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The peaceful atom comes to campus

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The peaceful atom comes to campus

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Youthful idealism, institutional ambition, and Cold War sensibilities all helped shape the Michigan Memorial–Phoenix Project, the University of Michigan's tribute to fallen World War II soldiers.

Columbus found a world, and had no chart,
Save one that faith deciphered in the skies;
To trust the soul's invincible surmise
Was all his science and his only art.

—George Santayana, "O world, thou choosest not the better part"

Reflecting on how university research could meet the challenges of the early 1950s, University of Michigan provost James Adams suggested that future historians would consider the heady post–World War II years to be "an age of invincible surmise."[1] He regarded the era with an optimistic eye. More so than at any point in history, Adams maintained, troves of useful knowledge lay within human grasp; as US society sought to turn that knowledge to its advantage, universities held "a special responsibility for the guardianship of truth." In the postwar years, the University of Michigan discharged that responsibility through a homegrown program exploring peaceful uses of nuclear science: the Michigan Memorial–Phoenix Project. In addition to producing notable research accomplishments, the project sparked systematic changes in the way the university supported research and it reshaped the university's relationships with the alumni community and industry.

The Atoms for Peace initiative in the US was most closely tied to the civilian nuclear power program that the Atomic Energy Commission (AEC) maintained in the national laboratory system. Historians tend to understand the phrase "atoms for peace," drawn from a speech President Dwight D. Eisenhower delivered before the United Nations General Assembly in 1953, as a kind of Cold War doublespeak. Yes, research on civilian nuclear technologies was a peacetime application of nuclear physics, but the goals of the AEC and its national laboratories were inextricable from the strategic and ideological conflict with the Soviet Union.[2]

The postwar years also saw American universities launching their own efforts to find new uses for wartime science. Stanford University and MIT recognized that new government and industry interest in funding academia presented a route to national prominence, and they launched research programs to capitalize.[3] The University of Chicago established its Institutes for Basic Research to maintain the programs and staff of the wartime Metallurgical Laboratory.[4] And at the University of Michigan, the atom came to campus in the form of a war memorial. The tale of that last case offers a striking contrast to the story of civilian nuclear research as seen from the perspective of the AEC and shows how the pursuit of the peaceful atom reshaped patterns of support for scientific research at Michigan.

A living, functioning memorial

The Phoenix Project started small. Its first crumpled dollars came in December 1946 from a raffle held at the J-Hop, the

