For example, it was predicted that the New York State Medicaid legislation (an external variable) would have a certain (budgetary) effect on the financial state of the City (and State). This prediction was wrong, and the cost to the taxpayer turned out to be much greater than had been expected. The reason: State planners assumed a low enrollment rate, due to ignorance and apathy, but welfare rights groups, neighborhood groups, and legal clinics in poverty areas were effective in making contact with, and educating, eligible patients and helping them enroll in the Medicaid program.

Summary

The cyberneticist, practicing his profession in the environs of city hall, finds that city government can be viewed as a feedback control system. The basic elements of goal-setting, information feedback, actuation, and disturbances are present, although not in familiar form. An examination of those elements is useful for disclosing ways to improve urban government. This analogy suggests the possibility that the cybernetics sector of the intellectual community can be drawn to the problems of the cities in earnest, and that political scientists, public administrators, and urbanologists will avail themselves of the rich concepts and theories of cybernetics to help guide improvements in urban government.

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Progress Report on the Big Accelerators

1. Batavia

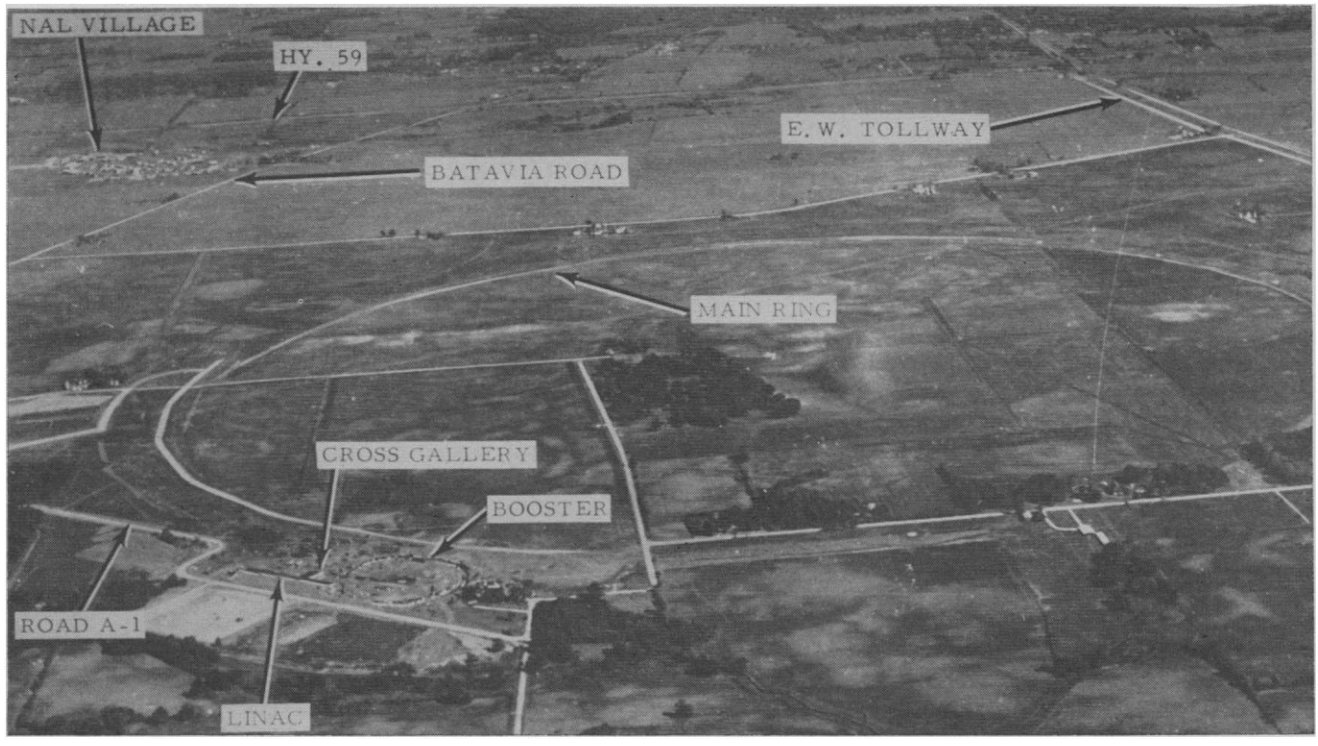
Batavia, Illinois. At a time of deep gloom in the American scientific community, there is little but "good news" emanating from the National Accelerator Laboratory, the site of the giant new proton accelerator which is under construction here on the flat Illinois farmlands some 30 miles west of Chicago. Despite slower-than-hoped-for funding from the federal government, the builders of the new high-energy machine expect to have a usable proton beam by mid–1971, a full year ahead of schedule. This must be counted a surprising achievement in these days when long construction delays and substantial cost overruns seem routine. Moreover, the accelerator chieftains expect to commence operations on a limited basis at 500 Gev—well above the 200 Gev originally planned as the start-up energy.

