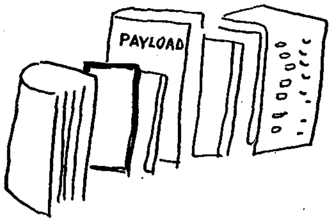
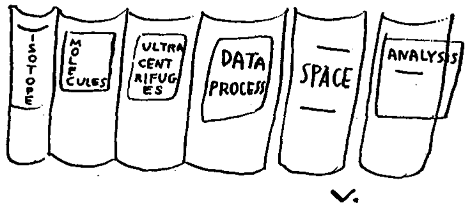




When Pure Science Meets Pure Politics

DANIEL S. GREENBERG

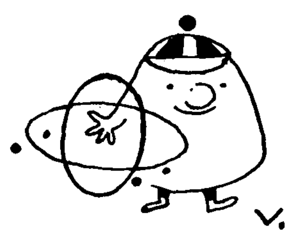
By Lyndon Johnson's own account —he said so in a letter to Senator Hubert Humphrey (D., Minnesota)—the civilian item that most occupied his attention in the frantic post-assassination budget review concerned something of which few Americans have ever heard, fewer would ever see, and scarcely any could understand.

Specifically, it was another entry in the growing series of furious pork-barrel fights over scientific facilities, this time involving a huge and controversial piece of scientific gear properly called a Fixed Field Alternating Gradient Synchrotron, referred to by scientists as the FFAG machine, but known to the layman, if at all, as a new kind of atom smasher or high-energy accelerator. For the Midwestern scientists who designed FFAG, it was unquestionably a tantalizing piece of scientific apparatus, but with construction costs estimated at $170 million and annual operating costs at a minimum of $30 million, Midwestern congressmen found it even more tantalizing for its pork-barrel implications. And, in an era when Federal research and development have come to exceed public works in pork potential ($15.2 billion compared with $7.2 billion, respectively, in the coming fiscal year), the accelerator quickly became the rallying point for one of the most tangled, bitter, and revealing fights ever to spill over from pure science into pure politics. Eventually, the fight itself achieved such high-energy proportions that the President had to serve as arbiter among the conflicting parties.

For background purposes, it should be noted that as military and space hardware, as well as many civilian products, becomes more complex, industry has tended to favor plant sites close to thriving university research centers. These centers—the Harvard-MIT complex is a good example—provide a pool of scientific and engineering consultants for industrial needs, and they also provide an attractive setting for highly specialized technical personnel, many of whom like to keep one foot in the academic world. Thus, industry and jobs tend to follow science, and, with this in mind, Midwestern congressmen have been angrily complaining that university research centers in their region have not been getting a fair share of the annual Federal outlay for research and development.

Money Runs in Circles

The crystallizing of their sense of injustice can be precisely dated to June



19, 1962, when the Defense Department, which spends about half of the Federal R&D budget, issued a remarkable booklet entitled "The Changing Patterns of Defense Procurement." Reporting that in the previous year California and the Eastern Seaboard states had received seventy-five per cent of Defense R&D expenditures, and that Ohio led the Midwest with only 2.3 per cent, the department quoted a study made by the Graduate Research Center of the Southwest that concluded:

"Management planners, in considering sites for new or expanded facilities, have found that the availability of trained minds overshadows even such factors as the labor market, water supply, and power sources. The evidence is overwhelming: Route 128 encircling Boston, the industrial complex around San Francisco Bay, that related to the California Institute of Technology and UCLA in the Los Angeles area, and similar situations are cogent examples of the clustering of industry around centers of learning."

Not only do production contracts follow research contracts, the report stated, but the acquisition of production contracts in turn leads to the ability to strengthen research staffs. "The process is circular; and it regenerates itself," the booklet concluded. It went on to point out that in 1961, while universities and nonprofit research institutions in California and Massachusetts were receiving $207 million in Defense research contracts and grants, Illinois, Michigan, and Ohio together accounted for a total of only $53 million.

For obvious reasons, the report became required reading among Midwestern legislators, industrialists, and university presidents, and in their ranks there quickly developed a bipartisan determination to see to it that the Midwest got a bigger slice of Federal R&D expenditures as a first step toward the even bigger procurement expenditures.

During this same period, by coincidence, the administration's scientific advisers had concluded that it was time to lay long-term plans for the future of high-energy physics. The need for looking far ahead was inherent in the high-energy physicists' working tool—the nuclear accelerator, an immense piece of apparatus that is employed to probe the structure of the infinitesimally small particles that make up the nucleus of the atom. This is accomplished by using energies in the multibillion-electron-volt range to hurl subatomic particles, usually around a circular track, into collision with other particles. When the particles collide, even smaller components fly off, whereupon, through various precision devices, the nuclear physicist can obtain data on their composition.

