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China's Space Activities, Policy and Organization

1956-1986

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ABSTRACT OF DISSERTATION

China's Space Activities, Policy and Organization

1956-1986

This dissertation examines the history of China's space program during the first three decades of its existence, from 1956 to 1986. Its major contribution is that is the first study to be written in English that draws extensively on Chinese language souses of information. In addition, it offers the most comprehensive knowledge about Chinese space activities, policies, decision-making, and space organization appearing outside of China.

This study examines how the space program survived and thrived in these chaotic times, which included the Anti-Rightist campaign (1957), the Great Leap Forward (1958-9), mass starvation (1960-2), the Cultural Revolution (1966-76), and economic reform (after 1979). Two primary sources of success are identified:

1)The space program continually received support from the highest levels of government, no matter who was in charge - Mao Zedong at the outset, Zhou Enlai (the program's single most significant supporter) in 1956-76,

Lin Biao in 1969-1971, the Gang of Four in 1971-1976, and Zhao Ziyang and Li Peng in 1983-1989.

2)The engineers, administrators, and workers in the space prorgam - a highly talented and persistent lot - consistently rose to whatever challenges they encountered. Chiefs among these were Marshal Nie Rongzhen, the program's political father, and Dr. Qian Xuesen, its technical father. Beyond these two important players, the second tier of leadership comprised primarily of Western-educated engineers, worked relentlessly to make the space program successful. Even rank-and-file engineers and technicians dedicated themselves selflessly to achieving the program's goals during dangerous period.

The study is divided into two major parts. The first examines government policy toward the space program during 1956-1986, beginning with Mao Zedong's call to establish Big Science in China through Deng Xiaoping's initiative to reform the defense industry. The second looks at the evolution of the space agency organization during this same time period, highlighting the seminal efforts of key players such as Zhou Enlai, Marshal Nie Rongzhen, and Dr. Qian Xuesen, and emphasizing the responsiveness of the agency to deal with changes in its mission.

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CHAPTER 1

INTRODUCTION

The idea of a Chinese space program has become a familiar one in the international space community over the past ten to fifteen years. This is a result of China's heightened space activities during this time period and the consequent generation of large quantities of information about the program's technical capacities, achievements, and even controversies. The available information focuses on recent times. However, there is still a significant missing piece of the whole picture -- and that is the piece that portrays the formative stage of China's space program, especially in the time period of 1956-1986. Recent research by Brian Harvey has filled some of the gap - particularly in dealing with the history of technical developments in the China space program,[1] but the holes in our knowledge are still quite pronounced.

The purpose of this dissertation is to reveal both the origin and evolution of Chinese space program over a time period of thirty years, from 1956 to 1986. Since there are few scholarly publications available that cover this period, particularly publications that focus on policy and organizational issues, this research aims to remedy this deficiency. In this introduction, I provide the rationale and background for the dissertation topic.

In the time period under review, the political and economic climate in China changed often and wildly[2]. Nevertheless the Chinese space program remained remarkably stable and achieved major successes. For example, it had established a full range of launching capabilities based on its military rocket technology; independently launched more than 20 satellites into low, solar and geostationary orbits for various purposes, and built a space-related industry from

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[1] Brian Harvey, *The Chinese Space Programme* (New York: John Wiley, 1998).

[2] To learn more about the Chinese contemporary history and culture during this time period, see Jasper Becker, *Hungry Ghosts, Mao's Secret famine,* (The Free Press, New York, london, Toronto, Sydney, Singapore, 1996), Sterling Seagrave, *Lords of the Rim,* (G. P. Putnam's Sons, New York, 1995), Harrison E. Salisbury, *The New Emperors, China in the Era of Mao and Deng,* (Little, Brown and Company, Boston, Toronto, London, 1992), Jonathan D. Spence, *Chinese Roundabout, Essays in History and Culture,* (W W Norton E Company, New York, London, 1992), Jonathan D. Spence, *The Search for Modern China,* (W. W. Norton & Company, New York, London, 1990), Bette Bao Lord, *Legacies, A Chinese Mosaic,* (Alfre A. Knopf, New York, 1990), Paul Theroux, *Riding the Iron Rooster by Train Through China,* (G. P. Putnam's Sons, New York, 1988), Edgar Snow, *The Long Revolution,* (Hutchinson, London, 1973).

scratch.[3] The relative stability in China's space activities in times of social chaos is a primary theme of this study.

A review of the literature supports the general observation that there is lack of scholarly investigation into the Chinese space program (see the next chapter). The quality of much of the literature is weak, and the quantity meager. However, enough evidence has accumulated, especially from Chinese sources, to carry out a scholarly study. My research sources come mainly from these materials.

This dissertation takes a historical approach to revealing the origin and evolution of China's space policy and organization. A brief review of studies on the history of China's space program will be discussed. The improvements my research makes to these studies are: 1) most evidence and information comes from Chinese sources; and 2) previously undisclosed facts are revealed for the first time in public.

Specific research questions (to be raised in chapter 3) focus on two broad areas: 1) How Chinese space policy supported and guided a strong space program; and 2) What organizations operate China's space missions.

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[3] China received valuable technical assistance from the USSR in 1956-1960. This assistance was directed at strengthening its missile program. At the time the Chinese space program was being developed (mid-1960s), China was working alone. See Chapter 4. See also, Song Jian, "Science and Technology in China," *Technology in Society*, Vol. 19, Nos. 3-4 (1997), 281-294.

Two explanations are offered for China's great successes in the space arena during 1956-86: 1) Constant high-level government support coupled with well-formulated space policy are the major factors keeping the space program stable and protected from the ups and downs of political, economic and social events in China; and 2) the existence of a highly motivated and technically capable workforce in the Chinese space organization assured the existence of a competent infrastructure that would rise to technical challenges implicit in any technologically advanced endeavor.

In order to disclose significant threads concealed among historical events, I borrow heavily from Vernon Van Dyke's approach to analyzing the rationale of a space program[4] and James Q. Wilson's framework for analyzing the role of internal factors in influencing how organizations establish goals and achieve results[5] to illuminate my approach to organizing the research materials.

Background

Cooperative and competitive international relations in space will be a continuing and significant reality in the years to come, and will both reflect and influence relations

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[4] Vernon Van Dyke, *Pride and Power: The Rationale of the Space Program,* (Urbana, IL: University of Illinois Press, 1964).

in the world. Much is known about the space activities of the United States, Russia (or the former Soviet Union), Europe, and Japan. By comparison, little is known about the evolution and current status as one of the world's largest space programs - that carried out by the People's Republic of China.

Before the 1980s, China was politically and economically isolated from the world. It was constantly in political and economic turmoil. China experienced the Korean War of 1950-53, the anti-Rightist campaign of 1957, the Great Leap Forward of 1958, the economic crises in 1960-62, the Cultural Revolution of 1966-76, the radical shifts of the economic reform of 1980-89, the Tiananmen turmoil of 1989, and the continuous economic reforms of the 1990s. In view of this chaos, it would be easy to conclude that China could achieve nothing worthwhile.

However, if we look carefully at Chinese society at this time, we see that some solid achievements were made despite the great disturbances. China's space program is an excellent example. Since China opened its space program to the world in 1980s, the facts about the program reported by both Chinese media and American media have increased dramatically. The following facts are well-known in the world space community:

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[5] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It,* (New York: Basic Books, 1989).

1. Today, China is one of a handful of countries with a full-scale space program.[6] China's space achievement in the security, applications, and commercial areas are particularly impressive[7].

2. China is one of only three countries that can retrieve payloads from space; one of five countries that can place a satellite into geostationary orbit; the third country to employ liquid hydrogen and oxygen as rocket fuels; and the third country to offer commercial launch services to the world[8].

3. By 1997, China had launched more than 50 satellites for domestic and international users. Since the first Chinese made satellite was launched by Long March-1 in 1970, Long March-1D, Long March-2C, Long March-2E, Long March 2E/HO, Long March-3, Long March-3A, Long March-3B, and Long March-4 boosters have been developed. China continues to work on more advanced models[9].

4. Chinese-made satellites have been employed for the purpose of remote sensing, scientific and technical experiments, meteorology and telecommunications, as well as for national security purposes. China's capability to recover

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[6] The other major players are the US, Russia, India, France, and Japan.

[7] Yanping Chen, "China's Space Program," *Ad Astra*, (September 1991), 11-15.

[8] China Aerospace Corporation, *China Aerospace Corporation,* (Beijing: China Aerospace Corporation, 1997).

satellites is probably its most impressive technological achievement[10].

China's manned flight program has been little known in the West, although it has had a history of more than twenty years. A growing curiosity about this program has recently arisen, owing to the 1992 announcement[11] that China would send its astronauts into space before the year 2000. (From the perspective of 1998, it seems unlikely that this goal can be achieved.) Not surprisingly, China's focus on a manned flight program will boost the visibility of the Chinese space program and the country itself.

China began commercializing its space products in the international market in 1985[12]. "Long March" and the "Chinese Great Wall Industry Corporation" have become familiar terms in both conversations and controversies in the international space community and aerospace industry. Although Chinese launch services so far have played a marginal role in the international market, they have threatened the dominant market position of both US and French launch service providers.

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[9] Ibid, 13-15.

[10] Zhang Rufan and Zu Danyin, *Hangtian (Space Flight)*, (26 January 1987), 3-6; Chinese Academy of Space Technology, *Chinese Academy of Space Technology,* (Beijing: Chinese Academy of Space Technology, 1996).

[11] *Space News*, "China Plans for Piloted Missions,", April 13-19, 1992.

[12] Jefferey M. Lenorovitz, "China Offering Space Launch Services to International Users," *Aviation Week & Space Technology,* (April 8, 1985), 25-26.

Advanced space technology producers really have begun to take the Chinese "Long March" seriously. So long as China maintains a strong and healthy space program, its payoffs will not only yield economic benefits but prestige as well[13].

How did the Chinese achieve such success in their space program in times of political, economical and social chaos? *Why* did this economically underdeveloped country pursue a dream that only affluent countries could make real? These questions lie at the heart of this dissertation.

Research Constraints

All research studies operate under constraints that place significant limitations on what can be examined and concluded. This study is no exception. In this section, I attempt to highlight three significant constraints that limit the boundaries of my work.

Constraint 1. The sole source of detailed information on China's space program is the Chinese government. There are no independent sources of information on China's space program. Anything coming out of China has met with the government's approval. The obvious problem here is that the government can

[13] Yanping Chen, "China's Space Commercialization Effort, Organization, Policy and Strategies," *Space Policy,* (May 1991), 116-128; China Great Wall Industry Corporation, *Space in China, Launch Services & Space Technology,* (Hong Kong: Ad Aid Design and Production Company, 1993).

filter out any information that it objects to (e.g., accounts of program failures, politically sensitive material), distorting the historical record of what really transpired in the space program.

Clearly, scholars reviewing Chinese material should interpret it carefully. They should certainly examine it in the context of the social, economic, military, and political environment in which reported events occur.

The good news is that information reporting the "simple facts" (e.g., launch dates, payload capabilities, reorganizations of the administrative infrastructure) appear to be accurate. What is most obviously missing from the record are accounts of key players describing the behind-the-scenes maneuverings that led to significant decisions.

Constraint 2. Chinese national security factors limit the amount of information that can be revealed. China views its space program as militarily sensitive, particularly since the space and missile programs are tied together closely (see Constraint 3). Items that might be openly discussed in the United States are kept quiet in China. People who reveal "sensitive" information can find themselves in serious trouble with the government. A recent example of this occurred in early 1998, when Hua Di, a former engineer in the missile program, was arrested and imprisoned for revealing secret information in an article he coauthored with the Stanford University scholar, Dr. John Lewis.[14]

Constraint 3. The missile and space programs are so closely connected that it is often difficult to distinguish the activities of one from the other. In discussing China's space program, it is sometimes difficult to distinguish developments in the space program from those in the missile program, because the two programs were carried out concurrently. The origins of the missile program can be tied to the first delivery of Soviet P-2 missiles to the Chinese in 1957. Within a year, in 1958, the father of China's space program, Dr. Qian Xuesen, organized a working group to explore the possibility of China launching satellites into space.[15] Also in 1958, Mao Zedong announced that China would work to create satellite development and launching capabilities.[16]

The close connection between missile developments and space programs is hardly unique to China. Both the US and Soviet space programs had their origins in missile programs. For example, the Americans' attempt to put their first satellite into orbit initially employed a Navy Vanguard

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[14] John W. Lewis and Hua Di, "China's Ballistic Missile Programs: Technology, Strategies, Goals," *International Security*, Vol. 17 (Fall 1992), 5-40.

[15] Wang Shoyun, "Qian Xuesen," *Zhongguo Dangdai Kexuejia Zhuanji (Chinese Contemporary Scientists' Biographies*, Vol.1 (Beijing: Science Publishing House, 1991), 807.

missile (a failure) and then switched to the Army's Jupiter C (a success).

An additional complication is that space agency and industry complex in China have simultaneously served both military and civilian missions up to the present time. For example, unlike NASA, the China space agency is responsible for serving both military and civilian missions. And, its chief engineers might find themselves working on a Long March missile and an ICBM at the same time. Another example: the same factories that produce missiles also produce space launch vehicles.[17]

Structure of Dissertation

The dissertation includes two parts. Part One discusses the origin and evolution of China's space policy and Part Two focuses on the formation and maturation of China's space agency.

First, Chapter 2 carries out a literature search examining the evolution of writings on the space program, ranging from virtually nothing through the mid-1980s to the beginnings of serious studies in the 1990s. It points out

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[16] Zhang Heping, "China Space Technology Achievement: A Summary," *Renmin Ribao (People's Daily)*, Section 4, 13 October 1989.

[17] The link between China's missile and space efforts are discussed extensively in Chapters 4, 5 and 8.

that the best information on China's space program is written in Chinese and has largely been ignored by Western writers.

Chapter 3 focuses on methodological issues. It shows how the dissertation is based largely on conceptual frameworks developed by Vernon Van Dyke[18] and James Q. Wilson.[19] It also examines methodological limitations of conducting historical research on contemporary China.

In Part I, it is argued that the space program has received constant support in an era of turbulence by examining Chinese space policy during four distinct periods.

Chapter 4 looks at space policy from 1956 to 1966. During this period, China experienced a number of traumatic political events: the anti-Rightist campaign, the Great Leap Forward, and the sudden withdrawal of Soviet support for Chinese science and technology due to the conflict between the Chinese and Soviets. Despite this great turmoil, China was able to establish its space program. The policy for the establishment of a missile program was embodied in national science and technology policy and reflected strong military needs. China's ultimate approach to developing missile technology was largely defined by the crisis created by the withdrawal of the Soviet technical assistance.

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[18] Ibid, 4.

[19] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 1989).

Chapter 5 examines the period 1966-1976. This period was dominated by the Cultural Revolution. While virtually all sectors of Chinese society were torn apart by its forces, the space program managed to stay the course. Key politicians intervened in space policy formation during this time. Included here were Zhou Enlai, Lin Biao and the "Gang of Four". Under a special and emergency management based on martial law, China was able to launch its first satellite during the Cultural Revolution era and truly entered the space age.

Chapter 6 reviews the third period, from 1976-1986, a time when the nation tried to recover from the excesses of the Cultural Revolution. The space program focused its attention on changes in China's most fundamental economic and social goals. This potentially posed the greatest threat to the space program since it entailed creating new economic and social priorities that did not favor expensive technological projects. China's economic development became a paramount concern and the space program's contributions to society had to be justified on economic grounds. Once again, the space program survived a major challenge. Although this chapter mainly examines the period of 1976-1986, the plan to develop space technology into the year 2000 is also examined. Basically, despite the continuing occurrence of dramatic events (e.g., Tiananmen turmoil and the collapse of the USSR), the Chinese government was committed to take the space program as a cornerstone of the national science and technology development effort.

In Part II, it is argued that a second assumption (that the space agency has provided an effective organizational mechanism to implement China's space policy) can be addressed by examining the Chinese space agency's organization transformation at the Ministry level. Three historical periods will be also distinguished[20].

In Chapter 7, the Fifth Academy of the Ministry of Defense (1956-1965) is examined; this is a military organization given primary responsibility for developing China's space program. In this period, the Fifth Academy was established and key people who are the pioneers of China's space program and the relationship between politicians and technical elite were introduced. Also, the capacity of the space agency to conduct missions was tested by the withdrawal of the Soviet technical assistance. Finally, organization management principles were outlined, the military and political significance of the space program surfaced and high-level political support was obtained.

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[20] Time distinctions in the Part I and II are slightly different due to the different criteria. However, it will offer little confusion to the purpose for making clear arguments.

The second period covers the history of the Ministry of the Seventh Machinery Industry (1965-1979). The new ministry, which evolved from the Fifth Academy, began functioning one year before the Cultural Revolution. In chapter 8, it is argued that by experiencing political protection from the top-levels of the power structure, during the biggest social turmoil in the contemporary Chinese history, the Chinese space program was able to acquire the know-how needed to perform technical tasks effectively and make major advances. A strong sense of mission led the Ministry to focus on continually building a solid infrastructure, and laying the foundation for the expansion of the space program in the future. During this time period, the Chinese space program successfully established a missile program, a satellite program and manufacturing bases. The Ministry successfully conducted numerous missile missions and launched 12 satellites.

Chapter 9 covers the third period: a history of the Ministry of Astronautics Industry (1980-1986). In this time, the major threat to the space program seemed to be economic reform. However, the Ministry was able to survive because of its mission-oriented focus in the early stage of Economic Reform, and later because entrepreneurial initiatives were developed to meet the goals of the Economic Reform. China launched an international space launch venture, introducing the Long March launcher into the international market. It also had the space industry reoriented from serving mainly defense needs to civilian needs by producing many civilian commodities. The autonomy that the Ministry enjoyed provided it with the opportunity to find a way to sustain and grow the space program even in times of economic liberalization.

Chapter 10 serves as a conclusion for the three decade history of China's space program. It discusses the future of the space program both in the domestic and international arenas. Four challenges are identified. First is the need for strong political support from top leaders during Economic Reform. Second is the challenge for the space agency to identify economically-oriented missions and tasks in today's business-focused climate. Third is the challenge to deal with a brain-drain, as China's "best and brightest" increasingly prefer commercial careers to technical ones. Fourth is the challenge to conduct international cooperation in space technology development. In conclusion, top-level commitment and support are crucial for a strong space program. A clear sense of mission of the space agency is critical for the health of space technology development in a situation when economic development has become the dominant social concern.

CHAPTER 2

LITERATURE SEARCH AND RESEARCH SOURCES

Lack of scholarly research on the topic of China's space program in the United States before the 1980s is reflected in a survey conducted by the Chinese Social Science Information Institute in 1980[1]. The survey disclosed that there were 1,045 scholars studying China in the United States at that time. They had about 2,276 major publications. In reviewing all the abstracts listed in this survey, it was found that there was no single publication dealing with China's space program.

However, a large quantity of information gathered by American and Chinese media, and comprehensive historical reviews from Chinese official publications on China's space program, have emerged since the mid-1980s, at which time China opened the program to public scrutiny. Table 1.1

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[1] The Chinese Social Science Information Institute, *Zhongguo Wenti Yanjiu Zai Meiguo (China Studies in the United States)*, (Beijing: The Chinese Social Science Publishing House, 1980)

details the results of an exhaustive search that was carried out as part of this research in 1992 on English language works focusing on China's space program.[2]

[2] In searching the literature on China's space program, I have covered the following databases:

1) *ABII* -- ABI/Inform (Business & Management Index)

2) *ALADIN* -- (the Washington Research Library Consortium)

3) *ASAB* -- Applied Science, Technology & Biology Indexes

4) *China Division in the Library of Congress.* A major valuable source -- *Space Flight*, a publication of the China Aeronautics Society.

5) *Dissertation Abstracts* (1861-present).

6) *DWIL* -- periodical indexes (multiple-subject)

7) *National Newspaper Index*, including the *The New York Times, Wall Street Journal, Washington Post, Christian Science Monitor* and *Los Angles Times*

8) *PAIS International* (Indexes journals, books and documents covering political science, public policy issues and international affairs; 1972- April 1992).

9) *First Search*, (Indexes of articles published in scholarly different journals)

10) Sino-Soviet Library of GWU. Major valuable sources -- Daily Report on China from *FBIS* (Foreign Broadcasting Information Service); *JPRS* (Joint Publications Research Service), and the *Beijing Review*

Table 1.1, Results of a Literature Search on

China's Space Program Conducted in 1992

Source	K[3]=China & Space	K=China & History & Space	Major contributors
ALADIN	2	None	
DWL	224	None	*Aviation Week & Space Technology* (118); the *Beijing Review* (35); *Far Eastern Economic Review* (8); others (63)
ASAB	24	None	*Aviation Week & Space Technology* (19)
ABII	17	None	*Far Eastern Economic Review* (2)
Dissertation Abstracts	None	None	
PAIS International	13	None	*Space Policy* (5)
FirstSearch	16	None	*Space Policy* (6), *Astronautical Sciences* (3)
FBIS	About 250	None	China Xinhua News Agency, *Peoples Daily,* and the Central Broadcasting Service
JPRS	About 50	None	*Space Flight,* other engineering magazines
National Newspaper Index	14	None	*New York Times, Wall Street Journal* and *Christian Science Monitor*
Total	594[4]	None	

[3] "K" refers to subject search categories

[4] Most of them are fact oriented news pieces and articles.

In the above chart, if we look at the three major scholarly databases -- *Dissertation Abstracts*, *PAIS International* and *FirstSearch*, we see that none has publications on the history of China's space program. In fact, none of the ten databases (including non-scholarly works) had any publications dealing with the history of China's space program. The articles explicitly dealing with some aspect of China's space program are mainly major information-oriented publications, such as *Aviation Week & Space Technology, Foreign Broadcasting and Information Service* and *Joint Publication Research Service*, and they simply report basic facts on such things as launch dates, payload capabilities, and new technical developments.

In the summer 1997, I amplified my database review, focusing on *Dissertation Abstracts*, *PAIS International*, *FirstSearch*, *ALADIN*, *FBIS*, *JPRS*, and the *National Newspaper Index*. While fact-oriented information has increased dramatically over the years from 1992 to 1997 (averaging 400-500 pieces per year), there is still no scholarly investigation on the topic of China's space program. The results, once again, confirm my general observation of the fact that scholarly study in this subject is lacking.

The surge of fact-based published information since 1986 may have two explanations. First, China's 1985 offering of Long March services in the international commercial launch market signaled to the world that China intended to be a serious competitor in the global space technology services arena. The space community and aerospace industry had to give serious attention to the competitive challenge coming from China. This required a good understanding of its space services capabilities.

Second, and more significant, is that for the first time in the history of the Chinese space program, details of its operations, achievements and infrastructure were made available to outsiders through the systematic efforts of the Chinese government working through its media and broadcasting services, such as Xinhua News Agency, *People's Daily* and the Chinese Central Television Station. In addition, research, manufacturing, and launch facilities were opened to foreign observers[5].

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[5] Examples of early descriptive articles include Phillip S. Clark, "Chinese Launch Vehicles aim for the Commercial Market," *Space Markets,* (Winter 1987), 178-187; Craig Covault, "Chinese Expand Launch Facilities to Attract Satellite Customers," *Aviation Week & Space Technology,* (July 13, 1987), 120-126; Craig Covault, "China Developing Technology for Future Manned Space Flight," *Aviation Week & Space Technology,* (June 29, 1987), 22-23; "Chinese Display Variety of Space Vehicles, Support Equipment at Launch, Tracking Sites," *Aviation Week & Space Technology,* (April 15, 1985), 52-53; Craig Covault, "Austere Chinese Space Program Keyed Toward Future Buildup," *Aviation Week & Space Technology,* (July 8, 1985), 16-21.

More recently, access to newly released information has enabled one British scholar, Brian Harvey, to write a solid historical review of technical developments in the China space program from its earliest days until today.[6] Harvey's book, *The Chinese Space Programme*, tends to be descriptive rather than analytical. That is, it provides comprehensive information on such things as characteristics of launch vehicles and satellites, launch locations and dates, and descriptions of key organizational players in recent years. Nonetheless, this work represents the most comprehensive study by a Westerner of China's space program to date.

For the most part, works on China's space program have been highly descriptive, focusing primarily on such things as the type of services offered, payload capabilities, and manufacturing infrastructure[7]. Newer and more penetrating information has recently been released through Chinese official publications. These publications offer previously unknown historical facts and express Chinese official views on the space program. To date, none of the official Chinese

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[6] Brian Harvey, *The Chinese Space Programme* (New York: John Wiley, 1998)

[7] *Op cit* all the items in footnote 5.

publications on the history of the space program has been translated into English.[8]

In this literature review, I examine the evolution of studies on Chinese high technology endeavors, most of which have been carried out in the military arena. I begin by examining Western attempts to get a handle on Chinese military and high technology policy beginning in the early 1960s and then go on to describe the increasing sophistication of studies in this area.

Western Examinations of Chinese Policy in the Political and Military Arenas

Research on China's contemporary history, especially in political and military areas, has typically entailed the analysis of Communist China's official doctrines. As with scholars studying the Soviet Union, China watchers

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[8] Major publications here include Zhang Jun et al, *Dangdai Zhongguo De Hangtian (Contemporary China's Space Effort)*, (Beijing: Chinese Social Science Publishing House, 1986); Liu Congjun and Huang Weilu, *Hangtian Gongyebu Di Er Yanjiuyuan Yuanshi, 1957-1987 (A History of the Second Academy of the Ministry of Astronautics Industry, 1957-1987)*, (Beijing: The Second Academy of the Ministry of Astronautics Industry, 1987); The Ministry of Astronautics Industry, *Hangtian Shiye Sanshi Nian, 1956-1986, (China's Space Activities in Thirty Years, 1956-1986)*, (Beijing: Changhong Printing House, April, 1988); Liu Jiyuan et al, *Zhongguo Daodan Yu Weixing Shiye Fazhan Shiliao, 1956-1986 (A History of Missile and Satellite Development, 1956-1986)*,

discovered that owing to the atmosphere of secrecy in China, they had little information upon which to base their analyses. So as with Kremlin watchers, they depended on any tidbits of information they could get on events transpiring in China. The great bulk of information was provided by the Chinese government in the form of articles appearing in the *People's Daily* newspaper, published speeches of key decision makers, and other official pronouncements on Chinese events and attitudes, especially those covered by the Foreign Broadcast Information Service (FBIS).