With everything running so smoothly, the United States seems virtually certain of surging a giant step ahead in the international race to achieve higher and higher energies. The most powerful accelerator currently in operation—at Serpukhov in the Soviet Union—reaches only 76 Gev. The European Organization for Nuclear Research is planning a 300-Gev accelerator which might ultimately be boosted to 800 or 1000 Gev (see following article) and the Russians are considering an accelerator that might reach 1000 Gev, but both projects are still in the talking stages.

There are many critics, both in the scientific community and outside it, who question whether the new accelerators are really worth the mammoth sums they cost. But such sentiments are not detectable out here on the Illinois prairies. The high-energy physicists hope the new machine will help them gain insight into the bewildering variety of elementary particles that has been discovered in recent years. In particular, they hope the new machine will provide answers to the question of whether two particularly important fundamental particles that have been postulated—namely, the quark and the intermediate boson —really exist. No one can say for certain what energy will be needed to answer these questions, but the higher the energy the better the chances.

To refresh the minds of those who may have forgotten, the accelerator ended up here after a long and acrimonious political wrangle over where the new pork-barrel prize should be located. Initial design of the machine had been carried out at the Lawrence Radiation Laboratory in Berkeley, and the assumption was that the machine would be located in Berkeley, but after loud complaints from midwestern representatives that their region was being shortchanged in the awarding of "big science" plums, a nationwide competition was held to select the best site. To no one's surprise, the Midwest won out. The winning site was the now defunct village of Weston, Illinois, a cluster of some 100 modest frame houses that were the remains of grandiose development schemes that never panned out.

What to call the new facility has been a problem from the beginning. Initially, it was generally referred to as the "Weston accelerator," taking its name from the village, but laboratory officials have tried hard to shed that name, partly because Weston no longer exists, and partly because the name has bad connotations. Weston, after all, was a real estate "bust." Moreover, its name became associated with the fight over open housing that occurred when the site selection was announced. The facility is currently called the National Accelerator Laboratory, and it is often identified with the nearby town of Batavia. But the Atomic Energy Commission has already announced that the laboratory will be rechristened the "Enrico Fermi Laboratory" in 1972, in honor of the late pioneer in nuclear



Aerial view of the National Accelerator Laboratory site, looking eastward, toward Chicago, which is 30 miles away.

studies. Meanwhile, a public baffled by the terminology of high-energy physics has been devising its own names. Letters arrive addressed to the "National Exhilirator Laboratory," the "National Archaeological Laboratory," and the "National Exterminator Laboratory."

The new laboratory can be described by some impressive statistics. The site covers a total area of about 6800 acres —more than 10 square miles—all of it donated to the Atomic Energy Commission by the state of Illinois as part of the inducement to locate the accelerator in Illinois. The state put up $30 million to buy the necessary land, and some farmers collected close to $1 million in compensation for the loss of their holdings. The total cost of the project, exclusive of land, is estimated at $250 million for construction plus an additional $60 million for research equipment that will be bought during the construction period. Annual operating costs are estimated at about $60 million.

The public relations handouts distributed by the laboratory boast that the accelerator will be the "world's largest single instrument for basic research." The main ring has a diameter of about 1.25 miles and a circumference of about 4 miles. It uses almost 1000 magnets, each 20 feet long and about 10 tons in weight, to bend the protons into a circular path. The accelerator has a few new design features, but by and large it will simply be the Cadillac of the proton synchrotrons—bigger and better than its predecessors but not significantly different from the lower-priced models. As Edwin L. Goldwasser, deputy director of the laboratory, expressed it, the accelerator embodies "a lot of ingenious things that have resulted in economies, but nothing dramatically new in design."

