

## Chapter 2

# Why is China Going into Space?

### An Historical Perspective

The 1966–1976 Great Proletariat Cultural Revolution (文化大革命) has had lasting effects on China’s aerospace industry. These impacts can be seen in terms of technological hardware and selected missions, rules and norms in decision-making, institutional infrastructure and organization, and on the aerospace professionals and Chinese people.

The aerospace industry under Mao Zedong (毛泽东) was inexorably tied to the social and political currents of the Cultural Revolution.<sup>1</sup> As a result, residual impacts by the Cultural Revolution remain evident in China’s modern space programs.<sup>2</sup> Whereas Mao, and his successor Deng Xiaoping (邓小平), quite successfully utilized the nascent aerospace industry for military and political goals, neither could foresee the momentum China’s emerging aerospace industry would gain that helped transform China into a modern society.<sup>3</sup>

Mao took full advantage of the technologies coming from the nascent aerospace industry to support his military and political objectives. However, Mao never fully resolved the contradiction of how to mobilize the masses, support class struggle, and persecute the intellectual class, while also supporting high-technology endeavors for national defense. Therefore, during the Cultural Revolution, a large-scale reorganization of the aerospace programs under the Chinese Academy of Sciences (CAS 中国科学院) was undertaken. Because many of the space-related programs were stripped from CAS and handed over to military control, they were better able to survive much of the chaos of the Cultural Revolution and were partially protected from the Red Guard (红卫兵), who were made up of millions of

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<sup>1</sup> For more on political considerations for science and technology studies in China, see Ref. [1].

<sup>2</sup> The term “aerospace industry” encompasses China’s entire civil, military, commercial, and academic sectors, whereas, the term “space program” indicates one space endeavor such as the human spaceflight program, the lunar program, the Fengyun meteorological satellite program, the Beidou navigation satellite program, etc.

<sup>3</sup> For more on the aerospace industry during the Cultural Revolution, see Ref. [2].

red arm-banded militant students across China mobilized by Mao to tear down the heart of Chinese culture, which included institutionalized education and scientific research.<sup>4</sup> The reorganization to turn over many of the space programs to military control alleviated some of the rampant paranoia directed toward CAS and the scientists and engineers that staffed it, since more trust was placed in the People's Army versus the intellectual class. For example, Premier Zhou Enlai (周恩来) placed the China Space Technology Research Institute in Beijing under the People's Liberation Army (PLA 人民解放军) and renamed it the 529 plant to avoid Red Guard attacks on its work.<sup>5</sup> This institute manufactured the Shijian-1 satellite ("Practice-1" 实践一号), which was designed to measure the distribution of the magnetic field in the near-Earth environment.

Also, shortly before China's first satellite launch of the Dong Fang Hong-1 ("East is Red-1" 东方红一号) on 24 April 1970, the entire Dong Fang Hong (DFH) program was handed over to the PLA's 7th Ministry of Machine Building for Astronautics. Other CAS resources were handed over to the PLA's 3rd Ministry of Machine Building for Aeronautics, including the CAS research institutes responsible for developing China's first low-altitude sounding rockets [4]. The reorganization of CAS and placement of control of several institutions under the military provided some protection from the Red Guard, ensuring survival of the aerospace industry. The impacts from those events are reflected in the modern aerospace organization, and, although there have been subsequent reorganizations, the backbone of China's aerospace industry has its roots in the Cultural Revolution.

In addition to the reorganization, Mao and other leaders of the Cultural Revolution attempted to diffuse popularity of aerospace technology achievements by associating them with national pride and deep politico-cultural responsibilities to serve the people. National pride for aerospace endeavors grew from the "Liang Dan, Yi Xing" ("Two Bombs, One Satellite" 两弹一星) program, which resonated with the people despite not having a direct technological impact on their daily lives. "Liang Dan, Yi Xing" connected with the Chinese people due to a very concerted public relations effort and, perhaps, in part due to the need for some joy during the chaotic time.

