The OST visitors in July came away with the impression that U-25's operation to date is at power levels below the design level. Some of the problems come from the high operating temperature; some from the nature of the fuel, some from a combination of both factors.

The temperature of operation needs to be above 2,600 degrees K. If combustion gases (from coal as envisioned in the United States or from natural gas as done in the Soviet Union) are used, combustors that will supply them at these temperatures steadily over the long term must be designed and built. Combustors are a large priority item in the first three years of the MIT study group's program. (The only thing besides combustion gases that might be used would be exhaust from a thermonuclear fusion reactor, and they don't exist yet. Gases from fission reactors are not hot enough.)

The heat provides a very severe environment for the solid materials used in the generators. Getting rid of the moving parts helps some: Gas turbines, for instance, could not work at these temperatures because thermal effects would foul up the clearances between moving and stationary parts. But there still remain difficult problems of compatibility at the interfaces of different materials.

The major problem that must be solved to ensure an economic lifetime for an MHD generator is corrosion and erosion of the walls of the chamber and the electrodes. Most people in the field seem to think special coatings will do it. Lately AVCO has developed a process whereby liquid zirconia is continuously sprayed into the MHD chamber to coat the walls and electrodes. Company engineers have an experimental machine called Mark VI which they intend for a long-duration test: 20 hours at half a megawatt. The previous long-duration test, an AVCO spokesman says, was at only 10 kilowatts. AVCO's Mark V was able to produce 30 megawatts, but for only a few seconds.

Use of coal gases for fuel requires development of ways to remove sludge from the MHD chamber. Natural gas is cleaner, but the United States has a shortage of natural gas and an abundance of coal. Whatever the fuel, a number of things must be processed out of the gas after it leaves the MHD chamber. First and foremost is the seed material that has to be added to increase the electrical conductivity of the fuel gas. This material will most likely be potassium dioxide. It is so expensive that it must be recovered and recycled for economic operation of the generator. Getting back the seed will provide an antipollution bonus: It will require the installation of very efficient electrostatic precipitators. Precipitators are not necessary to the operation of conventional plants, and there are many complaints that power companies are sluggish about putting them on.

As in all cases where coal is burnt, nitrogen oxides and sulfur oxides will be produced and must be dealt with. Proponents of MHD believe that, in part due to the higher operating temperatures, methods for removing these pollutants can be developed that will be more effective than those used on conventional plants. The high temperature also means less thermal pollution: The higher the operating temperature the less heat the system rejects into the atmosphere.

All in all the proponents of MHD are poised and ready. (The MIT study group found 26 institutions, private, nonprofit and public and 200 professionals plus supporting staff that could be brought in at the beginning of a national program.) They are hoping that current interest and the information exchanges with the Soviets may lead to a takeoff for the American program. But, says an AVCO spokesman, "We're still waiting; it hasn't happened yet." □

McGovern's science pie: Any new plums?

McGovern and Nixon both want more relevant research but differ on what to sacrifice

by Louise A. Purrett

Every four years the tribal councils of the United States undergo a major upheaval, and those who are not actively promoting one potential chief over another are wondering just how a change in government will affect them, if at all. Though scientists as a group are historically aloof from such worldly matters, they have recently become a much more vocal group and often take definite stands on political issues. And indeed, since a large proportion of the money for research in this country does come from the Federal Government they have a very real interest in the outcome of the elections.

The problem is to sift through the masses of verbiage and isolate just what each candidate advocates on a given issue, let alone what he'll do when he gets in office.

President Nixon's science policies have been before the public for four years. It is easier to figure out his policies simply because they have taken the form of concrete actions or non-

"Science is slowly dying in this country."

—Palevsky

actions. He has, for example, created a new agency to oversee research in oceans and atmospheres and has increased funding for several areas of applied research. Ft. Detrick, formerly devoted to biological warfare is now in the hands of cancer researchers, and an intensified anticancer effort has been launched. Defense research is as big a giant as ever. In March Nixon sent the first message by a President to the Congress on R&D. Its emphasis was on applying research to society's needs.

McGovern is another matter. He has had less chance to influence science funding and operations, so observers must rely more on what he says. As yet no coherent, official "McGovern Science Policy" has been released. A high-powered group called Scientists for McGovern is in the process of preparing position papers on nine subjects that McGovern's staff thinks are most likely to arise in the course of the campaign: space, energy, environmental control and protection, strategic weapons, conversion to a peacetime economy, employment, transportation, housing and technological institutions (a study of how we fund science and technology).