The driving force behind the accelerator's progress so far has been Robert Rathbun Wilson, an acknowledged master builder of high-energy machines, who was appointed laboratory director in 1967. Wilson was not the first choice for the post—that honor fell to Edward Lofgren, head of the original design group at Lawrence Radiation Laboratory—but after Lofgren turned the job down, there seems to have been virtual unanimity that Wilson was the obvious choice. He had directed the cyclotron group at Los Alamos during the war, had helped design a cyclotron at Harvard, and had built a succession of electron synchrotrons at Cornell. Wilson seems to have insisted on considerable autonomy before accepting the job at Batavia. The laboratory is legally operated for the Atomic Energy Commission by an organization known as Universities Research Association, Inc. (URA), a sprawling consortium of 50 research-oriented universities. But in actuality URA seems to have granted Wilson great freedom to develop the lab as he sees fit.

There were some initial fears that it might be difficult to staff the laboratory, but these have not materialized. Indeed, with the job market tightening for scientists and engineers, there has been no dearth of applications. There are currently more than 660 employees, of whom about 135 are scientists and engineers. By 1975 the staff is expected to reach 1700. Wilson's key assistants include Goldwasser, the deputy director, who was professor of physics at the University of Illinois and who is a member of the General Advisory Committee to the AEC; M. Stanley Livingston, associate director, who collaborated with the late E. O. Lawrence in building the first cyclotron and who headed the Cambridge Electron Accelerator; Thomas L. Collins, associate director, who had been assistant director at the Cambridge accelerator; Francis T. Cole, assistant director, who participated in the original design studies at Berkeley; and Donald Getz, assistant director, who came from the University of Chicago.

Subordinates at the laboratory give Wilson most of the credit for driving the accelerator toward completion ahead of schedule and at higher-than-

expected energies, but Wilson chalks it all up to luck and the drive and dedication of his staff. "We've just been lucky everywhere," he said.

Take the matter of reaching 500 Gev from the start of operations. Originally the plans had called for opening at 200 Gev but retaining the capability of boosting the power to 400 Gev, possibly even 500 Gev, at a later date. These plans represented a compromise between the desire to hold down costs and the desire to achieve high enough energy to retain world leadership for some years to come. The machine was to be fitted with magnets capable of reaching 400 to 500 Gev, but would lack the power supply and cooling system needed to reach the higher energies. The idea was that additional power and cooling could be added later if desired. Then, at the last minute, there were some lucky breaks. The cost of the transformers needed for higher power turned out to be less than expected, and, most important of all, there was an unexpected advance in the technology of thyristors, which are used as rectifiers in the power supply. The net result was that it became possible to install from the beginning a power supply adequate for 500 Gev at smaller cost than was originally estimated for 200 Gev. Moreover, tests on production magnets made it clear that they will be effective at fields needed for 500 Gev. "The technical developments made it possible," Wilson said. "I didn't think about what great discoveries could be made at 500 Gev. It was just efficient, economical, and possible to do it right now."

The cooling capacity will not be upgraded at this point. But, by lowering the intensity of the beam somewhat, it will be possible to operate the accelerator at 500 Gev using the cooling capacity designed for 200 Gev.

Luck on Timing

Similar good fortune played a role in advancing the date at which the accelerator is expected to become operational. One stroke of luck occurred when a number of major contracts were let shortly before a national directive was issued on 4 September 1969 requiring a 75 percent reduction in new building financed by the federal government. "Had the directive been issued a few months earlier it would have had a devastating effect upon the accelerator," according to a report issued by URA. The laboratory has also been fortunate in that there have been no major strikes and few delays caused by bad weather. Moreover, contractors have come in with surprisingly low bids and have completed their work on time.

Luck is hardly the only reason for the laboratory's progress, of course. The advance in schedule results largely from a deliberate decision—taken in response to reduced funding levels—to concentrate on producing high energy protons while ignoring construction of some other parts of the laboratory. Ultimately a 14-story high-rise building will be built to give the site a visual focal point and provide the denizens with a panoramic view of the otherwise dull Illinois landscape. But, for the time being, the staff is operating out of the 100 abandoned houses that were once Weston (now called NAL Village), supplemented by some old farmhouses and some additional buildings that were thrown up to house the operations.

Bubble Chamber Reduced

Other parts of the laboratory that are being delayed or reduced in scope include the computing facilities and the shop and warehouse area. The laboratory has also abandoned, at least temporarily, a proposal to build a 25-foot bubble chamber in conjunction with Brookhaven National Laboratory, and will settle for a much smaller one.

The experiments that will be performed first—around the middle of 1971—will be run by the laboratory staff on a "catch as catch can" basis while construction continues. They will utilize targets that are inserted into the main ring. When the accelerator goes into ordinary operation, around the middle of 1972, the beam will be extracted from the main ring and fed into an external experimental area.