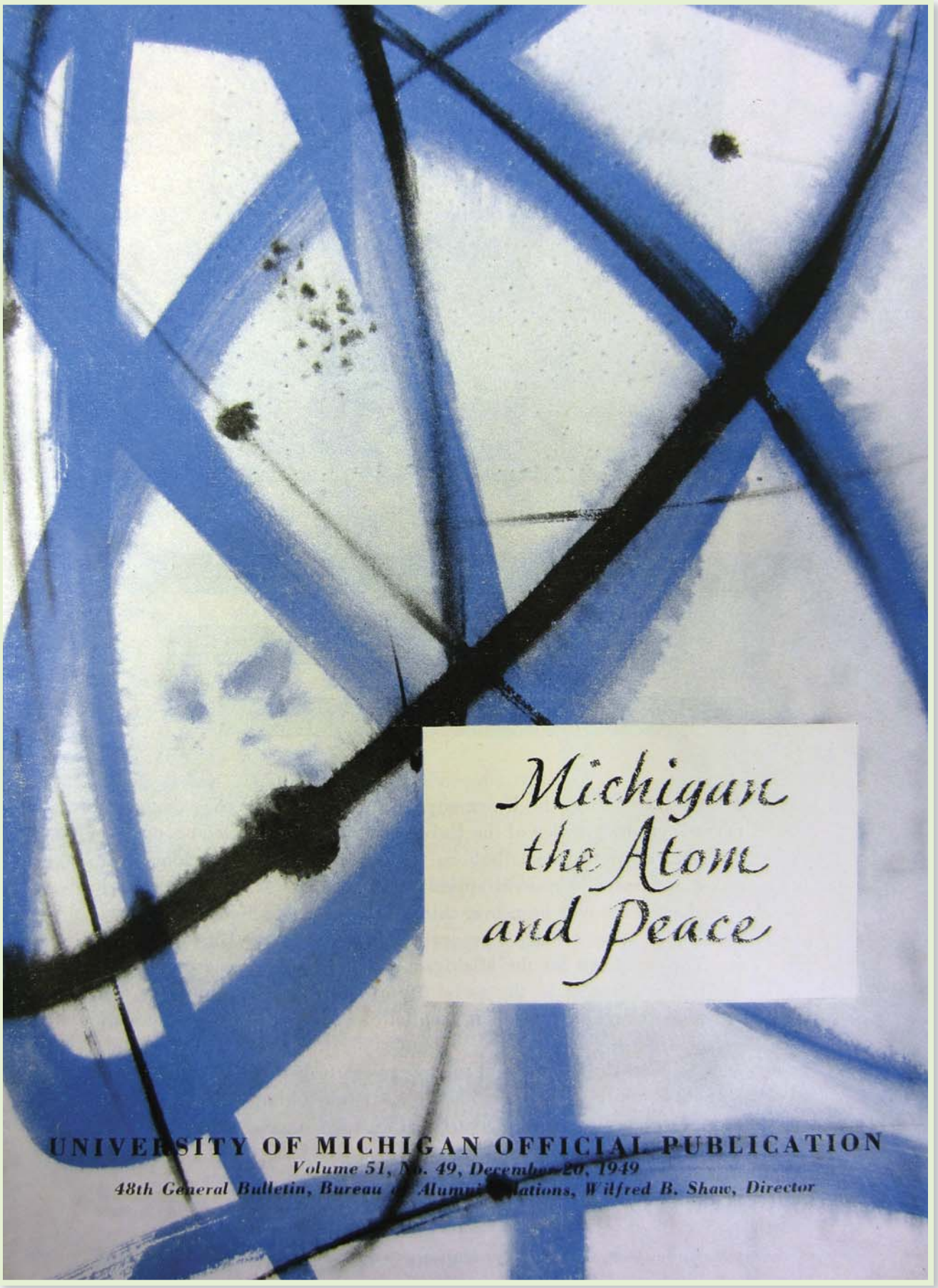

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FIGURE 1. LOGOS for the Michigan Memorial–Phoenix Project. **(a)** An early concept from 1948, likely drawn by one of the students on the memorial planning committee. **(b)** The official logo as adopted in the 1950s. (Courtesy of the Bentley Historical Library, University of Michigan.)

annual student formal. The student legislature organized the raffle to raise funds for a war memorial. Operation Phoenix, as it was sometimes called, was the result. Its mission was both to commemorate the University of Michigan students and alumni who had died in World War II and, as its logo illustrates (see figure 1), to refocus to constructive ends the destructive power unleashed in the war.

The project officially launched in 1948 in the midst of a massive fundraising campaign, the first in the university's history that sought support from the entire alumni base. Eventually Phoenix offered grants to a wide array of faculty-led projects dealing with peaceful uses of atomic and nuclear science. By 1960, the year Donald Glaser was awarded the Nobel Prize in Physics for his Phoenix-funded work on the bubble chamber, the project had raised more than $10 million. But at the dawn of 1947, it was little more than a twinkle in the eyes of a few sincere students who surmised that they might do a small part to craft a better postwar world.

The students who organized the campaign were not content to build a monument; they insisted on a living, functional memorial. University administrators embraced that concept, but just what the memorial should accomplish was not immediately clear. Early ideas generated by the planning committee ranged from the modest proposal to keep a permanent light in a quiet corner of the library to the grand and idealistic vision of an international program to prevent war.

The task of soliciting further suggestions fell to the dean of students, Erich Walter. He began by surveying memorial plans at other colleges and universities across the country. Oberlin College and Stanford had established scholarships to pay tuition for children of alumni or students who had died in the war. The University of Texas and Princeton University had proposed more-general scholarship programs. New library buildings, student unions, auditoriums, and chapels were in the works at Swarthmore and Dartmoth Colleges and Indiana and Michigan State Universities. The planning committee, however, fueled by the students' insistence on a distinctive function for the Michigan memorial, was hesitant to follow the precedents those schools set.