The deep politico-cultural responsibility to serve the people grew from the ancient tradition of the emperor asking the heavens for good weather and good harvests. Therefore, weather monitoring and disaster management, as provided by the aerospace industry, helped fulfill Mao's responsibility to serve the people on multiple levels. To illustrate, in 1968, China began to use foreign satellite weather data. But, to remove any perceived dependencies on foreign technologies, Chinese engineers began developing an indigenous satellite capability for meteorological

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<sup>4</sup> The students were encouraged to destroy traditional Chinese society to make way for a new socialist China, which resulted in young students turning against their teachers and even their parents, and laid the foundation for deeply seated suspicions and distrust that remain evident in today's society.

<sup>5</sup> In the exhibition room of the 529 plant sits the backup SJ-1 satellite on display [3].

data collection [2]. But the program suffered due to lack of funding and was postponed until the end of the Cultural Revolution, at which time the Fengyun (“Wind Cloud” 风云) satellite program, headed by Weng Jie (翁杰), was resurrected and resulted in the first Fengyun satellite launch in September 1988.<sup>6</sup> Due to the attention given to this mission during the Cultural Revolution, the Fengyun program remains a strong technological accomplishment in the current aerospace industry.

Because mass mobilization and continuous revolution were not sustainable, the Cultural Revolution ended, but the evolution of the aerospace industry did not. There is no doubt China succeeded in building the foundation for a strong and robust aerospace industry during a time when there was very little infrastructure, minimal financial support, and the continuous threat of persecution of scientists and engineers. On the one hand, foreign technologies were no longer entering China, nor were scientists and engineers cultivated to support the growth of space technologies. On the other hand, certain programs of the aerospace industry were financially supported during a time when there were very few economic resources, as long as they were deemed vital to national defense and political objectives. Indeed, the Cultural Revolution had a significant impact on the direction and pace of scientific and technological developments in the aerospace industry and, whether viewed in a supportive or destructive way, one can see effects of the Cultural Revolution in China’s modern aerospace industry.

## Deng Xiaoping Unleashes a Tsunami of Technological Change

Under the leadership of Deng Xiaoping, the aerospace industry that emerged from the Cultural Revolution underwent another round of changes in direct response to the previous decade. Deng Xiaoping’s Four Modernizations, promulgated in 1978 at the Third Plenum of the 11th Chinese Communist Party Central Committee (CCPCC),<sup>7</sup> was a policy designed to end the chaos that reigned during the Cultural Revolution by modernizing agriculture, industry, science and technology, and national defense. Deng’s policy created a pragmatic approach toward space sciences and technologies and resolved the place of scientists and engineers in Chinese society, which ended class struggle for the intellectuals.

As a part of the pragmatic approach to science and technology developments, aerospace scientists and engineers were encouraged to leapfrog technologies to

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<sup>6</sup> For more on the history of the Fengyun satellite program, see Shanghai Academy of Spaceflight Technology’s homepage at [www.sast.org.cn/index.htm](http://www.sast.org.cn/index.htm).

<sup>7</sup> For more on decisions made during this plenary session, please see the original proceedings 中国共产党十一届三中全会 on 22 December 1978.

catch up to the Western world. It was also under Deng's leadership that China's aerospace technologies were connected to the people on a practical level. For example, in order to fulfill the deep politico-cultural responsibility to serve the people, space programs were vectored toward communications, education and entertainment, and life science applications. Satellite applications by the aerospace industry into the lives of the people are how the Chinese made a direct connection to space-related technologies that reached beyond the goals of national defense, political objectives, and international prestige.

However, like Mao, Deng, too, could not fully realize that by supporting aerospace endeavors, he unleashed a tsunami of technological change that would shape China and the global space community. Jim Dator coined the phrase "surfing the tsunamis of change" [5] to signify the novelty, magnitude, and power of technologies on societies. Dator draws the metaphor of a tsunami coming from the future that will wipe everything out as it sweeps society into the future.

