Pynchon and Cornell Engineering Physics, 1953–54

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One of the few established facts about Thomas Pynchon, based on the evidence of his four novels and six short stories, is that somewhere he learned a lot about science. But even this simple declaration immediately invites questions. Where did he learn about science? And, more important, is it *science* we respond to in reading his work, or the applications of science through engineering and technology? Any attempt to characterize the structure or metaphor of Pynchon's fiction as "scientific" must be shaped by answers to these questions.

Given the density and richness of his references to things scientific, and the paucity of our knowledge about him as a person, the little we do know about Pynchon's life may tempt us to make false assumptions. According to Mathew Winston, Pynchon entered Cornell University in 1953, at sixteen, as a scholarship student in Engineering Physics.[1] "Engineering Physics" sounds like an impressive program, and, as we shall see, it was indeed a major innovation in technical education in the post-war period. But inspecting Pynchon's first and only year of work in the Cornell College of Engineering discloses a program of study that could not by itself offer even the most exceptional student the knowledge of science demonstrated in the short stories Pynchon later wrote at Cornell, much less inform what appears in the novels. Entropy, for example, was not part of that first-year curriculum; the thermodynamics and communication theory in "Entropy" did not come from formal training in the Cornell engineering physics program. To Pynchon, then, must go the credit for learning how to learn on his own; for, as we shall see from examining the Cornell engineering curriculum, most of his considerable learning about science and engineering must have occurred outside the classroom.

Winston suggests that Pynchon pursued an interest in physics at Cornell, and reports that "one of his teachers still wonderingly remembers his apparently voracious appetite for the complexities of elementary particle theory" while studying in the (incorrectly named) "division of Engineering Physics" (257). Such an account, however, grossly overrates the exposure to modern physics available to entering Cornell Engineering Physics students in 1953. Pynchon remained in

Engineering Physics for only one year before transferring to English as a sophomore and subsequently taking a two-year leave of absence from the university. Despite Winston's account of Pynchon's covering his tracks at Cornell and elsewhere, readily accessible public records yield some interesting answers to questions about how, where, and what Pynchon learned of science and engineering.

Engineering Physics was not a program in the pure sciences. The curriculum available to the entering freshman in 1953 did not include elementary particle physics as part of the intellectual menu. For the decade after the Second World War, the Engineering Physics curriculum offered a sophisticated program mixing science, engineering, and technology. It is crucial to understand that science, engineering, and technology are not synonyms: science is concerned with the principles underlying natural phenomena; engineering applies those principles to successful designs for efficient ends; technology implements and maintains those designs. These distinctions are not impermeable, for in practice, of course, one person's work may involve all three activities. But those largely schooled and teaching in the humanities must remember that the education, careers, and "communities of discourse" of these three often-confused professions are very different.

Engineering Physics at Cornell was one of several branches or departments of specialized engineering, according to the 1953–54 Catalog of the College of Engineering. Engineering Physics at Cornell was founded as an innovation just after the Second World War precisely to break down the barriers separating the two disciplines named in its title: physics with its concern for underlying principles, and engineering with its emphasis on practical application through elegant design. A history of Cornell engineering observes that:

> Immediately after World War II two additional units were added [to the College of Engineering]: the Graduate School of Aeronautical Engineering (later Aerospace Engineering) and the Department of Engineering Physics (now the School of Applied and Engineering Physics). The establishment of these disciplines, both highly analytic and scientific, was largely in response to a feeling prevalent among leading engineering educators throughout the country that a more scientific component or thrust was needed. In the 1920s and 1930s the orientation of engineering schools had been toward serving the needs of industry, and educational programs had been shaped accordingly. During World War II, however, it had become apparent that a great deal of engineering development—often work that could not possibly be handled by engineers—was actually being carried out by scientists without engineering training. Engineering colleges had to

> provide more scientifically oriented engineers, especially in areas such as electronics, aeronautics, and applied mathematics, or their graduates would find themselves outflanked by young scientists.[2]

The 1953–54 Engineering catalog's description of the program Pynchon entered presents this innovation in engineering education as follows:

> The Department of Engineering Physics is a new department constituted so as to provide a type of education and training which will effectively bridge the gap between that of the basic sciences and that of conventional engineering practice. The general aim is to prepare students for a prospective career in technical research and advanced engineering development. As a result of the expanding technological activities in the country, the industrial research laboratories and engineering development laboratories are in urgent need of graduates with the vigorous and exacting course of study which the curriculum of this department provides.[3]

