillips, Karras's lawyer in Chicago, could not be reached for comment. The case number is CV-79-L-20237, Circuit Court, Cook County.

Around the Country . . . Electric field levels of up to 450 V/m but averaging 22-57 V/m at head height were recorded on the 102nd floor observatory of the Empire State Building in New York City. EPA's Richard Tell, who took the measurements in July 1980, found that field strengths increased with height. He guessed that reflective glass, installed elsewhere on the floor to reduce radiation levels, was not put in the transom window where the highest reading was found. . . . The next meeting of the Scientific Advisory Panel for New York State's study on the health effects of power lines was scheduled for July 31 in Massena, NY. The panel hopes to finalize its selection of study research areas at the meeting. . . . State Representative Joseph Lashinger, Jr., of Pennsylvania is preparing legislation to bring non-ionizing radiation under the authority of the state's Department of Environmental Resources (DER). Lashinger is also drafting action to require DER approval before utilities can begin new construction or operation of microwave devices. . . . The zoning board hearing on COMSAT's proposed \$50 million earth station in Cleveland Township, PA, is set for August 3. Among those scheduled to testify for COMSAT are Colonel Budd Appleton and Dr. Herbert Pollack. . . . RCA Corp.'s plan to build a satellite communications earth station on Bainbridge Island, WA, has stirred community concern. RCA is now purchasing land for the station.

VDTs . . . Plastic cabinet VDTs at the Montreal *Gazette* will get metal shields and will be retested for radiation emissions. The Quebec Department of Environment will make the measurements. In department tests last January, high emission levels were recorded from several terminals at the paper. . . . The seven newspaper guild locals participating in the Mt. Sinai VDT study headed by Dr. Arthur Frank are listed in the June 12 *Guild Reporter*. Members will fill out questionnaires to de-

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petition to enter the new field earlier this year. . . . The Federal Aviation Administration (FAA) has recommended the threat-alert and collision avoidance system (TCAS) for US aircraft. FAA's J. Lynn Helms says the airborne system should be in operation by 1984. . . . The Frequency Management Advisory Council (FMAC) met June 19 in Washington, DC, and continued work on its national long-range spectrum planning project. A joint FCC-NTIA contract will soon be negotiated to support this work. The next FMAC meeting is scheduled for September 11.

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termine if full medical examinations are warranted. . . . Action on a VDT safety bill requiring employers to inform workers about VDT-related hazards and the precautions to minimize them was indefinitely postponed by the Maine legislature this May. Representative Edith Beaulier, the bill's sponsor, said she will propose the bill again in the next session. . . . Next year the Illinois legislature will consider a VDT bill similar to Beaulier's. . . . The preliminary agenda and a list of participants are out for the *Symposium on the Impact of Video Viewing on Vision of Workers*, August 20-21 in Washington, DC. The NAS Committee on Vision is sponsoring the meeting. For information, contact Key Dismukes at the committee, (202) 389-6068. . . . An article by Eliot Marshall summarizing the May 12 congressional hearings on VDTs appeared in the June 5 *Science*. . . . The final NIOSH report on its Bay Area VDT study is now available. For a copy, send a self-addressed mailing label to: NIOSH, Publications Dissemination, DTS, 4676 Columbia Parkway, Cincinnati, OH 45226, Attn: VDT, DHHS Publication No. 81-129. . . . "Video Display Terminals, Are They Hazardous to Your Health?" an article by Eric Maloney, appears in the July *Microcomputing*.

Technology. . . . The market for cellular mobile radio equipment will reach into the billion-dollar range over the next decade, according to Frost & Sullivan of New York. In a 258-page report, the research firm anticipates significant market expansion in 1984 when the first commercial cellular systems are expected to be in operation. Carrier revenues are also expected to surge, reaching \$42 million in 1984 from \$3.5 million in 1981. "Cellular Systems and Alternatives for Mobile Radio Communications" is available from Frost & Sullivan, Inc., 106 Fulton Street, New York, NY 10038, (212) 233-1080, \$900. . . . Lockheed will investigate the effects of very low frequency radio waves on the ionosphere. The June issue of *Microwaves* reports that scientists suspect VLF transmissions might lessen the mirror effect of the ionosphere and thereby disrupt long-range communications. The "simulated emission of energetic particles," or SEEP, experiment is being paid for by the Office of Naval Research. . . . Scientists from California Institute of Technology's Jet Propulsion Lab have reported on the first map of sea surface temperature in the June 19 *Science*. Measurements taken by Seasat scanning multichannel microwave radiometer (SMMR) in 1978 were used to produce the map. . . . Hughes Aircraft Co. is developing a special sensor, microwave imager (SSM/I) to monitor severe weather from space. *Aviation Week & Space Technology*, June 15, reports that the instrument detects a combination of reflected and emitted microwaves from a designated area. SSM/I is part of the Air Force defense meteorological satellite program. . . . NASA and Georgia Tech have built a prototype radar sensor for remote control of coal mining equipment. In the June issue, *Microwave Journal* reports that the device electronically measures the cutting machine's location in the shaft, enabling the operator to position and control the equipment far from the heavy coal dust produced at the shearing site.

