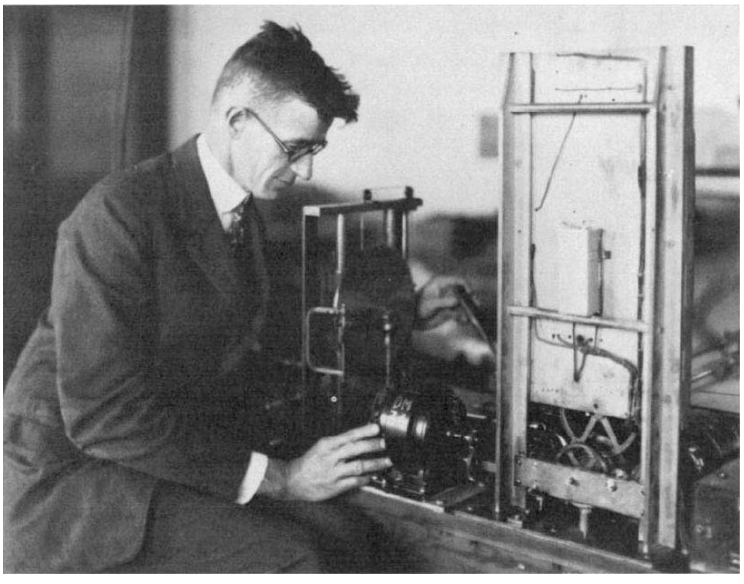
The Typical American Scientist: Vannevar Bush

President Franklin Delano Roosevelt understood the necessity of scientific advancement for national security. The involvement of science in the war effort was not only required for the development of new, more powerful, and longer-range weaponry, but also for aiming the new ordnance. Accurate trajectory charts for the various ballistic weapons were in high demand, but required astronomical scales of calculation to produce.



Vannevar Bush with his Product Integraph, 1927.

Vannevar (pronounced like "achiever") Bush (1890-1977) had already been concerned about producing number crunchers, in the tradition of Leibniz and Babbage. Just before the war broke out, the Army Ordnance Department had commissioned him to apply his machine shop at the Massachusetts Institute of Technology to the calculations of ballistics trajectories. He had been working on improving his Differential Analyzer since 1931, and was assembling a new, more powerful version. This analog computer, which performed calculations by physically acting out the principles, opened up the prospect of applying mechanical calculation to problems involving the integral calculus.

Bush had built his first machine, the Profile Tracer, to obtain his doctorate in engineering. This machine was slung between two bicycle tires and pushed like a lawnmower. As it moved, a pen inside would continuously draw the changing elevation of the land onto a rotating drum of paper, producing a virtual photograph of the cross section of the land traversed. The mechanism formed the basis for his next machine, the Product Integraph. This device, built with his student Herbert Stewart, was the key to performing integral calculus using an array of rotating wheels. The Differential Analyzer used more than a dozen of these Product Integraphs, in a structure half the size of Bush's laboratory. By the end of the war, it was the most important calculating machine in the United States, as it was the fastest and most accurate producer of trajectory tables.

The development of the principles governing analog computers lost all funding after the death of Roosevelt. At that point, the new program of Cybernetics, driven by London through Columbia University, had virtually taken over. Norbert Wiener, Bush's former student,[1] had been installed as the head of MIT's Research Laboratory for Electronics (RLE), and all research was now directed towards development of the digital computer.

In Wiener's recommendations for development of the computer, he specified: "That the central adding and multiplying apparatus of the computing machine should be numerical, as in an ordinary adding machine, rather than on a basis of measurement, as in the Bush differential analyzer."[2]

Today, Bush's Differential Analyzer sits in a museum case in the basement of MIT, while the digital computer has become the false symbol of "technological advance." Each somewhat faster component is advertised as a breakthrough, though the principles remain the same. Let us break this cycle, and return to true scientific advancement, using scientists such as Vannevar Bush, as an inspiration.

—Peter Martinson, LaRouche Youth Movement

1. Wiener, who got his start when Bush appointed him to head up the anti-aircraft ordnance department, faced the problem of targeting a German Luftwaffe dive bomber, which moved as fast as the bullets used to shoot it down. His innovations included his concept of feedback loops, modeling the targeting of a weapon after the mind's control over the body. He then went off the deep end, when he started modeling the mind after weaponry control systems.

2. Norbert Wiener, *Cybernetics* (New York: MIT Press, 1961).

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