In an act that reveals both the breadth of possibility the memorial fund represented and the sense that the university was navigating unmapped territory, Walter wrote to public figures around the world to solicit their input. Those included American literary stars such as John Hersey, military giants like Chester Nimitz, and international political icons Winston Churchill and Madame Chiang Kai-shek. Walter's letter emphasized the desire for a functional memorial, gave as an example one veteran's suggestion of an enduring light at a prominent point on campus, and asked advice on how best to proceed. Among those who replied was Lewis Mumford, who pitched a fellowship to allow students to broaden their horizons by traveling to non-Western countries. E. B. White, reasoning that a war memorial should bolster the institutions of peace, imagined a fund to send students to sessions of the United Nations. Others had more utilitarian visions. Orson Welles suggested a dormitory that would alleviate housing shortages for veterans and their families. Popular songster Fred Waring, riffing on the suggestion that the memorial be a light of some kind, proposed that the light be affixed to the top of a broadcast tower, possibly for a radio station with the call letters HERO.

Idealism and ambition

The idea that became the seed of the Phoenix Project, however, did not come from a famous writer, warrior, or warbler. Walter had also issued a request for input to Michigan alumni, and Fred Smith, an executive with the New York–based Book of the Month Club, replied in October 1947, "I think it is wrong to try to think of things to do, or gadgets to build, to perpetuate the memory of a lot of men who are far more interested in making their work and their sacrifices count for something, than they are in being remembered. . . . It is my feeling that the University might take unto itself the administration and coordination of research in some specific phase of peacetime atomic research." Smith recalled how he had bristled at the suggestion by Frédéric Joliot-Curie, France's high commissioner for atomic energy and an outspoken communist, that the US, having unleashed nuclear weapons on the world, was shirking its duty to turn nuclear physics to the purposes of peace. After talking with his contacts in the AEC and in the medical community, however, Smith grudgingly concluded that Joliot-Curie had a point. When Walter's letter landed on his desk, he saw an opportunity for his alma mater to help right what he perceived as an embarrassing wrong.

Consensus rapidly crystallized around Smith's suggestion. It complemented the students' idealistic motives and resonated with the administration's ambitions. In the 1920s and 1930s, the Michigan Summer Symposium in Theoretical Physics—affectionately known in physics circles as the Michigan Summer School—routinely hosted European luminaries such as Niels Bohr, Paul Ehrenfest, Enrico Fermi, Werner Heisenberg, and Hendrik Kramers. Those symposia were critical to the dissemination of quantum mechanics in the US. (See the article by

J. H. Van Vleck, PHYSICS TODAY, June 1964, page 21.) Michigan sought to recapture that momentum, which the war disrupted, and nuclear research loomed large as an area that would dominate physics for decades. Dedicating a memorial research program to peaceful uses of the atom spoke to the fresh-faced idealism of the students' memorial proposal while also supporting the university's ambition to maintain and advance its status as a premier research institution.

Smith remained involved in the program's early planning. He sketched a design, shown in figure 2, for a memorial rotunda at the entrance to the Phoenix Project laboratory. Though never adopted, Smith's conception illustrates the close connection the project sought between its research and memorial missions. It was also Smith who proposed that the program be named after the phoenix. The image of the mythical bird rising from the ashes, he suggested, best illustrated the goal of reclaiming the atomic nucleus from the forces of war and putting it to work on behalf of scientific, medical, technological, and civic progress. The mythological imagery captured his hope, shared by the project's administrators, that the Phoenix Project would represent a new, enlightened age born from the destruction, both physical and psychological, wrought by nuclear weapons.