Wilson's influence seems omnipresent on the site. "Very little goes on that he doesn't have a hand in," says one staffer. Another associate reports that Wilson amazed the group of four architectural engineering firms doing the detailed engineering plans by continually questioning small items. "Bob goes through the plans in detail," the associate said. "Sometimes he'll have a temper tantrum and throw them on the floor because they cost too much or they destroy the aesthetics of the site. The first time he tore up the plans the engineers were flabbergasted."

Wilson is said to be particularly keen on the use of competition to keep contractors and suppliers on their toes. There are even two janitorial services working on the site so that neither gets complacent and assumes he can goof off. Wilson also continually stresses aesthetics. He has rejected plans for a pumping station that marred the sweep of the landscape, and he has taken pains to preserve the stands of trees that relieve the monotony of the Illinois prairies. One of his personal touches was to import a herd of six buffalo from Colorado, thereby creating a tourist attraction, generating some newspaper publicity and upstaging the white deer at nearby Argonne National Laboratory.

With construction progressing so well, increasing attention is being focused on the question of what experiments will be performed on the new machine and by whom. Meetings have been held with potential users, and an advisory committee has been appointed to help decide what experiments should be run, but the decision will essentially be Wilson's. About three-fourths of the experiments will be performed by outsiders and one-fourth by the laboratory staff. Proposals for the initial experiments—those to be performed after normal operations begin in 1972—are due by 15 June. Since many of the experiments proposed are apt to be similar in nature, Wilson may be in the touchy position of deciding which of two competing investigators will be given first crack at the machine and thus, conceivably, will be in position to perform the pioneering research that might lead to a Nobel Prize. But Wilson doesn't seem troubled by the delicacy of his position. "The question of Nobel Prizes is a personal problem," he said. "As long as the physics gets done by someone, I'm not going to lose sleep worrying about it."

Not everyone is pleased that the accelerator is being built, of course. At the recent meeting of the American Physical Society in Washington, D.C., several young dissidents complained that money was being spent on such a "frivolous" project. They suggested that the chief reason new accelerators are built is to keep the accelerator builders employed, and they suggested that the $250 million which will be spent to build the new machine might better be spent to solve urgent social problems or to support the work of young scientists who are now finding it difficult to find employment. But given the fact that the accelerator project is under way—and that there is no likelihood it will be junked—the progress made to date must be considered a rousing success story. Wilson and his colleagues have their fingers crossed that their luck will continue to hold.—PHILIP M. BOFFEY

2. CERN

Geneva. While construction proceeds on the high-energy accelerator at Batavia, Illinois, the European Organization for Nuclear Research (CERN) is still seeking enough multinational harmony to get started on a competitive machine. And once again the news from CERN is that the accelerator designers, confronted by new political difficulties, have produced a new plan. This time, however, the plan involves a radical departure from the past, for now it is proposed that the new accelerator be built on farmland right next to CERN's existing facilities, which are near here, on a 1-kilometer-square site bisected by the French-Swiss border.

Throughout a decade of discussions, it was a given of the situation that, because space was lacking at CERN's present site, the new machine would have to go elsewhere, since additional nearby land was considered unobtainable. On the basis of this assumption, site proposals, involving some considerable expense for preparation, were submitted by France, West Germany, Austria, Belgium, and Italy. But West Germany later took the position that since it would be the largest single contributor to the costly venture, the machine should be built on German soil or Germany would reconsider its interest in the project. This view of the matter, formulated at cabinet level, was based on the Germans' feeling that they had had enough of being the biggest payer without ever having any of Europe's cooperative ventures located within their borders. Should this keep up, they warned, German legislators would rebel, and, regardless of how Europe-minded the government wished to be, it might find it difficult to obtain further appropriations for international high-energy physics. On this issue, the discussions became deadlocked, and so they have remained throughout this year.

Confronted by a political impasse and lacking the close government ties that have proved so valuable for their counterparts in the United States, the staff for the proposed accelerator, headed by Britain's John B. Adams, sought to devise a technical solution to a political problem. After literally looking out their windows toward some 16 square kilometers across the road, mostly farmland and mostly in France, they held some very quiet conversations with French authorities and con-

M.I.T. Administration Makes Public Its Intentions

Cambridge, Mass. The Massachusetts Institute of Technology has reached what may be a resolution of its responsibilities toward two of the largest and most distinguished university defense research centers, Lincoln Laboratory in Lexington, Mass., and Draper (formerly Instrumentation) Laboratory in Cambridge.