Scientists for McGovern was formed about six months ago and is headed by Harry Palevsky, a physicist at Brookhaven National Laboratory and Herbert York of the University of California at San Diego. The organization's list of sponsors includes six Nobel laureates and, claims Palevsky, "all the people in physics that count." Palevsky

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says the position papers will probably be ready Sept. 1. Whether and when they will become public will depend on what direction the campaign takes. (There is no corresponding organization of scientists for Nixon, a fact that may or may not be significant. A staffer with the Committee for the Re-election of the President says that Sheldon Dean, an Olin Corp. chemist, heads a Connecticut state group of pro-Nixon scientists and may eventually organize a national group.)

In the meantime, McGovern has made statements of science policy on various occasions and has sponsored some science legislation that can be drawn together into a fairly complete picture.

One point he has emphasized repeatedly is that federally funded research on national problems must be increased. In a speech to a California aerospace research firm, he enumerated some of the areas that need special attention: finding new sources of cheap, clean energy; building new systems of public transit; setting up traffic-control systems to make more efficient use of streets and roads and to counter air traffic congestion; development of nonpolluting engines; devising safer and healthier working conditions in factories and mines; applying technology to such areas as crime control, emergency medical services, education and new building materials. "We ought to approach these peacetime needs with the same relentless determination and the same kind of dollar commitment that we have shown in getting to the moon, in building the world's biggest stockpile of arms or in making rubble out of Indochina."

In the course of solving these problems, he says, the nation would automatically solve another—the high rates of unemployment among scientists, engineers and technicians. The Political Action Committee for Engineers and Scientists estimates that some 200,000 engineers and scientists are presently unemployed or underemployed as a result of what McGovern calls the boom and bust cycle in the employment of technical personnel. Changes in Federal priorities or cutbacks in funding for programs such as the space program have thrown many scientists and engineers out of work. Added to this group are a number of recent college graduates who majored in science and engineering as a result of the exaggerated promises made to them in the Sixties and now cannot find jobs.

As a partial solution, McGovern has proposed that "we should promote an atmosphere more favorable to independent enterprises launched by individual engineers and scientists." Specifically, he advocates Government subsidy of trial employment of unemployed engineers and scientists by private firms.

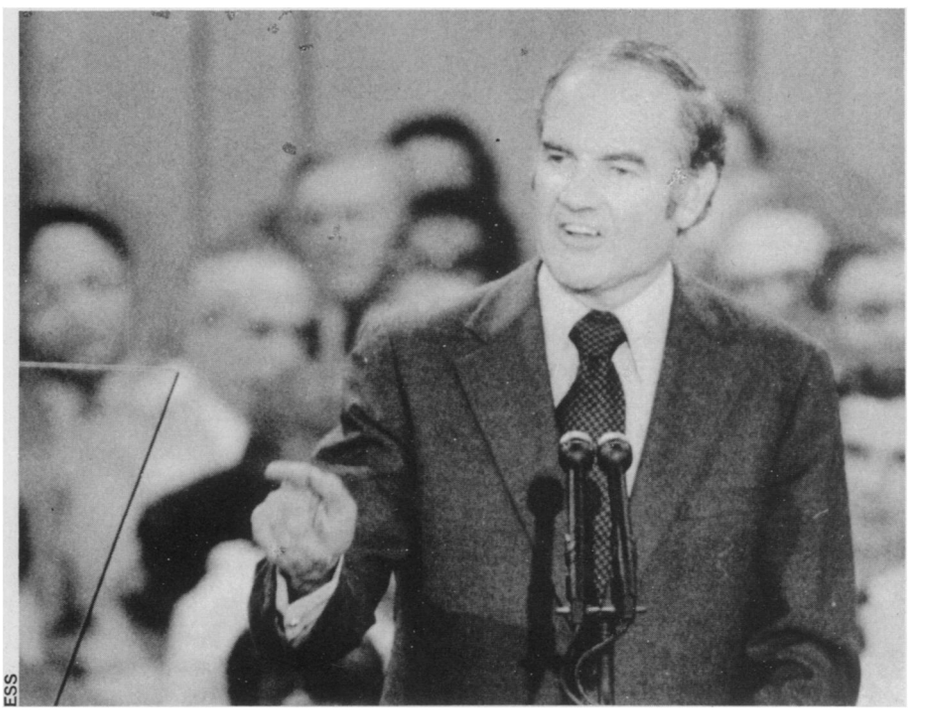
These ideas, of course, are not new. Sen. Edward Kennedy's S. 32 (SN: 8/12/72, p. 102), which is co-sponsored by 33 other Senators including McGovern, would make substantial increases in Federal funding of research aimed at solving national problems and contains specific proposals for conversion of unemployed scientists to civilian research.

Nixon himself has stressed the need for more applied research on the needs of society, and the budget for fiscal 1973 contained substantial increases for research on pollution-free transportation, reducing effects of natural disasters, cancer and new energy sources.