Consequently, early works on China policy required Western scholars to sift through piles of official pronouncements and to attempt to separate fact from fiction. A great deal of attention focused on reading between-the-lines of published official doctrine. Did a change of wording reflect a change of policy? Who wrote a particular piece and who was his or her political sponsor? Was the timing of a pronouncements significant, reflecting an internal struggle in the Communist Party hierarchy? And so on.

Early studies of Chinese policy that reflected this perspective include:

John W. Lewis' book on China's leadership[9]; Ellis Joffe's study of the role of politics in the operations of China's army[10]; Arthur Huck's examination of China's defense policy[11]; Jean-Pierre Brule's overview of current developments in China[12]; William Whitson's study of politics and the military in China[13]; Jurgen Domes' analysis of post-Cultural Revolution China[14]; David Shambaugh's description of how China's military-industrial complex acquired technology[15]; and Gerald Segal's review of the defense establishment and defense policy in China.[16]

With the thawing of China's attitude toward secrecy in the mid-1980s, a vast store of information was made available on the details of military and other high technology policies and events. More will be said about

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[9] John W. Lewis, *Leadership in Communist China* (Ithaca, NY: Cornell University Press, 1963).

[10] Ellis Joffe, *Party and Army: Professinalism and Political Control in the Chinese Officer Corps, 1949-1964* (Cambridge, MA: Harvard University Press, 1965).

[11] Arthur Huck, *The Security of China* (New York: Columbia University Press, 1970).

[12] Jean-Pierre Brule, *China Comes of Age* (New York: Timely Publications, Inc., 1972).

[13] William W. Whitson, *The Military and Political Power in China in the 1970s* (New York: Praeger Publishers, 1972).

[14] Jurgen Domes, *China after the Cultural Revolution: Politics between Two Party Congresses* (London: C. Hurst & Company, 1976; translated from German).

[15] David L. Shambaugh in Paul H. B. Godwin's (ed.), *The Chinese Defense Establishment: Continuity and Change in the 1980s* (Boulder, CO: Westview Press, 1983).

this in the next section of this chapter. Suffice it to say here that the publication of Zhang Jun's *Dangdai Zhongguo De Hangtian Shiye (Contemporary China's Space Efforts)* in 1986 provided scholars and analysts with hitherto classified information on the space program. This enabled China military and high technology policy research to advance dramatically.

The great Western pioneer who took advantage of the loosening of access to information by China was John W. Lewis of Stanford University. His classic work, *China Builds the Bomb*, published in 1988 and coauthored with Xue Litai, represents a major breakthrough in China policy studies.[17] In this work, Lewis and Xue are the first Western-based writers to employ a broad array of Chinese language sources to provide them with the information needed to study China's nuclear bomb program. Included here were a broad range of Chinese newspaper and magazine publications (including technical journals), as well as Chinese political, technical, and encyclopedic books.

Lewis made another breakthrough in 1992 with the publication of an article describing China's ballistic

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[16] Gerald Segal, *Defending China* (London: Oxford University Press, 1985).

[17] John W. Lewis and Xue Litai, *China Builds the Bomb* (Palo Alto: Standford University Press, 1988).

missile program.[18] This piece was coauthored with Hua Di, a former Chinese missile engineer. It represented the first time that Western scholars made extensive use of internal government documents, including classified material. The consequence of using such sources was dramatic: Lewis and Hua's article provided more valuable insights on a difficult subject than any previous work. Regretably, this article also had negative consequences for Hua Di, who was arrested and imprisoned in early 1998 for releasing classified military documents.

Lewis continued to break ground in 1994 with the publication of *China Strategic Seapower* (coauthored with Xue Litai).[19] This book examines China's nuclear submarine program. For the first time, a Western publication made use of hard-to-obtain material reflecting the views and pronouncements of senior Chinese policy-makers on a large, high technology program. Some of the material came from classified documents.

Despite these advances in China policy scholarship, few significant, in-depth analyses have been carried out by

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[18] John W. Lewis and Hua Di, "China's Ballistic Missile Programs: Technology, Strategies, Goals," *International Security*, Vol. 17 (Fall 1992), 5-40.

[19] John W. Lewis and Xue Litai, *China Strategic Seapower: The Politics of Force Modernization in the Nuclear Age* (Palo Alto: Stanford University Press, 1994).

Western scholars on China's space program. One exception is a literature review written by Anne Gilks in 1997.[20] Another exception may be found in work being conducted by Joan Johnson-Freese of Asia Pacific Center for Security Studies in Hawaii, who is presently engaged in a study of the space program[21].

In my work, I have made heavy use of both Chinese and Western sources. A 1991 article, "China's Space Program," provided a historical review describing key achievements of the China space program.[22] Another 1991 article, "China's Space Policy," was the first detailed analysis of China's space policy based on Chinese sources.[23] A 1993 piece, "China's Space Commercialization Effort," offers the first description of organizations involved in China's space program, and presents the first distinction between decision-making processes in the Chinese and American space

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[20] Anne Gilks, "China's Space Policy: Review and Prospects," *Space Policy* (August 1997), 215-227.

[21] Joan Johnson-Freese, *The Chinese Space Program: A Mystery Within A Maze* (Malabar, Florida: Krieger Publisher/Orbit Books, scheduled published in December 1998).

[22] Yanping Chen, "China's Space Program," *Ad Astra* (September 1991), 11-15.

[23] Yanping Chen, "China's Space Policy -- A Historical Review," *Space Policy* (May 1991), 116-128.

programs.[24] Another 1993 paper, "Remote Sensing Technology and Its Utilities in China and Future Space Cooperation," was the first article to appear in the West systematically describing the Chinese remote sensing effort.[25] A 1994 article, "The Need for a Greater Chinese Role in Missile Non-Proliferation Issues" described the Chinese perspective on the Missile Technology Control Regime.[26] Finally, a 1996 piece, "China's Space Interests and Missile Technology Controls," examines the connection between China's missile and space launching programs in terms of policy, organization, and technology.[27]

An American, Iris Chang, wrote a well received book describing the life of Qian Xuesen, the Father of China's space program, during his stay in the United States from 1935 until 1955.[28] The book focused on Qian's struggle with

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[24] Yanping Chen, "China's Space Commercialization Effort: Organization, Policy, and Strategies," *Space Policy* (February 1993), 45-53.

[25] Yanping Chen, "Remote Sensing Technology and Its Utilities in China and Future International Cooperation", a paper presented at the 25th International Symposium, Remote Sensing and Global Environmental Change, Graz, Austria, 4-8 April, 1993.

[26] Yanping Chen, "The Need for a Greater Role in Missile Nonproliferation Issues," *The Non-Proliferation Review* (Spring-Summer 1994), 66-70.

[27] Yanping Chen, "China's Space Interests and Missile Technology Controls," in Peter Hayes (editor), *Space Power Interests* (Boulder, Colorado: Westview Press, 1996), 71-84.

[28] Iris Chang, *The Thread of the Silkworm* (New York: BasicBooks, 1995).

the American government during the McCarthy years in the early 1950s, and says little of Qian's life after he returned to China in 1955.

Fact-oriented Material in English and Chinese

In the arena of fact-oriented materials, there are several key journals and magazines that play significant roles in describing Chinese launches, satellites, infrastructure and other space related activities.

Among English language sources, *Aviation Week and Space Technology* (a weekly magazine) have played a significant role reporting observations on China's space program activities. It offers news and reports on missile, satellites, manned flight activities as well as international cooperation activities.

Other important sources in English include *China*, published daily by the Foreign Broadcast Information Service (FBIS)[29]; and *Science and Technology, China*, published daily by the Joint Publications Research Service (JPRS)[30]. The

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[29] A not-for-profit organization, It primarily records and translates the news from major foreign broadcasts and newspapers. It is one of primary sources for international affairs scholars to obtain raw information from targeted countries.

[30] It serves the same function as FBIS. In addition, it publishes translated technical documents from targeted countries.

first source offers direct translations of major Chinese news media -- newspapers and broadcasting services. The second entails the direct translation of major Chinese scientific and technical magazines and journals. Among translated materials from the Chinese media, the news provided by Xinhua News Agency has been seen as most significant, reflecting the official line of the Chinese party and government. From these translated Chinese news stories, one can obtain a dynamic sense of China's space program and activities.

In the Chinese language, *Beijing Zhoubao (Beijing Review,* a weekly journal) and *Renmin Ribao (People's Daily,* a daily newspaper) not only provide the facts but reflect government attitudes toward particular issues. Comparing the two, *Beijing Zhoubao* is more liberal in reporting the facts and making comments on current issues. It has been a tradition among Western scholars studying China to use these two publications as basic sources to identify facts and to analyze Chinese governmental views.

Almost all comprehensive publications come from Chinese official sources. There are no comprehensive English sources, not even in translation. I have collected pertinent Chinese publications since 1986, when the first book on China's space program came out.[31] These comprehensive works cover three areas -- China's space program history, managerial approaches, and personal memoirs and biographies. Here, I review some key publications.

Chinese Sources of Information

Beginning in 1986, the Chinese government made public information on the space program that previously would have been treated as classified. The primary reason for this loosening of controls on information was tied to the fact that in the mid-1980s, China decided to sell space launch services and to become active in international space affairs. Following are some of the materials that the government made public.

China's Space Program History. Since 1986, China began to publish a series of official history books -- *Dangdai Zhongguo Congshu (The Contemporary China Series)*. A book on China's space program has been included in this historical series. Entitled *Dangdai Zhongguo De Hangtian Shiye (Contemporary China's Space Efforts)*, the book is a collected work of key people in the Ministry of Astronautics

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[31] Zhang Jun et al., *Dangdai Zhongguo De Hantian Shiye (Contemporary China's Space Efforts)* (Beijing: China Social Science Publishing House, June 1986).

Industry.[32] The Chief Editor, Zhang Jun, is a former Minister. The Editorial Committee members are the key chief engineers in China's space program.

This book enhances the knowledge of the history of China's space program in three ways. First, it provides rich facts on the missile program, satellite programs, launch sites and ground stations, as well as technical management methods for carrying out the space program. Second, the book contributes selected information on the decision making process for carrying out the program. For example, the book offers the facts on the involvement of top leaders, including Mao Zedong[33], Zhou Enlai[34], Deng Xiaoping[35], Nie Rongzhen[36] and others, in policy decisions

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[32] Ibid 31.

[33] Mao Zedong,(1893-1976), Chairman of the Chinese Communist Party Central Committee and Central Military Committee. He favored a major space program for its political and symbolic value. He had the final authority in approving major strategic missile test and launch activities until his death in 1976.

[34] Zhou Enlai,(1898-1976), Chinese premier (1949-1976), Member of the Standing Committee of Politburo (1949-1976), Director of the Special Committee (1962-1976). Until his death in 1976, he was personally involved in making and implementing Chinese space development policy and coordinating space activities between the Chinese agencies.

[35] Deng Xiaoping,(1904-1997), Vice premier (1954-1966, 1973-1976, 1977-1980), member of the Standing Committee of the Politburo (1956-1966, 1975-1976, 1977-1987), General Secretary of the Chinese Communist Party Central Committee (1956-1966), Vice Chairman of the Chinese Communist Party Central Committee (1975-1976, 1977-1982), Chief of the Central Staff (1975-1976, 1977-1980), Deputy Director of the

and space activities. These facts are helpful for analyzing the role of the leadership in providing government commitment to the space program. Third, it furnishes information on the government managerial approach for carrying out space program missions and tries to explain the reasons of the successes of China's space program. For instance, explicit managerial principles pursued by the Ministry of Aerospace Industry are discussed.

A major weakness of this book is that it offers the official line. In discussing policy making, it neglects to mention possible conflicts in the policy making process. In praising achievements, it avoids discussing some major failures in technical missions. Because of considerations of national secrecy when the book was published, it did not discuss any organizational structures and functions. Also, references to the manned flight program were not included for the same reason.

Central Special Commission (1977), Vice Chairman (1975-1976, 1977-1981), and Chairman (1981-1989) of the Central Military Committee. He took a practical attitude in dealing with Chinese space developments and decision making.

[36] Nie Rongzhen (1899-1992), Chairman of the Commission of Science and Technology for National Defense (1958-1974), Vice Premier, member of the Special Committee, Vice Chairman of the Central Military Committee (1959-1987). As the first administrator of the Chinese missile program and space program, he was the most influential person in implementing China space development policy.

Space program management in the context of China's defense R&D and industry. *Retrospection and Prospection, Forty Years of Defense Technology and Industry of the New China* is a major publication undertaken by the Commission of Science, Technology and Industry for National Defense (COSTIND) at the end of 1989.[37] This work represents the first time since 1949 that information on China's defense R&D complex and defense industries was revealed. The book is a collection of managerial review articles from major administrators and chief engineers working in defense R&D and defense industries.

Managerial and technical personnel working on China's space program are the major contributors. These include the administrators of the COSTIND, Nie Rongzhen[38], Zhang Aiping[39], Chen Bin[40] and Ding Henggao[41]. They describe their

[37] Nie Li and Huai Guomo, et al., *Huigu Yu Zhanwang, Xin Zhongguo De Guofang Keji Gongye Sishi Nian, 1949-1989 (Retrospection and Prospection, Forty Years of Defense Technology and Industry of the New China)*, (Beijing: National Defense Industry Press, August 1989).

[38] Ibid, 29.

[39] Zhang Aiping, Chairman of the Commission of Science and Technology for National Defense (1975-1982).

[40] Chen Bin, Chairman of the Commission of Science, Technology and Industry for National Defense (1982-1987) and the first Vice Chairman of the Commission of Science and Technology for National Defense (1975-1982).

[41] Ding Henggao, Chairman of the Commission of Science, Technology and Industry for National Defense (1987-1996).

personal experiences in managing large scale programs at the national level.

The Ministers and Vice Ministers of the Chinese space agency, Zhang Jun[42], Li Xuer[43], and Liu Jiyuna[44], contribute articles on how the Ministry is managed and how its missions are conducted.

Major scientists and chief engineers working on China's space program, such as Qian Xuesen[45], Ren Xinming[46], Chu Shouer[47], Liang Souye[48], Huang Weilu[49], and Ming Guirong[50],

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[42] Zhang Jun, Minister of Ministry of Astronautics Industry (1982-1985).

[43] Li Xuer, Minister of Ministry of Astronautics Industry (1985-1988).

[44] Liu Jiyuan, Minister of Ministry of Aerospace Industry and President of China Aerospace Corporation (1988-1992). The Ministry and coporation are one organization with two names.

[45] Qian Xuesen, (1911-),Chinese space program gatekeeper. His detailed biography was written by Wang Shouyun, "Qian Xuesen," *Chinese Contemporary Scientists' Biographies,* Vol. 1, Science Publishing House, Beijing, 1991, pp. 767-802 and Iris Chang, *Thread of the Silkworm*, Basis Books, A Division of HarperCollins Publishers, New York, 1995, and also see chapter V of this dissertation for details.

[46] Ren Xinming, (1915-), Deputy Chief Engineer of Dongfeng 1 and 3 in 1960s and Chief Engineer of the first telecommunication satellite in 1970s, Chief Engineer of Weather Satellite in 1984 and Chief Engineer of Long March International Launching Activities in 1986.

[47] Chu Shouer, (1917-), Deputy Chief Engineer of Red Flag Missile in 1959-1960 and Chief Engineer of Sea Eagle 1 in 1960-1962; Deputy Chief Engineer of Dongfeng 2 in 1960s; Chief Engineer of Dongfeng 5 in 1978-1982; Chief Engineer of Long March 2C in 1985.

describe their experiences in participating in policy decisions and designing the technical mission for rockets and satellite programs.

A major advantage of this book is that it provides overviews from these people on managerial issues.

Personal memoirs, biographies and personal profiles Personal memoirs are limited to the top-level leaders in China. So far, among the people involved in managing China's space program, only Nie Rongzhen has written a memoir. Other people, including Qian Xuesen, have not been encouraged to write a personal memoir. This is an unfortunate feature of the Chinese system which cherishes secrecy.

There are two books offering a profile of Nie Rongzhen as the first administrator who carried out the space program at the national level as well as some insights on decision making at the highest level. One is *Nie Rongzhen's*

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[48] Liang Shouye, (1916-), Chief Engineer of 1059 missile in 1959, Chief Engineer of Sea Defense Missile Series in the 1960s through 1980s.

[49] Huang Weilu, (1916-), Deputy Chief Engineer of Dongfeng 1, 2 and 3 in the 1960s; Chief Engineer of Ju Lang 1 in 1978 and the ground-to-air missile system in the 1980s.

[50] Ming Guirong, Deputy and later Chief Engineer of the Jianbing Recoverable Satellite series in the 1980s.

Memoirs[51] and the other is *Comrade Nie Rongzhen and Science and Technology Works*[52]. Here, I will discuss Nie's memoirs.

In his memoirs, Nie describes the motivations for the government to carry out a space program in the 1950s. Also, he describes his personal motivation to support the space program as a political advocate. Some historical facts on the decision to launch a space program, made in the Central Party Committee, the Central Military Committee, and the Central Special Committee are also disclosed in the memoir.

Nie's memoirs provide a basic understanding why the first generation of political and military leaders desperately wanted a missile program. It also narrates how they approached the space program as if it were a large scale military action employing limited resources, and how they collaborated along with scientists and engineers in carrying out missions.

Zhongguo Xiandai Kexuejia Zhuanji (The Chinese Contemporary Scientists Biographies),[53] a biography of Qian

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[51] Nie Rongzhen, *Nie Rongzhen Huiyi Lu (Nie Rongzhen's Memoirs)*, (Beijing: People's Liberation Army Publishing House, 1984).

[52] Guangming Daily (editor), *Nie Rongzhen Tongzhi He Keji Gongzuo (Comrade Nie Rongzhen and Science and Technology Works)*, (Beijing: Guangming Daily Publishing House, 1984). This is a collection of Nie's works in dealing with issues how to manage science and technology programs in China.

Xuesen (written by his former secretary who worked for Qian over more than thirty years) provides the historical facts on how Dr. Qian was involved in China's space program since his return to China from the United States in 1955. He became the father of the space program.

In the biography, Dr. Qian's role in launching China's missile and satellite activities is laid out. Unlike his work for the U.S. military during the World War II, he was not directly involved in the technical design of missiles and satellites. Instead, he played a significant role in introducing newly developed space technology into China's space program. His extensive academic knowledge of jet propulsion, missile technology, and military technology program management enabled him to carry out a unique role in China's space program as a technological and managerial gatekeeper.

Other personal profiles and the reports of interviews have been published piece-by-piece in Chinese magazines or newspapers, such as *Hangtian (Space Flight*, a monthly journal) and *Renmin Ribao (People's Daily*, a daily newspaper). These personal profiles and interviews cover key engineers working on rockets, satellite and the

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[53] Lu Jiaxi, et al, *Zhungguo Xiandai Kexuejia Zhuanji (Chinese Contemporary Scientists Biographies)* (Beijing:

manned flight program, such as Ren Xinmin,[54] Chu Shouer,[55] Huang Weilu,[56] Xie Guangxuen,[57] and others.

Personal working memoirs of key engineers were collected in a book entitled *Zhongguo Hangtian Keji Jingyan Xuan (A Collection of China's Space S&T Experience)* (Astronautics Publishing House, Beijing, 1989).[58] In this collection, key senior engineers describe their experiences in conducting major projects. This collection provides a first-hand look into China's space program at the mission level.

Chinese Scholars Publishing in Western Journals

Increasingly, we are likely to encounter Chinese scholars publishing works on China's space program in Western scholarly journals. A first foray in this respect occurred in early 1998 with the publication of Chinese authored articles in two issues of *Space Forum*, edited by guest

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Science Publishing House, 1991).

[54] Liu Dengrui, "Three Chief Engineers of the Space Program," *Hangtian (Space Flight)*, Vol. 6 (26 November 1987), 2-3.

[55] Ibid.

[56] Xin Qinggao, "Dream of Flight: Biography of Huang Weilu, Chief Engineer of Launchers," *Renmin Ribao (People's Daily, Overseas Edition)*, 26 September 1989, Section 2.

[57] Yi Jianru, "The Paved Road into Space: The Biography of the Chief Engineer of Long March 3," *Hangtian (Space Flight)*, Vol. 4 (26 July 1988), 2-3.

[58] Ministry of Aerospace Industry, *Zhongguo Hangtian Keji Jingyan Xuan (A Collection of China's Space S&T Experience)*, (Beijing: Astronautics Publishing House, 1989).

editor Hu Wenrui.[59] Particularly pertinent pieces appearing in the *Space Forum* issues include Shen Xinsun's description of launch vehicle technology[60]; Zhang Xinxia's historical review of China's commercial launching services[61]; Qi Faren and Yang Zhaode's description of Chinese satellite technology[62]; Fang Zongyi, Xu Jianmin, and Guo Lujun's examination of China's efforts in developing meteorological satellites[63]; Hu Wenrui's general overview of Chinese space science[64]; and Wei Jinghe's treatment of Chinese efforts in the area of space medicine.[65] The articles provide interesting facts on various aspects of the China space effort. However, they are chiefly descriptive and offer little analysis of space policy and organization in China.

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[59] *Space Forum,* Vol. 2, No. 1 (1998) and *Space Forum,* Vol. 2, No. 2 (1998).

[60] Shen Xinsun, "Launch Vehicle Technology in China," *Space Forum,* Vol. 2, No. 1 (1998), 65-76.

[61] Zhang Xinxia, "The Chinese Commercial Launch Services -- A Review on History and Prospect," *Space Forum,* Vol. 1, No. 1 (1998), 77-83.

[62] Qi Faren and Yang Zhaode, "Satellite Technology of China," *Space Forum,* Vol. 1, No. 2 (1998), 85-104.

[63] Fang Zongyi, Xu Jianmin, and Guo Lujun, "The Development of Meterological Satellite and Its Applications in China," *Space Forum,* Vol. 1, No. 2 (1998), 117-134.

[64] Hu Wenrui, "An Overview of Space Science in China," *Space Forum,* Vol. 1, No. 2 (1998), 135-148.

[65] Wei Jinghe, "Studies on Space Medicine and Medical Engineering in China," *Space Forum,* Vol. 1, No. 2 (1998), 149-156.

Conclusion

We have reached the point today where a critical mass of information exists on China's space program, enabling us to develop comprehensive insights into its technical, policy, and organizational aspects. This information is scattered across many areas, appearing in press reports (e.g., in *People's Daily* and *Aviation Week and Space Technology*), English translations of Chinese government pronouncements (e.g., through the Foreign Broadcast Information Service), Chinese language classified and unclassified documents, the memoirs of key players in the space program, and scholarly analyses by academics.

The challenge is to go through this material and make sense of it. This entails locating the material, identifying which material has value and which does not, assembling the facts and opinions, organizing them cogently, and presenting the results in a meaningful fashion. This dissertation approaches this effort by taking a historical approach to assembling, analyzing and reporting the facts and using this information to develop insights into how China's space program has functioned from a policy and organizational perspective. The next chapter describes the methodology employed in this dissertation to gather, report and analyze existing information on China's space program.

CHAPTER 3

FRAMEWORK

This dissertation takes a historical approach to examining China's space program. Historical research tends to focus on addressing six questions:

- *What* happened?
- *Who* were the key players?
- *Where* did the events transpire?
- *When* did the events transpire?
- *Why* did the events transpire?
- *How* did the players deal with the events?

Many historical works focus only on the first four items. This can be viewed as the *secondary school approach* to history, because when secondary school students study history, all they are expected to learn is *what* the key events were, *who* the key players were, *where* the events took place and *when* they took place. The emphasis is on facts and figures. When final exams are issued, students are tested on their mastery of the names of people, places, and events, and the dates associated with these events.

Most of the efforts in this dissertation go beyond the *what, who, where* and *when* questions. This work is primarily concerned with the last two questions in the list: *why* and *how*?

Why was China's space program able to function effectively during a tumultuous period? *How* did the China space program achieve its objectives during this chaotic period of its history?

In addressing the full range of historical options, I am following the example of two other space-related histories: the works of Logsdon and MacDougall. In his *Decision to Go to the Moon*, Logsdon engages in a comprehensive historical review of decision-making processes leading to the decision to undertake the Apollo mission to put people on the moon by 1970, and to bring them back safely to earth.[1] Included in his history is a detailed space policy analysis of the Apollo decision. Logsdon addresses all six of the questions that define a comprehensive historical study.

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[1] John M. Logsdon, *The Decision to Go to the Moon: Project Apollo and the National Interest* (Chicago: University of Chicago Press, 1970).

Similarly, in his *The Heavens and the Earth,* MacDougall offers a political history of the space age, examining both the basic facts of the US and Soviet space programs (*what, who, when,* and *where*) and also providing an in-depth analysis of space-related decision-making in the Cold War context (focusing on *why* and *how*).[2]

Data Collection Methodology

The dissertation has three distinct parts to it, and each part entails different approaches to data collection.

Data collection for the main body of the dissertation

The main body of the document — a narrative describing the history of the China space program — entailed the employment of a conventional approach to data collection for a historical document. Data came from:

- *Reviews of the academic literature on China's space program.* Because so little has been written on China's space program in the conventional academic literature, little historical data were generated from this source, particularly for the time period up until the 1990s. Beginning in the 1990s, conventional academic studies of

[2] Walter A. MacDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985).

China's space program began yielding interesting historical insights.

- *Reviews of Chinese government documents.* Chinese government documents offer a mother lode of information on China's space program, particularly since 1986 when the government became more open in reporting China's space activities. However, the objectivity and reliability of government-approved data are questionable. Government-filtered data must be handled carefully.
- *Memoirs and Biographical Sketches.* Some of the richest information on China's space program comes from memoirs written by key players and other individuals associated with the space program, and biographical sketches appearing in news accounts, such as those published by *People's Daily.* This material puts a human face on developments in the space program. A primary contention of the dissertation is that China's successes in space are closely tied to the quality and persistence of thousands of engineers, technicians, administrators and politicians who were personally committed to making the space program work. Consequently, information gleaned from memoirs and biographical sketches proves to be an enormously valuable source of insights into the people who contributed to the achievements of the space program.

- *Western Sources Scanning Chinese Speeches and Publications*. Western services, such as the Foreign Broadcast Information Service (*FBIS*) and the Joint Publication Research Service (*JPRS*), scan broadcasts and periodical articles appearing in China and translate them into English. Their value lies in their consistent monitoring of important Chinese sources of information on a wide range of developments in China, including those that pertain to the space program.

