A difference maker

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Image courtesy of the MIT Museum.

In January 1942, a month after the United States entered World War II, Japan launched a new series of attacks in the Pacific, while German submarines started a new wave of strikes in the Atlantic. Against this grim backdrop, *Collier's* magazine ran a story for its 2.5 million readers about one vital person who, it claimed, could turn the tide: "Meet the man who may win the war," the publication said.

That man was Vannevar Bush PhD '16, inventor, engineer, former professor and dean of the School of Engineering at MIT, and, as of 1942, head of President Franklin Roosevelt's newly created Office of Scientific Research and Development (OSRD), where Bush oversaw much of the United States' wartime scientific research. Some scholars have called Bush "the first presidential science advisor," a role that did

not formally exist then. *Time* magazine, in a 1944 cover story, dubbed Bush "The General of Physics."

But no single job description encapsulates Bush's accomplishments. The technologies Bush helped introduce gave the United States its critical military edge: He oversaw the development of radar and accelerated the Manhattan Project to produce the first atomic bombs. Moreover, Bush created his own wartime role when, sensing a need for new military technology, he persuaded Roosevelt in 1940 to establish a science-research agency in the first place. Essentially, Bush provided America's military research the direction and urgency it needed.

By war's end, Bush had also created a roadmap for America's future with his report, Science: The Endless Frontier, which advocated long-term government funding of academic research to produce progress through innovation. "No American has had greater influence in the growth of science and technology than Vannevar Bush," former MIT president Jerome B. Wiesner once wrote.

'Mr. President, what the hell do you think I've been doing?'

Vannevar (rhymes with "beaver") Bush was born in 1890 in Everett, Mass. He received his undergraduate degree from Tufts and his PhD in engineering jointly from MIT and Harvard in 1916. He joined MIT in 1919 as an associate professor of power transmission and became dean of the School of Engineering in 1932. Bush could intimidate colleagues and play hardball professional politics, but he also took a romantic view of his work: "He who struggles with joy in his heart struggles the more keenly because of that joy," Bush wrote.

Bush also had an inventive mind. His best-known innovation, the

"differential analyzer," was a room-size calculating device representing an important step toward the computer. As an MIT professor, Bush advised Claude Shannon, the pioneer of information theory, and Frederick Terman, who helped develop Silicon Valley as a technology hub.

In 1938, Bush left MIT to head the Carnegie Institution of Washington, and he soon approached Roosevelt with the aim of improving America's scientific research. "Bush realized what universities had to offer in a way that nobody else realized at the time, especially concerning defense," says David A. Mindell, the Frances and David Dibner Professor of the History of Engineering and Manufacturing at MIT, who has written about Bush. (Mindell is also director of MIT's Program in Science, Technology, and Society; professor of aeronautics and astronautics; and chair of the MIT150 Steering Committee.) Through the OSRD, the United States military harnessed the intellectual power of academia while universities — especially MIT — received massive increases in government funding.

Shepherding radar and the atomic bomb to completion also involved years of bureaucratic struggles with Washington's military leadership. To succeed, Bush doggedly formed good working relationships with Roosevelt and his successor, Harry Truman.

As Bush recounted later, Truman once remarked, "Van, you should be a politician." Bush replied: "Mr. President, what the hell do you think I've been doing around this town for five or six years?"

In 1945, Bush outlined his vision of a permanent federal agency to fund research in *The Endless Frontier*. "We have no national policy for science," Bush wrote, although, he asserted, science provides "much of our hope for the future." Bush's proposal led to the creation of the National Science Foundation (NSF) under Truman, in 1950.

However, Bush was not chosen to head the NSF, which became an agency very different from what the OSRD had been. As Mindell points out, Bush ran the OSRD as a gentlemanly science organization where program managers made successful decisions by knowing the scientific establishment intimately. By contrast, the NSF was subject to congressional oversight, and distributed grants based on peer review.

“Bush was an elitist in some ways that worked well,” says Mindell. “He felt that scientists saw the landscape better than other people and should be able to parcel out resources accordingly.” That approach was effective during World War II, but was less necessary afterward, Mindell notes: “In 1939, he was on an incredible rising trajectory, but by 1947, his vision had to compromise with the needs of a democracy.” Bush returned to the Carnegie Institution, then served as chairman and honorary chairman of the MIT Corporation. He died in 1974.

As we may link

Still, Bush’s legacy lives on in multiple ways. The growth of computing has brought renewed attention to his ideas about processing and storing information, including the “Memex,” an information-storage concept detailed in Bush’s 1945 essay “As We May Think,” in *The Atlantic Monthly*.

The Memex, as Bush described it, would be a microfilm-based device “in which an individual stores his books, records and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged supplement to his memory.” Some personal-computing pioneers have cited the Memex as a source of inspiration presaging the ways we link digital information today.

“I remember being thrilled” after reading “As We May Think,” Douglas Engelbart, inventor of the computer mouse, once said, because of Bush’s

vision of “a memory structure [creating] relationships in ways that linear paper couldn’t.”

Ultimately, though, it took all of Bush’s knowledge and skills — technological, intellectual and political — to transform America’s scientific establishment at a moment of urgent wartime need. That *Collier’s* article from the dark days of 1942 turned out to be prophetic.

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