

# Chinese American Hero: Wen Tsing Chow

In celebration of our Independence Day on July 4th we will be highlighting some of our veterans and others who have made major contributions to America's national defense as well as the protection of our liberties and freedom.

We lead off with someone who wasn't a veteran, but his national defense contribution and contribution to the modern world was extremely important. For many today the Cold War is ancient history, but less than a generation ago, many Americans feared the Soviet Union and their nuclear weapons.

In the early 1950s through the mid-1960s a missile system known as the Atlas F ICBM system was built for America's own nuclear deterrence. Many scientists and engineers were involved in developing our Atlas F, but one Chinese American computer engineer, trained at MIT, played a very key role. His name was Mr. Wen-tsing Chow and his contribution was in developing PROM (programmable read-only memory) that enabled a guidance computer that took up an entire room in the 1950s to be shrunk down to a few feet and fit inside the nose cone of a missile. Although a military secret until the mid-1960s, the creation of accurate space guidance systems later enabled the accurate deployment of satellite communication systems now used every day to beam news and information instantly across the globe. PROM's also live on in the computer game machines that many American households own in the 21st Century. Mr. Chow's subsequent engineering contributions played a major role in all American military missile systems and NASA space programs up to the Space Shuttle.

Wen Tsing Chow

**Name in Chinese:** 周文俊;

**Name in Pinyin:** Zhōu Wénjùn

**Gender:** Male

**Birth Year:** 1918 – 2001

**Birth Place:** Taiyuan, China

Father of American ICBM guidance systems



**Profession(s):** Aerospace and Electrical Engineer, Computer Pioneer

**Education:** 1940, B.S. in Electrical Engineering from Jiaotong University, Shanghai; 1942, M.S.E.E. from the Massachusetts Institute of Technology

**Awards:** In 2004, the United States Air Force posthumously awarded Wen Tsing Chow one of their highest awards, the Air Force Space and Missiles Pioneers Award, held by only 30

individuals. Chow is one of only a handful of civilians to receive this award, and, along with Dr. John von Neumann, one of only two computer scientists so honored. The Organization of Chinese Americans honored Mr. Chow in 2006 posthumously as a Pioneer and “Unsung Hero.”

**Contribution(s):** Wen Tsing Chow, produced many breakthrough inventions while he worked for American Bosch Arma Corporation (now a part of United Technologies Corporation), Aerospace Corporation, and IBM. While working for American Bosch Arma Corporation in the late 1950s he designed the first all-inertial guidance computer for the United States Air Force Atlas E/F ICBM (Intercontinental Ballistic Missile.) His was the first production digital computer now used to guide all missiles, satellites, and spacecraft guidance systems accurately through space. Chow became known as the “Father of American ICBM missile guidance.” His invention helped make satellite communications possible, instantly linking up the entire world in the late 20th and 21st Centuries.

While there were many American scientists and engineers who helped develop the Atlas ICBM system, Chow played a critical role. In the 1950s, mainframe computers were too large to fit into the nosecone of an ICBM so there was little accurate guidance beyond unreliable mechanical controls. A missile or satellite could very well end up miles off target. Chow’s breakthrough was in designing and miniaturizing a computer that would fit. Central to this was his invention of “Programmable read-only memory” or PROM that enabled guidance instructions to be locked into a computer. This invention was kept a secret for national security reasons for several years during the operational life of the Atlas as a ICBM but eventually found civilian use in many different products such as video game machines.

Mr. Chow, uniquely, worked on the guidance systems for every major United States Air Force ICBM and NASA manned space program from the very beginning with the Atlas, through Titan, Gemini, Saturn, Skylab, and the Space Shuttle, to the Minuteman ICBM still in service today.

**Publications/Patents:** Mr. Chow invented and held the patent on what is now commonly known as programmable read-only-memory or PROM. PROM, in the late 1950s called a “constants storage matrix,” was invented for the Atlas E/F ICBM airborne digital computer.