The program dispensed its first awards in November 1948. A building soon followed in the new North Campus, a campus expansion planned by up-and-coming architect Eero Saarinen.[5] Ralph Sawyer, a physicist and dean of the School of Graduate Studies, became the program's first director. Sawyer boasted a strong nuclear-physics resumé. He had earned his PhD under Robert Millikan at the University of Chicago and in 1946 had served as the US Navy's scientific liaison officer for the Operation Crossroads nuclear bomb tests at Bikini Atoll. Phoenix, however, was a different animal. Under Sawyer's stewardship, it established a nuclear research program that gave military applications a wide berth. It also focused on a broad array of small projects, rather than on large-scale nuclear infrastructure; in that way, it was substantively different from the Atoms for Peace program that would emerge a few years later within the AEC.[6]

The fruits of Phoenix

It didn't take long for the Phoenix Project to generate notable results. On 12 June 1952, Glaser submitted a letter to the *Physical Review* in which he described the principle behind the bubble chamber and acknowledged project support. Glaser, shown in figure 3 working on the device, had demonstrated the principle on a small scale: He heated pressurized diethyl ether, $(C_2H_5)_2O$, to 130 °C in a sturdy glass tube and exposed it to radioactive cobalt, conditions in which "liquid in the tube always erupted as soon as the pressure was released."[7] That simple demonstration presaged the particle detectors that produced some of the most iconic images in 20th-century physics; figure 4 shows one example, the first detection of a neutrino interaction. By allowing physicists to visualize previously obscure processes, the bubble chamber enabled discoveries that added considerably to a growing menagerie of new particles, and it was instrumental to the development of the standard model of particle physics.[8]

The bubble chamber is the best-known fruit of the Phoenix Project, but it was just one of many. One of the most enduring was, literally, fruit. An early and long-running Phoenix program investigated the use of radiation to sterilize and preserve foodstuffs, including fruits and vegetables. The program was a publicity coup and earned a prominent place in promotional materials. Phoenix assistant director Henry Gomberg, along with his fellow professor of nuclear engineering Lloyd Brownell, pursued techniques for irradiating pork to prevent trichinosis, a recognized public health threat in the 1950s; their work merited a notice in the *Times* of London in 1954.

Food irradiation grew rapidly during the Cold War, especially as the United Nations began to envision it as a tool to aid the Green Revolution of the 1960s and to bring developing countries into the modern—that is, atomic—age.[9] Radiation-based sterilization and preservation techniques remain widespread; in the US, for example, approximately 100 000 tons of food are irradiated annually.[10] Another major class of Phoenix investigations explored the applications of radioisotopes to medicine. Much of that work was cancer research conducted

FIGURE 2. A MEMORIAL ROTUNDA. Fred Smith, the University of Michigan alumnus whose letter initiated the Michigan Memorial–Phoenix Project, also assisted in the project's early planning. He conceived and sketched this rotunda, intended to serve as an entrance to the Phoenix Project laboratory in 1948. (Courtesy of the Bentley Historical Library, University of Michigan.)

FIGURE 3. DONALD GLASER WORKING ON A BUBBLE CHAMBER at Lawrence Berkeley National Laboratory in the early 1960s. Glaser's invention of the bubble chamber, which was recognized with the 1960 Nobel Prize in Physics, was funded by the Michigan Memorial–Phoenix Project. (Photograph © the Regents of the University of California, courtesy of Lawrence Berkeley National Laboratory.)

under the auspices of a special fund endowed in the name of Alice Crocker Lloyd, Michigan's long-time dean of women, who died of cancer in 1950.

However, the Phoenix Project's multidisciplinary scope was what most clearly distinguished it from similar programs at the AEC and at other universities. Enlisting a wide array of campus departments was integral to the Phoenix mission. Sawyer informed Michigan's president Alexander Ruthven in 1949 that work was already under way to identify projects outside the physical sciences: "Professor [Horace] Miner in a preliminary survey of local possibilities has described more than twenty important projects in law, economics, psychology, business administration, and other fields which await financial support for their initiation." A handbook for Phoenix staff codified the reasoning for framing Phoenix so broadly:

> History tells us that the advent of every new form of energy has resulted in tremendous changes in the social and economic life of each human being. In the past, development of new forms of energy was concerned mainly with technological perfection, with little regard to social, political and economic consequences. This left unemployment, confusion and much suffering. Social scientists at Michigan hope to change history this time by preparing, in advance, for the atomic age.

Phoenix funded numerous projects on the social dimensions of the nuclear age, from law research designed to ease legal barriers that limited civilian uses of nuclear technology to studies of radioactivity levels in archaeological materials.