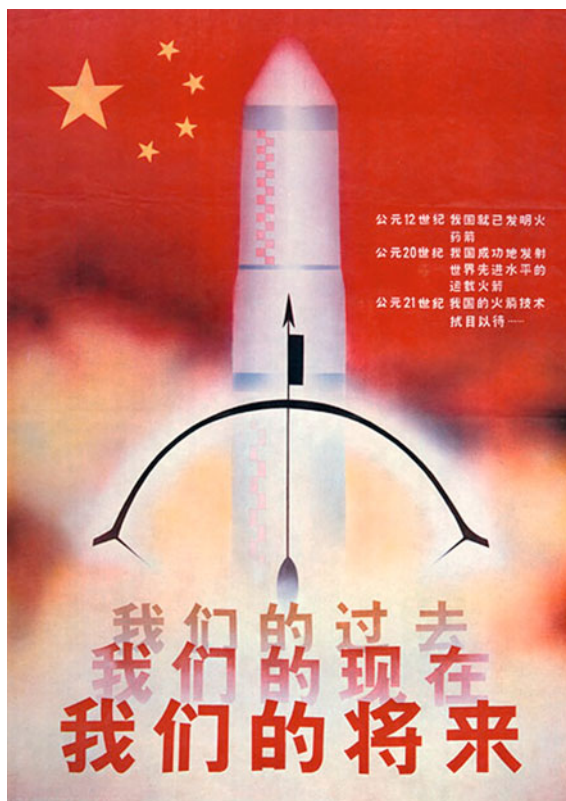
While the tsunami of technological change comes racing toward the beach, society is having a picnic and is focused on small problems such as the ants in sandwiches, the sand in the drinks, and who forgot to bring the chicken salad. He recommends, instead, taking the attitude of a surfer. Turn around and face the tsunami. Study it and ask other surfers about the conditions of the ocean. Then, wax up the board, plunge in, paddle out, and try to surf it [6]. It is clear that China's space programs are focused on the future and the technological changes aerospace endeavors will bring to society (see Fig. 2.1).

Deng Xiaoping found himself in command of a shattered country when he came to power in the mid-1970s. How was he to heal the economic, political, and social disasters of the Cultural Revolution? What was he to do about a fragmented and dangerous army, and how was he to rebuild a nation? Deng's leadership in the late 1970s to early 1980s, and his vision for aerospace endeavors during this time are partly responsible for unleashing a tsunami of technological change for China's future.

There are six basic reasons Deng fundamentally transformed Chinese science and technology (S&T) with respect to aerospace endeavors. He needed to create an environment in which the aerospace industry could flourish by leading China toward construction of (1) an orderly society, (2) a strong economic base, (3) S&T as the linchpin to the Four Modernizations, (4) a cultivated intellectual class, (5) a modern army, and (6) a solid national educational system.

The Chinese abhor chaos, and yet they suffered through it for a decade. The Cultural Revolution planted the seeds for a shattered, deeply wounded, and paranoid society. Deng's first order of business was to establish order and regain internal stability. As early as 1975, Deng was calling for order, stating, "By putting things in order, we want to solve problems in rural areas, in factories, in science and technology, and in all other spheres.... There was a unit known for its tough and long-standing problems. Its leaders were like tigers whose backsides no one dared touch. Later we made up our minds to spank the tigers... and soon they produced the desired results [7]."

