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OPERATION PHOENIX:
The Peaceful Atom Comes to Campus

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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[1]

Reflecting on how university research could meet the challenges of the early 1950s, University of Michigan Provost James P. Adams suggested that future historians would consider the heady post–World War II years to be "an age of invincible surmise."[2] 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 American 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. Alongside notable research accomplishments, the Phoenix Project sparked systematic changes in the way Michigan supported research and reformed its relationships with its alumni community and industry.

The "Atoms for Peace" initiative in the United States was most closely tied to the civilian nuclear power program that the Atomic Energy Commission (AEC) maintained within the national laboratory system. Historians tend to understand the phrase, 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.[3] In the same era, however, American universities launched their own local efforts to find new uses for wartime science. Stanford and MIT recognized new government and industry interest in funding academia as a route to national prominence and launched research programs to capitalize.[4] The University of Chicago established its Institutes for Basic Research to maintain the programs and staff of the wartime Metallurgical Laboratory.[5] And at the University of Michigan, the atom came to campus in the form of a war memorial. This 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 reformed patterns of support for scientific research at Michigan.

Phoenix Rising: Idealism and Ambition

The Michigan Memorial–Phoenix Project started small. Its first crumpled dollars came from a raffle held at the J-Hop, the annual student formal, in December of 1946. The raffle, organized by the student legislature, raised 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 depicting the rising Phoenix bird illustrated, to refocus the destructive power unleashed in the war to constructive ends (Figure 1).

The project 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. Phoenix offered grants to a wide array of faculty-led projects dealing with peaceful uses of atomic and nuclear science. By 1960, when Donald Glaser won the Nobel Prize for his Phoenix-funded work on the bubble chamber, the project had raised over $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 upon a living, functional memorial. University administrators embraced this plan,

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Figure 1. The Michigan Memorial–Phoenix Project logo: an early concept from 1948, likely drawn by one of the students on the memorial planning committee (*left*), and the official logo as adopted in the 1950s (*right*). (Phoenix Project Records, Bentley Historical Library, University of Michigan.)

but the exact function the memorial should accomplish was not immediately clear. Early ideas generated within the planning committee ranged from the modest—a permanent light in a quiet corner of the library—to the grand and idealistic—an international program to prevent war. The task of soliciting further suggestions fell to the dean of students, Erich A. Walter. He cast a wide net, beginning with a survey of memorial plans at other colleges and universities across the country. Oberlin 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 had proposed more general scholarship programs. New library buildings, student unions, auditoria, and chapels were in the works at Swarthmore, Indiana, Dartmouth, and Michigan State. The committee, however, fueled by the students' insistence on a distinctive function for the Michigan memorial, was hesitant to follow the precedent these institutions set.

In a stark indication of the breath of possibility the memorial fund represented, and of the sense that the university was navigating unmapped territory, Walter wrote to public figures around the world to solicit their input. These included American literary stars such as John Hersey, military giants like Admiral Chester W. Nimitz, and international political icons including 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 a prominent point on campus, and asked advice on how best to proceed. Among those who replied were 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 Wells suggested a dormitory that would alleviate housing shortages for veterans and their families. Popular songster Fred Waring riffed on the suggestion that the memorial be a light of some kind to propose that the light be affixed to the top of a broadcast tower, possibly for a radio station with the call letters HERO.

The idea that became the seed of the Phoenix Project, however, came not from a famous writer, warrior, or warbler, but from an alumnus. Walter issued a similar request for input to Michigan alumni, and Frederick Smith, an executive with the New York–based Book of the Month Club, replied in October of 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 Unit-

ed States, 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 had 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 percieved as an embarrassing wrong.