Collection of Space-related Photographs

A second feature of the dissertation is its offering of photographs of key technologies (e.g., boosters, satellites) and players in the China space program. Nearly all of these photographs were inaccessible to the West up until the time I collected them. In fact, the Smithsonian's National Air and Space Museum requested that I donate copies of the photos to their archives, which I did. I collected these photos one item at a time. In my searches of various Chinese archives, I would ask Chinese authorities for copies of pertinent photographs as I came upon them. The Chinese authorities were generally helpful in responding to my requests.

Collection of Data for the China Space Chronology

A third part of the dissertation is contained in the Appendix, *A Chronology of Space Events in the People's Republic of China, 1956-1986*. The *Chronology* attempts to identify the significant events transpiring between 1956 and 1986 that affected developments in the space program. I created the *Chronology* by systematically going through all my information sources to identify what I perceived to be events that had a measurable impact on the space program. These items were placed into a database, then were sorted chronologically.

Removing Distortions from Chinese Government Sources of Information

Good science strives to be unbiased and replicable. This is captured in the concept of measurement *reliability*, which postulates that a measure is *reliable* if after repeated measurements we have results that are reasonably consistent.[3]

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[3] Abraham Kaplan, *The Conduct of Inquiry: Methodology for Behavioral Science* (Scranton, PA: Chandler Publishing Company, 1998).

Unfortunately, in conducting a study on events in a country like China, where secrecy prevails and scholars must depend on information supplied from "official" government sources, it is difficult to develop *reliable* insights into what is happening. This is certainly the case with the China space program. In order to deal with the issue of government bias in issuing information, I was forced to depend upon my own filters as a knowledgeable expert who has been personally involved in China's space program for more than one decade (as an active participant). Consequently, I consciously attempted to cut through government propaganda to identify the truth behind facts that were being reported. This entailed subjective judgments on my part, which reduced the reliability of my measures (i.e., other scholars without my insights would report events differently). On the other hand, I believe that my approach has increased the *accuracy* of information on China's space program. (Reliability has its own problems — one can have highly reliable measures that are fundamentally inaccurate, i.e., consistently off-target, owing to calibration errors.)

In the final analysis, it would be helpful if other knowledgeable experts could validate and verify my conclusions. While I am confident that the conclusions presented here are on target, they can be strengthened by having other scholars validate them.

Methodological Framework

The framework of my study has been guided by the works of Vernon Van Dyke and James Q. Wilson. Van Dyke and Wilson helped me formulate my approach to addressing two significant historical questions: *Why* did China, a poor country, support a costly space program during tumultuous times (Van Dyke)?; and *how* were the space program's efforts carried out so effectively (Wilson)? Each of these perspectives will be discussed in turn.

Why Did China Support a Costly Space Program during Tumultuous Times?

My approach to examining the *why* question is closely tied to the perspective of Vernon Van Dyke.[4] Van Dyke was the first scholar to comprehensively address the question: Why would a country (e.g., the US or USSR) support a costly space program whose practical outcomes were uncertain? He concluded that the rationale for a costly space program is

[4] Vernon Van Dyke, *Pride and Power: The Rationale of the Space Program* (Urbana, IL: University of Illinois Press, 1964).

based on arguments that show that it serves the interests of:

- national prestige, associated with having a leadership position in space activities
- national security
- expansion of scientific observation and experimentation and the satisfaction of human curiosity
- social and economic values embodied in space technology, such as realizing the benefits of satellite-based telecommunications, broadcasting, navigation, remote sensing, meteorological insights, and so on.
- international cooperation
- special interests and ulterior motives

It should be noted that Vernon Van Dyke wrote at a time - in the early 1960s - when there were only two space powers: the United States and the Soviet Union. At that time, there was an intense public debate on whether the United States should be dedicating valuable resources to exploring space when so many issues -- such as poverty, disease, racial discrimination, and war -- remained unresolved right here on earth. Presumably, a parallel non-public debate on these matters was being carried out in the Kremlin.

While Van Dyke's observations were directed explicitly at the US space program, their implications are relevant to China as well. After all, the US was the richest country on earth and could, if it chose, expend its economic surplus on extravagances. China, in contrast, ranked among the poorest countries and by any measure could hardly justify squandering its meager resources on an activity that did nothing to alleviate its depressed economic state.

The principal value of Van Dyke's contribution is that it highlights the fact that the prime motivating forces behind space programs have little to do with economic arguments. Specifically, he focuses on the five motivations listed above, which largely ignore economic issues (with the exception of item 4).

In this dissertation, Van Dyke's framework is applied systematically to an examination of how and why China's space program received high-level support during turbulent times, appearing in Chapters 4, 5 and 6. The fact that Van Dyke's work was published in 1964 is viewed here as a strength, since Van Dyke's perspective reflected the prevailing concerns of a bipolar world during the Cold War.

How Did China's Space Program Carry Out Its Efforts So Effectively?

My approach to the *how* question owes a debt to the work of James Q. Wilson.[5] Wilson maintains that the best way to study government bureaucracies is to focus on *how* their decision-making systems function. He is less worried about the environment in which decisions are made than on processes organizations possess to make decisions. Specifically, he identifies three criteria for predicting the successful functioning of a technology-rooted government organization, such as China's space program. They are:

- possession of know-how to perform critical tasks
- possession of a sense of mission
- operating with autonomy and possessing external political support[6]

In discussing these three criteria, he contrasts the successes of two US government agencies: NASA (National Aeronautics and Space Administration) and the EPA (Environmental Protection Agency). To Wilson, NASA owes a great deal of its success in its early years to the fact that it scored highly on his three criteria. First, it was a technically competent engineering organization with the know-how to carry out space-related projects. Second, it had

[5] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 1989).

a clear sense of mission at different stages of its life (e.g., to put a satellite in orbit in 1958, to put men on the moon by 1970). Third, it was able to function autonomously, with high levels of political support.

In contrast, the EPA did not score so highly on the three criteria. While at its earliest stage, it was technically capable and possessed high levels of autonomy and political support, its mission was always vague: "to clean up the environment." Such a mission can be interpreted in many ways. Ultimately, the EPA began losing its political support as industry lobbied strongly to limit its ability to restrict environment-damaging business activity.

NASA itself began losing sight of its mission in its later years. By the time of the Space Shuttle program, it was unclear what its mission was. For example, was the Space Shuttle some kind of bus service that would put people in orbit on a routine basis, or was it still a high risk, state-of-the-art undertaking? NASA public relations specialists tried to portray it in the former light (in order to maintain public support), whereas the reality was closer to the second. The Space Shuttle Challenger disaster reflected NASA's loss of direction, according to Wilson.

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[6] Ibid., 25-27.

I employ Wilson's framework to explain how China's space agency functioned with a clearly defined mission in the 1950s through 1970s, how its senior managers nurtured external political support, and how they employed their autonomy innovatively to avoid being washed away during the tumultuous events of 1956-1986. In discussing these issues, I describe how the agency's structure evolved during this time and how its dependence on high-quality technical personnel enabled the program to perform well.

It is interesting to note that since Wilson's time the literature on bureaucracy has taken a decidedly anti-bureaucracy tone. For the most part, the new literature has little relevance to conditions in China during 1956-1986, although it may be pertinent to China's future attempts to scale-down the government enterprise. Since the "Reagan Revolution" of the early to mid-1980s, it has become popular to point out the failings of bureaucracy and the need to re-engineer it. Examples of this new approach are found in works by Osborne and Gaebler,[7] Osborne and Plastrik,[8] Gore,[9]

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[7] David Osborne and Ted Gaebler, *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector* (Reading, MA: Addison-Wesley, 1992).

[8] David Osborne and Peter Plastrik, *Banishing Bureaucracy: The Five Strategies for Reinventing Government* (Reading, MA: Addison-Wesley, 1997).

Bennis,[10] and Pinchot and Pinchot.[11] Bureaucracy-bashing has even become a popular public activity, as evidenced in the enormous success of the cartoonist, Scott Adams, whose book *The Dilbert Principle* makes fun of bureaucratic enterprises.[12]

Wilson's framework is applied to an examination of the structure and organization of China's space program, appearing in Chapters 7, 8, and 9.

Research Limitations and Future Research

As chapter 1 highlighted, this study was carried out under a number of research constraints. The chief constraints are:

Constraint 1. The sole source of detailed information on China's space program is the Chinese government.

Scholars who choose to examine the U.S. space program have an abundance of information available to them: official

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[9] Al Gore, *Common Sense Government: Works Better and Costs Less* (Washington, DC: National Performance Review, 1995).

[10] Warren Bennis, *Beyond Bureaucracy: Essays on the Development and Evolution of Human Organization* (San Francisco: Jossey-Bass, 1993).

[11] Gifford Pinchot and Elizabeth Pinchot, *The End of Bureaucracy and the Rise of the Intelligent Organization* (San Francisco: Barrett-Koehler, 1993).

[12] Scott Adams, *The Dilbert Principle: A Cubicle's-Eye View of Bosses, Meetings, Management Fads and Other Workplace Afflictions* (New York: Harper Business, 1996).

government documents, reports from the press, articles written by former government workers and contractors that offer behind-the-scenes insights into space program activities, memoirs of those who participated in the space program in either an official or unofficial capacity, and so on.

Scholars face an entirely different situation when examining China. The great bulk of information on China's space program comes from the government. Clearly, one must approach this information carefully in order to develop accurate insights into what is happening in China. In general, fact-based information appears to be reliable — items such as launch dates, payload sizes, and launch locations.

Beyond this, the best scholarly research material is written in the Chinese language, which makes it largely inaccessible to Western space experts.

Constraint 2. Chinese national security factors limit the amount of information that can be revealed by scholars.

Occasionally, China scholars may come across valuable information that they cannot reveal because it is classified as "secret" by the Chinese government. In past few years there have been incidents where the public release of classified material by Western scholars has created situations where their Chinese information sources have encountered legal problems and have even been jailed. Consequently, in writing this dissertation I have constantly balanced the desire to include new and interesting information against the ethical and legal consequences of doing so.

Constraint 3. The missile and space programs are so closely connected that it is often difficult to distinguish the activities of one from the other.

As I pointed out in Chapter 1, in the time period examined in this study (1956-86), the China space agency, which incorporates a space industry complex, served civilian and military missions simultaneously. Managers and engineers often found themselves working concurrently on civilian and military projects. The upshot of this is that it becomes impossible to deal with China's civilian and military space activities as separate threads. This feature of the China space program distinguishes it from conditions at NASA and the European Space Agency, organizations that exclusively carry out civilian missions.

China is definitely growing more open in revealing information about its space activities. As this trend continues, Constraints 1 and 2 will be less serious. Given better access to higher quality data, future researchers can move away from descriptive historical presentations towards deeper policy analyses.

In addition, with better data and increasingly mature insights, future scholars can create richer and more accurate models of policy-making processes in China.

Conclusion

Given the current limits of our knowledge of China's space program, the historical approach to studying the program offers a good first-step in defining what it is all about. At this point in time, a critical mass of information exists on the space program's political and technical origins, key players, and organizational structure. The information is scattered in many places: some resides in classified government documents, some in the memoirs of key players. Some can be gleaned by reviewing the records of the Foreign Broadcast Information Service, some is highlighted in press reports appearing in *People's Daily* (China) and *Aviation Week and Space Technology* (USA). Some is written in English, most is written in Chinese.

At this time, the first steps taken to understanding China's space program should focus on assembling, organizing, interpreting and presenting cogently the vast amount of information scattered here and there. This is the historian's chore and the principal focus of this dissertation. Once, this first step is taken and we develop a good sense of the nature of the space program, scholars can then turn their attention to more sophisticated and refined analyses using advanced behavioral science research methodologies.

PART I, CHINA'S SPACE POLICY

CHAPTER 4

THE FIRST STEPS TO A SPACE PROGRAM, 1956-1966

Missile Technology —

A Military Establishment under Big Science

The origins of China's space program can be tied to advances achieved in the military realm. Specifically, as this chapter makes clear advances in missile technology enabled China to establish a foundation leading to the creation of a space program.

This chapter explores China's efforts to establish and strengthen its capabilities to design, build and launch missiles. Without understanding efforts in this arena, it is impossible to appreciate how China's space program - including its civilian aspects - evolved over time. Chapter 5 ("China Enters the Space Age, 1966-1976") details from a policy perspective how the missile program transitioned into a comprehensive space program. Chapter 8 ("The Ministry of Seventh Machinery Industry, A Full Functional Organization with a Space Industrial Complex") explores the transition from an organizational perspective, showing how in the mid-sixties the government committed itself to creating an explicit space industry infrastructure.

The link between China's missile and space efforts can be confusing to analysts who are unfamiliar with China's historical circumstances. From the beginning, in the - mid-fifties - through the late 1980s, the two efforts were seen to be inextricably linked. A space program needs launching capabilities, and these would be supplied by means of high-performing missiles. On the other hand, a major rationale for supporting the missile program was that it would lead to the establishment of a space program. In large measure, the linkage was reinforced by the reality of China's limited resources. By tying the two efforts closely together, China hoped to do a double job, thereby husbanding scarce resources.

Within a few years after Liberation in 1949[1], China was solidly on the road to reconstruction. For decades the country had faced terrible social turmoil. Two key problems were the struggle between the Kuomindang and the Communists and the war with the Japanese. But by the mid-1950s, agricultural and industrial reforms were taking hold and the economy was strengthening[2]. The Chinese leadership under Mao Zedong saw a bright future for China and set out to establish a sophisticated society built on the principles of Marxism and Leninism. The optimism of the leadership was reflected in setting up the second Five-Year Economic Development Plan (1958-1962), which called for continued, rapid economic growth.

Discussion and approval of the Second Five-Year Plan began on January 25, 1956, when the Supreme State Conference (SSC) convened in Beijing. Mao Zedong announced that "China should have a long-term plan aimed at changing the backward status of its economy, science, and civilization. It should accelerate the process to join the international community."[3]

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[1] In 1949, China dominated by the Koumindang (National People's Party) was formally replaced by the People's Republic of China dominated by the Chinese Communist Party.

[2] In the period of the First five-year Plan (1952-1957), total industrial output value increased by 129 percent; total agriculture output value by 25 percent; national income by 53 percent.

[3] People's Publishing House, *A Collection of Documents of the Supreme State Conference,* (Beijing: People's Publishing House, April 1956).

The leadership saw the strengthening of science and technology as a key to China's development. On January 14-20, the State Council established the Science Planning Committee to guide the growth of science and technology in China and reviewed the "National Long-Term Plan for the Development of Science and Technology, 1956-1967." This document was drafted by 600 scientists and technologists.[4] On January 31, Premier Zhou Enlai called for developing advanced science and technology in China at the Chinese People's Political Consultative Conference (CPPCC)[5].

A cornerstone of China's science and technology development strategy was to use the considerable talents of Dr. Qian Xuesen to build a space program. Dr. Qian was highly qualified to launch this effort. He emigrated to America as a young man in 1935, where he received graduate education in aeronautical engineering at Caltech. He studied under Professor Theodore von Karman. During the Second World War, he was a key player in America's attempt to build a rocket program. After Liberation in 1949, he heeded Mao's call for overseas Chinese to return home to

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[4] Cheng Jin (Ed.), *A Chronology of the People's Republic of China, 1949-1984*, (Beijing: Foreign Languages Press, 1986), 16.

[5] People's Publishing House, *A Collection of Documents of the People's Political Consultantive Conference,* (Beijing: People's Publishing House, April 1956).

China to build a new society. However, in view of his knowledge of advanced missile technology, the US Army opposed his return. By 1955, he was permitted to leave the United States and at that time he returned to China[6].

On February 17, 1956, Dr. Qian made his famous proposal to the Central Government, entitled "A Proposal to Establish China's Defense Aviation Industry." In this proposal, he provided important technical guidelines to develop a Chinese rocket and missile program[7]. The guidelines were reviewed by China's top leaders and established the technical foundation for the development of missile and jet propulsion technology. In March, the State Council issued the *National Long-Term Plan for the Development of Science and Technology, 1956-1967.* It stated that China should develop effective missile and jet propulsion technology within the next twelve years.

The Aviation Industry Committee (AIC) was established to implement the plan on 14 March[8]. (Later — in October

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[6] For a review of detailed episodes of Dr. Qian's life in the United States see Iris Chang, *Thread of the Silkworm,* (New York: BasicBooks, 1995).

[7] Wang Shouyun, "Qian Xuesen", *Zhongguo Dangdai Kexuejia Zhuanji (Chinese Contemporary Scientists' Boigraphies),* Vol. 1, (Beijing: Science Publishing House, 1991), 776.

[8] Liang Dongyuan, *Tian Xiao, Zhongguo Guofang Jianduan Jishi (Heaven's Voice, Chinese Defense High Tech Notes),* (Beijing: Auhor Publishing House, October 1997), 66.

1958 — it was merged into the newly established Committee of Science and Technology for National Defense (CSTND). CSTND became the Central Government's agency charged with developing military technology and weapons systems in China.) AIC's first chairman was Marshal Nie Rongzhen, Vice Premier of the State Council. Marshal Nie had a lifelong belief that science and technology are engines of economic development. He would be a major champion of the space program in the future[9].

Marshal Nie was instrumental in establishing the Fifth Academy, which would serve as the organizational home of the nascent space program. On May 10, he submitted a proposal to the Central Party Committee of the Chinese Communist Party entitled "An Initial Proposal to Establish Missile Technology Research in China.[10]" Two weeks later Premier Zhou Enlai approved this proposal. As a result, the Fifth Academy of the Ministry of Defense was established[11].

On October 8, the Fifth Academy became a physical reality. It occupied a former military hospital West of Beijing. Mr. Zhong Fuxiang, a military veteran, was

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[9] For details on Nie's contribution to the China space program see Nie Rongzhen, *Nie Rongzhen Huiyi Lu (Nie Rongzhen's Memoir)*, (Beijing: People's Liberation Army Publishing House, 1984).

[10] Ibid. 802

appointed as its Director and Dr. Qian Xuesen was made its First Deputy Director and Chief Engineer[12].

The Fifth Academy was made part of the military establishment. China's leaders recognized that China's military weakness allowed the country to be victimized by external aggressors for more than a century, beginning with the British during the Opium Wars and extending to the Japanese occupation that only ended with Japan's defeat in the Second World War. After Liberation, China found itself with a large infantry that possessed primitive weapons. The newly established Air Force and Navy had almost no equipment in hand. The country lacked any kind of strategic defense system[13].

China's leaders believed that the development of missile technology capabilities was the perfect solution to the defense needs of the country. China's geography gave it a long coast and vast expanses of land. Its limited economic resources restricted the country's ability to develop deep weapons capabilities. Its conventional weapons

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[11] The Fifth Academy was also known as the Missile Technology Academy.

[12] Zhang Jun, et al, *Dangtai Zhongguo De Hangtian Shiye (Contemporary Chins' s Space Efforts)*, (Beijing: China Social Science Publishing House, June 1986), 8-10.

[13] Academy of Military Sciences, *Zhongguo Renmin Jiefangjun De Qishi Nian (Seventy Year History of the People*

systems were weak. From both a strategic and economic perspective, the development of strong missile capabilities made good sense. In Mao's words: "If we do not want to be bullied around in today's world, we cannot afford to not do this thing.[14]" Of course, by developing missile capability, China also was providing the means for access to space by Chinese satellites. Thus the events described in this chapter, which focused on missile for security purposes, were also critical to the development of the Chinese space program.

Defining an Approach to Developing Missile Capabilities — Reliance on Foreign Technology or Development of Indigenous Capabilities?

At the outset, the Chinese expected that the Soviets would help them establish a missile program, just as they helped them develop industrial capabilities in Northeast China in the early 1950s. However, the hope for cooperation soon faded as China and the USSR began to encounter

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Libration Army), (Beijing: Military Science Publishing House, 1997), 452-464

[14] Jiang Minghe (Ed.), *Hangtian Chuantong Jingshen Gailun (An Introduction to the Space Tradition and Spirit)*,

political conflict. A central issue facing policy makers in 1956-1966 was to identify how China should acquire missile development technology if it could not gain needed technical assistance from the USSR.

In the beginning, it was appeared as if the Soviets would give the Chinese whatever assistance they needed. One of the first steps taken by the newly-established Fifth Academy was to propose to acquire Soviet missile technology. Assistance was needed in the areas of missile research, manufacturing, and maintenance.

On July 17, 1956, Vice Premier Minister Li Fuchun sent a letter to Bulganin, the Chairman of the Council of Ministers of the Soviet Union. The letter contained a request for Soviet assistance in the building of Chinese missile capabilities[15]. Meanwhile, the Fifth Academy began to make a detailed management plan that covered organizational structure, personnel actions, and near-term plans. The Soviets demonstrated their willingness to cooperate with the Chinese by sending the Fifth Academy two P-1 missiles by the end of the year.

In July 1957, a Chinese delegation led by Marshal Nie Rongzhen, signed a pact with the Soviet Union, *New Defense*

(Beijing: China Astronautics Publishing House, December 1990), 4.

Technical Accord 1957-1958, ratified on 15 October 1957. In this pact, the Soviets agreed to provide missile and aviation assistance to China. In the area of missile technology, they agreed to provide missile samples and technical documentation, and to send technical experts to China. They also promised to increase the number of Chinese students studying rocketry in the USSR[16]. On December 24, they shipped two P-2 rockets and supporting equipment to the First Institute of the Fifth Academy at Yungang, Beijing[17].

With Soviet assistance, the First and Second Institutes and a missile assembling factory began to function in January 1958. Meanwhile, construction began on the first launch site at Jiu Qun in Gansu Province. Jiu Qun is a small town located in the Gobi desert in the northern part of China. In October and November of 1958 the Chinese acquired another six P-2 rockets and two C-75 surface-to-air missiles from the Soviets[18].

In the following year, in a new technology agreement, the Soviets agreed to provide technical assistance to help the Chinese develop capabilities in producing C-2 coast-to-ship, II-15 ship-to-ship, and P-IIM submarine missiles. The

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15 Liang Dongyuan, *op cit,* reference 8, 67
16 Ibid, 71-73
17 Zhang Jun, *op cit,* reference 12, 562
18 Ibid, 563-564

Chinese missile developers were excited by the quantity and pace of assistance they were receiving. They realized that at this rate they would develop good missile development capabilities quickly. Engineers involved in this effort later recalled that they would work day and night on the missile projects and would eat and sleep at the office[19].

However, the missile developers did not know that political tensions between the Chinese and Soviet Communist parties had reached a critical juncture. The Soviets decided to restrict their assistance to the Chinese in sensitive areas, such as military and technology assistance. In June 1959, the Soviet Communist Party Central Committee sent a letter to the Chinese Communist Party Central Committee notifying them that they would terminate some missile projects. As an excuse, they said that supplying the Chinese with missile technology could weaken their bargaining position in negotiating the Nuclear Non-proliferation treaty with the Americans and British[20].

The Sino-Soviet arguments focused on the issue of what the international socialist community should look like. In reality, the Soviets were angry that the Chinese resisted

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[19] Ministry of Astronautics Industry, *Hangtian Shiye Sanshi Nian, 1956-1986 (China's Space Activities in Thirty Years, 1956-1986)*, (Beijing: Changhong Printing House, April 1988), 102-108

their attempts to control Chinese policy. The arguments became public. Soon the Soviets announced that they would withdraw all of their technical experts from China, including the experts working on the missile program. On August 12, the last group of Soviet missile technicians left China.

The Chinese reaction to the Soviet withdrawal was strong. The withdrawal had significant negative effects on China's strategic defense plans. The Party Central Committee appointed General Liu Yalou, the Commander of the Chinese Air Force, as Director of the Fifth Academy; the Air Force Deputy Commander — Wang Bingzhang — as Deputy Director; and Dr. Qian Xuesen as a second Deputy Director.

On August 14, 1960 — two days after the last Soviet experts left China — General Nie held a meeting at the Fifth Academy. He urged the Chinese missile developers to adopt a self-reliant approach in order to continue with the missile program. He said to the assembly: "We are forced to climb Liang Mountain. [i.e., Our backs are against the wall.] We have to do things by ourselves. We cannot depend

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[20] Nie Rongzhen, *op cit,* reference 9, 806-809

on others. We place our hopes in you, our missile experts."[21]

Marshal Nie, an experienced military leader, firmly believed that for a country to grow strong, it could not depend upon free assistance from a super power. Even at the outset of the missile program in 1956, he wrote a report that he submitted to the Party Central Committee in which he proposed that the missile program be "mainly self-reliant, while trying to acquire some assistance from the West and employing Western technology."[22] Years later, Chinese leaders would repeat this statement whenever they wondered whether they should compromise their principles in order to gain advanced technology from overseas.

Rather than give up in the face of insurmountable obstacles, the Chinese decided to speed up their missile technology development efforts. On September 13, 1960, the Central Military Committee established technology development as a high priority item. It issued a statement that said: "The nuclear and missile programs have high priority. The missile program should be top priority."[23]

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[21] Xin Qixin and Li Peicai, "A Great Monument. Marshal Nie Rongzhen — A Great Founder of Defense Science and Technology Undertakings," *Sheng Jian (Magic Sword)*, Vol. 46, No. 4, (August 5, 1992), 2-10.

[22] Nie Rongzhen, *op cit,* reference 9, 802

[23] Ibid.

At this time, the Fifth Academy also submitted a report to the Central Military Committee stating that it was committed to developing a missile program independently, without any foreign assistance. High level support for the missile program was dramatically reflected in visits to the Fifth Academy and its facilities by China's highest leaders, including Mao Zedong, Deng Xiaoping, Chen Yi, Li Fuchun, Bo Yipo, Liu Lantao, Peng Zhen, Lin Biao, Nie Rongzhen, He Long, Zhang Jingfu, Luo Ruiqing, Yang Chengwu, and Wang Bingzhang.

At this time, the importance of the missile program to foreign policy first became apparent. This fact was signaled several months after the Soviet withdrawal of technical assistance when Foreign Minister Chen Yi jokingly stated: "We will do what it takes to support the nuclear bomb and missile programs, even if this means we can't afford to wear pants! As Minister of Foreign Affairs, I need these programs to back me up in my foreign policy formulation."[24]

Social turmoil does not stop the missile program

The missile program never had it easy. Not only did missile engineers face technical challenges everyday, but in the years following the establishment of the missile program social turmoil challenged its very existence. Two major events during this time stand out: the Anti-Rightist Campaign and the Great Leap Forward and the ensuring famine.

The Anti-Rightist Campaign. The year 1956 began auspiciously for China's intellectuals. In January the Party Central Committee convened a meeting to examine the role of intellectuals in China. One outcome was recognition of the importance of science and technology to China's development — and by implication, the importance of scientists and engineers. On May 2, 1956 Mao Zedong issued his famous statement on "letting a hundred flowers blossom and a hundred schools of thought contend."[25] This statement suggested that the Chinese leadership would tolerate diverse viewpoints, and as a consequence, intellectual life flourished. Many intellectuals who had fled China in 1949 decided to return to the country.