A decision to cut loose from Draper while retaining ties to Lincoln, already approved by M.I.T.'s Corporation (trustees), was announced to the faculty 20 May by President Howard W. Johnson. The decision constitutes, in effect, a declaration that M.I.T. wants to get out of developing specific weapons systems (as at Draper) but will continue working on broader military problems (as at Lincoln).

M.I.T. decided to begin the tortuous and lengthy process of divesting itself of Draper because it had failed in the short run to find the money needed to implement a policy of "converting" the two laboratories toward a greater civilian emphasis. Furthermore, Draper Laboratory insisted on continuing its "cradle to the grave" involvement with specific weapons systems such as guidance for Poseidon multiple-warhead missiles (MIRV's) and a possible winged successor called SABRE (Self-Aligned Boost and Re-Entry), which would be equipped to maneuver almost all the way down to its target.

Draper Laboratory, with nearly 2000 employees, had a budget of $54.6 million in the year ending 30 June 1969, of which the National Aeronautics and Space Administration supplied $28.4 million (mostly for guiding Apollo mooncraft), the Navy $17.3 million, and the Air Force $7.2 million. The remaining $2 million came from the Army, the Atomic Energy Commission, the Federal Aviation Administration, and various industrial firms. When divestment of Draper is complete, a year or more from now, M.I.T. will lose some $5 million a year in compensation for administrative functions. This pours into M.I.T.'s general treasury and helps support such activities as the library and health services.

Lincoln, with 1770 employees, of which 594 are classed as "professionals," had a 1968–69 budget of $65.5 million, all but $1 million of it from a single Defense Department contract.

During the same period, M.I.T.'s on-campus research, all of it nonclassified, totaled $55.8 million, of which $49 million came from the federal government, including $16.9 million from the Department of Defense.

Although Lincoln worked during the 1950's on developing the Semi-Automatic Ground Environment (SAGE) and Distant Early Warning (DEW) bomber-detection systems, and the Ballistic Missile Early Warning System (BMEWS), its emphasis has become increasingly academic and general. Classified work now accounts for only 40 percent of the total. Lincoln's broad work on communications, radar, and other electronics problems has led it into such nonsecret projects as the 130-foot (39.6 m) "Haystack" radio telescope near Tyngsboro, Mass., and the Large Aperture Seismic Array in Montana.

The process of divestment of Draper will take place in two steps. The first step begins 1 June with the formation of a separate Draper Laboratory division under a ten-man board of directors, temporarily headed by the Laboratory's sprightly, 68-year-old founder, Charles Stark Draper, and including James McCormack, former M.I.T. vice president for defense labs and recently retired chairman of COMSAT; Carl Kaysen, director of the Institute for Advanced Study in Princeton, N.J.; and Emanuel R. Piore, former chief scientist of the Office of Naval Research and now a vice president and chief scientist of IBM. The board will work on such problems as the exact

cluded that there was no reason why a redesigned accelerator could not be constructed within a proton's throw of the present CERN campus and its 28-Gev accelerator. History records that over the years suggestions for using nearby land were raised now and then, but the five bulging proposals for faraway sites are ample evidence of the long-standing assumption that the new laboratory would have to go elsewhere. In fact, most of CERN's 12 member nations have already ratified a treaty to provide a legal basis for a second CERN.

Just how, if at all, a site within France gets around the German objection is not clear. But it has been suggested that the new plan provides the Germans with a face-saving exit; furthermore, some people hope that the Germans will have an incentive to take that exit, since building and operating next door to the present CERN center is expected to be considerably less costly than setting up an altogether new research facility at a distant site. All that the Germans will say at this point is that the decision was made by the cabinet and can be unmade only at that level. Some of them express puzzlement as to why they should be interested in a face-saving exit. Nevertheless, advocates of the new plan strongly hint that the Germans are sympathetically interested.