Where McGovern does differ from Nixon is that he would cut back defense spending and transfer the excess money and personnel to civilian research. The "preoccupation" with defense research, he says, has "twisted and distorted our national economy . . . much of our technical and scientific talent—as much as 63 percent of the total—has been working on more efficient methods of destruction instead of on maintaining and improving commercial productivity." In March 1971, he introduced a bill to assist workers whose jobs may be terminated by reductions in defense spending. The bill, now in the Senate Government Operations Committee, would require that a portion of a corporation's profits earned on military, space and atomic energy contracts be deposited in a reserve to be paid out to workers whose jobs have been eliminated or downgraded.

Another McGovern proposal, again not a novel idea, is for a Cabinet-level Department of Science and Technology which would consolidate all Federal R&D programs. He introduced a bill to that effect in March 1971, which has been sent to the Senate Subcommittee on Executive Reorganization and Government Research.

McGovern also advocates patent reform. Independent and unemployed inventors should be able to use patents not exploited by the sponsoring Government agency or business within a given period. McGovern opposes the



space shuttle because he believes that to be economical, it would require an expanded space program.

Finally, McGovern says he would increase funding for basic research, reinstating funds and programs cut off by the Nixon Administration. It is true that basic research, particularly in physics, has not fared well under the Nixon Administration. R&D expenditures have been steadily declining in relation to gross national product and the Federal Government has been sponsoring a declining share of the research. The Administration budget for fiscal 1973 provides for a nine percent increase for Federal R&D with most going to defense and to applied research.

Physics research has been particularly hard hit. The recent study of the National Academy of Sciences' Physics Survey Committee reports that Federal support since 1967 has dropped by eight percent in terms of purchasing power. Over the same period, the cost of conducting physics experiments has risen about 25 percent. Palevsky notes that Brookhaven has had to let go some 500 employes over the past two years because of insufficient funds. The percent of Federal funds devoted to science has been falling since Nixon took over, he says. "Science is slowly dying in this country." The focus for physics research, an area the United States has dominated since World War II, has moved to Europe, says Palevsky.

Part of the problem has been Nixon's very emphasis on relevant science. "He's always looking for the payoff"—an immediate application for the results of research. Palevsky points out that these practical results cannot always be foreseen, or may be far in the future.

In spite of these concerns, they do not seem to be the overriding factors in a scientist's decision of whom to support for President. Palevsky says the main reason that the scientists he knows are supporting McGovern is opposition to the Vietnam war. "Thinking people in general are concerned about the terrible thing we're doing in Vietnam."

Ultimately, though many scientists choose between the candidates on the basis of what they'll do for science, it seems that many of them will vote for one candidate or the other for reasons that are, fundamentally, political. □

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CONSERVATIVE VS SURGICAL MANAGEMENT OF FOOT DISORDERS—James M. Griffin and Louis G. Buttell, Eds.—Futura Pub. Co., 1972, 321 p., photographs, drawings, $19.50. Scientific papers and discussions presented at 59th Annual Meeting of the American Podiatry Association, topics range from preventive foot care, and criteria for surgical approach to bunion deformities, to mini surgery vs open surgery.

CONTROL MECHANISMS AND PROTEIN SYNTHESIS—S. D. Wainwright—Columbia Univ. Press, 1972, 550 p., illus., $20. Thorough inventory of current research on the regulation of protein synthesis, the mechanism that switches on or off the synthesis of a large variety of enzymes and structural proteins, enabling the differentiation of cells to form highly specialized tissues.

COSMETICS: Science and Technology, Vols. 1 and 2—M. S. Balsam and Edward Sagarin, Eds.—Wiley-Interscience, 1972, 2nd ed., 605 p., 691 p., illus., tables, $27.50 each; $47.50 for set. Volume 1 deals with skin creams and lotions, suntan preparations, face powders, rouge, lipsticks, dentifrices and mouthwashes. Volume 2, with shaving preparations, shampoos, hair-grooming preparations, deodorants, aerosol cosmetics, nail preparations, eye lotions and fragrances.

DEVELOPMENTS IN OPERATIONS RESEARCH, Vols. 1 and 2—Benjamin Avi-Itzhak and others, Eds.—Gordon & Breach, 1971, 622 p., diagrams, tables, $35. Selected contributions to Third Annual Israel Conference held in Tel-Aviv in cooperation with the Operations Research Society of America. Emphasis is on specific applications of OR methods.

A DICTIONARY OF NAMED EFFECTS AND LAWS IN CHEMISTRY, PHYSICS AND MATHEMATICS—D. W. G. Ballantyne and D. R. Lovett—Chapman (Barnes & Noble), 1972, 3rd ed., 335 p., illus., paper, $6. Reference volume defines effects, laws, units and terms in modern and nuclear physics, as well as certain phenomena named after workers in the fields of chemistry, physics and mathematics.