Tolerance did not last long. Beginning in April 1957 with the Rectification Campaign, attention focused on the Rightists, who wanted a liberalization of China's economic and political system. Chief among its victims were intellectuals, including many scientists and engineers.

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[24] Ibid., 812
[25] Cheng Jin, *op cit,* reference 4, 17

Large numbers of them were imprisoned and lost their jobs. Both the short- and long-term impacts of the campaign on China's artistic and scientific development were disastrous.[26]

Fortunately, the scientists and engineers working on the missile and space program were buffered from the destructive forces of the campaign. Their work was considered important for national defense. Older scientists and engineers who had returned from abroad were treated like patriots. Younger ones were sent off to the USSR for advanced training, and thus escaped the more egregious excesses of the anti-Rightist campaign.[27]

The Great Leap Forward. The Great Leap Forward had its intellectual origins in the Second Plenum of the Eighth National Congress of the Chinese Communist Party, convened on May 5-23 1958.[28] The actual implementation of the Great Leap Forward policies began in August of that year. The

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[26] The anti-Rightist campaign started with an editorial paper "What Is This All About?" calling on the people to struggle against the Rightists on 8 June 1957. It was backed, on the same day, with a directive issued by the Central Committee of the Chinese Communist Party to repulse the Rightists attacks.

[27] Interview with Ding Hanggao and Nie Li in 1992. They were among the Chinese exchange students in the USSR during this time period.

[28] Cheng Jin, *op cit,* reference 4, 23. The general line of the Great Leap Forward was "going all out, aiming

overriding emphasis was to accelerate economic development through extraordinary measures. In agriculture, for example, all lands were subjected to communization, the better to rationalize food production.

There were two ways in which the Great Leap Forward could have had a negative impact upon the space program. One was the actual application of its principles to development work in the missile and space arena. Mao Zedong called for the development of satellite program at the Second Plenum of the Eighth National Congress of the Chinese Communist Party in May 1958.[29] It was grossly premature, since China was technically nowhere near able to achieve such a goal. Had resources been diverted from more mundane rocket-launching areas, this could have had a disastrous impact on the long-term health of China's missile and space program.

Fortunately, in January 1959 Secretary General Deng Xiaoping announced to the Chinese Academy of Science, which was responsible for proposing the satellite program, that developing a strong satellite program lay outside China's

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high and achieving greater, faster, better and more economical results to build socialism."

[29] Details on China's development of a satellite program, including the early stages, will be discussed in the next chapter as well as chapter 8.

immediate capabilities.[30] As a consequence, the program was not put into a position of trying to bite off more than it could chew.

A second danger was more general. Great Leap Forward actions had a negative impact on the economy. Unrealistic production measures and reports led to unrealistic consumption in towns and villages. This led to the terrible famine of 1960, which resulted in the deaths of millions of Chinese.[31] There was a danger that resources directed to the missile and space program would be shifted to help meet more immediate economic needs. During a conference on the defense industry held at Be Dai He in July 1960, this very issue was discussed. After many days of argument and debates, the view to continue giving full support to the missile and space program prevailed. This view was affirmed by the top Chinese leaders — Mao Zedong and Zhou Enlai — who authorized continued large-scale construction of space-related facilities.[32]

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[30] Zhang Jun, *op cit,* reference 12.

[31] Jasper Becker, *Hungry Ghosts, Mao's Secret Famine,* (New York, London, Toronto, Sydney, Singapore: The Free Press, 1996).

[32] Nie Rongzhen, *op cit,* reference 9, 810-813.

Conclusions

Van Dyke identified six rationales for countries to carry out comprehensive space programs:[33]

- achieving national prestige
- strengthening national security
- striving to expand scientific capabilities
- realizing social and economic benefits
- engaging in international cooperation
- pursuing special interests and ulterior motives

In the period 1956-1966, each of these rationales played a role in China's decision to undertake a comprehensive space program. At the top of China's priorities were the first two items on the list. Most significant was the desire to use space to strengthen national security. The Chinese appear to agree with the US Chairman of the Senate Armed Services Committee, Senator John Stennis, when he stated: "Space technology will ultimately become the dominant factor in determining our national military strength. Whoever controls space controls the world."[34]

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[33] Vernon Van Dyke, *Pride and Power: The Rationale of the Space Program*, (Urbana, IL: University of Illinois Press, 1964).
[34] Ibid., 34.

A second priority was to augment China's national prestige. For two thousand years, China was second to none in technological developments. But since the Opium Wars of the mid-nineteenth Century, China saw itself slip into the ranks of second-rate powers. With a space program, China could revitalize its reputation as a major power. This is captured in Mao Zedong's declaration: "If we do not want to be bullied around in today's world, we cannot afford to not do this thing."[35]

The third priority item in Van Dyke's list during the 1956-1966 time frame was to strengthen China's scientific capabilities. This item surfaced in the "National Long-Term Plan for the Development of Science and Technology, 1956-67," a document drafted by 600 scientists and technologists.[36] This document specifically cited the scientific benefits of undertaking the development of missile technology.

The fourth priority was to use the space program to engage in international cooperation with the Soviet Union. In the early years, the Soviets provided the Chinese with

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[35] Jiang Minghe (Ed.), *Hangtian Chuantong Jingshen Gaiyao (An Introduction to the Space Tradition and Spirit,* (Beijing: China Astronautics Publishing House, December 1990), 4.

substantial technical support. However, after the Sino-Soviet rift of 1960, when Soviet technicians suddenly pulled out of China, China's leadership resolved to move ahead alone. From 1960 until the late 1970s, the Chinese made this the lowest priority rationale for undertaking a comprehensive space effort.

The fifth priority in 1956-1966 was the argument that a space program generates social and economic benefits. At this time, this was largely a non-issue for the Chinese leadership. On the contrary, their principal social and economic concern was that society could generate the resources needed to support a massive space program.

Van Dyke's rationale of "special interests and ulterior motives" did not appear to play a major role as a rationale for supporting the space program. The Chinese leadership did not appear to have a personal stake in space affairs. However, as we shall see in the next chapter, "special interests and ulterior motives" became an important factor during the Cultural Revolution.

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[36] People's Publishing House, *A Collection of Documents of the People's Political Consultative Conference*, (Beijing: People's Publishing House, April 1956).

CHAPTER 5

CHINA ENTERS THE SPACE AGE, 1966-1976

The dominant political force operating in China from 1966 to 1976 was the Cultural Revolution, which created great social turmoil.[1] Everyone was affected by it, from the highest leaders -- such as Liu Shaoqi[2] and Deng Xiaoping[3] -- to the workers and peasants.

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[1] The Cultural Revolution began with the establishment of the Central Cultural Revolution Group. Chen Boda was its chair, Kang Sheng was its advisor and Jiang Qing, Mao Zedong's wife, and Zhang Chunqiao were its deputy chairs. The Group gradually replaced the Political Bureau of the Central Committee and became a leading force of the Cultural Revolution. Later, in August, Jiang Qing became the acting chair of the Group. The Cultural Revolution was officially launched throughout China in August 1966, when Mao Zedong published his famous big-character poster, "Bombarding the Headquarters," at the 11th Plenary Session of the Eight Central Committee of the Chinese Communist Party in Beijing. The article was aimed at Liu Shaoqi and Deng Xiaoping. For general information on the Cultural Revolution and Chinese leaders during this chaotic period, see Harrison E. Salisbury, *The New Emperors, China in the Era of Mao and Deng,* (Boston, Toronto and London: Little, Brown and Company, 1992).

[2] Liu Shouqi was the Chairman of P.R.China and Mao's successor at the time.

[3] Deng Xiaoping was the General Secretary of the Chinese Communist Party at the time.

Despite the national turmoil caused by the Cultural Revolution, the Chinese space program thrived. In fact, it was at this time that China finally entered the space age, with the launch of the *East is Red* in 1970. The space program survived the Cultural Revolution because its success served the interests of key players from all segments of the political spectrum. Zhou Enlai was a strong supporter of the space program because he cherished the strength and prestige it conferred upon China in the international community. To him, the space program was an emblem of China's scientific and technological capabilities.

At the other end of the political spectrum, the Gang of Four[4] were enthusiastic backers of the space program because they viewed it as a sign of their ability to carry out complex and sophisticated undertakings. They would use the space program to demonstrate their basic competence in running the country. Another important player -- Lin Biao[5]

[4] The Gang of Four were Jiang Qing, Zhang Chunqiao, Yao Wenyuan and Wang Hongwen. Wang Hongwen, a worker representative from Shanghai city and later raised to an important position in the Political Bureau, joined the other three in the later years of the Cultural Revolution. The other three were involved the Cultural Revolution from early on.

[5] Lin Biao was the Minister of Defense before the Cultural Revolution. In April 1969, at the Ninth National Congress of the Chinese Communist Party in Beijing, Lin Biao was officially proclaimed as Mao Zedong's successor.

-- promoted the space program as means to enhance his personal prestige.

During the Cultural Revolution, the space program found itself in the enviable position of receiving strong support no matter which of the contending forces held power!

In this chapter, attention focuses on three areas: achievements of the space program during the Cultural Revolution, administrative policies carried out at this time, and political forces that shaped the program's development.

Achievements of the Space Program during the Cultural Revolution: the Establishment of a Comprehensive Space Program

China's advances in its space program during this time period fall into four broad categories: advances in missile technology, advances in rocket-launching capabilities, advances in satellite capabilities, and advances in space-related biological activities. Each of these advances will be discussed in turn.

Advances in missile technology. Advances in space rocket design, construction, and performance were clearly tied to parallel advances in missile technology. In the early part of 1965, the Fifth Academy of the Ministry of

Defense was transformed into a full-scale civilian agency responsible for the development of China's missile and space program. The agency was called the Ministry of Seventh Machinery Industry. This agency, unlike space organizations in the West, focused on R&D, design and production of missiles and rockets for both civilian and military space programs.

The foundations of China's launch capabilities were laid in the early years of the Cultural Revolution, thanks to the significant strides made in the development of missiles. They include the first successful launch of a medium-range ground-to-ground missile, *East Wind 3* (Dongfeng-3) on 18 December 1968; the successful testing of a long-range ground-to-ground missile, *East Wind 4* (Dongfeng 4), on 30 January 1970; and the first successful experimental flight of an intercontinental ballistic missile, *East Wind 5* (Dongfeng 5) on 10 September 1971. Thus it was at this time that China first developed a decisive strategic missile defense capability.

Meanwhile, China also developed tactical missile capabilities such as a ground-to-air missile system, the *Red Flag* (Hong Qi) series; the coast-to-ship missile system, the *Sea Eagle* (Hai Yin) series; and the air-to-ship missile system, the *Thunderstorm* (Feng Lei) series. These soon were employed by the Chinese military forces[6].

Advances in rocket-launching capabilities. It was during the Cultural Revolution that China finally developed rockets that could launch payloads into space. The first such launch was of the *Long March 1*, which carried China's first satellite (*The East is Red*) into orbit on 24 April 1970. Not surprisingly, the *Long March* 1 was a conversion of *East Wind 4* (Dongfeng 4). Later, China launched *Practice 1* (Shi Jian 1), a scientific research satellite, with a *Long March 1* rocket on 3 March 1971. In August 1972, a rocket promoted by the Gang of Four -- the *Storm 1* - successfully launched China's first electronic reconnaissance(spy) satellite, *Far Sky* (Chang Kong 1). And on 26 November 1975, the *Long March 2* successfully launched a recoverable satellite, *Spear Soldier 1*. In the later years of the Cultural Revolution, China developed *Long March 2*, which converted from *East Wind 5* (Dongfeng 5) in 1975. During

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[6] Xie Guang, et al, *Dangdai Zhongguo De Guofang Keji Shiye* (*Comtemporary China's Defense Science and Technology Efforts*), Vol. II, (Beijing: China Social Science Publishing House, 1992), 3-97

this time period, China possessed the launching capability to send a payload into low earth orbit[7].

Advances in satellite capabilities. China wanted to develop satellite production and launching capabilities since 1957, after the Soviet launched its first satellite -- *Sputnik*. In January 1958, China's lead space scientists, Qian Xuesen and Liu Jiuzhang, proposed a plan to develop a Chinese satellite program. In May 1958, with Great Leap Forward launched politically, Mao called for a satellite program to catch up the Soviet and United States. Due to the setbacks of the Great Leap Forward and the ensuring national famine that occurred in the early 1960s, China was not able raise resources to support the satellite program during 1950s and the early of 1960s.[8] However, A team of scientists and engineers were able to grouped under the Chinese Academy of Sciences to conduct preliminary researches[9].

After the ordeal of economic chaos was behind them, the Chinese government concentrated once again on promoting its space program. In April 1964, the Commission of Science and

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[7] Yanping Chen, "China's Space Interests and Missile Technology Controls," in Peter Hayes (editor), *Space Power Interests,* (Boulder, Colorado: Westview Press, 1996), 71-84.

[8] The famine was an astonishing human catastrophe, resulting in an estimated thirty million deaths. For general information on the Chinese famine see Jasper Becker, *Hungry Ghosts, Mao's Secret Famine*, New York, London, Toronto, Sydney and Singapore: The Free Press, 1996).

Technology for National Defense scheduled work on China's first satellite. Reflecting the full commitment for a Chinese satellite program, the China Space Technology Academy was formed in January 1968 and was made responsible for satellite development. Once again, the government counted on Dr. Qian Xuesen to guide the program. He became the first director for the Academy and headed the satellite development effort.[10] The Cultural Revolution had already been launched in 1966, so we find a dramatic growth of work on satellite technology that appeared to be impervious to the pulls and tugs of the existing political chaos.

China launched eleven satellites during the Cultural Revolution. Among these, seven were launched successfully. This placed China firmly among a handful of countries -- all technologically advanced -- that had satellite-launching capabilities. Following is a list of the eleven satellite launches:

Launch 1. The *East is Red 1* (Dong Fang Hong 1) was launched on 24 April 1970. It was an experimental satellite. As a consequence of the success of this launch, China became the fifth country in the world to possess

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[9] Zhang Jun, *op cit,* Chapter 4, reference 12, 28
[10] Ibid., 238-356.

satellite technology, after the United States, the Soviet Union, France and Japan.

Launch 2. *Practice 1* (Shi Jian 1) was launched On 3 March 1971. It was successful.

Launch 3. *Far Sky 1* (Chang Kong 1) was launched on 18 September 1973. It failed due to a failure of the rocket *Storm 1.*

Launch 4. *Far Sky 1,* a second *Far* Sky launching, was launched on 12 July 1974. Once again, it failed due to the failure of the *Storm* rocket.

Launch 5. *Spear Soldier 1-A,* the first launch, was on 5 November 1974. It failed due to a faulty *Long March 2* control system.

Launch 6. *Far Sky 1* (Chang Kong 1), the third attempt in the *Far Sky* effort, was launched on 26 July 1975. It was successful.

Launch 7. *Spear Soldier 1-B* (Jian Bing 1) was launched on 26 November 1975. It was a spy satellite. A notable feature of this satellite was that it was retrievable, which made China one of only three countries (the others being the US and USSR) capable of recovering satellites.

Launch 8. *Far Sky 1,* the fourth attempt, was launched on 16 December 1975 successfully.

Launch 9. *Far Sky 1,* the fifth try, was launched on 30 August 1976. The satellite did not achieve a proper orbit because of rocket problems with the Storm rocket.

Launch 10. *Far Sky* 1, the sixth attempt, was launched on 10 November 1976. The satellite did not achieve the proper orbit.

Launch 11. *Spear Soldier 1*-C, was launched successfully on 7 December 1976. It was retrieved on schedule ten days later.

China also laid out plans to develop telecommunication satellites and weather satellites in the early part of 1980s.[11]

Advances in biological activities in space. From the beginning, China's space program was geared toward eventual manned space missions. Two months after Gagarin's April 1961 first flight in space, led by Qian Xuesen, Pei Lisheng and Zhao Jiuzhang, the Chinese Academy of Sciences began serious discussion to follow the steps. Twelve seminars were held from 1961-1963. In September 1963, Space Flight Committee was formed in the Academy. It conducted preliminary research and drafted the plans for future Chinese space flight missions.[12] The China Space Medico-

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[11] Ibid.
[12] Ibid., 31

Engineering Institute was established in 1968 and reflected the government's commitment to establishing a manned flight program. In November 1970, The Commission of Science and Technology for National Defense proposed inaugurating a manned flight program named *Dawn 1* (Shu Guang 1). According to this plan, China would send two astronauts into space for an eight-day mission. The time-frame required the launching of a launch flight module in 1973, followed by a man-flight module in 1974. Owing to major budget cutbacks, China was not able to fulfill its plan. However, it continued conducting experiments in the area of biological activity in space.[13]

China's biology-related successes during this period included the first sounding rocket launch and recovery of the dog Xiao Pao and other biological samples on 15 July 1966. The dog Shanshan was recovered on 28 October 1966.[14]

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[13] The author was the Director of the Office of Planning and Management at the Institute of Space Medico-Engineering from 1983-1987 in Beijing. The information provided here is based on her knowledge of the history of the institute.

[14] Zhang Jun et al, *Dangdai Zhongguo De Hangtian Shiye (Contemporary China's Space Efforts)*, (Beijing: Chinese Social Science Publishing House, Beijing, 1986), 97-98.

Martial Law: Protecting the Space Program from the Turmoil of the Cultural Revolution

To protect the space program from the extraordinary tumult of the Cultural Revolution, the government had to pursue extraordinary measures. They did this by imposing military control over the space program.

Mao Zedong officially launched the Cultural Revolution on 15 August 1966 by denouncing Deng Xiaoping and his designated successor Liu Shaoqi as the heads of "a bourgeois clique in the Party" in his famous big-character poster, "Bombarding the Clique". With the fall of Liu Shaoqi and Deng Xiaoping, many political leaders and military leaders were buffeted, including Marshal Nie Rongzhen and all major space program players, including Dr. Qian Xuesen.

The political struggle quickly spread among the ordinary people. Almost all organizations split into different political camps. The China space agency was not an Eden. It too felt the effects of political schism. On 22 January 1967, after the *People's Daily* issued a headline article, entitled "Proletariat Units, Seize Power from the Capitalists in Power," the people's political groups in the Ministry of Seventh Machinery Industry took over the Ministry and announced that they would manage the space program from now on. The Ministry turned into a battle ground. Productive work stopped as people focused on struggling over political issues. They criticized the early space developers (including Marshal Nie and Dr. Qian)and challenged their authority. The whole organization was paralyzed.[15]

Zhou Enlai grew alarmed that the Cultural Revolution was crippling the capacity of the defense community to function properly. On 17 March 1967, less than two months after political groups took over the Ministry of Seventh Industry, Zhou Enlai and his colleagues, Nie Rongzhen, Ye Jianying[16] and Li Fuchun,[17] met with the representatives of

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[15] Detailed political struggles in the Ministry of Seventh Machinery Industry can be found in the newsletters distributed by two major political groups, "915 Pai (915 Party)" and "916 Pai (916 Party)" during the Cultural Revolution.

[16] Ye Jianying was one of ten marshals in China and was the Vice Minister of the Ministry of Defense and a Member of the Political Bureau at the time when the Cultural Revolution began. He was repressed, by the Cultural Revolution Group, soon after this meeting as a member of the "February Adverse Current". Among those repressed were Tan Zhenlin, Chen Yi, Li Fuchun, Li Xiannian, Xu Xiangqian and Nie Rongzhen, because most of them were the members of the Political Bureau. This repression basically made the Political Bureau stop functioning.

[17] Li Fuchun was the Vice Premier of the State Council and a member of Political Bureau when the Cultural Revolution began. He was accused of being a member of the "February Adverse Current". He was repressed soon after this meeting also.

the political groups from the Second[18], Third[19], Fourth[20], Fifth[21] and Seventh Ministries in Zhong Nan Hai (the central quarters of Party officials). They firmly announced that people's committees were not allowed to take control of central government agencies. Control of these agencies should be restored to the central government. Meanwhile, they announced that martial law would be imposed on all defense-related ministries. In keeping with this directive, the Central Military Committee assigned General Yan Kuiyao to be the Director of the Committee of Military Administration of the Ministry of the Seventh Machinery Industry (May 1967). This committee assumed all administrative responsibilities associated with running the Ministry.[22]

Beyond establishing Martial Law, the Central Government, led by Zhou Enlai, put all defense-related

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[18] The Ministry of Second Machinery Industry was responsible for the nuclear technology and industrial development.

[19] The Ministry of Third Machinery Industry was responsible for conventional weapons technology and industrial development.

[20] The Ministry of Fourth Machinery Industry was responsible for electronic technology and industrial development.

[21] The Ministry of Fifth Machinery Industry was responsible for aviation technology and industrial development.

industries under the leadership of a military agency, the Commission of Science and Technology for National Defense, in December 1967. All the defense projects had to be assigned and approved by the Commission. Thus the Commission became the Central coordinating organization for all defense and space R&D and production projects.

Under this system, all projects were now treated as military activities and civilians were subject to military authority. As a result of the new order that had been established, all the senior engineers and key players in the space program were able to resume their positions. The people's political parties were prohibited from undertaking any political action in the work place. The workers from different political groups were forced to work on assigned projects. Violators would be disciplined. While the Cultural Revolution lasted for more than ten years in China, military authority protected the Chinese space agency from collapse and enabled the program to generate reliable and noteworthy results.

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[22] The Committee of Military Administration was withdrawn from the ministry in September 1973 as part of a larger reorganization.

Zhou Enlai: Guardian of the Space Program

As stated earlier, the space program survived the Cultural Revolution because all the key political actors supported it. The individual whose support was most significant was Zhou Enlai.

As mentioned earlier, Zhou was interested in the space program because he believed that China's accomplishments in space would confer great prestige upon it in the international community. During the Cultural Revolution, Chinese ceased growing and in most industries production stopped or was reduced to a trickle. Zhou felt that it was very important for the country to have at least symbolic achievements in production, so he selected two industries that he wanted to be protected from the turmoil: the steel industry and the space program. The first symbolizes domestic production capability while the second symbolizes the capacity of the nation to operate in the global environment.[23]

Throughout the Cultural Revolution, Zhou was afraid that political turmoil would disrupt progress on the space

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[23] This is a conclusion that is based on a large number of reports in the Chinese official newspaper, *the People's Daily*, during the Cultural Revolution. Zhou Enlai paid many visits to China's biggest steel mill, Anshan Steel Mill at Anshan, Liaonin Province and many visits to various sites of the Ministry of Seventh Machinery Industry.

program. Consequently, he instituted special measures to protect it, and, most significantly, made it clear that the program was supported by his personal involvement.

He showed his personal commitment in many ways. For example, he personally visited Ministry of Seventh Industry and space program sites some 50 times between 1966 and his death in January 1976. In 1968, he had the ministry's Committee of Military Administration identify scientists and engineers working in the space program so that they would receive special protection.[24] He personally issued an order to the Commander of the Beijing Military Area to protect Dr. Qian Xuesen and made sure that no one would be able to kidnap him. During most turmoil time, Dr. Qian stayed away from possible attack in quiet countryside in Huai Rou county near Beijing. Many years later, when Dr. Qian recalled this incident, he said "I would never forget the old generation of Chinese leaders who directly led us -- Premier Zhou Enlai and Marshal Nie Rongzhen. If it were not for Premier Zhou's big effort to protect me during the Cultural Revolution, I

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[24] Liu Jiyuan et al, *Zhongguo Daodan Yu Weixing Shiye Fazhan Shiliao, 1956-1986 (A History of Missile and Satellite Development, 1956-1986,* (Beijing: China Aeronautics Publishing House, December 1989), 78-126

perhaps would not be alive today... Whenever I recall this, I just cannot calm down."[25]

During the most tumultuous year of the Cultural Revolution in 1969, Zhou stated forcefully to the Ministry that the testing of the conversion of Dongfeng 4 to Long March rocket 1 was not to be interrupted by political struggles. He met with the personnel working on the test three times within the critical month from May to June to persuade them to work on the mission. During July of the same year, for the successful launching Chinese first satellite, he named 29 units totaling 3,456 people to stand by for orders and to complete the mission in a disciplined fashion.[26]

It is clear that without such detailed involvement of Zhou Enlai, it would not have been possible for China to make the achievements it did in the space program during the Cultural Revolution.

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[25] Qian Xuesen, *Thanks, Memory and Wishes,* a speech at the Reception to honor Dr. Qian Xuesen as National Distinguished Contribution Scientist and to award him the First Hero Award held by the State Council and the Ministry of Defense in Beijing, 16 October 1991.

[26] Ibid, 12.

Lin Biao and The Gang of Four:

Political Interests in the Space Program

Lin Biao held a high level of power in the early years of the Cultural Revolution. Lin Biao's role in Chinese history during the Cultural Revolution was tied to the increased role of the People's Liberation Army in national affairs, since he was the Minister of Defense at the time. Along with other Chinese leaders, Lin Biao formed a political coalition with Jiang Qing, Mao's wife, and gained more power in the Party Central Committee in the early years of the Cultural Revolution. In April 1969, Lin Biao was named as Mao's successor by the Ninth National Congress of the Chinese Communist Party.[27]

Like Zhou, Lin took a personal interest in the space program, believing that its success would strengthen him by demonstrating the competence of his administration. For one thing, he assigned his former subordinates to assume key positions in the Ministry of Seventh Machinery Industry. From the Ministry level to Academy's level in the Ministry, he personally selected personnel for posts.[28] With his

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[27] Ibid., *op cit*, reference 5.

[28] Many military commanders who used to be his subordinates became the directors of academies and institutes in the Seventh Ministry.

people occupying significant positions, he was able to exercise some control over the affairs of the space program.

Secondly, he personally visited the Ministry to engage in inspections of missile projects. By doing this he reinforced the signal that he had a personal stake in the missile and space programs. Thirdly, he had grandiose designs for the space program. Under his leadership, the Working Group of the Central Military Committee proposed a "Big Plan" in 1970.[29] The plan would have China launching nine satellites per year. Meanwhile, the plan included a very ambitious missile program. It proposed that China should catch up to the United States and the Soviet Union in 1974 in the areas of intercontinental ballistic missiles, underground-launched missiles and anti-missile systems. Before this plan could be fully implemented, Lin Biao was killed in an airplane crash while apparently fleeing China for the USSR after his plan to assassinate Mao and seize power of the nation was disclosed. After his death, the "Big Plan" was abandoned.