There can be little doubt that the "expanding technological activities in the country" which the Catalogue cites as a reason for the urgent need for graduates from this new program resulted from the Second World War. A catalog of the new technologies implemented during the war speaks for itself: jet and rocket flight, radar, computers, and the atomic bomb. Creating these technologies required the mastering of the new sciences which continue to revolutionize our daily lives. Jets provide travel with unprecedented ease, rockets establish new frontiers, and nuclear power offers both energy and weaponry. Perhaps most important yet less obvious, the theories of communications, computers, and cybernetics developed during and immediately after the war by Claude Shannon, Norbert Wiener, and John von Neumann created modes of organizing information that have subtly reshaped the way we communicate with everyone around us.

By supporting these technologies on an unprecedented scale, especially in America, the war effort supplied national resources for scientific and technological development. Fighting the war nurtured the development, not only of these new technologies, but of new relations among universities, industry, and the military to coordinate research programs. After the war, research programs in and out of the universities found access to Federal dollars hard to surrender. In short, the war's legacy included, not only the new technologies, but the continuation of these new linkages between academic, industrial, and military research.[4]

One result of these linkages was Engineering Physics at Cornell, which began in fall 1946 under the direction of Lloyd Preston Smith, Henri Sack, and Trevor Cuykendall.[5] Edmund Cranch, a young faculty member who served as an assistant in the program and went on to become president of the American Society for Engineering Education, recalled that Sack, Cuykendall, and others saw the program as a radical shift in engineering education.[6] The core faculty, with ties mainly to physics, sought other science and engineering faculty who shared their vision of the new curriculum required to keep up with post-war technological advances. Thus in Engineering Physics, in-depth college-level studies of the scientific principles which had yielded the spectacular advances of Second World War technology replaced the conventional study of successful applications and design formulas as the direction engineering education should take.

The new program, depending on the advanced study of scientific principles as well as applications, demanded the best students—truly "a vigorous and exacting course of study." Consequently, Engineering Physics sought only the brightest, and, according to Cranch, recruited heavily in the New York City area. The program regularly garnered the best students in the College of Engineering. Thirty to forty very select students entered the program annually, and faculty lavished attention on both teaching and careful advising. Nonetheless, the very calibre of students guaranteed that some would reject any standard format and go off in other directions. Many, Cranch recalled, ended up transferring to philosophy, motivated by a desire to ask questions on the broadest scale.[7] Pynchon, after his first year, transferred to English.

Despite Pynchon's reticence and the tales of missing academic records, his first-year program in Engineering Physics—his only formal training in science, engineering, and technology—can readily be reconstructed. The 1953–54 Engineering Catalog states that the "first year of study is essentially the same for all branches [of engineering, including Engineering Physics] and includes mathematics, physics, chemistry, English, and appropriate courses in descriptive geometry or drafting" (12). Professor Cranch recalled that the whole first two years were "exceptionally heavy on the fundamentals of physics, chemistry, and mathematics," but that correspondingly little time was available for advanced studies in either the sciences or engineering.[8]

Happily, our knowledge of Pynchon's first year can be supplemented by the recollections of other Cornell faculty active in the program in the 1950s. Pynchon's first-year advisor, physics professor Guy Everett Grantham, died years ago. However, Professor Emeritus Paul L. Hartman, whom I interviewed at Cornell on 11 November 1987 and 6 October 1988, was kind enough to review the early Engineering Physics program. Professor Hartman appeared at the 1987 interview at the Cornell Engineering Physics Department with Pynchon's first-year transcript in hand. It conformed to the catalog description of the freshman program and added a few details not otherwise available.

Pynchon's first-year transcript contained, curiously, only his autumn semester—the prescribed six-course program of mathematics, physics, chemistry, introductory engineering, English, and a liberal elective. Professor Hartman commented on only three specifics. Pynchon did not do well in freshman physics—perhaps an augury of his later defection to literature. Indeed, his highest first-term grade was in English 111, the introductory course. Third, his liberal elective was astronomy. English and astronomy: a foretaste of *Gravity's Rainbow*?

What beyond these individual clues we can glean from the general catalog reveals a conventional science and mathematics program consisting of Mathematics 161, Analytic Geometry and Calculus; Chemistry 105, General Chemistry; and Physics 115, Mechanics. Pynchon's elective was, presumably, the first astronomy course, 101, Introduction to Astronomy. Each of these courses continued into the spring, but only physics covered new subject matter: wave motion, sound, and heat. The course descriptions indicate standard topics found in any comparable college program today, though science and engineering students more than a generation after Pynchon normally start at a higher level in mathematics, usually with introductory or intermediate calculus. Pynchon's liberal elective in astronomy further bolstered his program in the sciences.