In its breadth, the Phoenix Project embodied the aspirations of the early postwar era. It was founded on an almost naively hopeful premise that the world—or at least the US—was prepared to pull together and leave the destruction of World War II behind. The program's role as a memorial helped sustain those lofty ideals. But research cannot run on ideals alone. Even as Phoenix administrators were crafting the program's image as a conscience-driven approach to the nuclear age, they were also proceeding with the nitty-gritty of raising the funds needed to get the program running.

Soaring campaign rhetoric

As the Phoenix Project took shape, its leaders worried that the AEC might scuttle the effort. Michigan's administrators were anxious about what they perceived as the federal government's desire to monopolize nuclear research. Michigan senator Homer Ferguson fueled those concerns during a December 1949 meeting with Ruthven and members of the Phoenix fundraising committee, when he suggested that "the University may anticipate jealousy on the part of the AEC as knowledge of the plans to establish an atomic research center becomes more widespread. It is well known in Washington that the government is anxious to keep all atomic energy affairs under government jurisdiction." Preliminary anxiety that the AEC might torpedo the Phoenix proposal proved unfounded. On Ferguson's recommendation, Phoenix administrators elicited endorsements from then general Eisenhower and Warren Austin, the US ambassador to the United Nations, to hedge against AEC opposition. By February 1950, after visits to campus from AEC scientists and lobbying in Washington by Sawyer and other university representatives, Phoenix had won the AEC's endorsement and issued a news release reporting that the commission "applauds the decision to further knowledge in this new field and the intent to explore the beneficial potentialities of atomic energy."

Phoenix leaders nevertheless consciously elected not to pursue federal funding. Their concern that the AEC would be jealously possessive of nuclear research reflected a larger desire to avoid the control they imagined federal dollars might exert over their researchers. Phoenix's appeals for support leaned heavily on the project's independence from government. One fundraising broadsheet boasted that this independence meant that Phoenix "does not insist on immediate or practical research results." A 1950 radio press release advertised that within the Phoenix research portfolio, "one of the studies to be made deals with the probable effect on our way of life if there should be complete government control of this vast new power." The conviction persisted that the university was in competition—more so than in cooperation—with the federal government for jurisdiction over nuclear research. That sentiment would shape the program's evolution.

The desire to insulate the Phoenix Project from government influence cut off its most obvious source of funding. The original proposal called for $6.5 million (about $65 million in 2016 dollars), $2 million for the construction of a building and $4.5 million to support research. With government funding ruled out, Michigan turned to its alumni and to industry. The fundraising appeal would be the university's first systematic development campaign and the first time it had approached its entire alumni base for contributions.

FIGURE 4. FIRST EXPERIMENTAL EVIDENCE of a neutrino interaction, 13 November 1970. This image, from Fermilab's 12-foot bubble chamber, captured an exciting interaction at the triple vertex to the right. The vertex is the location of a proton that has been hit with a neutrino. Emanating from the interaction point, from top down, are the scattered proton, a muon, and a pion. (Courtesy of Argonne National Laboratory.)

The campaign's rhetoric was soaring—and so were its expectations. As Ruthven wrote in a 1950 letter soliciting donations from alumni, "The Michigan Memorial–Phoenix Project is at once a tribute to the gold star sons and daughters of Michigan and an all-out program for investigating the peacetime applications and implications of atomic science. We have the opportunity and the ability to make a most important contribution to the world. All that we need to get going is the financial support of our alumni and friends." In light of those objectives, a guide for fundraisers explained, "Every former student of the University of Michigan is *expected to give something*." The expectation was notional rather than practical. When Phoenix launched, Michigan had neither centralized data about its alumni nor a permanent development program. Phoenix provided the basis for both. By 1952, pledges from 29 568 individual donors, the majority of them alumni, totaled more than $2.5 million for the project. Most regions achieved an alumni giving rate of better than 20%. When the first Phoenix campaign concluded in 1953, it had raised more than $7 million from combined individual and industry contributions. Michigan's Alumni Fund, an extension of the Phoenix campaign, was established as a permanent fundraising unit the same year.