**Fig. 2.1** “Our past, our present, our future” (Image from <http://chinese posters.net/themes/space-program.php>. Image courtesy of IISH/Stephan R. Landsberger)



Deng's direction for the country was not based on a future-oriented vision but one of a reactionary nature aimed to reestablish order and retain Chinese Communist Party (CCP 中国共产党) legitimacy. The consequential effects of unleashing the tsunami of technological change likely were not envisioned at that time. He wanted to heal the past and strengthen a weak society. Deng was able to create order out of chaos largely due to societal support for the return of order, which was rooted in an historical precedence. As ancient as the Yi Jing ("Book of Changes" 易经), a text dating back over 4,000 years ago and penned by the mythical Fu Xi (伏羲), the Chinese have viewed adaptation to one's circumstances by following the middle road as a societal value for which to strive, and thus instilling much needed calm back into Chinese society [8]. In ancient China, even the army's objective as a disciplined multitude was to exude a sense of order within society, thus supporting the concept of a People's Army [9].<sup>8</sup>

<sup>8</sup> Interestingly, today's PLA struggles with a lack of war fighting experience over the past several decades. Currently, it is gaining some experience through its anti-piracy activities in the Gulf of Aden.

Deng's second order of business was to build a stable economic base. Technologies, including aerospace technologies, played a critical role in economic recovery. During the 1958 Great Leap Forward (大跃进), Mao attempted to rapidly transform the country from an agrarian society into an industrialized socialist economy. Peasants were told to smelt their farming tools and cooking pots in backyard burners set up in the communes to make steel. Trees were cut to fuel the backyard burners, but the fires could not reach ideal temperatures and ended up producing useless lumps of iron. This failed industrialization of China, combined with natural disasters, resulted in the starvation of tens of millions of Chinese people. Right on the heels of such an unimaginable death toll came the calamity of the Cultural Revolution.

Deng's success with economic recovery was no small feat. Deng's Four Modernizations policy launched China into a trajectory it continues to follow today. As Deng stated in 1979, "Our vast territory and rich natural resources are big assets. But many of these resources have not yet been surveyed and exploited, so they do not constitute actual means of production [10]." Deng, thus, was able to get society focused on exploitation of resources to produce a basic economic foundation so that society could weather any future political turmoil or natural disasters.

Thirdly, as Deng stated, "The key to the Four Modernizations is the modernization of science and technology. Without modern science and technology, it is impossible to build modern agriculture, modern industry or modern national defense. Without the rapid development of science and technology, there can be no rapid development of the economy [11]." Of the Four Modernizations, S&T was the linchpin to economic recovery. Had the Cultural Revolution not taken place, there may not have been such a dedicated push toward S&T in the 1980s to recover the country from its dire state. Development of S&T directly led to exploitation and development of China's rich natural resources (land and labor) into productive assets for the country [12]. Thus, this goal fed into the tsunami of technological change.

Deng's fourth goal for China's recovery was directly related to the problem of the banished scientists and engineers, many of whom were "sent down" to the countryside to obtain political re-education. To obtain order and economic recovery, Deng had to support cultivation of aerospace scientists and engineers who would, in turn, help build the S&T base. As a result of Deng's calculated support of the banished intellectual class during this time, today's aerospace scientists and engineers remain strongly organized within the CCP. Deng reintegrated the scientists and engineers back into society by declaring that "everyone who works, whether with his hands or with his brain, is part of the working people in a socialist society [13]." However, by raising their status and material benefits, he also laid the seeds for an emerging middle class of technocrats [14].

Deng encouraged the selection of "several thousand of our most qualified personnel from within the scientific and technological establishment and [creation of] conditions that will allow them to devote their undivided attention to

research [15].”<sup>9</sup> Deng’s advocacy for wealth distribution, i.e., “to each according to his work,” helped to create the current economic class divide. Deng then stated, “There will not be excessive disparities in wealth [16],” perhaps illuminating a miscalculation of growing economic divide, which is perceived in current society as disparities between classes. Deng fomented growth of class status by encouraging class prosperity, which has risen above the standards of living for the majority of the Chinese people. This is a problem President Jiang Zemin (江泽民) exacerbated during his presidency by further elevating the status of technocrats within the CCP. Nonetheless, Deng was very successful in reintegrating scientists and engineers back into society and the CCP; and scientists and engineers in the aerospace industry were able to reclaim their status in society.