Strasbourg Biomedical Symposium

The Symposium on Biomedical Thermology brought more than 250 participants from 20 countries to Strasbourg, France, June 30-July 4. In many ways, the meeting allowed French scientists to display their progress toward the diagnosis and treatment of cancer with electromagnetic energy.

Three years ago, the French government set up a special committee to encourage research on the medical applications of non-ionizing radiation, with special emphasis on hyperthermia, microwave imaging and bioeffects research. The panel was chaired by Dr. Michael Gautherie of the medical faculty at the University Louis Pasteur in Strasbourg, who also organized the symposium. With a budget of about five million francs, centers around the country bought equipment, recruited researchers and sponsored a host of projects.

Most of the French scientists reported preliminary results at Strasbourg, and it is still too early to predict how well the government's investment will pay off. Nevertheless, an array of techniques has been developed and many clinical studies are under way. Now, new money, some from commercial sponsors, will replace the public support, and this will no doubt select the most promising systems.

Among the presentations were news of RF and microwave hyperthermia units controlled by passive microwave thermography developed by a team from Lille, headed by Dr. Maurice Chive. The RF unit (13.56 MHz) is already being used in the treatment of 30 patients with neck and throat cancer, while the microwave unit (2450 MHz) will be operational soon. Professor Lucien Israel from Bobigny has been heating stomach, pancreatic and lung tumors with RF energy and has concluded that the length of the sessions is an important variable in determining optimal treatment regimes. He began with sessions of less than an hour, increasing them to three hours, while also increasing the number of sessions. Of the 55 deep, inoperable tumors, he scored 35 partial responses and two total regressions. Anticipating the widespread use of NMR imaging, Dr. A. Bellossi of the medical school in Rennes has started exposing female rats to constant magnetic fields of 6,000 gauss. His preliminary results indicate that the fields could enhance the induction of tumors by chemicals.

Reports from other countries included:

- Poland's Stanislaw Szmigielski presented experimental evidence for a biphasic reaction of the immune system to microwaves: stimulation of the system for up to a few days of exposure followed by suppression of cell-mediated immune reactions in animals exposed for several months. In an interview, he said that he would soon begin a new three-year study, funded by the US Bureau of Radiological Health, on the teratological and developmental effects of 2450 MHz on mice. He will also continue to study the co-carcinogenicity of microwaves with chemicals.

- Professor H. Frohlich of the University of Liverpool, England, speculated about a mechanism for frequency-dependent, low-intensity microwave bioeffects: "The energy of the microwave is then used simply as a trigger to initiate a pro-

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MEDICAL APPLICATIONS

NMR Imaging

Three studies on the diagnostic application of nuclear magnetic resonance have been recently published:

1) In what the *New England Journal of Medicine* called the "first clinical application of this powerful technique," a team from the University of Oxford reported an examination of McArdle's syndrome (a rare, inborn metabolic disease) with phosphorus-31 NMR. The non-invasive method can measure intercellular pH and phosphorus-containing metabolites of ATP. (See B.D. Ross *et al.*, *NEJoM*, 304, 1338, and F.H. Epstein, *ibid*, 304, 1360, May 28, 1981.) The phosphorus NMR method is described in Jean L. Marx's "NMR Researchers Embark on New Enterprise," *Science*, 213, 425, July 24, 1981.

2) F.W. Smith and co-workers from Aberdeen, Scotland were able to differentiate malignant liver tumors from benign cystic lesions as well as derive useful data on cirrhosis and metastatic deposits using proton NMR. They concluded: "In demonstrating the presence of malignant tumors [NMR tomographic imaging] is as accurate as ultrasound and radionuclide liver scan and appears to be superior to them in the diagnosis of benign masses, obstructive jaundice, and inflammatory conditions such as cholecystitis." (See *Lancet*, p. 963, May 2, 1981.)