A humanitarian challenge to industry

An extensive and well-coordinated publicity campaign complemented Michigan's appeal to its alumni. The campaign placed news stories about Michigan's atomic programs in newspapers nationwide and produced glossy mailers and brochures with titles like *Michigan, the Atom and Peace* (see page 41) and *The Bountiful Atom* to distribute to visitors and give away at fundraising events. The project even commissioned a Phoenix-themed radio play, a western set in the New Mexico desert. And the 1951 Rose Bowl, in which the Michigan Wolverines defeated the California Golden Bears, featured a halftime tribute to the Phoenix program by the Michigan marching band. The attention to publicity reflected Ruthven's conviction that the Phoenix program was "one of the most important in [the] institution's history."

Phoenix wrought changes no less significant to the university's relationship with industry, which Michigan courted largely by emphasizing the role Phoenix could play in bolstering free enterprise based on nuclear science. The basic argument was twofold. First, investing in university research could be expected to produce a long-term return on investment in the form of discoveries that could form the basis for new technologies. Second, corporations had an obligation to collaborate with universities to preempt a government monopoly on nuclear science. The argument paid off: Corporations, which had not previously made significant contributions to Michigan's research program, furnished a narrow majority of the project's initial funding.

From the vantage point of the 21st century, the most notable aspect of the appeal to industry is the extent to which Phoenix staff relied on humanitarian justifications in their quest for corporate support. In their approach to General Electric, they explained that "the University of Michigan is encouraged to submit this proposal to the General Electric Company for a number of reasons. Both institutions, in their aims and purposes, transcend their basic functions—education on the one hand and industry on the other—to serve not only students or customers, but humanity at large." Ideals as much as pragmatism motivated the case that industry should get behind Phoenix.

In contrast to programs at MIT and Stanford, where relationships with industry and government tended to be based on contract research with well-articulated practical aims, Michigan relied on the Phoenix Project's status as a war memorial to access support that fell between direct contracting and philanthropy. The program's leaders sought to limit reliance on contract research, but also sought to avoid the caps and restrictions many companies imposed on charitable giving. The program's idealistic foundations helped it carve out a place on corporate ledgers as a business expense, but one that did not commit to specific deliverables.

Michigan's pitch to industry found a receptive audience. In December 1951 the National Association of Manufacturers board of directors ratified a resolution in support of educational institutions, which declared, "Business enterprises must find a way to support the whole educational program—effectively, regularly and now." The chairman of the board of General Motors, Alfred P. Sloan Jr, made a similar argument in *Collier's* that same year. US industry, Sloan insisted, had a duty to support American universities because "it is vital—if we are to perpetuate our free society—that we find a way to keep our colleges, universities and technological institutions virile, progressive and—above all else—free."[11] Sloan's commentary, which was subtly if not explicitly anticommunist, emphasized that extensive federal funding would entail excessive political