The Gang of Four also hoped to use the space program to serve their own interests. Much of their attention focused

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[29] The Ministry of Seventh Machinery Industry, *A Plan of Science and Technology Research, Production and Basic Construction during the Fourth Five-Year Plan Period.* Beijing, August - September 1970.

on shifting the locus of space activities from Beijing to Shanghai, where they had established the Shanghai Space Research and Production Base.[30]

The building of a base of space operations in Shanghai reflected the fact that much of the energy of the Cultural Revolution emanated from that city. The Gang of Four were based there and other powerful players in Shanghai (e.g. Wang Hongwen, Zhang Chunqiao and Yao Wenyaun) were keenly interested in the space program, which they saw as a potential vehicle for self-glorification. Consequently, they established what became known as the Shanghai Space Research and Production Base. In 1970, they founded the Shanghai Institute of Satellite Engineering, the Shanghai Institute of Launch Vehicles and the Heavy Rocket Engine Test Station. As this list of newly-established space organizations makes clear, they were interested in assuming responsibility for the development of both satellites and launch vehicles.[31]

The efforts of the Shanghai group duplicated existing efforts being carried out in Beijing. While Beijing focused on developing *Long March* launchers and *East is Red*

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[30] Liu Jiyuan, et al, *Zhongguo Daodan Yu Weixing Shiye Fazhan Shiliao, 1956-1986 (A History of Missile and Satellite Development, 1956-1986)*, Vol. I, (Beijing: Astronautics Publishing House, December 1989), 96

satellites, the Shanghai group worked on developing *Storm* launchers and their own variety of satellites. The efforts of the Shanghai group quickly paid off with the launch of the *Storm-1* rocket in 1972. In the next few years, the *Storm-1* launcher would put several satellites into orbit successfully.

The Space Program Emphasizes Self-reliance and Isolation

During the Cultural Revolution, China's space program achieved success owing in large measure to its ability to cordon itself off from the turmoil of the Cultural Revolution and to engage in a policy of self-reliance. The space program was able to do well because it received substantial support from all the key players in the Cultural Revolution, ranging from Zhou Enlai to Lin Biao to the Gang of Four. It repaid this support by achieving a number of great successes that put China on the map technologically. Beyond this, the successes provided Chinese policy makers with a new tool to pursue their foreign policy aims. This was seen in early 1969 when China supplied one of its few

[31] Ibid., p. 69-72

international allies -- Albania -- with 48 *Red Flag 2* tactical missiles in addition to ground equipment.[32]

Conclusions

The defining event of 1966-1976 was, of course, the Cultural Revolution, which created the greatest social turmoil in China since World War II. During the Cultural Revolution, China's rationale for supporting a comprehensive space program was quite different from what it faced in 1956-1966, with a major change in priorities. Using Van Dyke's framework,[33] we see that at this time, the top rationales were: 1) achieving national prestige, and 2) pursuing special interests and ulterior motives.

During the Cultural Revolution, China turned its attention inward and became obsessed with its self-image. Rhetoric describing its achievements was inflated. As China reflected on its perceived unique character, its leaders recognized that its emerging capabilities in the space arena could demonstrate to the whole world that it was a distinguished place. The public relations aspect of the space program was highlighted by the fact that China's first

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[32] Ibid., 93

[33] Vernon Van Dyke, *Pride and Power: The Rationale of the Space Program* (Urbana, IL: University of Illinois Press, 1964).

satellite, *The East Is Red*, carried out only one function, and that was to broadcast *The East Is Red* anthem to the whole world as it circled the globe, hardly a major scientific accomplishment.

Van Dyke's "special interests and ulterior motives" rationale was also a high priority item at this time. The space program was in the enviable position of receiving support from all the contending forces in the Cultural Revolution, including Zhou Enlai, Lin Biao, and the Gang of Four. Each of these players realized that by associating themselves closely with the space program, they could enhance their standing with the people whose support they sought.

The premier rationale of the 1956-1966 period - strengthening national defense - continued to play an important, although somewhat diminished, role. During 1966-1976, work continued on strengthening China's missile launching capabilities. In addition, substantial resources were dedicated to enable Chinese satellites to acquire remote sensing capabilities, providing China with spies in the sky.

Van Dyke's other three rationales - advancing science, achieving social and economic benefits, and encouraging international cooperation - played decisively secondary roles at this time.

CHAPTER 6

CHINA SPACE PROGRAM: FACING NEW CHALLENGE DURING ECONOMIC REFORM ERA

Economic Reform as a New Threat to Space Program (1977-1980)

The Cultural Revolution effectively ended on 6 October 1976 with the arrest of the Gang of Four (Jiang Qin, Zhang Chunqiao, Yao Wenyuan and Wang Hongwen). It ended formally during 12-18 August 1977, when the 11th National Congress of the Chinese Communist Party declared that it was over and defined China's basic task as building itself into a powerful modern socialist country by the end of the century.[1]

By 1977 China's social and economic system was in a shambles. Agricultural production was low; industrial output was stagnant. The education system was in disarray and civilian research efforts had almost come to a halt. On the political front, leadership of the country was assumed by Hua Guofeng (Chairman of the Military Committee, Chairman of the Communist Party and Premier of the State Council) and Deng Xiaoping (Vice Chairman of the Military Committee, Vice Chairman of the Communist Party and Vice Premier of the State Council). In the autumn of 1980, Hua Guofeng was stripped of his post as Premier of the State Council and replaced by Zhao Ziyang. On 27 July 1981, Hua also lost his positions as Chairman of the Military Committee (replaced by Deng Xiaoping) and Chairman of the Communist Party (replaced by Hu Yaobang).

Over next ten years, national attention focused on building up China's economic and social infrastructure. A major goal was the strengthening of the legal system, so that arbitrary "legal" actions of officials and mobs so prevalent during the Cultural Revolution would be replaced by the rule of law. It was during this time that China began to implement the four modernizations.[2]

Space policy now went through two phases. In the first (roughly 1977-80), the space community found itself without strong support in China's highest echelons for the first

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[1] Cheng Jin, *A Chronology of the People's Republic of China, 1949-1984*, (Beijing: Foreign Language Press, 1986).

[2] Zhou Enlai, the Premier, introduced the four modernizations at the First Session of the Fourth National People's Congress held in Beijing on 13-17 January in 1975. The four modernizations are "the modernization of agriculture, industry, national defense and science and technology."

time in its history because its key champions had been removed from the scene through either death or prison terms. This led ultimately to a decline in the morale of space workers and confusion about the future direction of the space program. In the second phase (1980-1985), the space community learned to adapt to the new realities. Action was taken by China's space program in order to adjust itself to meet new challenges.

By 1977, Chinese society was sick of political struggle. Both the people and their leaders turned their attention to strengthening the country's economic well-being. All other issues assumed secondary importance. This presented a new environment for the space program, which had been given special status throughout its life, irrespective of its economic value.

At the outset it appeared that nothing much had changed. This feeling developed in part because in September 1977 the Communist Party Central Committee defined three goals -- called the Three Missions -- that the missile and space community should focus on: 1) development of intercontinental ballistic missile capability and ocean tracking capability -- launching a continental missile from Xinjiang province to the South Pacific; 2) development of communication satellite capability -- launching an experimental communication satellite; and 3) development of submarine missile technology -- launching an experimental missile from a submarine. The energies of the scientists and engineers focused on achieving these goals and it appeared that there would be business as usual.[3]

As it turned out, the three missions occupied the missile and space community only temporarily. There were, however, fundamental changes underfoot. By 1977 the space program's political friends had disappeared. Zhou Enlai and Lin Biao were dead and the Gang of Four were in prison. The current leader, Hua Guofeng, had little interest in the space program and his second-in-command, Deng Xiaoping, had long argued that its glamorous efforts were a waste of resources and that that program's goal should be modest and practical.

Deng was not anti-science, however. In an important speech delivered to the National Science Conference of 18-31 March he remarked that science and technology were productive forces vital for economic growth.[4] He simply

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[3] For a report on China's space program at this time, see Wilbur L. Pritchard and James J. Harford. eds, *China's Space Activities by a Delegation from the American Institute of Aeronautics and Astronauts,* (New York: AIAA, November 1979).

[4] Ibid, 1, 65

believed that scientific and technological efforts should be oriented towards practical concerns.

Deng's practical, scaled-back view of the space program quickly became evident. In August 1978, he informed the Ministry of Seventh Machinery Industry that the space program must conform to society's large goal of economic development.[5] It should focus on developing satellites that would have economic value (e.g., in telecommunications and remote sensing). It should forget about sending rockets to the moon. As a consequence of this instruction, government support for the space program decreased.

China's new focus on economic affairs was formalized on 18-22 December 1978 during the Third Plenary Session of the 11th Central Committee of the Chinese Communist Party. This session formally announced that China's highest priority was economic development.[6]

The space program was not alone in experiencing closer scrutiny of its efforts. The entire defense sector -- through which the space program was funded -- was

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[5] Liu Jiyuan et al, *Zhongguo Daodan Yu Weixing Shiye Fazhan Shiliao (A History of Missile and Satellite Development, 1956-1986)*, (Beijing: China's Astronautics Publishing House, December 1989), 140.

[6] Zhao Ziyang, *Go Along the Way of Chinese Special Socialism: The Report of the Third Plenary Session of the 11th Central Committee of the Chinese Communist Party,* (Beijing: People's Publishing House, 1979).

increasingly challenged to justify its activities. During the Third Plenary Session of the 11th Central Committee the defense sector was instructed to see that its efforts in research, development and manufacturing were increasingly oriented to addressing civilian-sector needs.[7] Ultimately, this instruction resulted in a defense conversion campaign in the defense sector leading the defense sector to produce different types of consumer goods (including bicycles, refrigerators, and electric fans).

In the second phase (1980-1985), the reality of the new situation, with its emphasis on economic viability, began to sink in. Members of the space community realized they would have to adjust if they were to survive. Once two of the three missions were achieved (on 18 May 1982, China launched a ballistic missile to the Pacific and on 12 October 1982 it successfully tested a missile launch from an underwater submarine), the scientists, engineers and administrators began to take stock of their situation. What they found was disheartening -- with the new national priorities their prestige had fallen. And with declining budgets future prospects for salary increases were dim. Their salaries were already low, even by Chinese standards (about 100 yuan

[7] International Bank for Reconstruction and Development, *China - Socialist Development: A World Bank*

-- equal to $40 -- a month) and they often joked that a space scientist earned less than an egg vendor.

Declining budgets also meant that equipment was increasingly inadequate for the job and that insufficient funds existed to support all projects adequately. Clearly, something had to be done.

Unlike Zhou Enlai, Deng was not a close friend of the China space program. As mentioned before, Deng was not anti-science but rather very practical about the space program. He had, in fact, worked with the program since its inception. During the first year that the missile program was launched in 1956, Deng addressed its personnel needs. He instructed other ministries to contribute personnel to the missile program. In the early 1960s, he was involved in the decision making that led to the construction of space research and industrial bases in central China.

In 1973, Deng was back as Vice Premier in charge of day-to-day workings of the Party Central Committee. In 1974, he instructed the Ministry of Seventh Machinery Industry to limit its efforts in the development of the missile program, the *East Wind* series, and to avoid initiating too many projects. His action basically undid

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Country Study, (Washington DC: The World Bank, 1983).

the initiatives that Lin Biao undertook through his "big plan".[8]

On 1 August 1978, one year after the Cultural Revolution ended, Deng instructed the Ministry of Seventh Machinery Industry that it should focus on applied satellite technology to produce more satellites to meet China's economic needs.[9] China would not join the space race. It would not go to the moon in the near future. The defense industry should focus on defense industry conversion. He also approved a policy where the Ministry would abandon its self-sufficient stand and open the door to the import of technology. During his visit to the United States in January 1979, Deng signed the Space Cooperation Agreement with President Carter. Also, the visit raised the possibility that China would buy satellites from the United States.[10]

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[8] On 31 March 1974, Deng instructed the Ministry (with Zhou Enlai's approval) to limit the effort on the Dong Feng missile series.

[9] Ibid, 5.

[10] The Chinese attempt to buy American made satellites ultimately failed because of the technology control policy of the United States. The Chinese later turned to Germany to purchase satellite components. Germany's MBB was the beneficiary of the purchase.

The space program successfully survives the challenges of economic reform (1980-1985)

The response of the space community to the new challenge was to operate in a more entrepreneurial way. If government support was inadequate, they would have to raise their own funds by whatever means. Two broad sources of funding were identified: domestic and international.

In order to raise funds domestically, space factories began to produce domestic consumer and industrial goods. Factories that had been building space engines devoted some of their capacity to building motorcycles and cars. Factories producing electrical controls began manufacturing refrigerators and air conditioners. Engine designers began designing robots, and so on.[11]

For the most part, these efforts were successful. They led to major increases in income, which contributed to increased wages and the growth of capital and project investment funds.[12]

Raising funds from international sources required a more strategic outlook. Serious discussions of this option

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[11] Liu Litiang, "Out of the limitation of the defense industry, enter the major battle of the domestic economy," *Remin Ribao (People's Daily)*, overseas edition, 16 May 1988.

[12] Sun Guoshan, "The combined usefulness of military and civilian approaches in the defense industry led to great

began in 1984. Income would be generated from selling satellites and space launch services. It was clear that for this venture to succeed, the Chinese would have to be prepared to wait many years before they realized any gains.

China first signaled its interest in offering commercial space products and services in May 1985, when it announced to an international space conference in Geneva that it intended to market its *Long March* rocket for satellite launching services. It also exhibited the rocket at the International Fair in Zubo, Japan, from May to September. In order to establish a foreign marketing presence, China set up the China Great Wall Industry Corporation (CGWIC) to market both the *Long March* and Chinese-made satellites overseas.[13]

The most significant organizational change facing the space program during this period was the reformulation of the Ministry of Seventh Machinery Industry into the Ministry of Astronautic Industry on 9 April 1982. It now reported both to COSTIND and to the State Council, symbolizing a shift to civilian control over the Ministry.

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achievement in ten years," *Renmin Ribao (People's Daily)*, overseas edition, 10 October 1989.

Setting Up New Goals into the Year 2000

The period between 1986 and 1990 was highly satisfying for members of the space community.[14] The space program was put firmly back on track and this was demonstrated in a number of ways. First, its mission was clearly defined for the foreseeable future, giving it top priority over all other scientific and technological programs in China.

Second, it became evident that it was again receiving support from the highest levels of leadership. In particular, Premier Zhao Ziyang and Vice Premier Li Peng (who became Premier in 1987) were both champions of the program.

Third, China had now accumulated a critical mass of scientific and technological capabilities so that years of investment into the space program were about to pay off.

Finally, during this time China established its international credibility in space. This was partly helped by the *Challenger* disaster of 1986 and by a series of *Ariane* launch failures, which removed the USA and Europe from the international launch scene for a while. For the first time,

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[13] For details about the China Great Wall Industry Corporation, see *Launch Services and Space Technology,* (Beijing: CGWIC, 1988).

[14] The primary information for events in this period comes from *China Daily Report; Aerospace Daily; Defense*

the *Long March* rocket looked like a viable alternative to the launch services provided by the wealthy powers.[15]

The national focus on economic development led to neglect of science and technology in the post-Cultural Revolution era, because the economic benefits of science and technology are not always obvious. However, the dangers inherent in neglecting science and technology led an influential group of scientists to issue in March 1986 what came to be known as the '863 Proposal' (denoting the year and month it was issued).

The scientists asserted that China must not neglect developing high-technology capabilities. Ultimately, this strength would serve as a cornerstone for future economic progress. Their proposal caught the attention of Deng Xiaoping and Zhao Ziyang, who instructed the science and technology community to identify which fields should be emphasized and what goals established. The 863 Proposal identified seven areas in which China should develop strong capabilities: biological engineering, space technology,

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Daily; Aviation Week & Space Technology; AIAA Bulletin; and *Space Business.*

[15] Euroconsult, "Space industry - 10-year survey," *Space Policy,* Vol 6, No 3, (August 1990), 250-259; Phillip Clark, "Chinese launch vehicles aim for the commercial market," *Space Markets,* (Winter 1987), 178-185; G. Lynwood May, "New directions for the People's Republic of China space program," *Signal,* (December 1987), 39-46.

information technology, laser technology, automation technology, energy and new materials technology.

The proposal was debated among the science and technology community throughout the spring and summer. The space program came out of these discussions in good shape. On 29 August 1986 Premier Zhao Ziyang held a hearing to discuss that part of the proposal dealing with space technology. It was decided by the State Commission of Science and Technology and COSTIND that the space program would be the highest priority technological program in China. On 25 September, Zhao sent a report to Deng Xiaoping that laid out the future direction of the space program. Its long-term goals were threefold:

- to build a space station;
- to develop a heavy launch vehicle;
- to develop a space transportation system.

Thus by the winter of 1986-87 the space program was acknowledged to lie at the center of China's national effort to develop strong scientific and technological abilities.[16]

The 863 Proposal ensured that from 1986 to 1989 the space program again received high-level government support.

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[16] Song Jian, "Aerospace will be the central position defined by China high technology development strategy," *Remin Ribao (People's Daily)*, overseas edition, 9 December 1988.

Zhao Ziyang had no specific interest in the program, but he was a proponent of strong science and technology in general. He thus supported the program to the extent that it strengthened China's scientific and technological capabilities in relation to the national economy.

When, in early 1987, Deng Xiaoping made Zhao his designated successor and appointed him Communist Party Chairman, Vice Premier Li Peng assumed the premiership. Li's background was in engineering. He had studied in the USSR and was impressed with Soviet space accomplishments. Besides, he was one of the adopted sons of Zhou Enlai and influenced by Zhou's interests and working style. When he assumed the role of premier, he took an active interest in China's space program and became its champion in government. He showed his personal interest by attending the launch of a communications satellite from the Xichang launch site on 22 December 1988.[17] Even after the Tiananmen Square incident of 3-4 June 1989, Li remained an unabashed supporter of the space program.[18]

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[17] See Foreign Broadcast Information Service (FBIS), "Li Peng hails launching," *China Daily Report*, FBIS-CHI-88-246, (22 December 1988), 17.

[18] FBIS, "Satellite receives praise, heightened priority, Li Peng comments," *China Daily Report,* FBIS-CHI-89-166, (29 August 1989), 35; and "Li Peng discusses astronautics industry,"; "Li Peng, Yao Yilin meet space

Domestic pay-off from the space program. By this time, China's technological capabilities in space had reached a critical mass, enabling it to move from experimentation to practical results. China successfully launched 25 satellites by 1989, of which 11 were recoverable. The strength of China's program was reflected in the fact that the satellites were placed in low-Earth orbit, geosynchronous orbit and solar synchronous orbit. By 1989 Chinese-developed satellites were serving a number of useful purposes -- weather monitoring, telecommunications, remote sensing of natural resources, marine navigation, satellite-TV education, materials processing and biotechnology. Thanks to a 30-year investment in space China was finally reaping the fruits of its labors.

International pay-off. The *Challenger* accident and a series of *Ariane* launch failure made it clear to the international business community that space launches were not fully reliable, even among the leading payload deliverers. The hammerlock that the American and Europeans appeared to have had on the commercialization of space disappeared. Other space delivery systems -- like the *Long*

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scientists," *China Daily Report,* FBIS-CHI-89-170, (5 September 1989), 23.

March and the Soviet *Proton* systems -- had to be viewed as serious contenders.

China began to market its payload delivery system in earnest and it emphasized the reliability of its launches.[19] It made its entry into the international market with the launch of a Chinese recoverable satellite carrying a French payload on 5 August 1987.[20] Its second launch was of a satellite carrying a German payload on 5 August 1988.[21] On 7 April 1990, China launched its first US-made satellite (built by Hughes Aircraft) using the *Long March* rocket.[22]

In addition, the Chinese also concluded international cooperative agreements with other countries. The China Great Wall Industry Corporation (CGWIC) signed an agreement with McDonnell Douglas for the possible use of its Payload Assist Module (PAM) on the *Long March* series of rockets on 21 October 1988.[23] In November 1988 the country signed an agreement with Brazil to build two remote-sensing satellites

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[19] Karl A Rofrer and Marcia S. Smith, *Space Commercialization in China and Japan,* CRS Report for Congress, 89-367 SPR, (Washington DC: Congressional Research Service, 9 June 1989).

[20] "Industry Observer", *Aviation Week & Space Technology,* (7 September 1987).

[21] FBIS, "Liu Hua-qing observes launch," *China Daily Report,* FBIS-CHI-88-173, (7 September 1988), 22.

[22] Paul Proctor, "China returns salvaged spacecraft to orbit," *Aviation Week & Space Technology,* (16 April 1990), 25-26.

jointly,[24] while China and Australia signed a five-year agreement to cooperate in space technology. This agreement focused on cooperation in remote sensing satellite ground support and meteorological and oceanographic satellites.[25]

The Tiananmen Square turmoil. Just as China's space program was increasing its credibility, the democracy movement arose. It culminated in the crackdown in Tiananmen Square, an incident that shocked the West. Great concern was expressed that China was reversing its long-standing policy of liberalization, and confidence in China's ability to run its affairs effectively waned. In the space arena, there were doubts over the future of China's space commercialization efforts, if a return to central planning was implemented.

However, the facts show that even after the crackdown, the space program remained in good shape. Premier Li Peng, who became head of the State Astronautic Committee in April 1989,[26] reaffirmed his commitment to the program in two pubic presentations after the Tiananmen turmoil. In one, he

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[23] "China/McDonnell sign agreement to use PAM on Long March," *Defense Daily,* (21 October 1988), 304.

[24] FBIS, "Satellite project with PRC discussed," *China Daily Report,* FBIS-LAT-88-225, (22 November 1988), 33.

[25] FBIS, "Space cooperation accord signed with PRC," *China Daily Report,* FBIS-EAS-88-225, (22 November 1988), 59.

[26] FBIS, "Li Peng heads new state astronautics group," *China Daily Report,* FBIS-EAS-88-225, (22 November 1988), 59.

told participants at a national conference on the satellite industry that the government would make special efforts to promote applied satellite technology.[27] In the other, he told a meeting of space scientists that in view of the recent political disturbances and negative international reactions to government actions, it was clear that China would have to maintain self-reliance in the areas of space and defense.[28]

On 19 December 1989, President George Bush gave approval for the launch of three US-made satellites using Chinese rockets.[29] This had enormous significance -- an important critic of Chinese actions in Tiananmen Square (i.e., the US president) was acknowledging that US-China commercial transaction in space was still on track.

Conclusions

With the end of the Cultural Revolution, China radically altered its national priorities. Its leader, Deng Xiaoping, made it clear that China's highest national priority was to create a wealthy society, and this would be done through economic reform that emphasized the benefits of

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[27] FBIS, op cit, Reference 13.
[28] Ibid.

a market-based economy and deemphasized the role of the central government. Suddenly, a space community that had enjoyed generous central government support for two decades was asked to demonstrate that its efforts provided economic benefits to society.

In 1977-1986, the priorities of Van Dyke's rationales underlying the support of comprehensive space programs[30] changed to reflect the new economic and political realities. The "realizing social and economic benefits" rationale went to the top of the list. If the space community expected to receive solid support from the government, they needed to demonstrate that the space program was not an economic sinkhole, but that it contributed to the economic vitality of Chinese society in a clear and positive way. The space community's response to this new priority was to emphasize the commercial benefits of the national space program. Thus the China Great Wall Industrial Corporation was formed and China began to offer satellite launching services to commercial clients throughout the world. Beyond this, the space and missile manufacturers earned income by

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[29] Xinhua News Agency (Xinhua She), "Americans cancel the sanction on shipping communication satellites," *Remin Ribao*, Overseas edition, 20 December 1989.

[30] Vernon Van Dyke, *Pride and Power: The Rationale of the Space Program* (Urbana, IL: University of Illinois Press, 1964).

transferring much of their unique technologies to commercial undertakings in automotive, refrigeration, telecommunication and other industries.

Van Dyke's "engaging in international cooperation" rationale also was resurrected at this time. After the Sino-Soviet rift of 1960, the Chinese vowed that they would move forward alone in their missile and space program in order to avoid dependency on unreliable outsiders. However, it became obvious in the 1980s that owing to the great expense and complexity of space technology, no country - and this included the United States, the Soviet Union, and China - could pursue space exploration alone.

Three of Van Dyke's rationales - strengthening national security, enhancing national prestige, and strengthening scientific capabilities - continued to play a significant, though diminished, role. The sixth rationale - pursing special interests and ulterior motives - disappeared entirely. The space program had lost a substantial amount of its glitter. There were easier ways to pursue special interests than to capitalize on the advantages of the space program.

PART II, CHINA'S SPACE ORGANIZATION

CHAPTER 7

THE FIFTH ACADEMY, A CRADLE OF THE CHINESE MISSILE PROGRAM

The period from 1956 until 1965 was a formative one for the Chinese missile program. During this time, the program was initiated and put into operation, paving the way for further achievements.

In 1956, a site near Beijing was selected for the missile program's operations. A limited government budget was issued. Marshal Nie Rongzhen became the program's champion and volunteered to be its first administrator. Dr. Qian Xuesen became its technical guru. He had recently returned to China from the United States, where he had spent five years under house arrest. The program attracted other scientists and engineers, most of whom had studied or worked overseas. Management principles were established to guide the program's development.

Establishment of the Fifth Academy

On 10 May 1956, Marshal Nie proposed to establish an administrative and research organization whose function would be to develop Chinese-made missiles. This proposal was entitled *An Initial Proposal to Establish China'a Missile Research Program.*[1] Zhou Enlai ultimately approved this program and ordered the creation of a Missile Administration within the Ministry of Defense (also named the Fifth Bureau of the Ministry of Defense) and a research institute named the Fifth Academy of the Ministry of Defense (referred to in short as the Fifth Academy). Mr. Zhong Fuxiang and Dr. Qian Xuesen served as the respective heads of these two organizations.[2]

After it was established, the first action that the Fifth Bureau took was to propose to the Party Central Committee that it seek assistance from the Soviet Union. In a report entitled *A Request for Assistance from the Soviet Union for Research, Production and Operation of a Missile System* the Fifth Bureau requested Soviet assistance in areas such as research planning, manufacturing planning, and technical training of students and missile operations

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[1] Ibid, Chapter 4, reference 9.