3) Two groups led by F.H. Doyle from Hammersmith Hospital, London and I.R. Young of Thorn-EMI Ltd. applied proton NMR to make images of the brain. Using an "inversion recovery technique," they were able to generate "unparalleled differentiation between gray and white matter in the brain." They went on to note that "in localization of lesions within the brain the white matter detail provided by the brain by NMR may allow a precision not possible with" X-ray computed tomography. The team concluded that "the technique will require clinical evaluation but appears to have considerable potential in the diagnosis of neurological disease." (See *Lancet*, p. 53, July 11, 1981.)

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Other new articles describing NMR imaging include: Jorge Llacer; "Nuclear Medical Imaging," *IEEE Spectrum*, July 1981; and Ellen R. Shell, "NMR: Beyond the X-Ray," *Technology Review*, July 1981.

Hyperthermia

Last March, Drs. Michael Douglas, Leon Parks and Jose Bebin of the University of Mississippi Medical Center reported three cases of acute myelopathy (disease of the spinal cord) in patients receiving hyperthermia cancer treatment within two months of spinal cord X-ray irradiation (*New England Journal of Medicine*, 304, 583, March 5, 1981).

Now, in a letter to the *Journal*, Drs. John Leith and Arvin Glicksman of Brown University write that, given the cellular processes at work, the potentiating effect of the two treatments was not surprising; they too favored caution when the two therapies are used in combination (*NEJoM*, 304, 1549, June 18, 1981).

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The July issue of *Microwaves* features a profile of Dr. Fred Sterzer, director of the Microwave Technology Center at RCA Labs in Princeton, NJ. The article describes the center's work with microwave hyperthermia and its joint cancer treatment program with Montefiore Hospital in Bronx, NY.

Controlling Paralyzed Muscle

A group led by P. Hunter Peckham at Case Western Reserve University in Cleveland has published a paper on a new implantable stimulator, controlled by RF power for exciting paralyzed muscle. (See *IEEE Transactions on Biomedical Engineering*, *BME-28*, 530, July 1981.)

New Journal

The IEEE will begin publishing a new quarterly journal, *IEEE Transactions on Medical Imaging*, early in 1982. For more information, contact: Dr. Glenn Knoll, Department of Nuclear Engineering, 119 Cooley Building, University of Michigan, Ann Arbor, MI 48109 (313) 764-4260.

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EMBS Conference

Among the papers to be presented at the 3rd annual Engineering in Medicine and Biology Society Conference (see conference calendar on p. 8 for details) next September 19 are: "Microwave Radiometry Thermal Profiles of Breast and Drainage Lymph Node Areas," by J. Shaeffer *et al.* of Eastern Virginia Medical School; two papers on non-invasive blood flowmetry by groups from the Medical College of Wisconsin led by J.H. Battocletti (using NMR) and S. Salles-Cunha; "Endogenous Electricity in Bone," by S.R. Pollack, *et al.* from the University of Pennsylvania; "Electricity-Induced Bone Formation in Rats," by A.A. Marino *et al.* of Louisiana State University Medical Center; and "The Role of Pulsing Electromagnetic Fields in Orthopaedic Surgery," by J.S. Kort and A.L. Bassett of Columbia-Presbyterian Medical Center.

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For more news on medical applications, see the items on the L.H. Gray Conference and on the Biomedical Thermology Symposium on pp. 8 and 5.

MICROWAVE NEWS is published monthly, except in January and July • ISSN 0275-6595 • PO Box 1799, Grand Central Station • New York, NY 10163 • (212) 794-9633 • Editor: Louis Slesin, Ph.D., Associate Editor: Martha Zybko • Subscription: \$165 per year (overseas \$200) • Copyright © 1981 by Louis Slesin • Reproduction in any form is forbidden without written permission.

Red Light for SPS

The National Academy of Sciences' panel on solar power satellites (SPS) offered a cool appraisal of the proposed DOE-NASA project to collect solar energy in space and beam it down to earth with microwaves. The principal conclusion of the National Research Council's Committee on Satellite Power Systems was:

"The concept of an SPS is presently faced with sufficiently serious difficulties—in technological readiness, cost, competing technologies for generating electricity, magnitude of the enterprise, and international concerns—that no funds should be committed during the next decade to pursue development of an SPS."

Among the areas "requiring vigorous research in order to clarify future decisions on SPS," the committee listed the biological effects of low-level microwave radiation. It went on to note that "public concerns about the potential effects of exposure to microwave radiation produced by an SPS will have to be resolved if an SPS is to be pursued," and concluded that: "There are also issues of political and social acceptability such as those related to the fear of possible hazards to health from exposure to microwaves." In addition, the allocation of orbital positions and microwave frequencies could require international cooperation.