In addition to these mathematics, science, and English courses, the catalogue lists three engineering courses Pynchon could have taken: Engineering 3117 and 3118, Drawing and Descriptive Geometry, and Engineering 3403, Fundamentals of Machine Tools. These courses in some form find a place in most contemporary engineering programs, with 3117–18 covering drafting (now normally at the computer terminal), and 3403 introducing students to the machines which fabricate materials. These three courses represent Pynchon's only formal training in engineering and technology respectively of which any record remains at Cornell. Their level of difficulty, by contemporary standards, is rudimentary. Unlike the contemporary engineering student, for whom drafting is actually an introduction to computer-aided design, engineering neophytes of Pynchon's generation slaved over drafting boards and indelible ink to master the techniques of flawless plan preparation and projection. Fundamentals of Machine Tools—described succinctly in the catalog as "Credit one hour. One laboratory period a week. Demonstration and operation of the basic machine tools and their accessories. Small tools and their applications" (90, 94)—is clearly a shop-work introduction to very basic technologies of metal working. None of these courses could have afforded Pynchon the sophisticated grasp of engineering, science, or technology later evidenced in his fiction.

What emerges from this record is a first-year program of courses in mathematics, physics, and chemistry that we can assume were taught with uncommon rigor—compared to normal expectations in conventional engineering of the 1950s, if not by today's standards. Pynchon chose to satisfy his one liberal, broadening elective in astronomy, but the three courses available in engineering and technology came nowhere near the sophistication he demonstrates in the descriptions in *Gravity's Rainbow* of how the V-2 was designed.

What *cannot* emerge from the printed record is the sense of dedication many Engineering Physics students must have felt. Less than a decade after American technology had brought the Second World War to its close, these select students were members of an elite group. (Remember that Pynchon himself went to Cornell at sixteen, well before the usual high school graduation age.) Their "vigorous and exacting" program proclaimed in the department description prepared them for "the industrial research laboratories and engineering development laboratories . . . in urgent need of [such] graduates." How did Pynchon respond to this sense of mission on behalf of the "expanding technological activities in the country"? In short, what did he make of the ambience of Engineering Physics, that here truly were the Elect of science and engineering?

No answer to this question about how the ethos of Engineering Physics affected Pynchon is at hand. Like so many of Pynchon's characters, we look at pieces of evidence but see no certain light. We can, however, lay to rest some common misconceptions about Pynchon and science in light of this research. First, it is simply not accurate to say Pynchon was formally educated in science, or engineering, or technology, at Cornell or anywhere else that we know of. Whatever esprit de corps he may have encountered among highly selected and motivated Cornell Engineering Physics students, the program itself in its first year, judging from the catalog descriptions, provided only the rudiments of basic physics, chemistry, and calculus. An introduction to drafting can in no way be called a formal education in engineering theory, nor does a first course in machine tools cover much applied technology. Nothing covered here is at a level remotely approaching that of the history of rocket technology in *Gravity's Rainbow*.

Second, Pynchon's first-year program provided little or no mention of the scientific concepts so many critics have rightly recognized as fascinating Pynchon, perhaps even shaping the worldview he crafts in his fiction. Thermodynamics (with entropy, information theory, and Maxwell's Demon), relativity, Heisenberg's Indeterminacy Principle, complementarity, and the energy-field visualization of the world were not to be found in Cornell Physics 115–16, or General Chemistry, or Astronomy 101. To be sure, upper-level courses did address these issues, but we have no way of knowing whether Pynchon attended any, even as a casual auditor. If he did, his competence in mathematics would have needed to far accede what he could have gained from his introductory calculus course—which does not appear to have been the case, judging by the references to his mathematical abilities in the introduction to *Slow Learner*.

Third, his program did cover all three of the areas—science, engineering, and technology—I insisted we must distinguish in examining Pynchon's use of "scientific" metaphors and ideas. After the first year of formal study at Cornell in the early 1950s, an Engineering Physics major would be no wiser than the rest of us about Maxwell's Demon. But he would have encountered basic physics and chemistry as fundamentals in the sciences, and five hours a week per semester in drafting plus two-and-a-half hours a week in machine tool technology. Instruction in these two engineering topics was predominantly laboratory- rather than lecture-based; the emphasis on application and design, rather than underlying theory, would have been obvious in contrast to the science and math courses. With only one year of Engineering Physics under his belt, Pynchon would have attained a clear idea of the interdependencies and differences among science, engineering, and technology. But his formal training would not have prepared him to understand entropy, or write "Entropy."