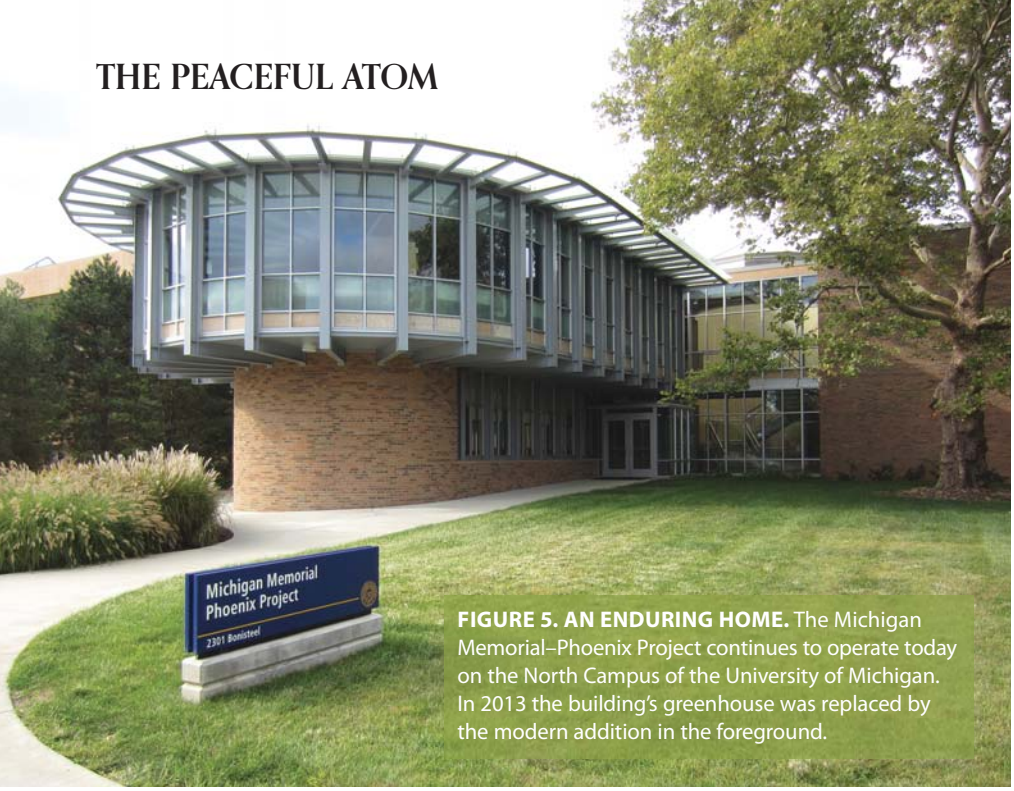

FIGURE 5. AN ENDURING HOME. The Michigan Memorial–Phoenix Project continues to operate today on the North Campus of the University of Michigan. In 2013 the building's greenhouse was replaced by the modern addition in the foreground.

control. It rang musically in Phoenix staff's ears. General Motors would eventually contribute $1.5 million toward Phoenix's $6.5 million goal, and Sloan's article became required reading for project fundraisers. Through its connections to industry, Phoenix benefited from the looming ideological conflict with the Soviet Union, a clash that made the rhetorical link between industry support for university research and the health of US capitalism more persuasive to industrial patrons.

The better proportion of early corporate gifts to Phoenix—including those from Dow Chemical, Detroit Edison, General Motors, and Eli Lilly—were either unrestricted or directed to a general research fund. That mode of corporate support continued for decades and cemented the university's newly close relationship with local and national corporations, especially those in the automotive sector. The most visible outcome of that relationship was the Ford Nuclear Reactor, a research reactor built with a $1 million grant from the Ford Motor Co. The reactor came online in 1957 and operated until 2003. The process by which the University of Michigan courted and acquired corporate support for the reactor and similar projects suggests a model of science funding that historians have not yet adequately explored. The ideals and ideologies at the heart of the Phoenix Project underwrote the program's pitch to industry, and industry's willingness to go along reflects both the optimism and the uncertainty surrounding nonmilitary nuclear research in the early Cold War period.

Optimism in the face of anxiety

As a program pursuing peaceful applications of nuclear science, the Phoenix Project was subject to the many contradictions of the Cold War. It was dedicated to peaceful research while under a director fresh from coordinating bomb tests at Bikini Atoll. Overtures to industry rested on implicitly anticommunist rhetoric about free enterprise. But at the same time, Phoenix was imbued with a youthful optimism borrowed from Michigan's students. It offers us a different take on the history of civilian nuclear research than does the Atomic Energy Commission, which, as a governmental agency, was much more sensitive to both national politics and geopolitical strategy. Eschewing government support prompted Michigan to navigate the contradictions of the Cold War in a very different way, and the university's success doing so can be attributed to Phoenix's dual role as a war memorial and a nuclear-science initiative.

The Phoenix Project outlasted the Cold War, and it functions today within the University of Michigan's Energy Institute as a distinct entity dedicated to nuclear science. (Figure 5 shows its renovated home.) The early success that made such longevity possible reflects an aspect of the early nuclear age that has received less historical attention than the potent mix of power, fear, and secrecy driving government-based nuclear programs. The students who proposed the memorial did so with a spirit of optimism for the future that captured the enthusiasm of their peers, Michigan's administration, and university alumni. Similarly, enlisting industry in a common purpose reflected the pervasive, if unfocused, sense of possibility that surrounded nuclear research, despite the anxiety the bomb had precipitated.[12] It was, perhaps, inevitable that the University of Michigan would establish a nuclear research program, raise funds from alumni, and develop closer ties with industry after World War II. The particular way those developments unfolded, however, owes a great deal to a handful of students and their invincible surmise.

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