[2] Zhang Jun, et al, *Dangdai Zhongguo De Hangtian Shiye (Contemporary China's Space Effort)*, (Beijing: Chinese Social Science Publishing House, 1984), 560.

personnel. In addition, the Fifth Bureau asked for missile samples and supplies, production assembly parts, technical blue prints, production and research equipment, and technical experts and advisors. On 17 August, Vice Premier Li Fuchun submitted the request to the Soviets. This marked the beginning of Soviet assistance to the program.[3]

On 20 August, the Fifth Bureau and the Fifth Academy were physically established in a Beijing suburb. The Department of the General Staff of the People's Liberation Army (PLA) contributed the buildings of a military hospital. Thus China's missile and space program had its roots in a number of dilapidated buildings.

In September, the Soviets responded to the Fifth Bureau's initiative by stating that they were willing to assist the Chinese in establishing a missile program. They offered to receive 50 students majoring in rocketry and to provide P-2 missile samples to the Fifth Academy.[4] Meanwhile, 42 scientists, most of them newly returned from sojourns overseas, gathered at the Fifth Academy to start operations. The government issued the Fifth Academy 3.71

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[3] Ibid.

[4] The Soviet P-2 missile is merely a copy of the German V-2 missile.

million Yuan to begin building its research operations.[5] On 8 October, the Fifth Academy was formally established.

In November, ten research laboratories were constructed under the Fifth Academy. They were:

- the General Design Laboratory (Ren Xinming, Director)
- the Aerodynamics Laboratory (Zhuang Fenggan, Deputy Director)
- the Structural Strength Laboratory (Chu Shouer, Director)
- the Engine Laboratory (Liang Shouye, Director)
- the Propulsion Laboratory (Li Naiji, Director)
- the Control System Laboratory (Liang Sili, Deputy Director)
- the Control Components Laboratory (Zhu Jingren, Deputy Director)
- the Radio Laboratory (Feng Shizhang, Deputy Director)
- the Computing Technology Laboratory (Zhu Zheng, Deputy Director)
- The Technological Physics Laboratory (Wu Deyu, Deputy Director)

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[5] Liu Jiyuan et al, *Zhongguo Daodan Yu Weixing Shiye Fazhan Shiliao, 1956-1986 (A History of Missile and Satellite Development, 1956-1986)*, (Beijing: China Astronautics Publishing House, Beijing, December 1989), 19.

By the end of 1956, the Soviets sent fifteen missile experts and two P-2 missile samples to China.[6] China was now set to move ahead with its missile program.

During this stage of the missile program, the organizational structure changed three times in a four year period. The structural changes reflected a growing ability of top Chinese leaders to fashion the organization to meet the evolving requirements of a growing organization.

As noted earlier, the missile program had two leadership centers: the Fifth Bureau and the Fifth Academy. The former served as an administrative agency while the latter functioned as a technological development agency. This organizational relationship is pictured in Figure 7.1.

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[6] Ma Yuntao et al, *Hangtian Shiye Sanshi Nian (China Space Program in Thirty Years)*, (Beijing: China Astronautics publishing House, September 1986), 81-87.

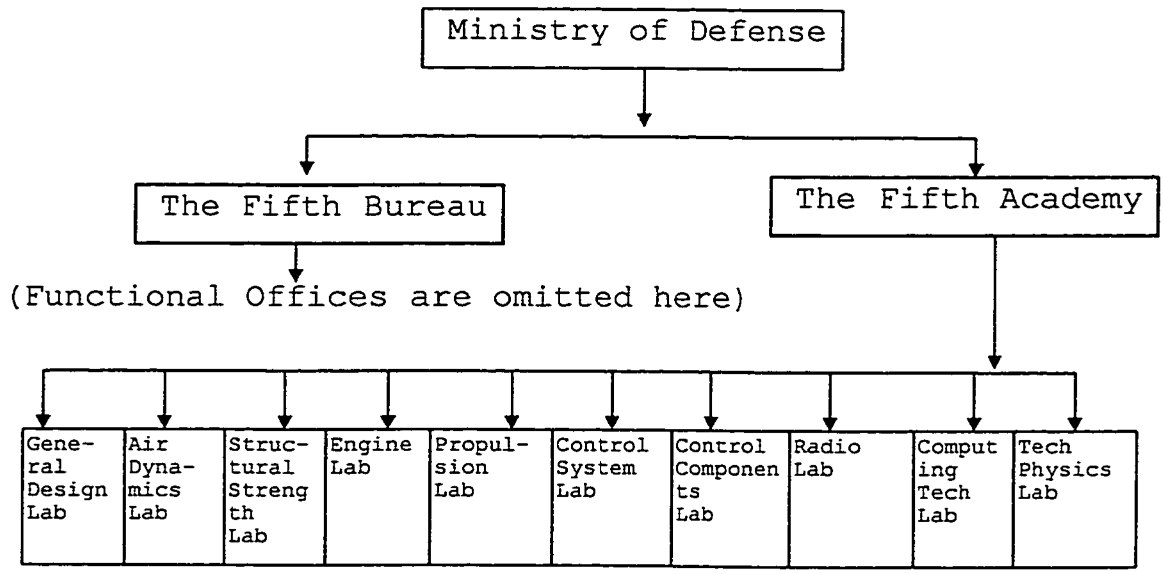

Figure 7.1: Organization Chart of the Chinese Missile Program in 1956[7]

[7] This organization chart is compiled from information supplied by Liu Jiyuan (ed), *Zhongguo Daodan Yu Weixing Shiye Fazhan Shiliao, 1956-1986 (A History of Missile and Satellite Development, 1956-1986)*, (Beijing: Astronautics Publishing House, December 1989), 210.

During the second year of the program, it became clear that the program would be best served if the functions of the two agencies were combined into a single agency. The Fifth Bureau was abolished and its administrative functions transferred to the Fifth Academy. Figure 7.2 illustrates the structure of the missile program after the reorganization.

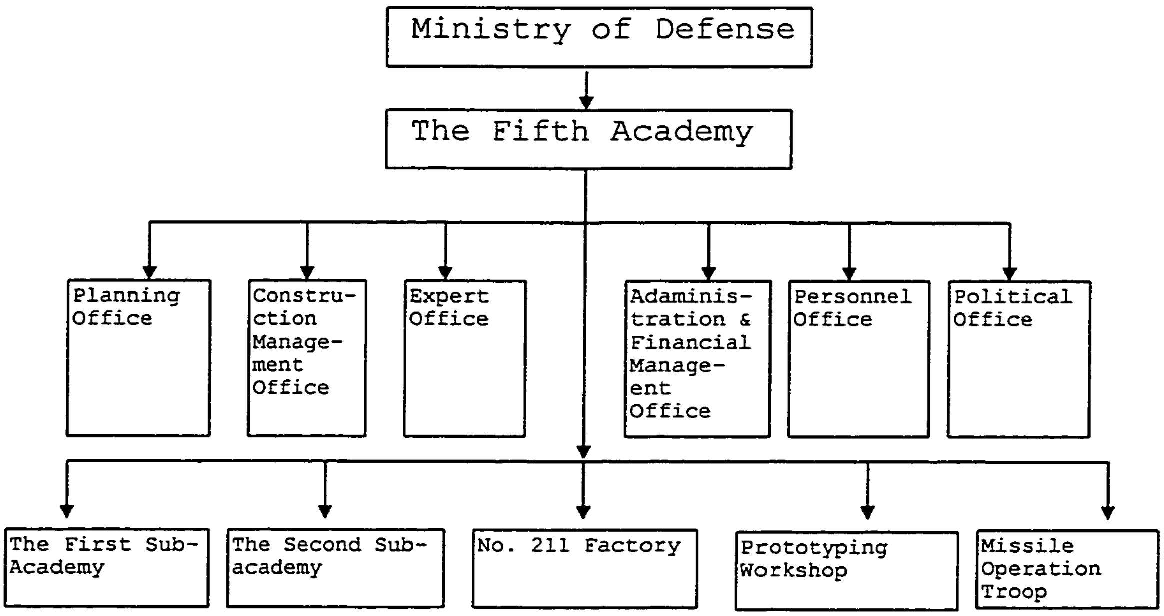

Figure 7.2 Organization Chart of Chinese Missile Program in 1957[8]

[8] Ibid, 211.

By the fourth year of its operations, the Chinese missile program took on most of the characteristics of a full-fledged program. The program's organizational structure was changed to reflect this maturity. Figure 7.3 pictures the structure that endured from 1959 until 1964. A cursory review of this organization chart suggests a focus on research, design, and testing at this time. Later, attention would also be given to manufacturing.

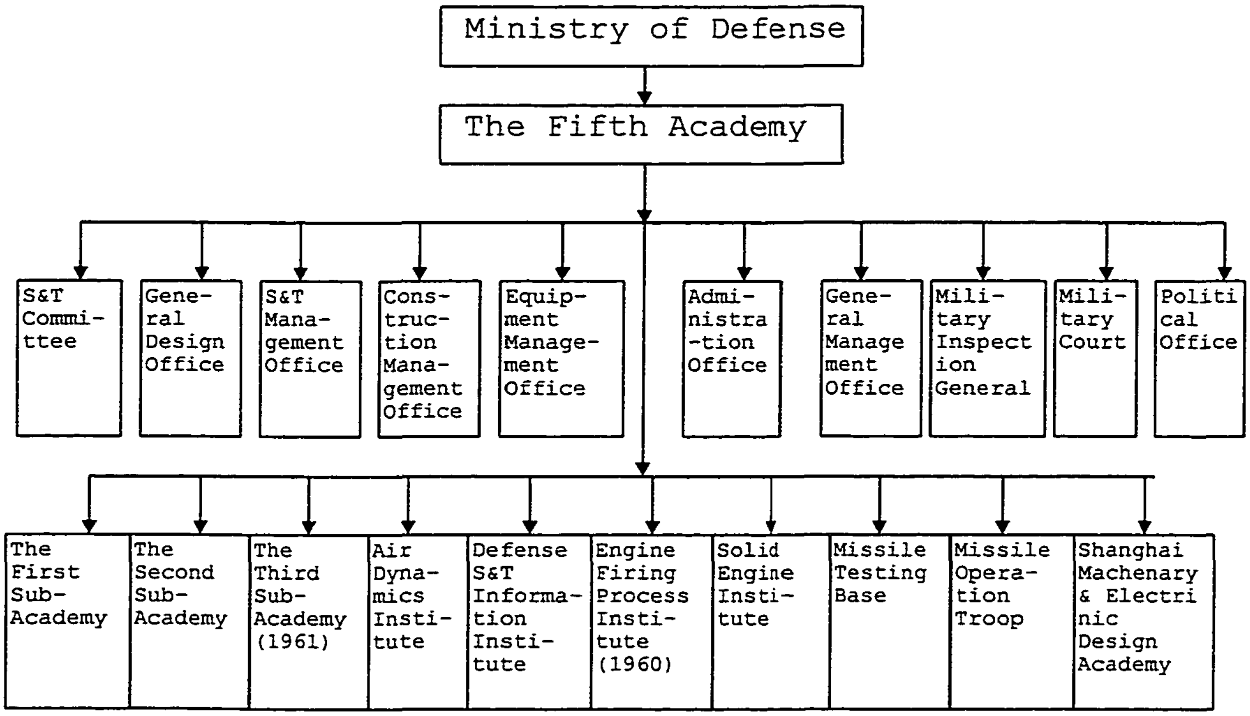

Figure 7.3 Organization Chart of Chinese Missile Program from 1959-1964[9]

[9] Ibid, 212.

Key people

During the formative years of China's missile program, two people played important roles in creating a viable program. One was Marshal Nie Rongzhen and the other Dr. Qian Xuesen. Nie, a towering military leader and significant political figure in the government, was instrumental in the development of Chinese military-technological development. Qian, an American-trained missile expert, functioned as a gatekeeper to introduce advanced missile technology into China.

Marshal Nie Rongzhen. Marshal Nie was one of a handful of Chinese leaders — including Deng Xiaoping and Chen Yi, one-time Minister of Foreign Affairs — who studied in France in their youth. They lived in France in the early 1920s. Their European experience profoundly influenced their perception of what a strong country should be. They were especially impressed by Europe's technological and industrial achievements. Later, when they became significant leaders in the Chinese revolutionary movement, they continued to hold the belief that strong technological and industrial capabilities were vital for any country that hoped to be a world power. After they assumed the leadership mantle of China, they consciously strove to build the country's technological and industrial capacity.

In October 1956, Marshal Nie was give three job choices. One was to assume the role of key champion of science and technology in China. Another was to serve as mayor of Beijing City. And the third was to continue to play a lead role in managing the defense industry.

Nie rejected the second choice out of hand: "I didn't want to be mayor," he said in a memoir in published in 1984. Rather, "I am interested in science and technology. China was so backward and we really needed them. The defense industry is closely tied to scientific and technological developments. I hoped that I could be permitted to take care of both these areas."[10]

Nie made it clear that his commitment to strengthening China's scientific and technological capacity was long-standing. He stated in his memoir: "I never changed my mind about my commitment to science and technology. I love them and see them as the changing force in my long-suffering country. This is a view I held since I was a young man.

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[10] Nie Rongzhen, *Nie Rongzhen Huiyi Lu (Nie Rongzhen Memoir)*, (Beijing: People's Liberation Army Publishing House, 1984), 763.

After the revolution, I felt compelled to devote my life to fulfilling this view." [11]

Nie's wish was granted. He assumed primary responsibility for building scientific and technological capabilities in China and continued to be the principal leader in nurturing the military industry.

Nie was an experienced military leader, with more than two decades of combat experience under his belt. In the 1920s, he fought against the Chinese warlords. From 1927 until 1937, he fought against Kuomindang troops in the First Civil War. After the Japanese invasion of 1937, he struggled against Japanese forces until their defeat in 1945. Then from 1945 until 1949, he led troops in the Second Civil War against the Kuomindang. In the 1950s he fought against the Americans on the Korean peninsula.

Nie's military experience convinced him that technologically advanced weapons systems could make a decisive difference in battles. This perspective was reinforced during the Korean War, at which time he was involved heavily in organizing logistical efforts. He wrote: "We recognized the importance of military logistics during the Korean War. To win a modern battle, you are to a certain extent running a manpower and material power race,

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[11] Ibid.

especially when facing a technologically advanced army, as we did with the Americans[12] ... Our backwardness with military equipment in the Korean War contributed to many failures in battle. To rid ourselves of this backwardness, we must catch up."[13]

Dr. Qian Xuesen. Qian Xuesen was a student of Dr. Theodore von Karman at Caltech.[14] In June 1939 he earned his PhD in aeronautical mathematics. He became a Research Follow and later an Assistant Professor there until 1944. At the end of the 1930s, the US military began working on missle research. In 1942, the US Army Air Corps contracted Caltech to offer training classes in aerodynamic technology for military personnel from the Army, the Army Air Corps, and Navy. Dr. Qian was one of the trainers.

During 1943-1945, Dr. Qian was one of the founders of the Jet Propulsion Laboratory (JPL) in charge of propulsion section. In 1944, after the US military learned about the development of the German V-2 rocket, it contracted Dr. von Karman's group to undertake research on long-range missiles. They designed a missile they called "Private." Dr. Qian

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[12] Ibid, 747.

[13] Ibid, 765.

[14] Qian Xuesen went to the United States as an exchange student from Qinghua University in August 1935. In October 1936, he became a student of Dr. Karman, studying applied

became the research leader for the design theories and analysis in these classified projects. In 1945, he became one of the members of the missile advisory board for the Air Force. He was involved in the Air Force's long-term planning for missile development.

Dr. Qian's academic status grew at this time. At the end of the war, he was an associate professor at Caltech. In 1947 he was made a professor at MIT and became a permanent resident in the United States. In 1949, he returned to Caltech as a professor at the Department of Aerodynamics and Jet Propulsion.[15]

In 1950, as McCarthyism gained hold in America, Dr. Qian was accused of having Communist leanings. As a consequence, he was denied a security clearance to work on defense research projects. He decided to return to China. When he attempted to leave the US, he and his family were stopped by US immigration authorities in response to a military order. He was placed under house arrest until 1955.[16]

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physics and later an assistant professor. He focused his studies on aviation engineering.

[15] For details on Qian's life in the United States see Iris Change, *Thread of the Silkworm,* (New York: BasicBooks, 1995).

[16] Wang Shouyun, "Qian Xuesen", *Zhongguo Dangdai Kexuejia Zhuanji (Chinese Contemporary Scientists'*

Recognizing that he had no future in the United States, he wrote a note to family in China on a piece of cigarette paper, asking them to seek help from the Chinese government to release him from the United States.[17] The letter was ultimately forwarded to Zhou Enlai, who instructed Wang Binzhang, China's representative to the United Nations, to negotiate with the American representative at the UN to gain Dr. Qian's release.[18] On 17 September 1955, Qian and his family were finally permitted to exit the US. They left Los Angeles aboard the ship *President Cleveland* to return to China.

After Dr. Qian's return to China, he became director of the Institute of Physics at the Chinese Academy of Science. In early 1956, at the urging of Zhou Enlai, he submitted his famous proposal to establish a Chinese missile and rocketry program. In his proposal, he suggested that China not only should have the capability to make missiles and rockets, but do develop and design them for its long-term needs. Also,

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Biographies), Vol. 1, (Beijing: Science Publishing House, 1991), 773

[17] Ibid.

[18] Details of the negotiation can be seen in a declassified Incoming Telegram, Department of State, Action Copy, from Johnson to Secretary of State, Control No. 3826 and No. 4125 in August 8, Control No. 7471 and No. 8037 in September 15, 1955.

Qian identified twenty-one senior engineers to serve as an elite group for this undertaking.

In March 1956, the Central Military Committee led by Zhou Enlai decided to form a working group to establish an Aeronautics Committee to shepherd the missile project. Marshal Nie was named Chairman and Dr. Qian was a working group member. After that time, Qian became the key gatekeeper of the Chinese missile and rocketry program.[19]

Dr. Ren Xinmin. A member of Qian's elite group, Dr. Ren Xinmin studied in the United States from 1945 until 1948. He gained his Ph.D. in Engineering Physics from the University of Michigan. He became an assistant professor at the University of Buffalo, but left this post in 1949 to return to China. In 1956, he joined the Chinese missile program as the first director of the General Design Laboratory. He served in a variety of other posts: Director of the Department of Liquid Fuel Missile Engine; Deputy Director of the first Institute; Vice Minister of the Ministry of the Seventh Machinery Industry; and chair of the Science and Technology Committee of the Ministry.

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[19] For details on the early time of Dr. Qian's involvement in the Chinese missile program see Wang Shouyun, "Qian Xuesen", *Zhongguo Dangdai Kexuejia Zhuanji (Chinese Contemporary Scientists' Biographies)*, Vol. 1, (Beijing: Science Publishing House, 1991), 767-802

Dr. Ren was one of the key people involved in the design and production of the *Dong Feng* (East Wind) family of missiles. He was the chief engineer for designing and producing the *Long March I, Long March III, Long March IV,* the *Dong Fang Hong* (*East is Red II*) telecommunications satellite, and the *Feng Yun I (Windy Cloud I)* meterological satellite.[20]

Dr. Liang Shouye. Dr. Liang Shouye graduated from MIT in 1939. After graduating, he returned directly to China. In 1940, he taught at Southwest University in Kunming, China. He held the rank of associate professor. During World War II, he worked on designing airplane engines to support the Chinese war effort. After the war, he returned to his teaching at Hangzhou University as a professor. In 1956, he was assigned as director of the Engine Laboratory of the fifth Academy. He was also head of a training program to develop the missile technology capabilities of 156 college graduates. He also served as Chief Engineer for the reverse engineering of Soviet missiles in the Chinese missile program in the early years. In 1965 he became

[20] For details on Dr. Ren Xinmin's involvement in the Chinese space program see Tan Bangzhi, "Ren Xinmin", *Zhongguo Dangdai Kexuejia Zhuanji* (*Chinese Contemporary Scientists' Biographies)*, Vol. 1, (Beijing: Science Publishing House, 1991), 834-843.

Deputy Director of the Third Academy and Chief Engineer in charge of the Chinese sea defense missile program.[21]

Dr. Chu Shouer. Dr. Chu Shouer graduated from MIT in 1943. After graduation, he took a job as an engineer in an airplane factory in Buffalo. After World War II ended, he returned to China. In 1946, he was an associate professor at Southwest University at Kunming and became a professor at Qinghua University in 1947. Later, he was made Assistant President of Beijing Aviation University.

In 1957, Marshal Nie asked him to join the missile program. After that time, he worked as a structural strength expert in the missile program. In 1961 he became Deputy Director of the First Institute. He was involved in major design efforts for Chinese strategic missiles, such as the *Dong Feng 1, Dong Feng 2,* and *Dong Feng 5* missiles. In 1978, he was assigned as Chief Designer for the *Long March II*. In 1980, he was made Chief Engineer of the Ministry of Seventh Machinery Industry. Later in the 1980s, he was chief adviser for designing the *Long March II E* rocket.[22]

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[21] Detailed Liang's Bio see Chen Encai, "Liang Souye", *Zhongguo Dangdai Kexuejia Zhuanji* (*Chinese Contemporary Scientist's Biographies*), Vol. 1, (Beijing: Science Publishing House, 1991), 844-853

[22] Details in Chu's involvement in Chinese missile and launcher program see Shen Xinsun, "Chu Shouer", *Zhongguo Dangdai Kexuejia Zhuanji (Chinese Contemporary Scientist's*

Other Key Players. Dr. Liang Sili, an expert on missile control systems, went to the United States in 1942. In 1950, he completed his PhD at the University of Cincinatti. He returned to China in 1950. He was made head of the Control System Laboratory when the Fifth Academy was established. He led the Chinese effort in the missile control field for thirty years.[23]

Wang Xiji, a satellite expert, graduated from the University of Richmond in Virginia in 1950. He led the Chinese sounding rocket program and later the Chinese recoverable satellite program.[24]

Li Naiji, a Chinese trained propulsion expert, graduated from the Chinese National University in 1933. He contributed to developing Chinese solid fuel capabilities for the missile program for thirty years.[25]

Biographies), Vol. 1, (Beijing: Science Publishing House, 1991), 865-871

[23] A brief biography of Liang Sili was released in "Brief Bios of Chinese Space People," *Space Flight,* Issue No.5 (September 1988), 5-6

[24] A brief Bio of Wang Xiji was published in "Brief Bios of Chinese Space People,' *Space Flight,* Issue No. 5, (September 1988), 5

[25] A brief bio of Li Naiji is in "Brief Bios of Chinese Space People," *Space Flight,* Issue No. 5, (September 1988), 6

Organizational Challenges in the Early Stage

The establishment of the Chinese missile program not only challenged the technical capabilities of the missile team but its management capabilities as well. During the early stage of the program, three key management challenges emerged.

- First, how to deal with unrealistic technical goals that had been established for the program?
- Second, how to deal with the allocation of limited resources, especially in view of the grandiose goals that were continually being imposed on the program?
- Third, how to treat the highly capable technical team members in order to keep them motivated?

Each of these challenges will be discussed in turn.

Challenge 1: Dealing with Unrealistic Goals. China began its missile program at the very time that the space age commenced. At the time, both the US and USSR possessed advanced missile and missile launching capabilities, satellite capabilities, and the rudiments of manned space flight capabilities. The Chinese program was only just beginning when the Soviets launched the world's first satellite — Sputnik — on 4 October 1957. Of course, that momentous event marked the beginning of the Space Age. Over the next three decades, the Americans and Soviets would devote enormous amounts of resources to push their space exploration capabilities forward in competition with each other.

The Chinese missile program was certainly influenced by these events. Various voices were heard from both the political and technical realm suggesting that China should move forward at a break neck pace. A slogan even emerged that exorted the missile program to "Complete the Twelve Year Program in Seven Years." While the spirit of such exhortations may have been admirable, they led to pressures to move on with research and technological development at an unrealistic pace. Some engineers wanted to skip the painstaking reverse engineering efforts that were being undertaken to learn from Soviet missile technology. They wanted to jump into the creation of advanced designs.

Part of the problem was that unrealistic enthusiasm for the program came from the highest levels of the Chinese power structure. In May 1958, a time when the missile program was still trying to find its way, Mao Zedong stated that China should develop satellite capabilities. He joked that the Chinese would not build a skimpy satellite like the chicken egg the Americans had launched. Rather, they should build a much larger one.[26]

Under Mao's call, a Space Flight Committee was established in the Chinese Academy of Science. Dr. Qian Xuesen, Dr. Pei Lishen and Dr. Zhao Jiuzhang were the heads of the Committee. During three years, twelve symposia were held to discuss what steps should be taken to create a satellite program. Many unrealistic initiatives were launched.

Marshal Nie adopted a pragmatic approach to developing missile capabilities. He tried to convince people to employ what he termed a "step-by-step" approach.[27] He argued that the Chinese missile program was like an infant. Infants must learn to crawl before they walk, and walk before they run. Similarly, the players in China's missile program must be willing to acquire solid capabilities in a gradual fashion.

The step-by-step approach was ultimately accepted as the operating management principle for carrying out the missile program. Using this approach, the Chinese first

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[26] Hu Haitang and Peng Ziqiang, *Shanguang De Shijie (The Shining World)*, (Beijing: Defense Industry Publishing House, August 1987), 190.

[27] To see how Marshal Nie promoted the "step-by-step" approach, see Nie Rongzhen, *Nie Rongzhen Huiyi Lu (Nie*

devoted enormous energy trying to learn from Soviet technology by taking apart Soviet missiles to see how they functioned. Under this process, an R&D approach was established and a sophisticated planning process implemented. Adopting a step-by-step approach turned out to be a wise decision a few years later when the Soviets withdrew their support of Chinese technological efforts. By the time the Soviets pulled out of China in 1960, the Chinese already had a good sense of how Soviet rockets worked. They also learned how to conduct a serious research effort. They would be able to take this knowledge and use it as the basis of creating their own original rockets.

Challenge 2: Dealing with Limited Resources. It soon became apparent that China lacked the resources to carry out so many missile and space-related initiatives. At the outset the resource scarcity simply reflected the fact that China was a poor country. The disastrous consequences of the Great Leap Forward and the ensuing famine that claimed millions of lives created economic stress that exacerbated conditions of scarcity associated with China's underlying poverty. The fact was that the economy was brought to the brink of ruin by Mao's ill-conceived policies, and resources

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Rongzhen Memoir), (Beijing: People's Liberation Army Publishing House, 1984), 776-780.

to carry out a space program simply did not exist. It was even debated whether China should be involved in a missile program at all.[28]

Managers in the missile program realized that whatever accomplishments they achieved would have to come from the employment of scarce resources. They implemented a rigid prioritization program. For example, they agreed that their first priority was to establish solid missile capabilities and they recognized that they did not have sufficient resources to support both a missile and satellite program. So they agreed to pull back on the satellite initiatives.[29]

Cutting back on programs was not enough. To deal with resource scarcity, they would have to use the resources they had as effectively as possible. Thus they implemented procedures to reduce waste in developing and testing missiles.