Consensus rapidly crystalized around Smith's suggestion. It flattered the students' idealistic motives and resonated with the administration's ambitions. In the 1920s and 1930s, the Michigan Summer Research Institute in Theoretical Physics—affectionately known as the "Michigan Summer School" in physics circles—routinely hosted European luminaries such as Niels Bohr, Paul Ehrenfest, Enrico Fermi, Werner Heisenberg, and Hendrik Kramers. These symposia were critical to the dissemination of quantum mechanics in the United States.[6] 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 therefore spoke to the fresh-faced idealism of the 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 for a memorial rotunda at the entrance to the Phoenix laboratory (Figure 2), which, though never adopted, 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, suggesting that the image of the mythical bird rising from the ashes 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 Phoenix 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

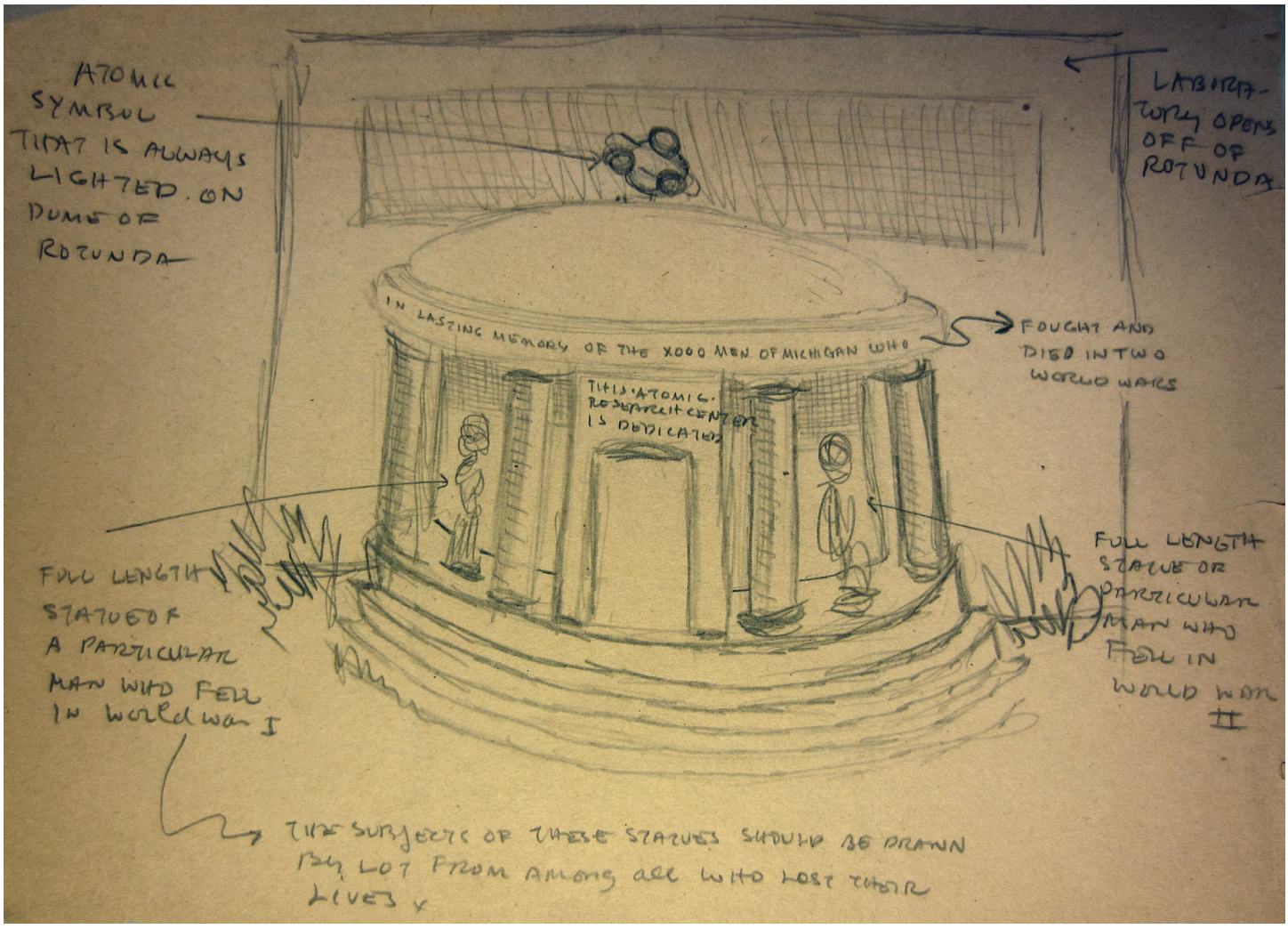

Figure 2. Frederick Smith's sketch of a memorial rotunda, incorporating the idea of a perpetually burning light, to serve as an entrance to the Phoenix Project Laboratory. (Phoenix Project Records, Bentley Historical Library, University of Michigan.)

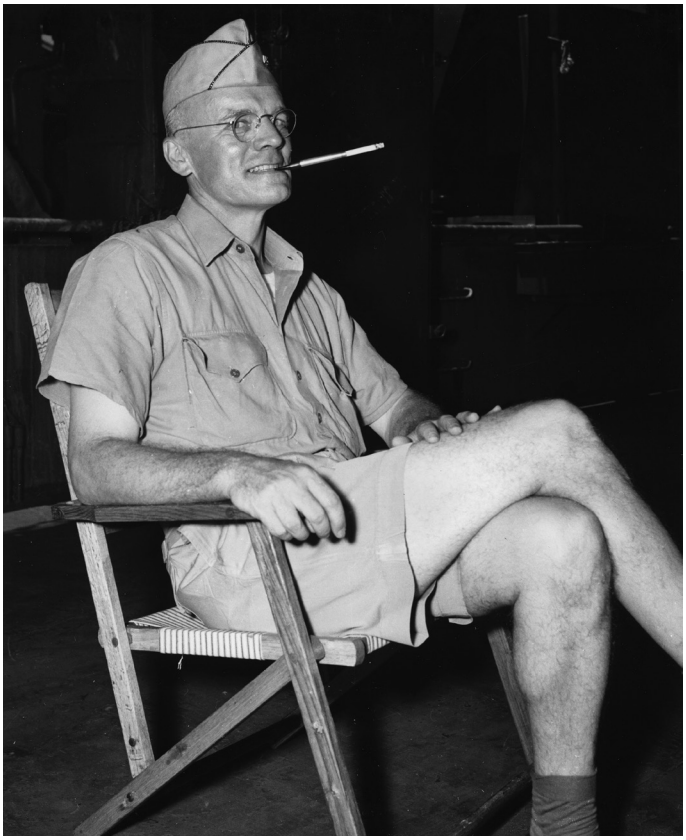

Figure 3. Ralph Sawyer, the first Phoenix Project director, photographed during the Operation Crossroads nuclear tests at Bikini Atoll in the mid-1940s. (Ralph A. Sawyer Papers, Bentley Historical Library, University of Michigan.)