The views of the present tillers of those 16 square kilometers are yet to be expressed, but it may be that no one has yet told them the news. CERN officials explain that the matter is naturally a sensitive one and must be broached in a suitably diplomatic fashion. They explain that, since it is planned to put the accelerator underground so as to get down to a firm foundation, there will be little permanent disruption of the surface; few, if any, of the buildings that are there now will be affected and, when the work is completed, the present farming activities will in all likelihood be able to continue. As for the French government, it is still formally backing the site that it has offered near Saint-Tropez, but then there are reports that it is backing a site in an economically depressed region of Belgium, motivated either by a desire to block the German site or to induce the Belgians to buy more Mirage fighter planes, or both. But it is said that the French like the new plan and have quietly approved of it. Sites in Austria and Italy are also on the official list, but have never been considered seriously in the running.

The possibility of using land next to CERN's present laboratory is enhanced by another aspect of the newly pro-

on Disposition of Draper and Lincoln Laboratories

form of private corporation into which the lab will be converted, the search for a new laboratory director, and the transfer of pension rights and union wage contracts to the new firm. The second step, total separation, could come within a year or could take much longer, Johnson told the faculty.

The decision on the laboratories culminates a year and a half of dissent, demonstrations, and take-overs. The almost continual crisis began in the fall of 1968 when a soldier absent without leave was harbored in the M.I.T. student center for a few days until police arrested him. The incident crystallized antiwar feeling among many M.I.T. students and faculty who had shied away from protest until then. Among the results were the all-day discussion of the dangers of science held at M.I.T. and other campuses on 4 March 1969 and a demonstration against Draper lab's work on Poseidon in which demonstrators burst into Johnson's office.

On 25 April 1969, Johnson announced formation of an all-institute panel under Dean William F. Pounds of the Sloan School of Management to consider M.I.T.'s future ties to the laboratories. The panel proposed, on 31 May, a policy of gradual conversion to civilian projects like air traffic control and declared the Poseidon program "inappropriate for Institute sponsorship." That view was specifically endorsed by the M.I.T. Corporation on 3 October.

The fall term of 1969 opened with an announcement that Draper would step down as head of the laboratory (which was to be renamed for him) on 1 January, 6 months earlier than planned. But radical pressures continued to rise. Demonstrators disrupted a General Electric recruiting session on 29 October, blocked one entrance to a Draper Laboratory building on 4 November, and occupied Johnson's office for several days in January, causing $6000 in damage before they left.

In late December, it was announced that Draper would not merely be a consultant to the lab, but would be called deputy director. This move was taken as a sign that Draper was definitely going to stay and fight. Both at M.I.T. and in the press, he continually predicted that significant funds for conversion would not turn up and asserted that the military guidance work of the lab was essential to the nation. With characteristic impishness, Draper created several minor storms with his predictions, beginning a year ago, that he might, regretfully, have to take his people away from M.I.T., that he hadn't resigned as director but really had been fired, and that officials within NASA were thinking that Draper's lab, once separated from M.I.T. would be an ideal tenant for the just-completed buildings of the Electronics Research Center, whose closing was announced 29 December.

Early this year it became apparent that potential money for big, new, civilian projects had evaporated. On 25 March the Department of Transportation announced it would take over the NASA center in Cambridge on 1 July and rename it the Transportation Systems Center. This step dried up any loose money for air traffic control research at Draper lab, and the M.I.T. administration realized there was no alternative to divestment.

The decision to cut loose Draper amounts to trading one headache for another. With the issue of Defense-related laboratories at least partially settled, M.I.T. must begin immediately to seek millions of dollars in new research support. As Hill said immediately after the announcement, "We'll have to live by our wits."

—VICTOR K. MCELHENY

Mr. McElheny, a former European correspondent for Science, *is now science editor of the Boston* Globe.

NEWS IN BRIEF

• **DEFENSE CONTRACTS AT STONY BROOK:** The faculty senate at the State University of New York at Stony Brook has passed a resolution urging the university community not to seek new research grants or contracts from the Department of Defense and not to renew existing grants or contracts. The recommendation applies to both classified and unclassified research. Some universities have previously banned classified research, but none is known to have banned all military research. The faculty action is an advisement to the president of Stony Brook, who has taken the matter under consideration.

• **BELL LABORATORIES**: Bell Telephone Laboratories has revealed it is getting out of the missile defense business after it finishes its current contracts on the Safeguard Anti-Ballistic Missiles. A company spokesman said that Bell originally agreed 15 years ago to work on government contracts when Bell had "unique capabilities" for the work, but that the company has long wanted to shift the contracts to other companies as soon as the others developed similar capabilities. Bell wants to shift some of its 16,000 personnel working on the ABM into civilian areas. A spokesman said rising protests against defense contractors also played a minor role in the decision.

