STEM AND INNOVATION IN WORLD WAR II

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(Image: The National WWII Museum.)

The ancient Greek philosopher Heraclitus once noted that "War is the father of all things." Since war is a matter of life or death, a "to be or not to be" moment for the armies fighting it, human beings will bend all their energy, strength, and ingenuity to fight and win. In the modern era, that means harnessing the power of science, technology, engineering, and mathematics, now popularly referred to as STEM, to the war effort.

Never was this process clearer than in World War II. Global war required global military forces, and all the combatants recruited them. Tens of millions of human beings put on a uniform of some sort during the war, serving as soldiers, sailors, airmen, and marines. But marching alongside those millions was another force: the force of new machines, new weapons, and new technologies. Technology was a "force multiplier," making all those humans even more efficient at fighting and winning.

Technology was everywhere in World War II. Some forms, like "radio detection and ranging" (RADAR), helped you find the enemy; others, like "walkie-talkies," let you communicate more effectively with your own troops. Some new technology (B-17 strategic bombers and proximity fuses) killed; other forms, mass-produced penicillin, for example, saved thousands of lives that would surely have been lost in previous wars.

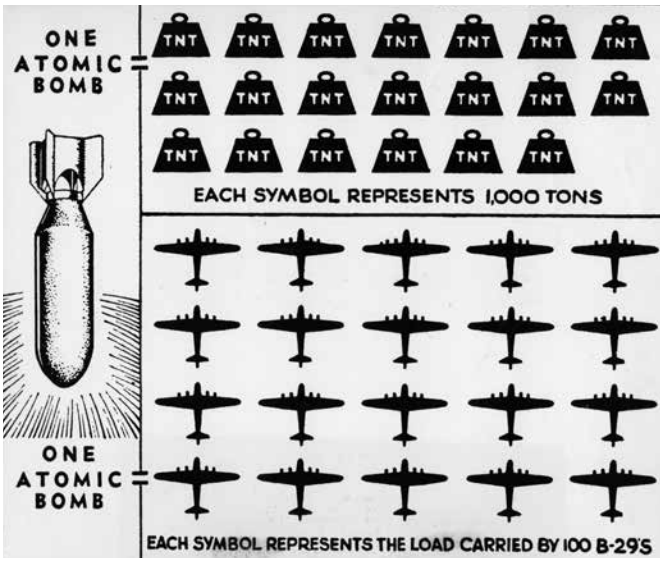

Chart illustrating the relative power of the atomic bomb. August 20, 1945.
(Image: The National WWII Museum, 2012.019.644.)

Now, STEM does not always mean a lone genius, staying up all night in her laboratory, and only emerging when she has the miracle invention that will win the war. Rather than solitary inventions, wartime scientists and inventors were more likely to adopt, adapt, and apply. Often, they took previously known technologies and employed them in the service of wartime. To give just one example, penicillin had been discovered in 1928 and was already seen as a "wonder drug" in killing bacteria. But the increased wartime need for penicillin to treat millions of wounded soldiers led to new experiments and techniques. All the major pharmaceutical companies in the United States were involved: Merck, Squibb, Pfizer, and others. Eventually, it was Pfizer that developed a process it called "deep tank fermentation," the technological breakthrough that made the mass production of penicillin possible and forever changed the face of war.

In fact, that might be the most important point to make about STEM in World War II. Modern warfare requires complex technologies, and rarely does it result from the work of a Thomas Edison-like genius. New high-altitude Boeing B-29 bombers, for example, were revolutionary machines, with pressurized crew compartments, automatic turrets, and analog computers. Each bomber consisted of over 8,000 separate parts and had 560,000 separate electrical connections. Designing and assembling a B-29 was a daunting task, requiring teams of scientists, technicians, and workers. The gigantic Boeing facility for B-29 production was located in Kansas, and so difficult was the development process that Boeing personnel dubbed it the "battle of Wichita."

In the end, you couldn't fight World War II without brave men and women, but you couldn't win it without up-to-date, cutting-edge science and technology. Those technological breakthroughs often appeared to be some sort of "miracle" (like iPhones and tablets today), but it was usually the result of a great deal of hard work, thousands of people, and millions of hours.