The key to progress in this work, considered by many to be one of the most exciting frontiers of fundamental science, is the amount of energy that goes into the collision. The greater the energy, the deeper the physicist can probe into the heart of the atom. In the cyclotrons of the 1930's, the energies were measured in millions of electron volts. But after the war, accelerators came into use employing billions of electron volts (bev) that hurled particles around tracks as much as a half mile in circumference. While using these high-energy machines, physicists were laying plans for even more powerful machines, so complex that their design and construction would take at least a decade. And it was these plans for the future that brought the nation's two great high-energy physics centers—the Berkeley, California, Lawrence Radiation Laboratory and Long Island's Brookhaven National Laboratory—into battle with each other and with two lesser Midwestern centers. Each, in alliance with neighboring universities, was determined not to be left behind in the evolution of high-energy physics.

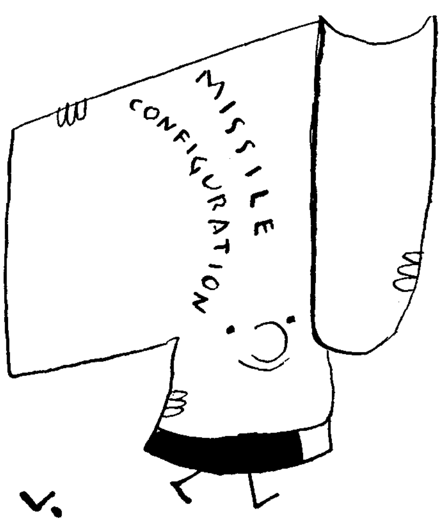
The main difficulty was that high-energy physics had rapidly become the nation's most expensive single scientific specialty, and some hard choices were going to have to be made. Almost entirely supported by the Federal government through the Atomic Energy Commission (the field is too remote from commercial utility to interest industry, and too expensive for any university to make more than token contributions), high-energy physics was budgeted in fiscal 1963 for $143 million to support the nine accelerators then in operation or soon to be. By comparison, the Federal government's chief channel for supporting cancer research, the National Cancer Institute, spent $119 million in that year. Clearly, in the quest for high energies, the machines were becoming astronomical in cost—and since the high-energy physicists were laying plans for machines that could cost as much as $1 billion each to construct, it was essential to lay out an order of priority if the present pace of research was to be maintained.

A Thousand Bevs to Choose From

The task, accordingly, was entrusted to a ten-man panel, chosen no doubt for its scientific ability but also with the sort of geographical care that is traditionally afforded Vice-Presidential candidates: three from Eastern universities, three from Midwestern universities, three from West Coast universities, and one nonuniversity scientist, home-based in Washington and presumably without regional bias.

The facts facing the panel were these: Brookhaven, which in 1960 had put into operation the nation's largest accelerator—33 bev—was working on plans for an 800- to 1,000-bev machine with a particle track some ten to twelve miles around, which would cost at least $800 million to build and at least $170 million a year to run. The machine would not be completed until 1978. At the same time, the Lawrence Radiation Laboratory was at work on designs for a 200-bev machine that could be fully operational six years earlier.

Meanwhile in the Middle West, a much smaller ($50-million, 12.5-bev) machine, known as a Zero Gradient Synchrotron and called the ZGS or "ziggy" for short, was nearing completion at the Argonne National Laboratory near Chicago. Though dwarfed by Brookhaven's 33-bev accelerator, it was considered an extremely fine instrument and was expected to appease the Midwestern physicists who had long complained that they had to travel too far to carry out their research. And finally, at Stoughton, near the University of Wisconsin, a special group of forty scientists and engineers organized by a fifteen-university combine known as the Midwestern Universities Research Association (MURA) was completing design work on a somewhat new type of accelerator, the FFAG. The virtue of this 10- to 12.5-bev machine was that it would provide higher intensities—that is, thicker streams of particles to fire at the target. A few years earlier MURA had lost out in a bitter fight to Argonne as the AEC's choice to build a Midwest machine, but the MURA group nevertheless stayed together, living on the hope that its high-intensity design would still win AEC's approval.



With these facts before them, the panel and the advisers it summoned settled down to work out the priorities for the next generation of accelerators. To the Argonne people, the MURA group represented nothing but competition for AEC's money and attention, and Argonne proceeded to bombard the AEC's Washington headquarters with memoranda attacking MURA's motives and scientific utility. In turn, MURA argued that its designs were close to completion, that it couldn't hold its research group together indefinitely on nothing but hope, and that its machine, though of only 10 to 12.5 bev, was designed to perform experiments that would be impossible with other machines. Argonne replied that with modest modifications, its soon-to-be-completed machine could do anything MURA's could do.