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[28] A defense industry conference was held in Bei Dai He in July 1961. The major argument at this conference addressed whether China should continue its missile and nuclear programs during times of economic desperation. The view to continue the programs won the argument. The missile program stayed on. For a historical background of the debate, see Nie Rongzhen, "In a Science and Technology Development Battle", *Huigu Yu Zhanwang, Xin Zhongguo De Guofang Keji Gongye Sishi Nian (Retrospection and Prospection, Forty Years of Defense Technology and Industry of New China)*, (Beijing: National Defense Industry Press, September 1989), 49-73

[29] Ibid.

Challenge 3: Motivating the Technical Team Members. The majority of managers at the outset of the missile program were military officers. While they were experienced in managing military affairs, they had little knowledge of how to manage civilian operations. One of the significant management challenges they faced was learning to work with talented intellectuals who came from the civilian sector.

Nie's Fourteen Points for Managing Scientific Activities

The anti-rightist campaign and the Big Leap Forward of the late 1950s created serious problems for China's intellectuals, including its scientists and engineers. Responsible leaders such as Marshal Nie recognized that abusing the nation's most talented individuals would only hurt China's attempts to strengthen itself. He initiated an investigation to identify steps that could be taken to make the best use of the country's scientific and technological human resources. The investigation first focused on the missile program. Later it was broadened to cover the scientific community in general.

In July of 1961, Nie and his colleague Mr. Zhang Jingfu, Director of the Chinese Academy of Science, presented a set of policy recommendations titled *Policy Issues Regarding Natural Science Research: Fourteen Points* *to Be Applied to Research Institutions.*[30] The spirit of these recommendations was to acknowledge the special contributions China's scientists and engineers made to society. The recommendations were designed to protect researchers from the vagaries of political and social forces then sweeping China.

Following is a summary of the fourteen points:

1) The basic task of a research institution is to produce research results and to nurture scientific and technical talent.

2) For researchers to operate effectively, the environment in which they function should be stable.

3) Effective research requires a balance between basic and applied research activities.

4) R&D planning should be realistic, focusing on what actually can be done rather than what might be done.

5) Research should be serious, disciplined and precise.

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[30] Details of the Fourteen Points can be found in "Policy Issues Regarding Current Natural Science Research", *Nie Rongzhen Tongzhi He Keji Gongzuo (Comrade Nie Rongzhen and Science and Technology Works)*, (Beijing: Guangming Daily Press, September 1984), 33-55; and Nie Li and Huai Guomo (eds), *Huigu Yu Zhanwang, Xin Zhongguo De Guofang Keji Gongye Sishi Nian (Retrospection and Prospection, Forty Years of Defense Technology and Industry of New China)*, (Beijing: National Defense Industry Press, September 1989), 68-72

6) The efforts of researchers should not be disturbed by political events.

7) Gifted young scientists should systematically be promoted to significant research posts.

8) The scientific community should stress scientific cooperation.

9) The bureaucratic system should be made to work *for* scientific research, assuring that researchers have adequate resources to do their jobs.

10) The scientific research endeavor should be governed by Chairman Mao's dictum, "Let a hundred flowers blossom and a hundred schools of thought contend." Scientific research should not be constrained by political exigencies.

11) Intellectuals should be treated fairly.

12) Political personnel should improve their scientific literacy and learn to work with scientific personnel.

13) Managers of research should improve their management skills.

14) Technical responsibilities should be established in order to guarantee an effective research process.

These fourteen point had a profound impact on the conduct of scientific research in China over the following years. They protected China's researchers in the missile program from the chaotic forces of the Cultural Revolution.

They remain the fundamental tenets for the management of the space program today.

Honor the Talents. From the beginning, leaders of the missile program motivated the technical workers by glorifying the program and focusing on the great achievements of its scientists. Scientific breakthroughs would be prominently highlighted in the press. High performers would be congratulated publicly by government leaders and the Communist Party Central Committee. Achievements would be spotlighted in elaborate banquets.

Scientists and engineers in the missile program were portrayed as patriots and treated like national heroes. Their opinions were sought on a wide array of technological projects, even on topics that lay outside their areas of expertise. For example, Dr. Qian was often asked to provide his opinion on dam-building and power generation projects. This attention helped motivate the scientists and engineers to serve the country and made them feel as if they were part of broad forces of history. Not surprisingly, China's most talented youth were attracted to the missile program and the best were sent to the Soviet Union to study missile technology.

Higher Living Standards. From the earliest days of the missile program, its scientists and engineers were given special privileges. They would be supplied with automobiles, roomy housing, and good working conditions. The advantages of being affiliated with the missile program became especially obvious during the terrible famine of the early 1960s. Scientists and engineers in the missile program would be provided with generous allocations of life's necessities through the issuance of food, meat, and oil stamps.

One researcher later recalled: "I cannot forget the fact that we were treated specially during the economic depression. One of my colleagues outside the missile program was a manager of the same military rank as me. He would sit in a different section of the cafeteria and eat poor quality food while I would have meat."[31]

Conclusions

As mentioned in Chapter 3, the methodology chapter, this dissertation has adopted Wilson's framework to identify how the Chinese bureaucracy was able to sustain a strong space program as it encountered different social, economic,

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[31] Yan Nangen, "From Simulation to Innovation: Retrospective View of the Ground to Air Missile Program", The Ministry of Astronautics Industry, *Hangtian Shiye Sanshi Nian, 1956-1986 (China's Space Activities in Thirty Years, 1956-1986)*, (Beijing: Astronautics Publishing House, April 1988), 102-108.

technical and political challenges during its first three decades of operation, from 1956 until 1986. Wilson focuses on examining three criteria to predict the effective functioning of a high-technology government effort, such as the space program.[32] They are:

- possession of know-how to perform critical tasks
- possession of a sense of mission
- operating with autonomy and possessing external political support.

In the formative years, 1956-1965, each of these criteria played an important role, but perhaps the most significant was the second item in Wilson's list - possession of a sense of mission. At this time, China's political leadership held the unanimous view that development of a strong, comprehensive missile and space program was vital to China's interests for a number of reasons. Chief among these, as Chapter 4 pointed out, were the fact that a space program would help strengthen national security, would increase China's national prestige, and would contribute to building strong scientific capabilities. The political leadership's sense of mission was paralleled

[32] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It*, (New York: Basic Books, 1989), 25-27.

by the missionary zeal of the scientists and technicians who were charged to create the missile and space program.

The strong sense of mission associated with the missile and space program enabled China's leaders to treat it specially, allowing it to operate autonomously with high levels of political support (Wilson's third criterion in the list above). This autonomy/political support was crucial for the survival of the space program in the earliest years, when China experienced the tumult of the Anti-Rightist campaign, the dislocations of the Great Leap forward, and the catastrophic suffering associated with the consequent famine that killed up to thirty million people. As the next chapter will make clear, this autonomy and political support would also protect the space program from the social chaos of the Cultural Revolution.

Regarding the first criterion in the list above -- the possession of know-how to perform critical tasks - this know-how initially came from the Soviet Union. Without advanced Soviet technology, the missile and space program would certainly have foundered in its earliest years. Nie's pragmatic step-by-step approach to acquiring technical skills[33] from the Soviets and building a viable infrastructure served the Chinese well when in 1960 the

Soviets suddenly removed their technicians from China and cut off all technical support. In addition, it was certainly helpful to China that most of the first generation scientists and engineers working on the program had received extensive education and experience abroad. Dr. Qian himself had first-hand experience dealing with the American rocket effort and worked closely with German rocket scientists in the immediate post-war period at the end of World War II. Although the Soviet pull-out was at first viewed to be a catastrophic blow, it soon became apparent that the Chinese missile and space program would be able to move forward alone.

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[33] Nie, *op cit.*, reference 27.

CHAPTER 8

THE MINISTRY OF SEVENTH MACHINERY INDUSTRY, A FULL FUNCTIONAL ORGANIZATION WITH A SPACE INDUSTRY COMPLEX

In 1965-1979, a period that encompassed the chaos of the Cultural Revolution, China's missile program moved forward rapidly and evolved into a comprehensive space program. In this time period, the program experienced three major accomplishments. First, the missile program matured into a fully developed, self-sustaining effort. Second, China began a sophisticated satellite program. Third, China established an integrated space industrial base in the interior of the country. During this time, organizational changes were instituted to enable these major achievements to take place.

Because details of the impacts of the Cultural Revolution on the missile and space programs were discussed in previous chapters, they will not be reviewed here.

New Organization, New Goals

By 1965, China had established a firm foundation for its missile program. It had weathered political setbacks arising from the economic and social crises of the late 1950s and early 1960s. It survived the pull-out of Soviet support in 1960. On a technical level, the Chinese moved from a focus on the reverse engineering of Soviet technology to the capacity to undertake a self-sustaining missile program (i.e., to design and build missiles without outside support). The Chinese were so confident of their ability to develop missiles that they established a goal to be able to achieve intercontinental ballistic missile capabilities by the year 1980.[1]

While the withdrawal of Soviet support did not cripple the missile program, it did create serious challenges that the program would have to address. Since the Chinese could no longer depend on the Soviets to supply them with missile samples and assembly parts, they needed to develop sophisticated manufacturing capabilities to produce needed missile components themselves. In 1960, the Fifth Academy proposed to the Central Military Committee that it set up its own production base. In October, the Central Military

Committee approved the request. It was decided that construction of manufacturing sites would commence in 1962. For security reasons, most of new sites would be built in China's interior regions, away from the cities along the coast. This would make them less vulnerable to military attacks from an enemy.[2]

Meanwhile, government support grew steadily. It was clear to the Central government that the Fifth Academy with the existing support was inadequate if larger and more sophisticated projects were to be carried out successfully. It was decided that a new organizational arrangement should be implemented to deal with the program's new requirements.[3] On 23 November 1964, the Party Central Committee and the State Council announced a joint decision to establish an organization with space industrial capability. In *An Announcement of the Establishment of the Ministry of Seventh Machinery Industry*, it was stated that a new ministry would be created to oversee China's missile and space program —

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[1] The Fifth Academy, *Missile Technology Development Plan, 1963-1980,* (Beijing: The Fifth Academy: 15 January 1964).

[2] Xie Guang, at al, *Dangdai Zhongguo De Guofang Keji Shiye, 1st Vol, (Contemporary China's Defense Science and Technology Efforts, Shang),* (Beijing: China Social Science Publishing House, October 1992), 62-64

the Ministry of Seventh Machinery Industry. The structure of the new Ministry would be built on the structure of the existing Fifth Academy. Other organizations that engaged in missile and space related work in the past would be folded into the new Ministry.[4]

The Ministry was given primary responsibility for managing the Chinese missile and launching industry. It would organize pertinent research, design, production, manufacturing, and basic construction efforts.[5] It would be placed under the commission of Science and Technology for National Defense (CSTND), the military organization charged with overseeing the activities of China's military industrial complex.

On 26 December 1964, the First Meeting of the Third Session of the People's Congress issued the order to establish the Ministry of Seventh Machinery Industry (to be called by its shortened name, the Seventh Ministry). On 4 January 1965, General Wang Binzhang was named Minister of the new Ministry. General Wang was a military veteran with extensive experience in military production. On 15 February, Dr. Qian Xuesen, Mr. Liu Binyan, Mr. Gu Shanguang,

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[3] Zhang Jun et al, *Dangdai Zhongguo De Hangtian Shiye (Contemporary China's Space Effort)*, (Beijing: Social Science Publishing House, 1986), 37

[4] Ibid., 32-47

and Mr. Zhang Fan were made Deputy Ministers. Under the new organizational structure, the four sub-academies of the Fifth Academy were subsumed by the Ministry. They played the same roles as before. In June 1965, all personnel in the former Fifth Academy were retired from the military and became civilian personnel.[6]

Figure 8.1 shows the organization chart for the Seventh Ministry at its inception in 1965.

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[5] Ibid., 35

[6] Liu Jiyuan, et al, *Zhongguo Daodao Yu Weixing Shiye Fazhan Shiliao, 1956-1986 (A History of Missile and Satellite Development, 1956-1986)*, Vol. 1, (Beijing: Astronautics Publishing House, December 1989), 60-67

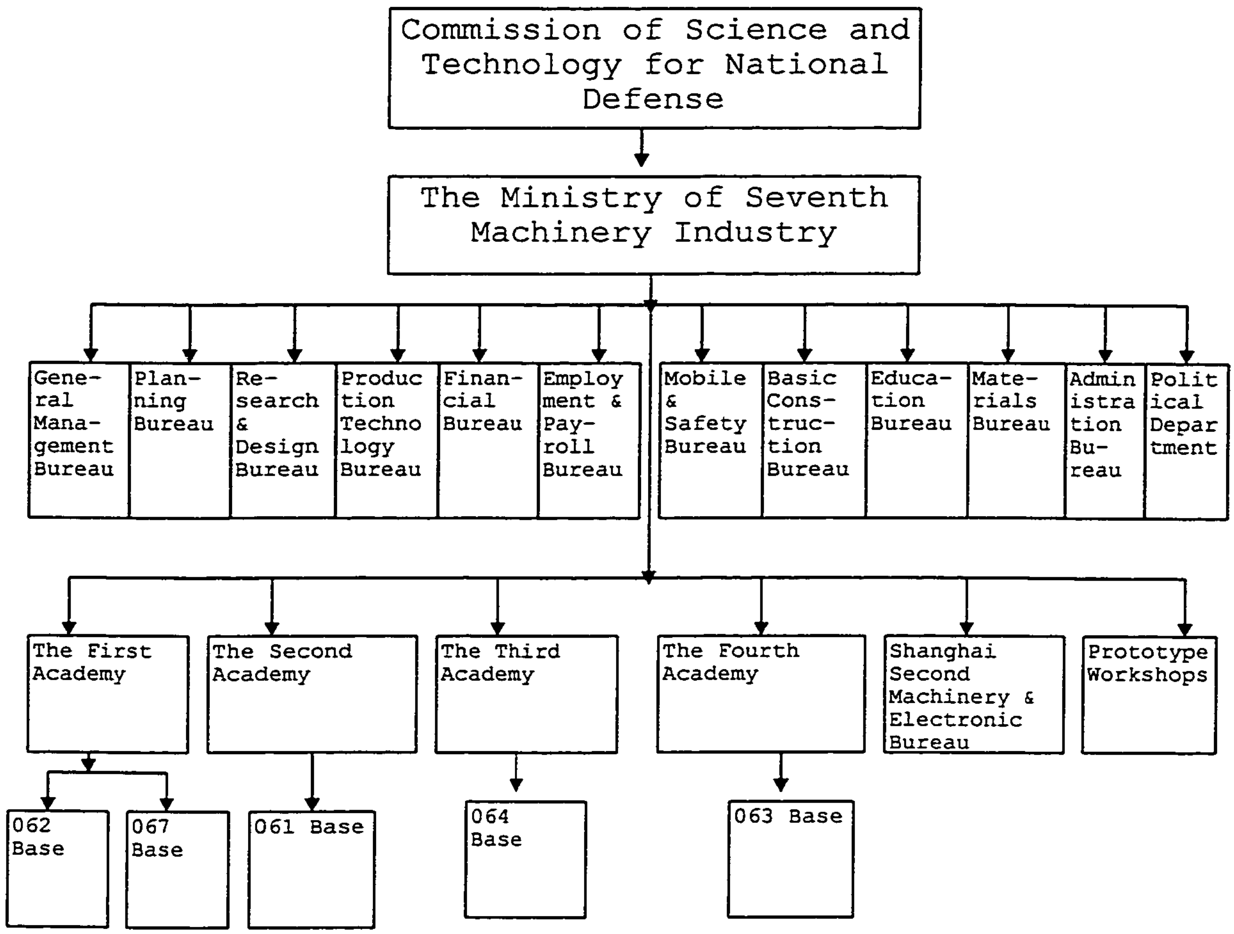

Figure 8.1 Organization Chart of the Ministry of Seventh Machinery Industry 1965[7]

[7] Compiled from Ibid.

This chart pictures the origins of the Chinese space industry complex establishment in 1965. It shows that the First Academy was given responsibility to construct the 062 and 067 industrial bases. The Second Academy was responsible for the construction of the 061 base, the Third Academy for the 064 base, and the Fourth Academy for the 063 base.[8]

Figure 8.2 shows the organization chart for the space industry as of 1971, during the time of the Cultural Revolution. The major changes in structure included the removal of the Third Academy from the Seventh Ministry (it was put into the Ministry of Sixth Machinery Industry, which was in charge of ship building) and the creation of a Fifth Academy, which incorporated the China Space Technology Academy (transferred to the Seventh Ministry from CSTND). Another significant change was the change in the labels given to the functional areas of the Seventh Ministry: they were now called "groups" in order to get rid of terms such as "bureau" or "department," which had unacceptable connotations of bourgeois bureaucracy.

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[8] An industrial base is a complex of factories, technical institutes and testing facilities whose efforts are geared toward producing space products. It has its own authority to administer all factories, facilities and institutions under the leadership the Ministry. For security reasons, its name was coded as described in the text.

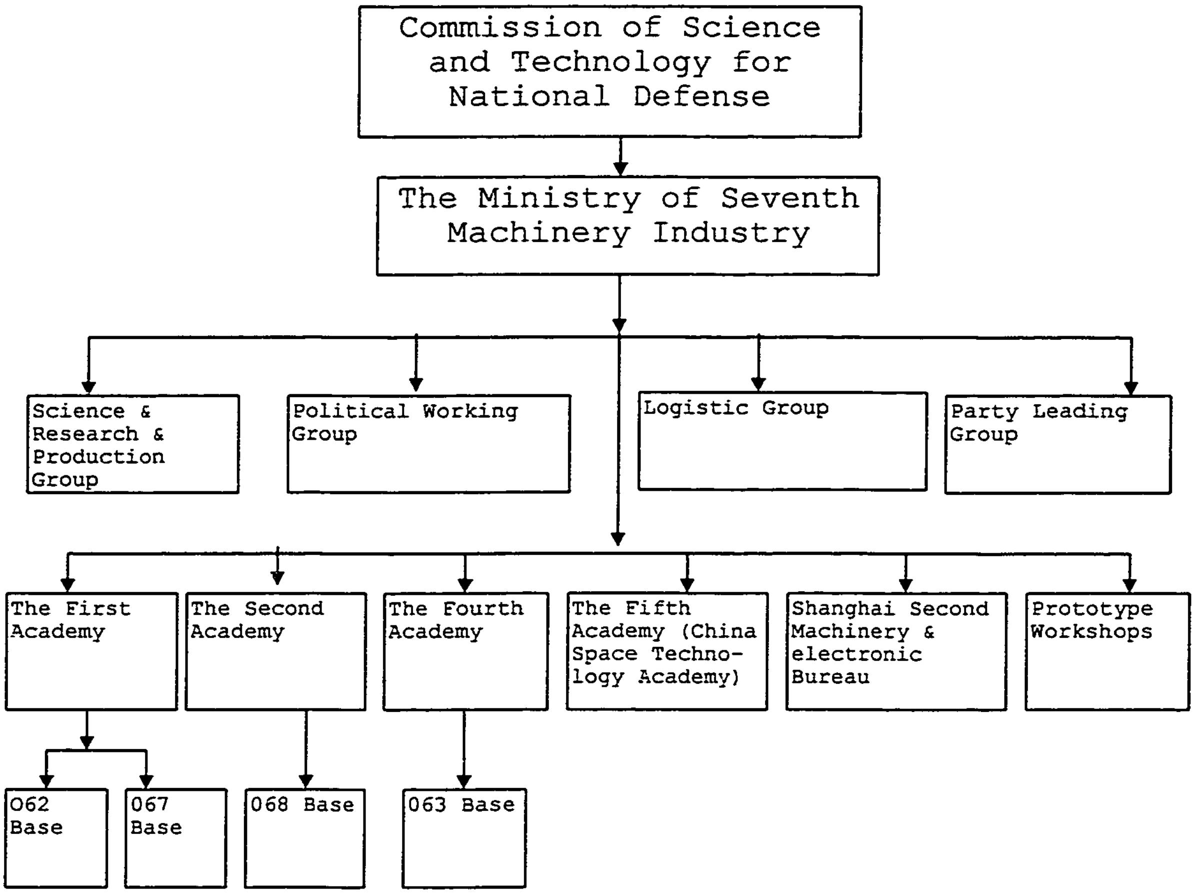

Figure 8.2 Organization Chart of the Ministry of Seventh Machinery Industry 1971[9]

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[9] Liu Jiyuan, *op cit.*, footnote 6.

Figure 8.3 pictures the structure of the Seventh Ministry as of 1979. At this time, the Ministry has transformed itself into a full-service space industrial complex, with research, design, production and manufacturing capabilities.

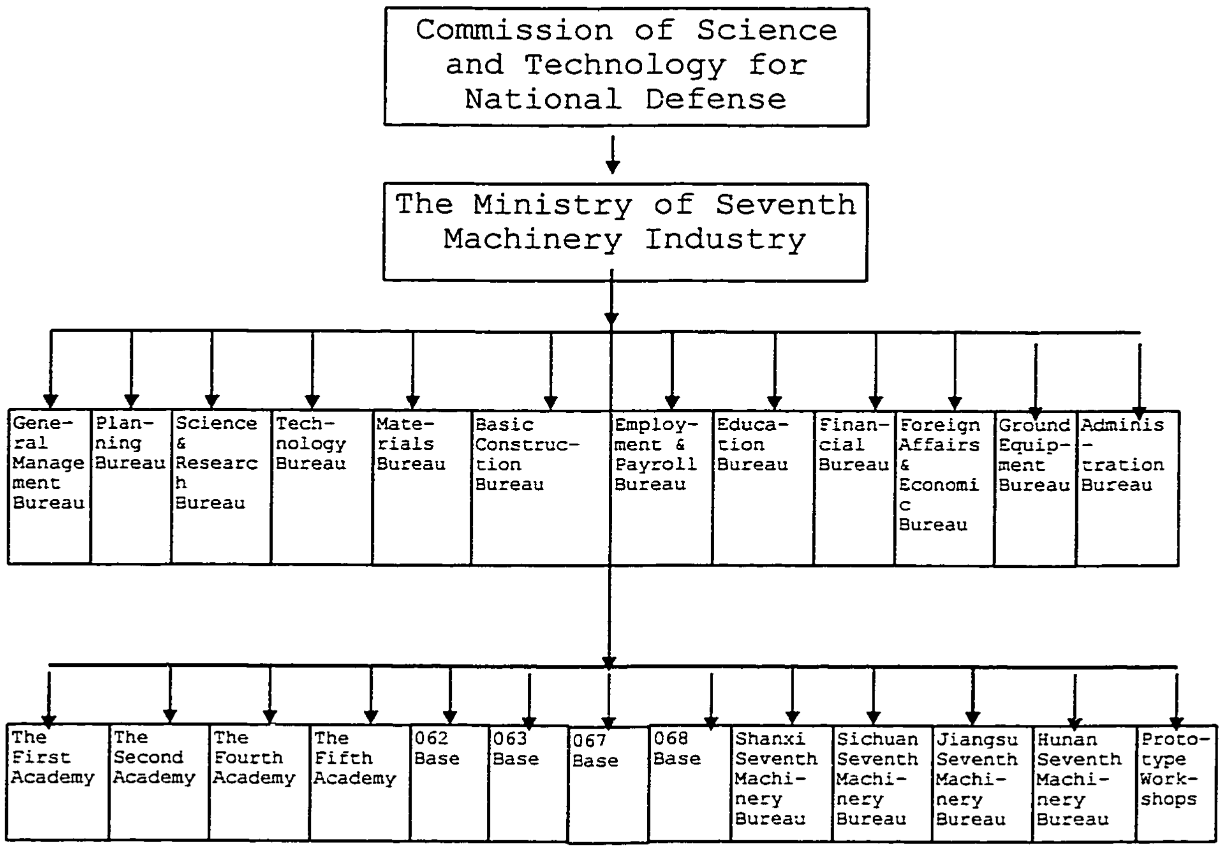

Figure 8.3 Organization Chart of the Ministry of Seventh Machinery Industry 1979[10]

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[10] Ibid.

Organization of the Missile Program under the Seventh Ministry

At the outset of the reorganization of the missile and space program, the new organization focused on missile technology. This was natural, since the Seventh Ministry evolved directly from the Fifth Academy, whose central function was geared toward the development of missile capabilities. Thus the Seventh Ministry's key sub-academies were concerned with missile development and construction. The First Sub-Academy (also called the Ground-to-ground Missile Research Academy) was responsible for developing ground-to-ground missiles.[11] The Second Sub-Academy (also called the ground-to-air Missile Research Academy) was responsible for developing ground-to-air, air-to-ground, and air-to-air missiles.[12] The Third Sub-Academy (also called the Coastal Defense Missile Research Academy) was responsible for coast-to-coast, ship-to-coast, and coast-to-ship missiles. The Fourth Sub-academy (also called the

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[11] Wang Yongzhi, et al, *Diyi Yanjiuyuan Dashiji, 1957-1987 (A Chronology of the First Academy, 1957-1987)*, (Beijing: Chang Hong Printing House, November 1987).

[12] Liu Congjun, et al, *Dier Yanjiuyuan Dashiji, 1957-1987 (A Chronology of the Second Academy, 1957-1987)*, (Beijing: The Second Academy of the Ministry of Astronautics Industry, 1987).

