

OBITUARY

Qian Xuesen (1911–2009)

Founder of China's missile and space programme.

Perhaps no one better embodies the irony of the cold-war era than Qian Xuesen, also known as Tsien Hsue-shen, the Chinese rocket scientist who died on 31 October at the age of 97. Widely acknowledged for his work on rocket propulsion and his contribution to the US missile programme during the Second World War, Qian was deported at the height of the McCarthyism hysteria on dubious charges of being a communist, only to become the driving force behind China's rise to the first rank of space nations.

Qian was born in the eastern city of Hangzhou in 1911, as China's 2,000-year-old feudal system was overthrown, and he was destined to encounter both turbulent historic events and social upheaval. After graduating from Shanghai Jiao Tong University as an engineer, in 1935 he went to study aeronautics at the Massachusetts Institute of Technology (MIT) in Cambridge. Theoretically inclined, he was dissatisfied with the practical emphasis that MIT placed on its curricula at the time, and soon moved to the California Institute of Technology (Caltech) in Pasadena. During his time there, he rose to become one of the most prominent rocket scientists in the United States.

At Caltech, Qian was the protégé of the legendary theoretical aerodynamicist Theodore von Kármán, and became a renowned theoretician in high-speed flight. The two men were the leading members of a group of rocket experimenters known as the Suicide Squad because of the dangerous nature of their work. In 1939, their research attracted the attention of the US Army Air Corps, which tasked Caltech, including Qian, with developing jet-assisted take-off technology — a means of helping heavy aircraft to take off by providing additional thrust in the form of small rockets.

The 1943 discovery of German rocketry development led to the acceleration of the US missile programme and the creation of the Jet Propulsion Laboratory at Caltech, which appointed Qian as a director. Two years later, Qian received high-grade security clearance from the Pentagon and, as a member of the Scientific Advisory Board, began advising on the latest classified technologies for military development. By 1949, he had laid the theoretical groundwork for a spaceplane with winged rockets, a predecessor of the space shuttle.

Meanwhile, Sino-US relations had deteriorated with the onset of the cold war, and this had devastating consequences for Qian's career. In 1950, he was accused of



being a communist spy — allegations that have never been substantiated — and his security clearance was revoked. Deeply hurt by the accusations, and realizing that he was no longer welcome in the United States, Qian attempted to return to China, whereupon he was arrested and imprisoned by the US Immigration Service for two weeks. He spent the next five years living under partial house arrest, enduring constant humiliation and harassment, although he was able to continue teaching and to conduct limited research at Caltech. He was eventually allowed to leave the United States in 1955, as part of the conditions of China's release of eleven American soldiers captured during the Korean War.

Qian received a hero's welcome in China, and was soon asked to create a missile programme — a daunting challenge in a country where even telephones were luxuries. He began by retraining Chinese scientists and engineers, attracting Western-trained Chinese researchers to return, and building an efficient education and management system for research and development, all of which were to have lasting effects on the country's rocketry development. He joined the Communist Party in 1958 and became a trusted, high-ranking party official. With access to the top Chinese leaders, including Chairman Mao Zedong, he was able to persuade officials to support whatever measures he felt China needed to progress.

In 1956, Qian founded the Institute of Mechanics in Beijing, now one of the world's leading aeronautics institutions, and influenced the teaching of engineering at many Chinese universities. Under his

leadership, China progressed from copying the intermediate-range Soviet R-2 missile (a version of the V-2 rocket developed by Nazi Germany) to launching Dongfeng-2 in 1964 (a medium-range ballistic missile based on home-grown technology), and successfully tested its first atomic bomb a few months later. China's first nuclear ballistic missile was launched using Dongfeng-2 two years later, and the first Chinese satellite went into orbit using Long March-1, a three-stage space-launch version of Dongfeng-4, in 1970.

Qian's endeavours were responsible for the development of the Haiying family of anti-ship missiles, widely known in the West as Silkworms. They also paved the way for a succession of increasingly ambitious space programmes. For example, Shenzhou-5, China's first manned space mission, was launched in 2003, and Chang'e-1, the first Chinese lunar probe, was sent into orbit in 2007, using the Long March family of rockets.

It is extraordinary that China's missile and space programmes took off against a backdrop of economic and political turmoil. They were postponed several times during the Great Leap Forward — a social and economic plan enacted in 1958 that brought the country's economy to a standstill and triggered widespread famine. In an ironic twist of fate, Qian also endured the Cultural Revolution, an 'anti-revolutionary' witch-hunt launched by Mao in 1966. Some of Qian's friends and colleagues were removed from their positions as a result; Qian himself, although largely unaffected, was forced to write letters of 'confession'.

Despite the grave injustice Qian suffered in the United States, it is clear that his time at Caltech was one of the most enjoyable periods of his life. He revelled in the great relationship he had with von Kármán, enjoying his mentor's jokes and their often heated arguments. He also reminisced, with great affection, about the intellectual ethos and creative spirit fostered at Caltech. He contrasted these with China's academic culture and science infrastructure, which he thought had not, and would not, lead to any real scientific innovation.

Towards the end of his life, Qian was confined to bed, but he still received regular visits from the Chinese premier Wen Jiabao, with whom he discussed the problems that he felt affected China's scientific development. Although delighted to witness the tremendous advances in the missile and space programmes that he had helped to establish, Qian felt that the intellectual legacy he had brought from Caltech had largely failed to take root in the academic soil of his own country, and this saddened him deeply. Despite his reservations, there is no doubt that he sowed the seeds of change for Chinese science.

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