Prominent East and West Coast physicists argued that the quest for higher energies should take precedence over any of the Midwest's seemingly trivial plans. All this took place against a background of growing Congressional agitation over the burgeoning Federal research budget—the total had increased fivefold since 1954—and the White House science advisers, with a better feel for the Washington scene than the out-of-town panel members, accordingly cautioned the panel to be price conscious.

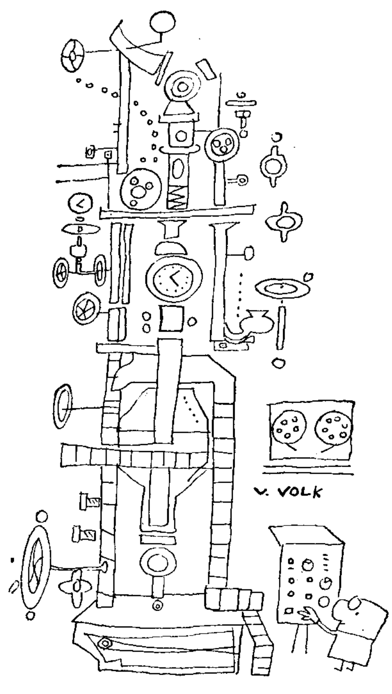
The result was a delicately worded series of recommendations—"expensive and restrained," as the panel put it—calling for an $8-billion program of construction and operations running through 1981. The panel agreed that MURA's FFAG had much to commend it as a scientific instrument, but the pressing need was for the higher energies proposed by Brookhaven and Lawrence. The first step, therefore, should be the "earliest possible" construction of the 200-bev Lawrence machine. Next, the panel said, Brookhaven should carry out intensive design studies for its 800- to 1,000-bev machine while modernizing its 33-bev machine. MURA's FFAG should be built only if its construction would not delay "the authorization of the steps toward higher energy." The order of priorities, which called for high-energy physics expenditures of $218 million in fiscal 1965, obviously put MURA out of the picture.

Barrage from the Midwest

Immediately, irate Midwestern university presidents bombarded their congressmen; and the congressmen, who needed no prompting, proceeded to direct every traditional badgering device at the White House science advisers, the Bureau of the Budget, the Atomic Energy Commission, and, whenever they got a chance, at John F. Kennedy himself. Typical of this political barrage was a letter from Senator William Proxmire (D., Wisconsin) to Jerome B. Wiesner, Kennedy's science adviser. Proxmire started by pointing out that he had recently become a member of the Senate Appropriations Committee, and then went on to predict: "The failure to approve an accelerator for the Midwest would seriously compromise the prospects for approving a $250-million accelerator on the east or west coasts a few years from now. . . . I say this not with any notion that there might be some kind of political retaliation. I say this from the standpoint of realism."

Eventually, the political pressure became so intense that the White House science advisers reconvened the advisory panel to seek a more clear-cut recommendation. The panel members failed to clarify the issue, and some went off grumbling that the White House was asking for a scientific decision when in reality it wanted a political decision. By then, November was at hand, and the time was approaching to settle the MURA issue so that the fiscal 1965 budget could be sent to the printers. About the middle of the month, word spread through the Midwestern congressional delegations that Hubert Humphrey was feeling highly optimistic about MURA after speaking to Kennedy. Such was the state of affairs when Lyndon Johnson succeeded to the Presidency on November 22.

THE Midwesterners, eager to nail down the issue, resumed their barrage, and it took President Johnson no time at all to recognize that deep political trouble was stirring inside this seemingly esoteric scientific row. Accordingly, he held two meetings



of about an hour each in December with Wiesner, Chairman Glenn Seaborg of the AEC, and Kermit Gordon and Elmer Staats, director and deputy director, respectively, of the Bureau of the Budget. Later, he also called in representatives of the MURA group and about a half dozen Midwestern congressmen. At this meeting, without openly committing himself one way or the other on the MURA project, he repeatedly stressed that the budget was being pared to the bone and that many worthy ventures would have to be put aside. Shortly afterward, the Midwesterners learned that AEC had given the MURA project the kiss of death by writing a $500,000 item into its budget to close it out.

The reaction among the Midwesterners was volcanic. Hubert Humphrey carried the message to the White House that the whole national program in high-energy physics might be jeopardized by the blow at MURA. Not long afterwards, Humphrey, at the President's suggestion, met with Wiesner and Seaborg to discuss the matter, and several days later Johnson revealed in a letter to Humphrey that the MURA verdict would be significantly modified. Noting that he had "devoted more personal time to this problem than to any nondefense question that came up during the budget process," Johnson went on to say that the MURA design group—which was unofficially slated for dissolution—would be able to continue in existence at Argonne. The President then added a word or two about co-operation: "I share fully your strong desire to support the development of centers of scientific strength in the Midwest, and I feel certain that with the right cooperation between the Government and the universities, we can do a great deal to build at Argonne the nucleus of one of the finest research centers in the world."