• **NSF BUDGET**: The House, acting on the advice of its Appropriations Committee, on 12 May approved a 1971 appropriation for the National Science Foundation of $497 million. This was $16 million less than President Nixon had requested and $30 million less than the House Committee on Science and Astronautics had recommended. The Senate has yet to act on the NSF budget.

• **INADEQUATE STUDENT FINANCIAL AID:** The National Association of State Universities and Land-Grant Colleges has revealed that financial aid offices on campuses across the nation are running out of money long before all student requests have been filled. Michigan State University and Ohio State University report they were forced to refuse approximately 1500 requests each. The situation is attributed to the fact that aid requests are increasing because of spiraling college costs while the amount of money available for students is tightening because of a slowdown in federal funding, the reluctance of some banks to make loans under the Guaranteed Student Loan Program, and the failure of some state legislatures to provide adequate appropriations.

• **CONTROL OF SULFUR OXIDE EMISSIONS:** A panel of the National Academy of Engineering and the National Research Council states that the emission level of sulfur oxides resulting from the use of sulfur-bearing fuels to generate electrical energy will be more than four times as great by the year 2000 unless immediate action is taken to control the problem. The panel further states that there is no commercially proven technology for control of such sulfur oxides (which are second only to automobile emissions as a cause of air pollution). These conclusions and others are contained in *Abatement of Sulfur Oxide Emissions from Stationary Combustion Sources* which will be available in a month or two for $3 from the Clearinghouse for Federal Scientific and Technical Information, 5285 Port Royal Road, Springfield, Virginia 22151.

• **YORK'S BIGGEST MISTAKE**: Herbert York, former research chief in the Pentagon, expressed chagrin last week at how he once supported development of chemical and biological weapons. "When I was director of Defense Research and Engineering under President Eisenhower," he said, "I believed that some chemical and biological weapons, especially the nonlethal variety, could be usefully incorporated into our defense arsenals and might, in some degree, make war more humane. I have come to realize that the situation is very much more complicated than I had then thought it was. Indeed, these weapons generally make war more inhumane especially when used in conjunction with conventional weapons. I consider my earlier support of biological and chemical weapons to have been perhaps my biggest mistake of that period." York made the comment while releasing a statement by the Federation of American Scientists opposing the use of chemicals in Vietnam. He chairs the FAS Council.

posed plan. This calls for making the accelerator considerably smaller in diameter than was originally considered desirable—1.8 kilometers, as compared with the 2.4 kilometers that figured in earlier designs. The smaller version, it is said, can fit comfortably onto the adjacent land without affecting various clusters of dwellings there. But, though smaller, it would hold the potential for far greater energies than were anticipated earlier because it would be equipped with the new separated function magnets, rather than with the conventional combined function type planned earlier. With the new magnets it would be possible to reach at least 300 Gev with the smaller diameter, and that is considered to be the minimum figure desired. But there is also a possibility that the accelerator might be raised to the 800- or 1000-Gev level. This hinges on progress in developing superconducting magnets, on which research is now being conducted in Europe and the United States. If they become available within the next few years—and the present signs are good—then the new CERN machine could go ahead of Batavia in energy, which is no small matter in CERN's planning. Superconductivity, however, remains to be proven, and CERN's designers and users are eager to start building. This leads to still another idea, one that is referred to as the "missing-magnet" plan, which, if successful, leads in turn to the solution of a bundle of difficult problems—scientific, technical, political, and financial.

Start at 150 Gev

Since CERN wants to start building the new machine as soon as possible and since superconductivity is still uncertain, the plan calls for starting out with separated function magnets, but at the outset putting in only half the number that could ultimately be accommodated. This would guarantee at least 150 Gev, which would put CERN behind Batavia in both starting date and energy. On the other hand, Batavia is cost-cutting on computer and bubble chamber facilities, and CERN is planning to use its extensive present facilities in support of the new machine; thus, a start up at 150 Gev might still be on the frontiers of particle physics. If superconductivity does not prove feasible, the remaining spaces could be filled with magnets of the type that were installed in the first round, bringing the energy up to 300 Gev. Batavia

would then be far in the lead, but CERN would be a powerful No. 2, and the Soviets' 76-Gev proton synchrotron at Serpukhov, currently the world's most powerful, would be in third position. But if superconductivity does work out, the empty spaces could be filled with superconducting magnets; eventually, the conventional ones installed at the outset would be removed and the entire ring would be equipped with the new and more powerful magnets. In this circumstance, Director Adams says, there are good possibilities of getting to 1000 Gev.