Figure 4. Donald Glaser works on his bubble chamber, the development of which was funded by the Phoenix Project, in the early 1960s. The bubble chamber was recognized with the 1960 Nobel Prize in Physics. (© 2010 Lawrence Berkeley National Laboratory.)

Saarinen.[7] Ralph A. Sawyer (Figure 3), a physicist and dean of the School of Graduate Studies, became its first director. Sawyer boasted a strong nuclear physics résumé. He had earned his PhD under R. A. Millikan at the University of Chicago and in 1946 had served as the Navy's scientific liaison officer for the Operation Crossroads 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, making it substantively different from the Atoms for Peace program that would emerge a few years later within the AEC.[8]

The Fruits of Phoenix

Phoenix quickly generated notable results. On June 12, 1952, Donald Glaser (Figure 4) submitted a letter to Physical Review, in which he acknowledged Phoenix Project support, describing the principle behind the bubble chamber. Glaser had demonstrated the principle on a small scale, heating pressurized diethyl ether ($(C_2H_5)_2O$) to 130°C in a sturdy glass tube and exposing it to radioactive cobalt, conditions in which "liquid in the tube always erupted as soon as the pressure was released."[9] This simple demonstration presaged the particle detectors that produced some of the most iconic images in twentieth-century physics (Figure 5). By allowing physicists to visualize previously obscure processes, it enabled discoveries that added considerably to a growing menagerie of new particles and was instrumental in developing the Standard Model of particle physics.[10]

