Symposium on the History of Technology: Past, Present, and Future
Massachusetts Institute of Technology
Program in Science, Technology, and Society (STS)
June 7-8, 2024 (Final Session)

Summary Thoughts on the History of Technology and its Importance in Today's World

Victor McElheny

As we begin the summarizing session, discussing what's missing in the history of technology, which is another definition, basically, of continuing excitement, I should mention the obvious fact that I have been approaching the history of technology in a different way from most people who have made this field an academic career.

For me as a science journalist, such history is an essential part of popularizing the things and processes that the generality takes up and uses. For the last 65 years, ever since the Russian launch of the Sputnik satellite atop a giant, already obsolete liquid fuel three-stage rocket in Central Asia, my job has been to pick a few events -- that dreaded term that Fernand Braudel shunned -- or developments that are judged by journalists to be making news, that is approaching or arriving at a time of widening application and impact on the daily lives of readers, listeners, viewers, and users of hand-held devices like Steve Jobs's iPhones.

At the twice-weekly *Exonian* at Phillips Exeter Academy, I covered a lecture by Walter Gropius who exclaimed, "We must humanize the impact of the machine." And he showed us a slide of Damascus. From the sky it just looked like a whole bunch of circles and squares. He was talking about how you can use what looks very uniform to make a vital world.

At the almost-daily *Crimson* at Harvard I wrote about psychological services available to students. At my first grown-up newspaper down in South Carolina in 1957, I wrote about local doctors' struggles to set priorities for receiving scarce vaccine against the expected epidemic of what was called Asian flu.

Moving soon to the Charlotte *Observer*, a Knight newspaper, I covered the rewriting of school science curricula in response to the shock of Sputnik as its rocket casing flashed overhead

in the night sky. It was probing the ionosphere as part of the International Geophysical Year. That's a backchannel between physicists East and West for which the Keelings began their regular measurement of carbon dioxide from a remote volcano in Hawaii and the South Pole.

In Charlotte's medical center, surgeons were pioneering cardiac catheterization. After a stunning visit to Bell Labs in New Jersey, I told people in Charlotte what was happening among the phone switches downtown as they began dialing long-distance phone calls themselves.

To get at the safety of the new nuclear power plants, I spent a week at Oak Ridge, Tennessee. They were actually rather worried about it. To get at the science surrounding the weather reports, I visited a slew of labs in and around Washington, D.C.

For the magazine *Science*, based in London, I covered explosions of research responding to *Le Défi Américain*, the American Challenge in Europe and then also Israel and India. For the *Globe* in Boston, I covered the Apollo moon flights as well as molecular biology and the chemistry of the cosmos. It does have one. Formaldehyde with clouds broadcast on a particular frequency.

And at the *New York Times*, I covered a jumble of subjects from subway car repair and sewage treatment to chemical pollution, struggles including the Ames Test, which was mentioned before, struggles over energy policy, the desalting of water, trends in worker productivity -- it wasn't going up so fast -- and the explosions of semiconductors and communications network and the rise of desktop computers.

I finished my time there with the dramatic electricity blackout of July 13, 1977, a perfect failure. It took them twice as long to fix it as the blackout in 1965 on the dreaded ninth of November. Perhaps I should mention that my career involved working for two leading American innovators, leading to later biographies. They were Edward Land of Polaroid and James Watson of Harvard and Cold Spring Harbor Laboratory.

For Land, I wrote a lay language description of the SX-70 film and camera system, a salient example of Schumpeter's creative destruction. For Watson, I ran 20 conferences and published 12 proceedings volumes about environmental sources of cancer.

But I've also been a member of MIT's STS family since 1982, setting up the Knight fellowships, which is a mid-career program like the Nieman at Harvard. Actually, when I described to President Paul Gray the prospect of doing this and endowing it, he asked me how much money was involved.

And I said, "Well, about $10 million." "That's a lot of money," he said. "I want to be involved, but down the road, I'm not here, you're not here. It's not the best way to spend the money." I said, "Well, I have been thinking about that very question for some years. We're not

endowing a means. We're endowing an object. And that object is the public understanding of technology and science." And Paul's immediate response was, "If we are not in that business, we are in no business."

In studying the abstracts that you have so kindly provided before the meeting to honor Roe Smith and the insights that he has brought to the history of technology, I became conscious of two themes that seemed underplayed – people and their politics. Any of us has a long list of people, including scientists like the tax farmer Lavoisier, who revolutionized chemistry, or Boltzmann, who among other things was Lise Meitner's teacher, or Carnegie or Rockefeller, the rationalizers of steel and oil. Let's try a little politics, which is involved intimately with infrastructure and also with the choices of developing tools and methods, not only the **"**What**?"** but also the **"**How fast**?"** and **"**At what scale**?"**

Most of us would accept that the extension in 1775 of Watt's 1769 patent on a separate condenser steam engine is the event signalizing the advent of the Machine Age. I even wrote a Sunday Business piece in the *New York Times* on the first of July, 1975, saying that the industrial revolution was exactly 200 years old that day. I had fun the next day in the *New York Times* "Second Front," a very big display page, with an article celebrating the Centennial of Bell's conceiving the idea of a telephone at the family farm in Ontario. He sold his stock very soon after the company was formed, by the way. Then they had to tear up the whole thing ten years later because you couldn't do it with one-wire earth return anymore.