Pynchon must then have acquired his working knowledge of all these scientific concepts on his own, at Cornell and elsewhere. Like Oedipa Maas in *The Crying of Lot 49* (presumably also a Cornell graduate and contemporary), Pynchon doubtless read *Scientific American* (at least the book reviews). We do not know, other than fellow novelist-to-be Richard Fariña, who his Cornell pals were (though his places of residence for all but his last year are recorded in Cornell directories, and so, with industry, his roommates could be tracked down). Short of uncovering some personal connections after the first year with majors in Engineering Physics or other non-literary fields, we can only assume, as the former Engineering Physics instructor Edmund Cranch speculates, that Pynchon's first year provided him with the

> base of fundamentals which has allowed Pynchon to penetrate further on his own into advanced topics. Although a highly unorthodox approach, it is conceivable that by reading on his own a completely dedicated, single-minded person could become well grounded in such advanced topics. Apparently Pynchon is one of those rare individuals who has high-level talent in both applied science and creative writing. (Letter)

In short, like much of what Pynchon brought away from Cornell in literature, in his studies of mathematics, physics, and technology, what really mattered to him he learned largely on his own.[9]

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Notes

[1] "Appendix: The Quest for Pynchon," *Mindful Pleasures: Essays on Thomas Pynchon*, ed. George Levine and David Leverenz (Boston: Little, Brown, 1976) 257.

[2] Donald F. Berth and Gladys J. McConkey, "Capstones of Century I," *Engineering: Cornell Quarterly* 6 (1971) 39. Gladys McConkey was the wife of James R. McConkey, Pynchon's first advisor in the English department.

[3] *Cornell University Official Publication: College of Engineering, 1953–54* 64.

[4] See Daniel Greenberg, *The Politics of Pure Science* (New York: New American Library, 1967), for a discussion of the historical developments in research support that Pynchon "anticipates" in *Gravity's Rainbow*. Pynchon comments on the post-war alliance between industry and research in one of the few published essays in his own voice, "Is It O.K. to Be a Luddite?" *New York Times Book Review* (28 Oct. 1984) 41.

[5] In conversation in April 1991, Donald F. Berth, former editor of *Engineering: Cornell Quarterly*, emphasized that Sack and Cuykendall had worked at Los Alamos during the Second World War and helped significantly to build a base of industrial and government support for the post-war Engineering Physics program after returning to Cornell. See also Berth, "Two Decades: Graduate School of Aerospace Engineering and Department of Engineering Physics," *Engineering: Cornell Quarterly* 1 (1966) 1, 39–44, and the tribute to Cuykendall under "Register" in the same issue, 32–34.

[6] Telephone interview with Professor Cránch, 23 July 1987.

[7] One such transfer from Engineering Physics to philosophy was Robert Eisenman, whose years at Cornell (1954–58) fell within the limits of Pynchon's. Eisenman, now Professor of Middle Eastern Religions and Chair of Religious Studies at California State University, Long Beach, confirmed in a telephone interview on 28 May 1992 much of Cranch's depiction of the rigor of the program. He added, however, that he and many classmates were

dismayed by the intense elitism of the program, and by the visible glee many faculty had in humiliating very bright students with over-difficult exams. Further, many of the best in Engineering Physics were frustrated with the single focus on technical topics among the faculty and many fellow students. The ultimate impact of the program—"to drive bright kids away from science and technology"—was "atrocious," according to Eisenman.

Professor Eisenman did not know Pynchon by name, but did recall that in 1958, during his senior year, he came to know the novelist by sight when Pynchon and his friends joined in demonstrations against Cornell authorities who were trying to repress signs of political and social unrest, threatening seniors with summary dismissal. Eisenman recalled the unlikely conjunction of fraternity brothers and pre-beat "Bohemians" (like Pynchon and Fariña) who vented their outrage by the then-unheard of act of publicly protesting at the president's house. Looking back, Eisenman and his Cornell peers regarded the 1958 protests as forerunners of the unrest of the 1960s and the political activism of organizations like SDS.

[8]Letter from Professor Cranch, 17 July 1987.

[9]I am indebted to Stephen Tomaske for comments on an earlier version of this paper.