DRUG METABOLISM IN MAN—Elliot S. Vesell, Ed.—N.Y. Acad. of Sciences, Annals Vol. 179, 1971, 773 p., illus., paper, $35. Conference papers on factors affecting drug metabolism in man, studies of the metabolism of certain drugs, and genetic aspects of drug metabolism in man.

EATER'S DIGEST: The Consumer's Factbook of Food Additives—Michael F. Jacobson, foreword by Jean Mayer—Doubleday, 1972, 260 p., tables, $5.95; paper, $1.95. Provides authoritative guidelines, states the options, weighs the benefits, costs and risks of additives in our food, singling out the most widespread, the most useful and the most questionable.

ESTROGEN TARGET TISSUES AND NEOPLASIA—Thomas L. Dao, Ed.—U. of Chicago Press, 1972, 369 p., diagrams, $22.50. Reports most recent findings on the effects of estrogen on traget cells, and treats the biochemical evidence for chemical transformation of various steroid hormones by mammary cancer tissues.

EXPLORING THE MEDICAL MALPRACTICE DILEMMA: National Medical Malpractice Seminar—Cyril H. Wecht, M.D., Ed.—Futura Pub. Co., 1972, 234 p., $15.95. Conference proceedings and relevant papers on such topics as legal implications of medical emergencies, professional negligence in hospitals, medico-legal aspects of adverse drug reactions, evaluation of malpractice cases, pre-trial discovery, and the defendent doctor as expert witness.

THE HIGH SIERRA: The American Wilderness—Ezra Bowen and Eds. of Time-Life Books—Time-Life Bks., 1972, 184 p., color plates, 125 illus., map, $7.95. Narrative tells of the history and geology of the region, its vegetation, climatic zones, its wildlife and preservation.

HISTORY OF BIOLOGY—Eldon J. Gardner—Burgess Pub. Co., 1972, 3rd ed., 464 p., photographs, drawings, $9.95. Presents the major landmarks, themes and concepts in the history of biology, the methods employed, the main accomplishments, and the individuals responsible for major contributions.

THE INORGANIC CHEMISTRY OF THE NON-METALS—John Emsley — Methuen (Barnes & Noble), 1972, 60 p., diagrams, paper, $2.75. Using covalent bonding as the unifying theme, the book discusses covalent bond in terms of length, energy and electron distribution within the bond. Separate chapters deal with individual non-metals.

LANGUAGE DEVELOPMENT: The Key to Learning—Morris Val Jones, Ed., foreword by Anthony W. Guidon—Thomas, C. C., 1972, 319 p., illus., $11.75. Places emphasis on the skills of the emerging profession of the language developmentalist, a trained clinician who must combine the abilities of a teacher, psychologist, speech therapist and language arts specialist.

MAGNETIC RESONANCE—K. A. McLauchlan—Clarendon Press, 1972, 105 p., illus., paper, $3.95. Short text embodies the principles and major applications of both electron spin resonance (e.s.r.) and nuclear magnetic resonance (n.m.r.), and shows their interrelations.

MEN AND MOLECULES—Norman Metzger, introd. by Isaac Asimov—Crown Pubs., 1972, 246 p., photographs, $5.95. Based on the American Chemical Society's radio series, the book presents the wide scope of chemical research today, while attempting to give the layman a basic understanding of the interaction and transformations of atoms and molecules.

THE NATURAL WAY TO PEST-FREE GARDENING—Jack Kramer—Scribner, 1972, 118 p., photographs, drawings, $6.95; paper, $3.95. Presents basic knowledge on nature's compost system and how plants feed, discusses soil and natural mulches, plant pests, the role of specific insects and birds, natural protective measures for lawns, flower gardens and evergreens.

ORGANIC SELENIUM AND TELLURIUM CHEMISTRY—Yoshiyuki Okamoto and Wolfgang H. H. Gunther, Eds.—N.Y. Acad. of Sciences, Annals, Vol. 192, 226 p., diagrams, paper, $21. Papers deal with the synthesis and properties of organic selenium and tellurium compounds, their characterization, physical properties, and biological aspects.

RNA SYNTHESIS: Selected Papers in Biochemistry, Vol. 5—Tadanori Kameyama, Ed.—Univ. Park Press, 1972, 327 p., diagrams, $12.50. Papers are limited to studies on the genetic transcription from DNA to RNA, the first step in the expression of genetic information and its regulation.

TRANSFER RNA: Selected Papers in Biochemistry, Vol. 6—Kin-ichiro Miura, Ed.—Univ. Park Press, 1972, 220 p., photographs, diagrams, $12.50. Collection of seminal papers, topics range from soluble ribonucleic acid intermediate in protein snythesis, to total synthesis of the gene for an alanine tRNA from yeast.