The bubble chamber is the best known of the fruits of Phoenix, but it was just one of many. One of the most enduring was, quite 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 subsequent promotional materials. Phoenix assistant director Henry Gomberg, along with his fellow professor of nuclear engineering Lloyd E. Brownell, pursued techniques for irradiating pork to prevent trichinosis, a recognized public health threat in the 1950s, meriting 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 aide the Green Revolution of the 1960s and to bring developing countries into the modern—atomic—age.[11] Radiation-based sterilization and preservation techniques remain widespread, with approximately 100,000 tons of food irradiated in the United States annually.[12] Another major class of projects explored the applications of radioisotopes to medicine, much of it

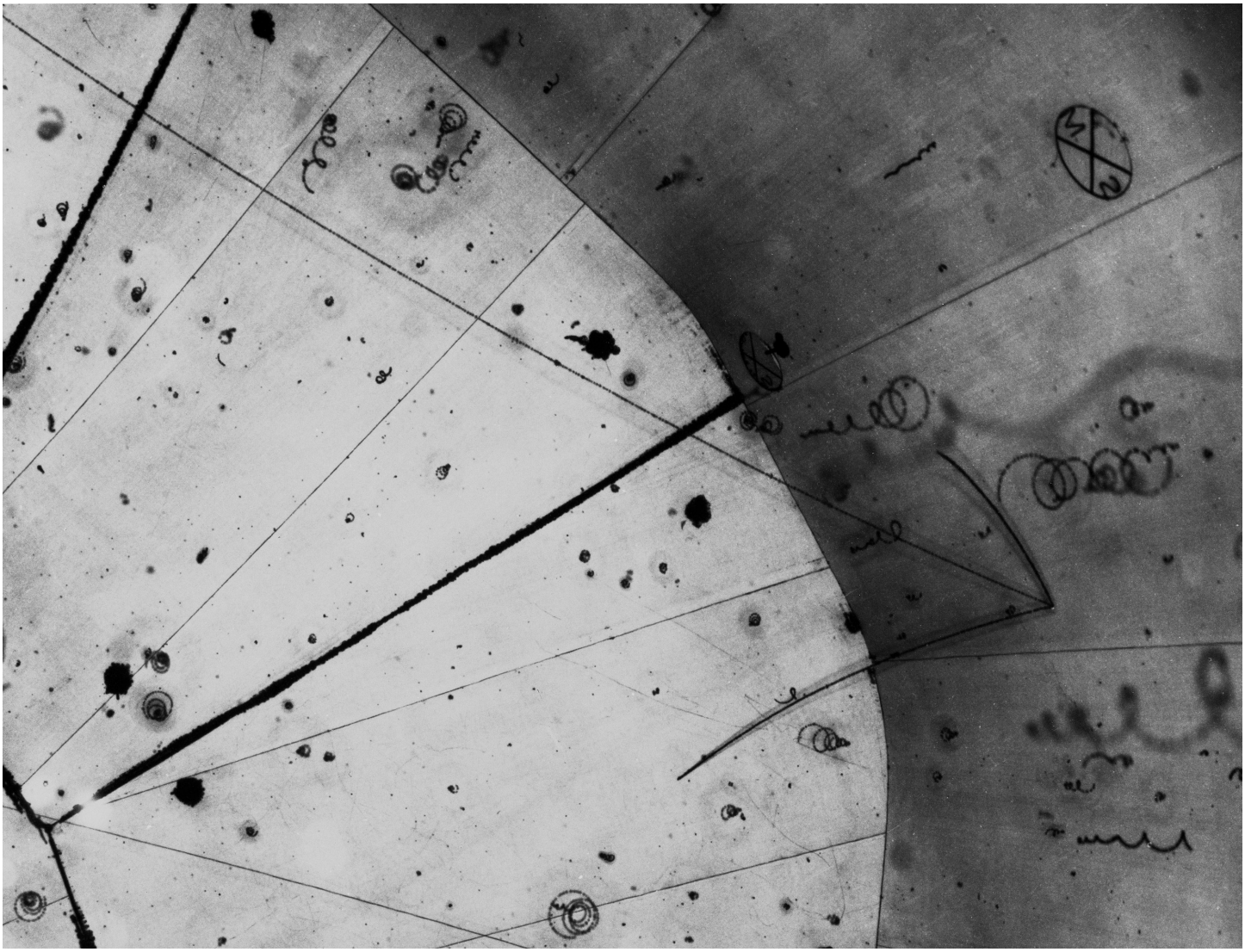

Figure 5. A Fermilab bubble chamber image showing the first direct experimental evidence of a neutrino interaction. (Courtesy of Argonne National Laboratory.)

cancer research conducted 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.

But it was the Phoenix Project's multidisciplinary scope that 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 underway to identify projects outside the physical sciences: "Professor [Horace M.] 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 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 to civilian uses of nuclear technology to studies of radioactivity levels in archaeological materials. Of all the research Phoenix supported, the bubble chamber in many respects epitomizes what the project hoped to accomplish. It represented the pure-physics side of nuclear research, the tradition that would branch off as high energy physics. Many physicists who had been disillusioned by American use of nuclear weapons against Japan transitioned into particle physics as a way to avoid the military interests closing in on nuclear research.[13] The bubble chamber, a tool to probe the arcane and bewildering new particle zoo, reflected both the scientific content Phoenix hoped to promote and the scientific conscience it endeavored to uphold. In one critical respect, however, the bubble chamber represents only a narrow sliver of the Phoenix Project's significance. From its inception, Phoenix was designed to advance research in the

physical sciences, but it was also aggressive in promoting a broad range of other activities. These encompassed biology, agriculture, forestry, the social sciences, law, and education, and ensured that Phoenix was a campus-wide effort.