With respect to non-ionizing radiation, the panel also found:

- The lifetime of existing klystron tubes for the conversion of energy to microwaves is "inadequate," and high-powered klystrons have not been tested in space.

- Although there are no demonstrated harmful effects of microwaves at power levels of 0.1–100 uW/cm², "no reliable theory exists on which to base an understanding of possible or alleged effects at these non-thermal power levels. Hence, while there is no evidence to suggest that such low power levels are not safe, neither is it possible now to prove that they are."

- Microwaves can heat the ionosphere in a way that might have an impact, either positive or negative, on radiocommunications.

- Satellite station-keeping tolerances, together with the intense microwave radiation, would make a portion of the orbital arc unusable to other electromagnetic systems, such as communication satellites.

- The costs associated with avoiding interference effects caused by electric fields in the vicinity of receiving antennas "could be substantial."

The SPS committee also found that the DOE-NASA *Program Assessment Report: Statement of Findings* on SPS, released last November (DOE/ER-0085), "tended to emphasize an optimistic rather than a pragmatic outlook" on the epidemiology of the effects of microwave exposure, among other factors.

Only the conclusions and recommendations of the committee's report, *Electric Power from Orbit: A Critique of a Satellite Power System*, have been released. The full report should be available soon from the National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418.

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To the Editor: In *MWN*, May 1981, there is an article concerning an Air Force contract with the University of Texas Health Science Center at San Antonio, Dr. David Ross, principal investigator. The article indicates that the study will be an attempt at a replication of the investigations of Adey and Blackman on amplitude-modulated radiofrequency radiation (RFR) on calcium efflux. Actually, this is not at all the case. In fact, this is an initial study in what will be a thorough Air Force-sponsored investigation of the effects of RFR on neuronal calcium function. Dr. Ross is specifically studying the effects of RFR on various calcium-dependent processes in mammalian synaptic tissue. Among the processes to be studied are affinity of calcium for receptor sites on the surfaces of myelin, synaptic membranes, and vesicles, potassium- and sodium-dependent calcium effluxes in synaptosomes, calcium transport protein, ATP-dependent calcium uptake in synaptic membrane fragments and calcium-dependent neurotransmitter release.

The reported alterations of calcium efflux from chick neuronal tissue in vitro has already been replicated. There have been intensive investigations over the past few years concerning the role of calcium in the functioning of the nervous system, and many advances have been made. The Air Force is taking advantage of this state-of-knowledge by extending the RFR-calcium studies beyond the simple efflux investigations to the underlying biochemical and physiologic mechanisms in an attempt to assess the biologic significance of the reported effect.

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To the Editor: Maybe no one at the last C-95 meeting was sure where the six-minute averaging time came from (*MWN*, May 1981), but I know because I was there. It was developed by the original 95.IV subcommittee of which I was a member and represents, of course, human biological time constants.

Contrary to what you report from CU's Eckhaus, the standard *does* deal with pulsed sources, and the six-minute time is precisely how it does so.

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Microwave News invites letters from its readers. We ask writers to be brief, and we reserve the right to edit contributions for length.

A second report on the SPS, one by the congressional Office of Technology Assessment, is now at the printer and should be released soon.

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In an article in the July issue of *IEEE Spectrum* ("Reflector Satellites for Solar Power"), Thomas Rogers proposes an alternative to the basic SPS concept: the collection of solar energy in widely separated arid regions around the world, the conversion of the energy into microwave energy, the distribution of the power by microwave mirrors in geostationary orbit and the collection of the energy by huge rectennas.

CONFERENCES

(continued from p. 5)

cess whose energy requirements is provided by the biological system."

- Dr. Nicholas Haimovici from Bremen, West Germany, described his successful treatment of 32 patients with broken bones in their feet with low frequency, pulsed magnetic fields, using a system like the one developed by Professor Andrew Bassett of Columbia University medical school.

- The US's Dr. James Schaeffer of the Eastern Virginia Medical School reported that he was able to identify breast tumors with microwave thermography (4.7 GHz) that could not be picked up with conventional X-ray mammography.

During one panel discussion, Canada's Professor Stanislaw Stuchly livened up the debate by asserting that he saw little long-term future for active microwave imaging: it cannot compete with X-rays and ultrasound. He felt that most of the results he had seen were artifacts.