That's a way of saying that the history of technology directly confronts people and politics. Watt was frustrated by the low level of craft and skill and quality of materials during the early trials of his invention at the Carron arms factory in Scotland. He knew that getting there would require a lot of time and a more vigorous partner. And he found one in Matthew Boulton. They needed to extend the patent to have time enough to recover their investment. And so the extension they sought was 25 years. They had to get that from Parliament.

Watt, think of that, had to go to London for the lobbying. This was exactly the same place engineers with a dream had to go to get the right-of-way for transportation infrastructure, that is, harbors, turnpike roads, canals, bridges, and not much later, railroads. So the pace and scope of technological developments were embraced from the beginning in a swarm of lay people with existing economic interests like landed property.

Wedgwood and his clays and temperature readings and artist decorators and the fashionable tastes of the queen of Great Britain -- that's Charlotte -- and the Empress of Russia -- that's Catherine of Anhalt-Zerbst -- was hip deep in social construction. That viewpoint, of course, immediately brings up what can be called national technological mobilizations. Examples

are legion. Maybe the classic one is Venice's arsenal, operating for centuries to build vessels for a combination of war and commerce. Maybe we can do some of the pre-industrial that Wolters was suggesting.

One could think of England draining the fens under Charles I, who was in all kinds of other trouble. And Louis XIV of France committing large resources over many years of war to building the Canal du Midi while Colbert was setting up oak forests for the navy. We think of Roe Smith's foundational study of the birth of clock-driven industrial discipline in the United States during a 30-year drive to perfect arsenal methods of making firearms with interchangeable parts.

This drive from the War of 1812, running from that war until the Mexican War**,** resulted in tools and methods consciously made available to civilian manufacturers, not only of weapons but also sewing machines, not just for fabric, also shoes. The sustained effort had its origins in the miserable performance of the American army in the War of 1812. And it was fostered by President Monroe's secretary of war, an upcountry South Carolinian named John C. Calhoun, better known for his fierce advocacy of the rights of minorities, that is Southern slave owners.

More recent is the famous American production blitz in World War II, energized by people like William Knudsen of General Motors, co-developer with Charles Sorensen of Henry Ford's Highland Park electricity-driven assembly line.

Roosevelt summoned Knudsen to this side on May 28, 1940. That was a quick conversation. "Knudsen?" "Yes, Mr. President." "I need you here to work on some production problems. How soon can you get here?" And Knudsen said, "Day after tomorrow. I have to talk to Sloan tomorrow." The tectonic American effort in production included an all-out rush to build both uranium and plutonium bombs and the Boeing B-29 super fortresses that deployed them, alongside the repeated fire-bombing of more than 60 Japanese cities.

The atomic bombs were developed because of an Anglo-American assessment that Hitler had a good chance of getting them first. That drive was accompanied by others such as America scaling up manufacture of penicillin for prompt use on wounded soldiers starting in Sicily in 1943. Proximity fuses for artillery shells, which were very useful against the V1 over the channel in the summer of 1944. Streams of merchant vessels. Synthetic rubber. High octane gasoline for war planes, pipelines to move liquid fossil fuels across North America.

And one desperate interval in the B29 project, Knudsen -- and remember they had dressed him up as a lieutenant general -- was employed as an ad hoc straw boss of the work in Seattle and Wichita. This man visited 1,100 factories in 1,100 days to inspire war workers to work more effectively. It was a frenzy, but it has been repeated several times. In the fifties, Americans

sought to counter Soviet militarization by developing a matching deterrent using bombers and submarines and missiles.

There was a companion decade-long drive into space, not only including voyages to the moon and back by astronauts and a start on exploring the planets, but also flotillas of satellites to follow weather patterns, establish broadband communication across oceans, and worldwide navigation. And perhaps most important of all to spy on military preparations of hostile powers.

Even decades later in 1988 to 2003, the United States spearheaded a global drive to read the genetic code embedded in the molecule DNA following a stair step upward and complexity from bacteria to yeast to fruit flies to mice to humans.

Readers of books like R.C. Allen's about Britain's start on the Machine Age or Robert Gordon's history of American growth with particular emphasis on material development of daily life in the late 19th Century gilded age -- think screens on windows, maybe towels -- would suspect that we aren't done with looking closely at the *Lives of the Engineers* written by Samuel Smiles. Dare I mention his name?

After all, the center ring developments we call modernity have taken place over about ten human generations, taking a generation at 25 years, during which human numbers have increased eight- fold. That is**,** five-fold since 1900. That's when you get gasoline. Real wages and income as well as the use of inanimate energy have all exploded, accompanied by at least a couple of centuries of capital growing faster than income, and a variable but persistent inequality in shares of income and wealth as shown by Piketty of Paris and his colleagues, just to mention an interesting example of data accumulation and analysis.

It also seems clear that we are engaged presently in a couple of very challenging technological mobilizations, the shift to renewable energy sources, and away from fossil fuels, and the struggle to prepare for and fight outbreaks of infectious disease across a world linked by many thousands of jet airliners.

From the point of view of a science journalist, we have big-scale challenges in both the physical and the life sciences – not much room left over for fashionable despair. In such a world, the history of technology is a vital tool and process in the material choices we humans make.