Four days later the AEC announced that the new MURA-Argonne group would take part in the design work on the up to 1,000-bev machine that had heretofore been the exclusive province of Brookhaven. Noting also that Lawrence was designing a 200-bev machine, AEC went on to state, "No decisions have been made for the construction of either of these large national accelerators, nor have site locations been selected."

It may be true that AEC hasn't selected the sites, but in the era of pork-barrel science, there are 435 representatives and a hundred senators who don't hold the slightest doubts about the best possible location.

VIEWS & REVIEWS

Beethoven Is Better Than Ever

FREDERIC V. GRUNFELD

BEETHOVEN'S nine symphonies have been recorded five times in their entirety since the advent of stereo—by Ernest Ansermet and the Suisse Romande Orchestra, Herbert von Karajan and the Berlin Philharmonic, Otto Klemperer and the Philharmonic of London, Josef Krips and the London Symphony, and Bruno Walter and the Columbia Symphony. This embarrassment of riches—not to speak of overproduction—has given rise to the usual disputes as to which conductor best exemplifies the hallowed "Beethoven tradition." The critics talk of "the Beethoven style," "the Viennese School," "the sound of Beethoven's orchestra," and so forth. One set of symphonies, symptomatically, is advertised under the headline ". . . as though Beethoven himself were standing there."

Tradition may be a frangible intangible in literature and painting, but in music it plays a rather more practical and concrete role—hence the tendency of musicians to identify themselves and each other with schools, genealogies, and lines of stylistic descent, wherein X. is shown to be a pupil of Weingartner, who studied with Liszt, a pupil of Czerny, who studied with Beethoven, a pupil of Haydn, and so on back to Orpheus. The kind of information that is passed down from one generation to the next is vital to the performance of music because the printed notes are dead signs that tell only half the story—they specify pitches but indicate rhythm, tempo, phrasing, and dynamics in only the most approximate, relative terms. These elements are left to the performer, working with the accumulation of habits, instincts, and customs he has acquired from aural tradition. But this legacy, obviously, is not synonymous with authenticity, nor is a performance within "the Viennese tradition" equivalent to having Beethoven "standing there."

If Beethoven could hear any of these recordings, he would be startled—pleasantly, I trust—by the sounds that are now being produced from his prescriptions of a hundred and fifty years ago. For one thing, the smooth, rather homogenized orchestral tone of today's best Beethoven is measurably louder than anything he could have anticipated. The size of the average orchestral string section has been doubled and redoubled; brass instruments are more agile and strident; the woodwinds can generate more penetrating sounds. Acoustical studies show that our concert halls are generally more resonant, with background noise levels correspondingly higher.

BUT the major difference between a 1964 *Eroica* and the one the Viennese heard in 1804 is a matter of organization and discipline among the rank and file. The orchestras for which Beethoven wrote, and which he occasionally conducted, were incredibly haphazard affairs, hired for one night, hastily rehearsed, frequently at loggerheads with the conductor. In today's parlance, this is a "pickup group" as opposed to an "orchestra," a term implying a certain continuity of training and membership. Whenever obeisance is made to "the Viennese tradition," no one seems to remember that there was not one permanent symphony orchestra in the city at any time during Beethoven's career. (He died in 1827; the Vienna Philharmonic was founded in 1842, the same year as the New York Philharmonic, and it did not begin to function properly until 1854.)

Although there were regular pit orchestras in Vienna's theatres, symphony concerts were the domain of amateur groups, the so-called *Liebhaber* and *Musikfreunde* associations, consisting of thirty or forty string-playing dilettantes reinforced by professional wind players and first-desk men. These groups were not in the habit of holding rehearsals—it was not a sporting thing for gentlemen to do, and besides, the pleasure was in the playing, not the listening. Admission was by invitation only.

To bring his works before a larger and paying public, Beethoven usually hired one of the theatre orchestras and added whatever talent happened to be available, amateur or professional. Though his men always complained that his music was "impossibly difficult" to play, he rarely had more than two or three rehearsals at which to whip them into some semblance of unanimity. At the first performance of the Fifth and Sixth Symphonies, for instance, "It had been found impossible to get a single full rehearsal for all the works to be performed, all filled with the greatest difficulties."

Like many Viennese "musical academies" (programs), this one lasted four full hours: in addition to the symphonies, it included parts of the C Major Mass, the aria "Ah! Perfido!," a piano concerto (probably the Fourth), an improvisation for piano solo, and the *Choral Fantasy*, Opus 80. The date was December