In its breadth, the Phoenix Project embodied the aspirations of the early postwar era. It was founded on an almost naïvely hopeful sense that the world—or at least the country—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. While Phoenix administrators were crafting the program's image as a conscience-driven approach to nuclear age, they were also proceeding with the nitty-gritty of raising the funds needed to get the program running.

A Plea to Alumni; A Challenge to Industry

As the Phoenix Project took shape, its leaders worried that the AEC might scupper the effort. Michigan's administrators were anxious about what they perceived as the government's desire to monopolize nuclear research. Michigan Senator Homer Ferguson fueled these concerns during a December 1949 meeting with Ruthven and members of the Phoenix fundraising committee, suggesting: "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 stonewall the Phoenix proposal proved unfounded. On Ferguson's recommendation, Phoenix elicited endorsements from then-General Eisenhower and Warren Austin, the US ambassador to the United Nations, to hedge against AEC opposition. By February 1950, following 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 government funding. Their concern that the AEC would be jealously possessive of nuclear research reflected a larger desire to avoid the control they imagined government 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 probably effect on our way of life if there should be complete government control of this vast new power." The conviction that the university was in competition, more so than cooperation, with the federal government for jurisdiction over nuclear research persisted, and 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 to support research. With government funding ruled out, Michigan turned to its alumni and to industry. It would be the university's first systematic development campaign, and the first time it had approached its entire alumni base for contributions.

The rhetoric of the campaign was soaring, with expectations to match. President Ruthven wrote in a 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 these 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, 29,568 individual donors, the majority of them alumni, had pledged a total of over $2.5 million to Phoenix, with most regions achieving an alumni giving rate of over 20%. When the first Phoenix campaign concluded in 1953, it had raised over $7 million from combined individual and industry contributions. Michigan's Alumni Fund was established as a permanent fundraising unit the same year.