Gray Conference

The tenth L.H. Gray Conference was billed as *Biological Action of Radiofrequency, Microwave and Ultrasonic Radiations*, but the emphasis was clearly on ultrasound, and to a lesser extent on RF and microwave hyperthermia. The 160 scientists, who came to Oxford, England, the week of July 13, heard a program of 60 papers on the therapeutic applications of non-ionizing radiation. The meeting began with overviews of hyperthermia by Professor Herman Schwan, presently visiting the Max Planck Institute in Frankfurt, Dr. E.H. Grant of the University of London and Dr. Norman Bleehen of Cambridge University. Grant reported on very recent results indicating the greatest differences in dielectric permittivity between tumor and normal tissues were below 100 MHz. As a possible explanation, Grant suggested that tumor tissues may be more membranous.

Among the other papers, there was a report from Germany by W. Grundler and co-workers confirming previous findings of frequency-dependent effects of microwaves on the growth rate of yeast cells.

The proceedings of the meeting will be published as Supplement No. V to the *British Journal of Cancer*, due out at the end of 1981 or early 1982 at the latest. Copies are available from: H.K. Lewis & Co., 136 Gower Street, London WC1 E6BS.

Next Month

In our next issue, we will report on last June's International Microwave Power Institute's Symposium, held in Toronto, and the upcoming Bioelectromagnetics Society meeting to be held in Washington, DC.

CALENDAR

- August 10-12: 3rd Annual *Bioelectromagnetics Society Meeting*, Washington, DC. Contact: BEMS, P.O. Box 3651, Arlington, VA 22203.

- August 10-19: 20th *General Assembly of the International Union of Radio Science (URSI)*, Hyatt Regency Hotel, Washington, DC. Contact: Richard Y. Dow, Organizing Committee of URSI General Assembly, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, DC 20418.

- August 11-13: *Microwave Semiconductor Devices and Circuits*, Ithaca, NY. Contact: Joanne Davenport, Conference Office, 221 North Campus Union, Cornell University, Ithaca, NY 14853.

- August 19-21: 3rd Annual *Satellite Communications Users Conference*, Regency Hotel, Denver, CO. Contact: SCUC '81, Satellite Communications Magazine, 3900 S. Wadsworth Blvd., Denver, CO 80235.

- August 20-21: *Symposium on the Impact of Video Viewing on Vision of Workers*, National Academy of Sciences, Washington, DC. Contact: K. Dismukes, NAS, 2101 Constitution Ave., NW, Washington, DC 20418.

- September 7-11: 11th *European Microwave Conference*, Amsterdam, The Netherlands. Contact: Microwave Exhibitions & Publishers Ltd., Temple House, 36 High Street, Sevenoaks, Kent TN13 1JG, England.

- September 19-21: 3rd Annual *Conference on Engineering in Medicine and Biology*, Shamrock Hilton Hotel, Houston, TX. Contact: J.W. Clark, Department of Electrical Engineering, Rice University, PO Box 1892, Houston, TX 77001.

- October 26-27: *Microwaves and Thermoregulation: A Symposium*, hosted by the John B. Pierce Foundation, New Haven, CT. Contact: Office of Graduate and Continuing Education, Yale School of Medicine, 333 Cedar Street, New Haven, CT 06510

- November 9-11: 1st Annual Meeting of the *Bioelectrical Repair and Growth Society*, Philadelphia, PA. Contact: Executive Secretary of the Society, 425 Medical Education Building, 36th and Hamilton Walk, Philadelphia, PA 19104.

- December 7-12: 6th International *Conference on Infrared and Millimeter Waves*, Carillon Hotel, Miami Beach, FL. Contact: K.J. Button, MIT National Magnet Laboratory, Cambridge, MA 02139.

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- January 13-15: *National Radio Science Meeting*, University of Colorado, Boulder, CO. Contact: S.W. Maley, Dept. of Electrical Engineering, University of Colorado, Boulder, CO 80309.

- March 15-18: *International Workshop on Physics and Engineering in Medical Imaging*, Asilomar Conference Grounds, Pacific Grove, CA. Contact: University Extension, University of California, PO Box AZ, Irvine, CA 92716.

- March 29-April 2: 3rd *International Congress of Thermology*, Bath, England. Contact: Congress Secretariat, Martlet Conference Services, 24 Preston Street, Brighton, Sussex BN1 2HN, England.

- June 15-17: IEEE MTT-S *International Microwave Symposium*, Hyatt Regency Hotel, Dallas, TX. Contact: J.R. Griffin, Texas Instruments, Mail Stop 3432, PO Box 405, Lewisville, TX 75067.