The fifth goal was to reign in a wild, undisciplined, and factionalized army. Lin Biao (林彪) and the Gang of Four (“Si Ren Bang” 四人帮) were responsible for the condition of the army in late 1970s. After the Cultural Revolution, Deng was skeptical the PLA was prepared to fight an invading army and was aware of the immediate need to consolidate the military [17]. In addition to leaving aerospace facilities under PLA control, his solution was to encourage scientific research and education within the military and train leading army cadres in modern warfare sciences and technologies [15]. At a meeting of the Central Military Commission in 1975, Deng proposed “peacetime education” for the army. This was an unprecedented action—given that the PLA, founded 1 August 1927, had been established 22 years before the founding of the People’s Republic of China (PRC 中华人民共和国).

Prior to the founding of the PRC on 1 October 1949, the PLA had been forged through years of fighting foreign invaders and civil wars. Army cadres “were promoted mainly on the basis of the test of the battlefield [18].” Deng promulgated a radical approach for the PLA Navy, Air Force, and special technical arms of the military to embrace higher-level schooling based on science and technology [19]. Aerospace technologies played an important part of this education, as military officers studied how space technologies could be a force multiplier for ballistic missile technologies; battlefield intelligence (indications and warnings, targeting, and battle damage assessment) via satellite intelligence, surveillance and reconnaissance (ISR) data collection; and beyond line of sight (BLOS) communications via satellites.

Lastly, the sixth reason for Deng’s actions that fundamentally transformed the aerospace industry was his work on reforming the educational system of China. During the Cultural Revolution, the country’s entire educational system was shut

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<sup>9</sup> Integrating the intellectual class back into society was accomplished in short order partly due to the Confucian ethic of hierarchical relationships, compiled in *The Analects of Confucius*, and the role of intellectuals in ancient dynastic political systems. This Confucian ethic supported the notion of man’s place in an hierarchical society where people’s relationships with one another are determined by their status as ruler, subject, father, son, husband, wife, elder sibling, younger sibling, or friend.



down. For 10 years, very little schooling took place across the nation. Deng encouraged reestablishing universities and colleges. He specifically called for reopening the Chinese People's University, reestablishing professional titles for lecturers and professors [20], and eradicating the Gang of Four's labeling of scientists and engineers as the "stinking number nine" (臭老九).

However, Deng was in a rush to see results because society and the economy were in such a fragile state. Therefore, while Deng encouraged the CAS to pay attention to the basic sciences and granted scientists time to work on basic research and teaching in the universities, he also urged them to simultaneously work on applied sciences and technologies [21]. The successes of rapidly reestablishing the educational system were supported by Confucian beliefs in codified education based on a system of rote memorization. Rote memorization stands in stark contrast to establishing independent innovation and is a system that continues to undergo reforms as China's central leadership seeks to find the right balance between rote memorization and creative thinking.

As Deng created a new China based on the six goals mentioned above, all conditions were right to create successful growth for the burgeoning aerospace industry. Deng had, in a very short time, unleashed a torrent of technological change across the country, one in which the aerospace industry could flourish. Deng was successful in restoring Chinese society not only due to support from ancient philosophies but also due to the power of charismatic leadership. In addition to the philosophical foundations of China's ancient ethics-based philosophies of Confucianism and the Yi Jing that supported his efforts, Deng also was adept at using the power of promulgation, a potent form of soft power in China. The Chinese people (老百姓), the army, the intellectuals, and even the Party cadres were in a malleable state during the post-Cultural Revolution. Deng's use of the power of promulgation created motivation for S&T research and development immediately following a time when such endeavors were ostracized (although still peripherally supported for national defense purposes) [22]. Deng was able to accomplish all this by convincing Chinese society that modernity was the answer to recovery and, to accomplish modernity, China had to ride the flood of technological change. Deng used the lure of S&T to offer the Chinese people an alternative to chaos. Research and development into S&T endeavors were transformed into a critical mission—a tsunami to surf—for the entire nation [23].