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 to distribute to visitors and give away at fundraising events with titles like "The Race Is On" and "The Bountiful Atom." 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 Project by the Michigan 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. A narrow majority of the project's initial funding came from corporations, which Michigan courted by emphasizing the role Phoenix could play in bolstering free enterprise based on nuclear science. The structure of the basic argument to industrial patrons, who had not previously made significant contributions to Michigan's research program, was twofold. First, investing in university research could be expected to produce a long-term return on investment in the form of discoveries which could form the basis for new technologies. Second, corporations had an obligation to collaborate with universities to preempt a government monopoly on nuclear science.

From the vantage point of the twenty-first century, the most notable aspect of this argument is the extent to which Phoenix staff relied on humanitarian justifications in their quest for corporate support. They approached General Electric, explaining: "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.

Even in such a sober document as a written proposal to GE, Phoenix administrators draped their pitch in idealistic rhetoric, quoting "In Flanders Field" in their account of the program's origins: "Far from the conventional monument of cold metal or stone, the Phoenix Project will function as a dynamic, working, life-serving tribute to our hero dead.... What more fitting way is there to answer the challenge of our gold star brothers and sisters: 'To you, from falling hands, we throw the torch; be yours to hold it high.'" 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 war memorial status to access support that fell between direct contracting and philanthropy. The program's leaders sought to limit reliance on contract research, but also 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, without also committing to specific deliverables.

Michigan's pitch found a receptive audience in industry. In December 1951, the National Association of Manufacturers' board of directors ratified a Resolution on Support of Educational Institutions, declaring: "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, made a similar argument in Collier's that same year. American 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."[14] Sloan's commentary, which was subtly if not explicitly anti-communist, emphasized that extensive federal funding would entail excessive political control. It rang musically in the ears of Phoenix staff. GM would eventually contribute $1.5 million toward Phoenix's original $6.5 million goal and Sloan's article became required reading for Phoenix fundraisers. Through its connections to industry, Phoenix benefitted from the looming ideological conflict with the Soviet Union, which strengthened the rhetorical link between industry support for university research and the health of American capitalism.

The better proportion of early corporate gifts to Phoenix were either unrestricted or directed to a general research fund, including those from Dow Chemical, Detroit Edison, General Motors, and Eli Lilly. This established a pattern of corporate support that continued for decades, cementing the university's newly close relationship with local and national corporations, especially those in the automotive sector. The most visible outcome of this relationship was the Ford Nuclear Reactor, a research reactor built with a $1 million grant from the Ford Motor Company. The reactor came online in 1957 and operated until 2003. The process by which Michigan courted and acquired corporate support for this 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 non-military nuclear research in the early Cold War.

Conclusions

Much of the Michigan Memorial–Phoenix Project's success can be attributed to its dual role as a war memorial and a nuclear science initiative. Linking those functions spurred research that was innovative and interdisciplinary. Phoenix straddled the blurry boundary between philanthropy and investment. This helped it mobilize alumni, who might not have been otherwise compelled to support the University's research activities, and draw greater interest from industrial patrons, who had scant incentive to fund a memorial, but who likely made fewer demands for direct payouts from their investments because Phoenix doubled as one.

As a program pursuing peaceful applications of nuclear science, the Phoenix Project was subject to the many contradictions of the Cold War. It dedicated itself to peaceful research while under a director fresh from coordinating bomb tests at Bikini Atoll. Overtures to industry rested on

implicitly anti-communist rhetoric about free enterprise. At the same time, Phoenix was imbued from the beginning with a youthful optimism borrowed from Michigan's students. As such, it offers of a different perspective on civilian nuclear research than the one told from the perspective of 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.

The Phoenix Project outlasted the Cold War, and continues to operate within the University of Michigan's Energy Institute, where it remains dedicated to nuclear science (Figure 6). 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 its 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.[15] 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 these developments unfolded, however, owes a great deal to a handful of students and their invincible surmise.

Figure 6. The Michigan Memorial–Phoenix Project continues to operate today as a division of the University of Michigan's Energy Institute. (Photograph by the author).

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