Rated high in the charms of the Geneva/missing-magnet plan are the financial savings that are expected in both construction and operations, plus the possibility that lower costs might induce more members of the present CERN consortium to sign up for the new machine. Legally, it is a separate venture, and so far only the five countries that offered sites, plus Switzerland, have agreed to share the cost. Standing aside from the project are Britain, whose decision was a near deathblow, Denmark, Greece, Sweden, the Netherlands, and Norway. Thus, it is six in and six out, a division that is considered to be eroding the famously smooth cooperative spirit that long made CERN a model of international cooperation. It is Adams' hope, however, that a substantially lower price tag, plus sharply reduced operating costs, might attract more participants, especially in his own country, which cited financial difficulties when it announced in June 1968 that it would not join the venture. Cost estimates have varied over the years as the designs have been revised for one reason or another, but a smaller diameter for the accelerator and the use of some of the existing experimental facilities at CERN are expected to bring the construction cost down to approximately $250 million; the most recent previous figure for construction was $330 million. With the two laboratories on one site, it is estimated that the total staff would be about 5000, rather than 7400, and that operating costs would be reduced by about 25 percent. (CERN currently has a staff of about 3000, plus 500 to 600 long-term visitors.)

Many laborious steps remain to be taken before CERN can go ahead. First it will be necessary for the West German government to reverse its position, and there is no public sign that it is disposed to do that. Then the CERN Council has to approve the plan; it will meet in mid-June, but it is doubtful that it will take up the new proposal at that meeting. Then many past actions will have to be undone to clear the way. At present, CERN is formally committed to building a conventional accelerator at one of five sites, all remote from Geneva. It took scores of meetings over 3 years to get that far.—D. S. GREENBERG

Campaign GM: Reformers Lose on Vote but Not on Influence

When the "Campaign to Make General Motors Responsible" first began arousing interest on university campuses this spring, Willis J. Winn, dean of the University of Pennsylvania's Wharton School of Finance and Commerce, speculated that GM would probably "vote down the [campaign's] proposals and then turn around and do something about them." Events during and associated with General Motors' annual shareholders meeting on 22 May in Detroit suggest that Winn may have spoken prophetically.

Campaign GM was announced in February by Ralph Nader, who was not, however, formally a part of the project. It has been run by four young lawyers operating on a shoestring budget out of a suite of cluttered offices in an old brownstone off Washington's Dupont Circle, the capital's gathering place for hippies. Twelve shares of General Motors, out of the 285 million shares outstanding, were purchased to qualify the Campaign GM staff as shareholders. The campaign has had two immediate goals. One was to demonstrate that the stockholders' meetings of GM and other large corporations are not an exercise in "corporate democracy" but a charade. The other was to persuade General Motors' major institutional shareholders to demand that GM open itself up to a kind of "social audit," make its board of directors less of an exclusive club for wealthy industrialists and financiers, and make a larger commitment to solving such problems as air pollution, highway safety, and job opportunities for minorities.

After the shareholders' meeting, James Roche, General Motors' board chairman, said that the GM management had received a large and gratifying vote of confidence. In a sense this was true, but Campaign GM had succeeded in generating among the universities, foundations, and other institutional shareholders pressures for change at General Motors. And, while the affairs of major corporations may be as much of a mystery as ever to most Americans, Campaign GM has afforded some of them a glimpse behind what Nader calls the "chrome curtain."

Many newspapermen who have had experience covering nearly every branch and level of government—from city hall to Congress, the White House, and the Supreme Court—have never attended a stockholders' meeting, even though the largest American corporations are veritable "subgovernments" which, directly or indirectly, affect the lives of millions of people. General Motors, by far the world's largest corporation, employs nearly 800,000 people and its gross receipts last year of $24.3 billion were greater than those of the governments of West Germany or Japan. In past years, GM shareholders' meetings have usually been covered by a few dozen business and financial writers. But, because of the interest generated by Campaign GM, the meeting last Friday was attended by about 130 reporters and many of their stories got "page one" play rather than being relegated to the business pages. What these reporters witnessed was in fact a charade.

The some 2600 stockholders at the meeting were mostly small shareholders from Detroit and nearby communities. Most were people fervently loyal to the company management, which was given a standing vote of confidence at the meeting's outset. As always, several "professional" minority shareholders such as Lewis D. Gilbert and Wilma Soss from New York were present.