

RESEARCH BRIEF

2015-5 January 2015

Puppies Who Climbed Out of the River: The Roles and Influence of Chief Commanders and Designers

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For all its limitations, China's "Two Chiefs" program management system has been highly effective. Through periodic efforts to improve the system, the "Two Chiefs" system and the leaders who run it have evolved considerably over five generations, with a trend toward more programs, more work, better incentives, and younger personnel. This research brief addresses the following dynamics concerning chief commanders and chief designers over the first six decades of defense industrial development in the People's Republic of China: their career trajectories, roles, and influence. It also examines broad demographic trends, incentives, and challenges. This brief focuses primarily on program managers from China's aerospace industry.

The Study of Innovation and Technology in China (SITC) is a project of the University of California Institute on Global Conflict and Cooperation. SITC Research Briefs provide analysis and recommendations based on the work of project participants. Author's views are their own.

This material is based upon work supported by, or in part by, the U.S. Army Research Laboratory and the U.S. Army Research Office through the Minerva Initiative under grant #W911NF-09-1-0081. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the U.S. Army Research Office.

INTRODUCTION

China's "Two Chiefs" program management system has been highly effective overall. Chinese program managers have been selected through on-the-job challenges and attrition, then entrusted with incrementally greater technological leadership roles.

However, since the end of the Cultural Revolution in the mid-1970s, problems have emerged, prompting periodic efforts to improve the system through revised guidance and regulations. The "Two Chiefs" system and the leaders who run it have evolved considerably over five generations. There has been a trend toward more programs, more work, better incentives, and younger personnel.

HISTORY

Official Chinese sources divide China's program managers into five distinct generations. The first generation, led by Qian Xuesen and other foreign-trained talents, returned from abroad to establish a defense industry for the newly founded People's Republic of China. In the late 1950s, Premier Zhou Enlai stated that while years of Sino-American ambassadorial talks had yielded little else:

We had won back Qian Xuesen. That alone made the talks worthwhile. Apart from Qian, there were quite a number of specialists returning from abroad. All of them have been placed on various leading technical posts to contribute to the space industry....

As technological challenges mounted, initial development under an elite cadre of foreign-trained experts give way to the more institutionalized "Two Chiefs" system. In developing its first surface-to-surface strategic missile, the R-2 (copied from the Soviet Union), under Qian Xuesen's 5th Research Academy, China initiated a program manage-

ment system consisting of administrative and technical lines of command. However, a 1962 launch failure, investigated by Qian, triggered implementation of a formal "two lines of command" program management system under the guidance of Nie Rongzhen, the commander of China's nuclear weapons program. To prevent future failures, the 5th Research Academy strengthened management and established regulations for program management that designated "a chief designer for each model and strengthening the system of responsibility for technical positions." Thus implemented, the "Two Chiefs" system helped coordinate early progress in China's strategic weapons complex.

China's second generation of program managers was trained in the Soviet Union before the 1960 Sino-Soviet split. During the Cultural Revolution (1966-76), these personnel, along with first-generation managers, suffered terribly. Nuclear submarine chief designer Peng Shilu, for example, was sent down to the countryside to a pig farm. Even Qian Xuesen had to spend time digging larvae from dirt paths. According to one account, "The technical command line, the administrative command line, and the designer system for R&D, were all shattered."

Larger dynamics were also at work. Space industry staff, for example, split into factions, halting research and production. Ground stations witnessed violent struggles. Communications were severed, material supply was stopped, and construction work halted. Warring factions delayed testing, prompting Zhou Enlai to call in the personnel concerned "to persuade and educate" them.

In addition, unrealistic goals led to dead ends. Under pressure from ideologists, excessive numbers of satellites and launches were planned. Some important projects began to be developed without thorough feasibility study or proper procedures. Serious losses were reversed, but

only after tremendous waste. The Cultural Revolution also led to poor construction of facilities, and the scattered, over-stretched distribution of R&D bases caused redundancy and poor utilization rates and investment results. The waste and inconvenience necessitated remedial measures to increase production and improve living conditions.

The years immediately following the Cultural Revolution were characterized by a period of recovery. In 1977, the Party approved the "Three Grasps" (三抓) missile and satellite initiatives, involving the development of the DF-5 intercontinental ballistic missile, the JL-1 submarine-launched ballistic missile, and the DFH-2 communication satellite. In 1978, China's space industry discarded "erroneous policies and slogans," restored technical titles and the chief designer system, appointed chief designers for major projects, restored and established S&T committees, established an administrative system for planning, reinstated rules and regulations, and established quality control and logistics systems.

During this time, the defense industry's homegrown third generation of program managers emerged. Leaders included communications satellite chief designer Sun Jiadong, satellite and manned spacecraft chief designer Qi Faren, and rocket system commander Huang Chunping. This generation served as program managers in a "two chiefs" system that was defined and regulated more formally after 1984.

The fourth generation of program managers, also homegrown, rose in the years following Deng Xiaoping's reform and opening up to succeed their significantly older predecessors. Deng's reforms unleashed economic development, but also resulted in budget cuts for military and strategic industrial programs, thus making even the highest positions in China's defense industrial sector far less desirable than emerging opportunities in

a burgeoning market economy. Some chief commanders and designers who began their careers in the 1980s and 1990s felt this tension acutely and considered “jumping into the sea” of the private sector. According to J-15 and J-31 chief designer Sun Cong, the budget cuts of the 1980s resulted in 20,000 professionals working on just four J-8II aircraft over an entire year, so they built another four outside the state plan. Moreover, there was little money to be made. Of the 48 university graduates who began working at the same time with Sun’s Shenyang Aircraft Design Institute (SADI) entrance cohort, only 20 persevered. As Xinhua news agency documents:

China’s market economy was beginning to boom. Many aerospace experts were lured to private or foreign-funded enterprises. A popular jingle at the time—“Making missiles earns less than selling tea eggs”—highlighted low salaries in the sector.