## References

1. Zuoyue, W. 2007. Science and the State in modern China. *Focus* 98(3): 558–570.
2. 张劲夫, “中国科学院与‘两弹一星’,” 光明网, 15日10月2004年; available from [http://www.gmw.cn/content/2004-10/15/content\\_111736.htm](http://www.gmw.cn/content/2004-10/15/content_111736.htm).
3. 费伟伟, “共和国的骄傲-北京卫星制造厂探秘,” 人民日报, 31日8月1998年; available from <http://rmrbw.net/read.php?tid=1153309>.
4. Jim Dator. 1994. “Dogs don't bark at parked cars” (paper presented at the World futures studies federation world conference, Turku, Finland, 23 August 1993).



5. Jim Dator. "Surfing the tsunamis of change" (paper presented at the construction beyond 2000 symposium, Espoo, Finland, 15 June 1992).
6. Shanghai Academy of Spaceflight Technology's homepage at [www.sast.org.cn/index.htm](http://www.sast.org.cn/index.htm).
7. Xiaoping, D. 1984. "*Things must be put in order in all fields*" In *Selected Works of Deng Xiaoping (1975–1982)*, 47. Beijing: Foreign Language Press.
8. The I Ching: Book of changes trans. Richard Wilhelm (New York, Bollingen Foundation Inc., 1950) 179–181.
9. The I Ching: Book of changes trans. Richard Wilhelm (New York, Bollingen Foundation Inc., 1950) 421–422.
10. Xiaoping, D. 1984. "*Uphold the four Cardinal principles*" In *Selected Works of Deng Xiaoping (1975–1982)*, 172. Beijing: Foreign Language Press.
11. Xiaoping, D. 1984. "*Speech at the opening ceremony of the national conference on science*" In *Selected Works of Deng Xiaoping (1975–1982)*, 102. Beijing: Foreign Language Press.
12. Jacques Ellul. 1964. *The technological society*, New York, Alfred A. Knopf Inc., 1964, 312.
13. Xiaoping, D. 1984. "*Speech at the opening ceremony of the national conference on science*" In *Selected Works of Deng Xiaoping (1975–1982)*, 105. Beijing: Foreign Language Press.
14. Deng Xiaoping. 1984. "Emancipate the mind, seek truth from facts and unite as one in looking to the future." In *Deng Xiaoping: Speeches and writings*, ed. Robert Maxwell, 72–73. Oxford: Pergamon Press Ltd., 1984).
15. Xiaoping, D. 1984. "*Respect knowledge, respect trained personnel*" In *Selected Works of Deng Xiaoping (1975–1982)*, 54. Beijing: Foreign Language Press.
16. Deng Xiaoping. 1984. "Build socialism with Chinese characteristics," 30 June 1984, available from <http://www.wellesley.edu/Polisci/wj/China/Deng/Building.htm>.
17. Xiaoping, D. 1984. "*The army should attach strategic importance to education and training*" In *Selected Works of Deng Xiaoping (1975–1982)*, 73. Beijing: Foreign Language Press.
18. Xiaoping, D. 1984. "*The army should attach strategic importance to education and training*" In *Selected Works of Deng Xiaoping (1975–1982)*, 74. Beijing: Foreign Language Press.
19. Xiaoping, D. 1984. "*The army should attach strategic importance to education and training*" In *Selected Works of Deng Xiaoping (1975–1982)*, 77. Beijing: Foreign Language Press.
20. Xiaoping, D. 1984. "*Some comments on work in science and education*" In *Selected Works of Deng Xiaoping (1975–1982)*, 71. Beijing: Foreign Language Press.
21. Xiaoping, D. 1984. "*Some comments on work in science and education*" In *Selected Works of Deng Xiaoping (1975–1982)*, 67. Beijing: Foreign Language Press.
22. Lampton, D. 2008. *The three faces of Chinese power: might, money, and minds*. Berkeley: University of California Press.
23. Thomas Kuhn. 1996. *The structure of scientific revolutions* (Chicago: The University of Chicago Press, 1996), xii.

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