Others, however, like Chang’e-3 deputy chief designer Jia Yang, who led the Yutu lunar rover development team in addition to working on Shenzhou 1-4, Beidou, the China-Brazil Earth Remote Sensing Satellite, and the Haiyang satellite program, stayed in the field. It was these engineers who would come to lead China’s defense industry programs. They benefitted from China’s military spending largesse during the 2000s, which resulted in more work and higher salaries for defense industry personnel.

China’s fifth generation of program managers have reached their positions at a time when China’s defense industry has received unprecedented resources, resulting in additional personnel, higher salaries, and better living conditions. China’s opening and reform also led to a cadre of better educated program managers leading weapons programs.

This generation of program managers is also noticeably younger than previous generations with average

ages in the 40s leading teams whose average age is in the 30s. From 1992 to 2003, rocket system engineers’ average age plummeted by 18 years. For example, the chief commanders and chief designers for all seven major Shenzhou-6 systems had an average age of 48.7, five years younger than their Shenzhou-5 counterparts. The Shenzhou-7 team was even younger, with chief designers of key subsystems ranging in age from 30 to 41. In January 2004, 42-year-old Zhang Bainan succeeded 71-year-old Qi Faren as chief designer of the Shenzhou spacecraft.

Despite an improvement in material incentives, program managers and their subordinates are often face a crushing workload generated by urgency to make progress. In the Maoist era, when material incentives were minimal, Chengdu Aircraft Corporation’s No. 611 Institute already operated on a “6-11” to “7-11” basis. This entailed working either six days at 11 hours per day or seven days at 11 hours per day.

As J-10 chief designer Song Wencong attests in his memoirs, test periods were shortened by working constantly every day despite the low salaries of the 1980s. Years later, similar norms persist. In December 2012, a CCTV *News Probe* program commemorated J-15 “scene-of-action commander” Luo Yang’s untimely death from cardiac arrest following overwork to prepare the aircraft’s first deck landing.

PROFESSIONALIZATION OF PROGRAM MANAGERS

As China’s program managers have become more educated, China’s defense industry has begun to pay increasing attention to professional training. Prior to the 2000s, chief commanders and designers received little to no professional training. Program managers were selected through trial by fire methods and then assigned progressively greater levels of re-

sponsibility. As former SADI director Liu Chunyi explains:

The most difficult part was selecting the right people. The first principle is what we call throwing puppies into water. ... a group of university kids come to us and all appear to be in high spirits, just like furry puppies. There is no way of telling which one of them will excel. You cannot judge them by their looks. Therefore, the best solution is to throw all of them into the river. ... Some manage to climb out of the river. You then make your selection from this group.

Promising talents thus selected “must go through all the steps, starting with, in particular, the basic design job.” It was in this fashion that J-15 and J-31 chief designer Sun Cong and six contemporaries were selected as an under-forty “new leadership team.” Known as the “Seven Wolves,” they replaced much older predecessors, who were forcibly retired.

A CHANGING WORKPLACE

In an effort to take the “Two Chiefs” system to a new level, China’s space industry has been experimenting with new workplace cultures that emphasize modern management, standardization, quality control, and emerging mass production ability—part of a larger trend in China’s dual-use civilian-military technological projects.

While some of the language from these reports are no doubt optimistic and self-serving, China’s recent profusion of relatively advanced satellites suggests significant advances in program management. For example, the employees of Qinghua Aerospace Satellite Technology Company, Ltd., can select departments in which to work according to their own disciplines and ambitions, with the company assigning a department head as a coach for a new employee with a term of three to six months, after which candidates may be promoted,

continue in their present position, or be terminated. The company also invites external experts to give lectures and encourages employees to attend short-term professional training and enroll in formal academic education.

Dongfanghong Aerospace Satellite Co., Ltd., China's foremost satellite manufacturer, instituted a new management system where one person may be responsible for multiple projects, and allows communication both horizontally and vertically. The new setup makes it possible to use fewer personnel to complete more projects and makes it possible to make various decisions quickly, accurately, and in a timely manner. The approach has played an important role in reducing development and manufacturing

costs while shortening the development and manufacturing cycle for satellites. Employee morale has also been improved under this system.

CONCLUSION

China's "Two Chiefs" system has been highly effective overall. The most difficult weapons development problems occurred before this system was implemented consistently in 1962 and during subsequent Maoist political excesses when it was crippled or eliminated altogether. Admittedly, problems have emerged, prompting periodic efforts to improve the system through revised guidance and regulations. Chinese program managers are selected through trial by fire to

determine talent and suitability, then entrusted with progressively larger technological leadership roles (subsystem to system to project, deputy to lead). Over five generations, the "Two Chiefs" system and its leaders have evolved considerably, towards more programs, more work, and better incentives. Average ages continue to decrease. Organizational innovation is growing, particularly for key programs. All this portends an even more promising future for China's defense industry.

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