Solid Fuel Missile Research Academy) was responsible for engine designs.[13]

The First and Second Sub-Academies were early workhorse research institutions playing an important role in creating Chinese missile capabilities. The First Sub-academy focused primarily on the development and building of the *Dong Feng* (*East Wind*) missiles, while the Second Sub-academy concentrated on developing the *Heping* sounding rockets, an air defense missile system (*Hong Qi* missiles), and a coast and sea defense missile system (*Hai Ying* missiles). Later, in 1961, responsibility for development of coastal and sea defense missile systems was transferred to the newly-established research institution, the Third Sub-academy. For the long-term development of missile technology, the Fifth Academy established a Fourth Sub-academy in April 1964. It was responsible for developing a solid fuel engine. The Fifth Academy is located in Luzhou City, Sichuan Province.[14]

By 1964, concrete development efforts were being undertaken for the following missiles:

- Ground-to-ground missiles — the *Dong Feng* program (DF)
- Ground-to-air missiles — the *Hong Qi* program (HQ)

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[13] Liu Jiyuan, *op cit.*

- Air-to-air missiles — the *Pi Li* program (PL)
- Ship-to-ship missiles — the *Shang You* program (SY)
- Coast-to-ship missiles — the *Hai Ying* program (HY)
- Underground-launched missiles — the *Ju Long* program (JL)
- Sounding rockets — the *He Ping* program (HP)

In 1965, the Seventh Ministry issued a statement defining its goals to fully develop missile research, design, and manufacturing capabilities. These goals were defined in "A Plan to Develop Four Missile Programs in Eight Years, 1965-1972." During these eight years, China would build *Dong Feng II*, *Dong Feng III*, *Dong Feng IV*, and *Dong Feng V*, an intercontinental ballistic missile. As stated in an earlier chapter, a remarkable feature of this effort was that it was carried out during the tumoil of the Cultural Revolution. While other parts of Chinese society came to a halt at this time, the missile program forged ahead. In September 1971, the *Dong Feng V* was successfully tested. The Seventh Ministry had achieved its eight-year plan and China now possessed long-range strategic missile capabilities.[15]

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[14] Ibid., 105-139

[15] Xie Guang, *op cit.*, 306-339

While the origins of China's space program were rooted in military needs for missiles, during the 1965-1979 time period, the Seventh Ministry began developing civilian launching capabilities as well. On 31 May 1966, CSTND held a meeting to decide a timetable for launching China's first satellite. During this meeting, it was decided that the *Dong Feng IV* missile would be converted into a satellite launch vehicle. This required adding a third stage to the missile that would be powered by a solid fuel engine. The new launch vehicle would be named *Long March I*.[16]

China clearly was eager to enter the space age. It had only been eleven years since the Chinese began their efforts to develop missile technology. Now they would convert this military technology to civilian uses.

A Shanghai rocket development base was founded in 1964. Because Shanghai possessed China's premier industrial capabilities, it was involved in the missile development program from early on. By the time a Shanghai base was established, it was comprised of an administrative arm called the Shanghai Second Machinery and Electronics Bureau,

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[16] The meeting was held by the Commission on Science and Technology for National Defense. The participants were Mr. Luo Shunchu, the Vice Chairman of the CSTND, Mr. Zhang Jingfu and Pei Lisheng from the Chinese Science Academy, responsible for satellite development, and Mr. Wang

a research institute called the Shanghai Machinery and Electronics Design Academy, and seven factories focused on producing missiles. In 1965, the Shanghai base was incorporated into the Seventh Ministry.[17]

In August 1969, Shanghai City requested more direct control over the Shanghai space base.[18] Zhou Enlai approved this request. In November, the Central Committee issued an order that Shanghai would develop satellite, launching vehicle, and intercontinental ballistic missile programs. From this point forward, Shanghai took control over satellite development projects, such as the electronic reconnaissance satellite, a telecommunications satellite, a meteorological satellite, and a ground tracking system. In the launch vehicle arena, the Shanghai base successfully developed the *Feng Bao* (*Storm*) launchers, which possessed

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Bingzhang and Dr. Qian Xuesen from the Seventh Ministry, responsible for developing launching vehicle.

[17] Shanghai Space Bureau of the Ministry of Space Industry, "Shanghai Hangtian Ju Ershi Wu Nian De Jianku Chuangye Daolu (The Experience of Shanghai Space Bureau in Twenty Five Years)", The Ministry of Astronautics Industry, *Hangtian Shiye Sanshi Nian, 1956-1986 (China's Space Activities in Thirty Years, 1956-1986),* (Beijing: Chang Hong Printing House, April 1988), 353-362

[18] Detailed arrangements included placing the Shanghai Second Machinery and Electronic Bureau chiefly under the authority of the Shanghai City government. The Shanghai base would focus on *Dong Feng* and *Hong Qi* missile development, as well as satellite development, regardless of how the space force in Beijing carried out its efforts,

the capability to launch multiple satellites with one rocket.[19]

Organization of the Satellite Program

China's desire to establish a satellite program can be traced to 1957, a response to the Soviet Union's successful launching of *Sputnik*. In its plan that was issued in January 1958, the Fifth Academy announced its intent to initiate a near-term study project and a longer term research project for the creation of satellite production capabilities.[20] On 17 May 1958, Mao Zedong signaled his support of the effort by stating, "We should make satellites too."

A Space Flight Committee was established within the Chinese Academy of Science. The committee was headed by Dr. Pei Lisheng, Dr. Qian Xuesen, and Dr. Zhao Jiuzhang. In June 1961, the committee held China's first symposium on satellite development. Dr. Qian presented an important paper titled "Today's Missile Propulsion Issues in Soviet and American Space Flight Activities, and Their Future."

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according to the terms of a 14 August 1969 meeting between Zhou Enlai and Ma Tianshui, Mayor of Shanghai City.

[19] Xie Gaung, *op cit.*, 413-416

[20] The Fifth Academy, *A Development Plan for Jet Propulsion and Missile Technology in Next Ten Year (1958-1967)*, (Beijing: The Fifth Academy, 10 January 1958).

From this time forward, active discussions were carried out regarding China's ability to build satellites. Inside a three year period, the committee sponsored twelve symposia. Meanwhile, success with sounding rockets in conducting biological experiments demonstrated that early space research was already bearing fruit.[21]

By 1965, the significant achievements of the missile program led many people to believe that China was economically and technically ready to move into satellite development in a big way. Once again, Dr. Qian took a lead role in moving the space program forward. He submitted a proposal to the Central government to begin physical work on the satellite program. He wrote: "Since the Soviets launched the first artificial satellite on 4 October 1957, the Chinese Academy of Science and the Fifth Academy have studied satellite technology, but we have not set up a concrete project yet. Given our solid background with missile technology foundations, and current skills in developing long-range missiles, we have reached the position where we are capable of launching satellites into space. We should start work soon to gain the needed technology.

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[21] Zhang Jun, *op cit.*, 26-31

Therefore, I propose that the government include a satellite program in the national plan to make the program happen."[22]

In April 1964, CSTND brought before the Central Committee a proposal to launch the first Chinese satellite in 1970 or 1971. In October 1965, CSTND held a symposium on the Chinese satellite project at the Chinese Academy of Science.

In January 1966, the Satellite Academy was established in the Chinese Academy of Science.[23] A technical plan for development of satellite capabilities was laid out. Not only did the plan review technical requirements — it outlined political requirements as well. Basically, China should be able to launch and satellite and successfully place it into orbit. It should also possess the capacity to track the satellite by means of ground stations. In addition, this satellite should be more advanced than the Soviet first satellite, *Sputnik*.

The attempt to make the satellite program a civilian operation failed with the onset of the Cultural Revolution. As political currents entered into the Academy of Science,

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[22] Hu Haitang and Peng Ziqiang, *Shanguang De Shijie (Shining World)*, (Beijing: National Defense Industry Press, August 1987), 190-192

[23] Ma Yuntao et al, *Hangtian Shiye Sanshi Nian (China Space Porgram in Thirty Years)*, (Beijing: Astronautics Publishing House, September 1986), 130-134.

decision paralysis ensued. In November 1966, the Academy requested that CSTND remove the satellite initiatives from their care, because decision-making authority no longer existed and the Academy was paralyzed in its operations.

To keep the satellite project going, CSTND set up a Satellite Project Office in the Academy over which it had direct control. On 27 June 1967, the Central Military Committee approved the creation of the Chinese Academy of Space Technology within CSTND. The space program was now back in military hands.[24]

The Chinese Academy of Space Technology came into being on 20 February 1968. Dr. Qian Xuesen was made its Director. The Academy's programs were not created from scratch. Rather, existing efforts from other programs were brought together. For example, the satellite program took control of the Earth Physics Institute of the Chinese Academy of Science, the Southwest Electronics Institute, the Lanzhou Physics Institute, the Beijing Electronics Institute, the Shanghai Science Instruments Factory, and the Biology and Physiological Research Institute of the Military Medicine Academy. All personnel working on the project were recruited as military personnel and operated under military discipline.

The official responsibility of the newly-established Academy was to participate in national space program planning, set up space flight technical requirements, oversee research, design, production and testing on various projects in the space flight arena, and establishing ground-based measurement networks for launching space flight objects.[25]

Figure 8.4 shows that unlike what transpired at the outset of the missile program, the satellite program began with a solid institutional capability.

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[24] Xie Guang, *op cit.*, 104-107.
[25] Zhang Jun, *op cit.*, 44.

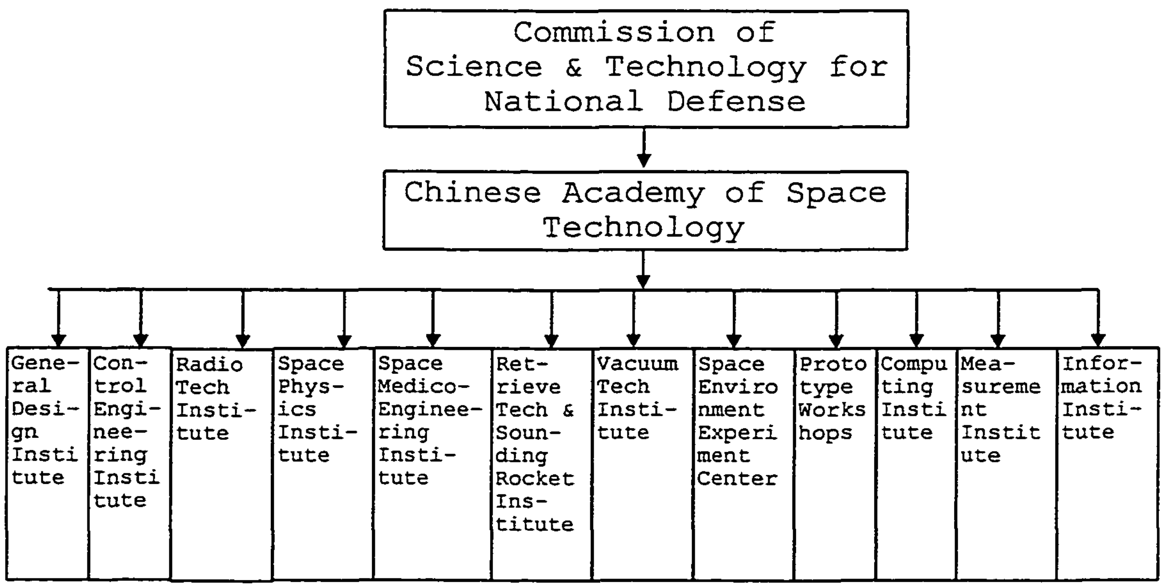

Figure 8.4 Organization Chart of

Chinese Academy of Space Technology[26], 1968[27]

In May, the Academy submitted "A Ten-Year Plan to Develop a Satellite and Manned-Flight Program in China" to

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26 This chart is compiled from the description of China's Space Technology Academy in Zhang Jun, *op cit.*, 44-46

27 Later, the Academy added the Space Remote Sensing Technology Institute, Space Science Achieve Center. Also, the Shanghai Satellite Engineering Institute later merged into the Academy. The Space Medico-Engineering Institute

CSTND. In January 1969, Zhou Enlai said to the Chinese Meteorological Bureau that China should develop its own meteorology satellites. In March, the Academy decided to carry out research on telecommunication satellites. In July, CSNTD staff created a plan to develop navigation satellites.

The satellite program bore tangible fruit in 1970. On 24 April, China successfully launched its first satellite, and it did this on schedule. China became the fifth country after the US, USSR, France and Britain to be able to build and launch satellites as a result of its own efforts. The success of the first satellite confirmed the merits of China's technical approach. Soon, a wide range of specialized satellites entered into full-design, testing, and production.[28]

On 24 July 1973, the Chinese Academy of Space Technology was transferred to the Seventh Ministry. Due to

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stayed in the COSTND after the Academy merged into the Ministry of Seventh Machinery Industry in July 1973.

[28] Chinses Academy of Space Technology, "Zhongguo Kongjian Jishu Yanjiu Yuan Fazhan Licheng Huigu (A Retrospection of the Development of the Chinese Academy of Space Technology", in The Ministry of Astronautics Industry, *Hangtian Shiye Sanshi Nian, 1956-1986 (China's Space Activities in Thirty Years, 1956-1986)*, (Beijing: Chang Hong Printing House, April 1988), 344-352

delays in the manned-flight program, the Institute of Space Medico-Engineering stayed within CSTND.[29]

Organization for Manufacturing

To have a competitive space industrial capability was a dream of the Fifth Academy. In the early years, when the missile program was in its infancy, there was virtually no production capability in China. Rocket parts were shipped to China from the Soviet Union. Even the rocket fuel was imported from the USSR. When China had to create missiles on its own, quality control became a major issue. Without good quality control, the missile program would lack reliable parts. The Fifth Academy recognized that if a missile program was to be developed, it would have to do a good sales job in convincing the central government to offer sufficient resources to build a good industrial base.[30]

With the establishment of the Seventh Ministry, the central government took two steps to assure the building of an adequate industrial base. First, it turned over many

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[29] Xie Guang, *op cit.*, 422-423

[30] Basic Construction Bureau of the Ministry of Space Industry, "Hangtian Gongye Jibeng Jianshe Jianhu Chuangye de Sanshi Nian (The Development of Space Industry in Thirty Years)", in The Ministry of Astronautics Industry, *Hangtian Shiye Sanshi Nian, 1956-1986 (China's Space Activities in Thirty Years, 1956-1986)*, (Beijing: Chang Hong Printing House, April 1988), 260-273

operating factories to the Ministry. Second, it authorized a significant growth in the labor force available to the Ministry.

In 1965, one research institute and eleven defense-related factories were transferred into the Ministry. Meanwhile, six secondary schools provided training for the skilled workers who were transferred to the Ministry. By the end of 1966, eight additional factories were merged into the Ministry. Most of these factories were specialized technical factories in areas such as electronics, chemicals, radios, optics, semiconductors, and specialty mechanics.[31]

Beginning in 1965, the government systematically increased the labor force to meet the expanding labor needs of the Ministry. In November, the Ministry of Labor issued an order to have 2,588 technicians and more than 1,300 retired skilled military personnel to join the Ministry. In 1966, another 3,500 retired soldiers with skills joined the Ministry's labor pool. Labor resources continued to be added, so that by the end of the 1970s, the Ministry had 250,000 personnel.[32]

Chinese space industrial bases can be put into three categories. One is the industrial network around Beijing

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[31] Liu Jiyuan, *op cit.*, 69-78.
[32] Ibid., 78-85.

City. These were established in the early years of the missile program. A second is the collection of industrial bases established in various provinces in China's interior. These industrial bases were set up from the mid-1960s until the late-1970s. The third is the industrial network established in the Shanghai area.

Table 8.1 outlines the timeline for the establishment of industrial bases in China's interior regions.

Table 8.1 Space Industrial Bases Establishment in 1960s and 1970s[33]

Industrial Base	Relationship to	Location	Year of Establishment	Year of Completion
061 Base	The Second Academy	Guizhou Province	1965	1975
062 Base	The First Academy	Sichuan Province	1965	1975
063 Base	The Fourth Academy	Shan'xi Province	1965	1977
064 Base	The Third Academy	Shanxi Province	1967	1978
065 Base	The Second Academy	Guizhou Province	1968	1970 merged by 061 Base
066 Base	The Third Academy	Hubei Province	1966	1978
067 Base	The First Academy	Shan'xi Province	1969	1976
068 Base	The Second Academy	Hunan Province	1970	1977

[33] The contents of this chart are compiled from Liu Jiyuan, *op cit.*

Conclusion

It was in the second phase of the space program, between 1965 and 1979, that China experienced the Cultural Revolution (1966-1976). One of the remarkable features of the space program is that it thrived during these tumultuous years. While universities shut down and intellectuals were sent off to plant rice in paddies and pitched battles were fought in the streets among contending forces, the space program evolved from infancy to grow into a full-scale industrial complex. Technologically, it was during this time that China developed satellite capabilities, giving it admission to the highly exclusive global space club. In retrospect, we see that the space program was one of the only institutional structures in the whole of Chinese society to avoid the social disasters affecting all of the nation.

The space program's privileged position did not come about by accident. Wilson's bureaucratic framework[34] is particularly helpful here in showing how the program survived the turmoil.

As Wilson suggests, large-scale government programs such as the China space program do well when they have a strong measure of autonomy and possess substantial external political support. The space program was provided with a large measure of autonomy in the early months of the Cultural Revolution when it was put fully under the control of the military. Under martial law, it received a degree of protection few other organizations experienced. Thus even while other institutions were torn apart by the pulls and tugs of contending forces, space program scientists and engineers were able to do their jobs with little interference from outside.

Another advantage the space program had was that it was supported by all of the powers that counted, including Zhou Enlai, Lin Biao, and the Gang of Four. As Chapter 5 mentioned, each of these players sought to associate themselves closely with the space program in order to derive some of the prestige associated with it. The result of this external support was that the politicians avoided using the space program to fight their political battles.

Wilson's framework also suggests that large-scale government organizations operate successfully when they have a strong sense of mission. The sense of mission that fired the space program from its earliest days in the mid-1950s

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[34] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It*, (New York: Basic Books,

persisted throughout the years of the Cultural Revolution. The program's scientists and engineers were making great technical strides that kept them highly motivated. Its senior managers were similarly stimulated by the opportunity to create a great organizational enterprise that would enable China to become a world-class space power. Whatever sense of mission all these people felt was further reinforced by the realization that during the Cultural Revolution, they could not afford to fail to achieve their goals. The consequences of failure were unknown and too unpleasant to contemplate.

Finally, Wilson's framework holds that in order to operate successfully, large-scale, complex government undertakings must possess the know-how to accomplish their technical goals. Unquestionably, the space program achieved a "great leap forward" technically during 1965-1979. It converted its fledgling efforts into a full-scale, self-sustaining industrial complex. Beyond this, it developed the capability to design, build, and deploy satellites into outer space, a remarkable feat even under the best of conditions. And these achievements were made with no assistance from the outside!

1989), 25-27.

Ironically, then, even as China was experiencing one of the worst social and political disasters of modern times, its space program was thriving.

CHAPTER 9

THE MINISTRY OF ASTRONAUTICS INDUSTRY, COPING WITH ECONOMIC REFORM

The Cultural Revolution left China and its people spiritually and materially drained. In order to improve the lives of the people, the leadership began focusing on economic development. The Open Door and Four Modernization policies set the tone for the new approach. From now on, the Chinese would devote their attention to getting rich as fast as possible.

The obsession with economic development provided the space program with a new set of challenges. As previous chapters showed, the missile and space programs were able to weather the chaos of earlier times. Now the space program had to deal with an entirely new issue — to justify its activities economically.

In the late 1970s and early 1980s, the program was buffered from dealing with the new realities. During this time, attention focused on completing a number of key missions established before the onset of the era of economic reform. However, in the early 1980s it became apparent that the space program could not ignore the economic forces at work on all of Chinese society. It would have to open itself up to market forces. This would entail a broad range of activities. For example, it would have to figure out how to raise funds for its efforts by selling goods and services in the market place. It would need to replace the cryptic names of its work units with commercially-relevant names. It would have to revamp its personnel policies to deal with an aging workforce and to attract young talent from a labor pool that was losing interest in government work. And so on.

This chapter examines how the space program adjusted to the new challenges in the period from 1977 to 1986.

Mission-oriented focus during the early stage of economic reform (late 1970s to early 1980s)

The earliest stirrings of economic reform had little impact upon the space program because the program had its own agenda which was supported by key political forces. This agenda focused on completing its organizational restructuring to reflect its development into a mature body and constructing its industrial bases. In addition, it would pursue a number of initiatives that had been established earlier to strengthen its strategic missile capabilities, develop heavy launch vehicles, and move forward on an advanced satellite program.[1]

Final Steps in Constructing Industrial Bases. By the end of the 1970s, the Seventh Ministry completed its construction efforts to establish industrial bases in China's interior regions. Concurrently, it restructured its operations to deal with its mature form.[2] The space program's organizational structure was expanded to include the Shanxi Seventh Bureau, the Sichuan Seventh Bureau, the Jiangsu Seventh Bureau and the Hunan Seventh Bureau. (See organization chart in figure 9.1).

Developing Intercontinental Ballistic Missile Capability. In the transition years, China's space program continued its goal to develop intercontinental ballistic missile capabilities. Two missions preoccupied the program in this area. The first was to launch an intercontinental ballistic missile from the deserts of Xijiang to the Pacific Ocean.

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[1] Nie Li and Huai Gumou, et al, *Huigu Yu Zhanwang, Xin Zhongguo De Guofang Keji Gongye Sishi Nian, 1949-1989 (Rstropection and Prospection, Forty Year of Defense Technology and Industry of New China, 1949-1989)*, (Beijing: National Defense Industry Press, September 1989), 100-105.

[2] Liu Jiyuan, et al, *Zhongguo Daodao Yu Weixing Shiye Fazhan Shiliao, 1956-1986 (A History of Missile and*

The second was launched an intercontinental ballistic missile from a submarine platform under water.

At this stage in the Chinese missile program, the key technological breakthrough was the development of missile tracking capabilities far from China. Two ships were designed and constructed by the end of the 1970s to serve missile tracking functions from ocean sites. Prior to these ships, China had little experience in building ships that would sail distant seas. To achieve success, the program required cooperation between the Navy and the shipbuilding industry. China spent three years, from 1976 to 1979, to complete the project.

A major missile launching achievement was made on 18 May 1980, when China successfully launched an intercontinental ballistic missile from its interior to the Pacific Ocean.[3] The total distance traversed was 9079 kilometers. The missile was the *Dong Feng V*. China was proud of this achievement since it demonstrated that China now had intercontinental ballistic missile capabilities. General Secretary Hu Yaobang announced that the successful launching of the missile symbolized China's strength in

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Satellite Development, 1956-1986), Vol. 1, (Beijing: Astronautics Publishing House, December 1989), 145-190.

developing sophisticated technology. Beyond symbolism, China's leaders were pleased that with intercontinental ballistic missile capabilities they could strengthen the nation's defense capabilities.[4]

China's second missile-related goal during this time was to launch a missile from an underwater platform. The achievement of such a feat was a major challenge to test China's ability to develop sophisticated solid fuel missile engines. It also required the Chinese to advance their ship-building skills. To this end they modified two submarines to serve as missile launching platforms. After extensive ground tests and underwater tests, the Chinese finally successfully launched a submarine-based intercontinental ballistic missile on 12 October 1982. China had now developed the capacity to launch missiles from a mobile platform from outside its borders.

Placing a Telecommunications Satellite in Geostationary Orbit. In the transition years, China also concentrated on placing a telecommunications satellite into geostationary orbit. This mission required the Chinese to possess heavy

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[3] Zhang Jun et al, *Dangdai Zhongguo De Hangtian Shiye (Contemporary China's Space Effort)*, (Beijing: Chinese Social Science Publishing House, Beijing, 1984), 571.

[4] On 10 June 1980, the ceremony for the successfully launching Dong Feng V was held at People's Great Hall in Beijing. Mr. Hu Yaobang gave a speech to the ceremony.

boosters with precise satellite positioning capability. Also it required them to have satellite design and operations capabilities.

At this time, the Chinese had developed relatively good launching and satellite positioning capability. However, their satellite capability was still weak. Consequently, they wanted to purchase transponders from the West in order to improve the performance of their satellites. Negotiations to acquire this technology from the West began in 1979. The Seventh Ministry received approval from the Party Central Committee and the State Council to cooperate with MBB of Germany to obtain the needed technology.[5] However, owing to Western rules governing exports of technology products to China, China was not able to acquire any usable technology for its first telecommunications satellite.

Progress in putting a satellite into geostationary orbit came quickly. On January 29, 1984 the Chinese launched a test telecommunications satellite. On 7 February, further tests led to good results. Finally, on 8

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[5] On 14 February 1979, A Recommendation to Sign An Agreement with MBB of Germany to Cooperate in Developing a Telecommunication Satellite was proposed by the Commission of Science and Technology for National Defense, the Ministry and the Ministry of Foreign Affairs. The next day, on 15

April, the Chinese launched their first geostationary telecommunications satellite successfully. Marshall Nie Rongzhen later proudly wrote the Seventh Ministry: "It took only eight days to position the satellite into geostationary orbit. This is a near record in the history of international telecommunications satellites. This suggests that we experienced an important breakthrough in space technology as well as information technology. This achievement will certainly enhance the Four Modernizations in China."[6]

Organizational Changes to Reflect the Economic Openness of the 1980s

Three significant organizational changes occurred during this period. The first was to transfer the tactical missile development program from the Ministry of Eighth Machinery Industry to the Seventh Ministry. The second was to provide the Ministry with more organizational resources. The third was to give all aspects of the space program a civilian face in order to enable it to operate more effectively in launching commercial enterprises.

February, the Central Committee and the State Council approved this recommendation.

Incorporation of the Tactical Missile Program into the Seventh Ministry. The origins of the tactical missile program are found in the earliest days of the missile development effort. During the Cultural Revolution, the military had the Seventh Ministry spin-off its tactical missile program and placed it into the Ministry of Eighth Machinery Industry, which was recently formed to take the lead on tactical missile activities. In its move to cut the government budget and shrink government programs in the 1980s, the Central government decided to fold the Eight Ministry into the Seventh Ministry, thereby reducing redundant efforts in missile research and production.[7] In October 1981, the Ministry of Eighth Machinery Industry transferred all of its assets and personnel to the Seventh Ministry. The resulting organization was comprised of 118 institutes, 107,000 employees, about 22,005 pieces of equipment with a budget of 1.58 billion Yuan.[8]

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[6] On 19 April, Nie sent a letter to Mr. Zhang Aiping, the Chairman of CSTIND at that time, to congratulate the event.

[7] At the same time, the Commission of Science and Technology for National Defense merged with the Commission of National Defense Industry. The new organization was named Commission of Science, Technology and Industry for National Defense in 1982. General Chen Bin, the author's father, was made the Chairman until 1987.

[8] Liu Jiyuan, *op cit.*, 165-169.

During this time period, the Chinese space program became an organization with a full spectrum of functions. The Seventh Ministry also changed its name to the Ministry of Astronautics Industry. The new organization structure is seen in following chart. (see Figure 9.1.[9])

In 1986, reflected in their names, the Ministry of Astronautics Industry became more open to the outsiders in terms of its functionality. (see Figure 9.2.[10])

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[9] Compiled from *Ibid.*
[10] Ibid.

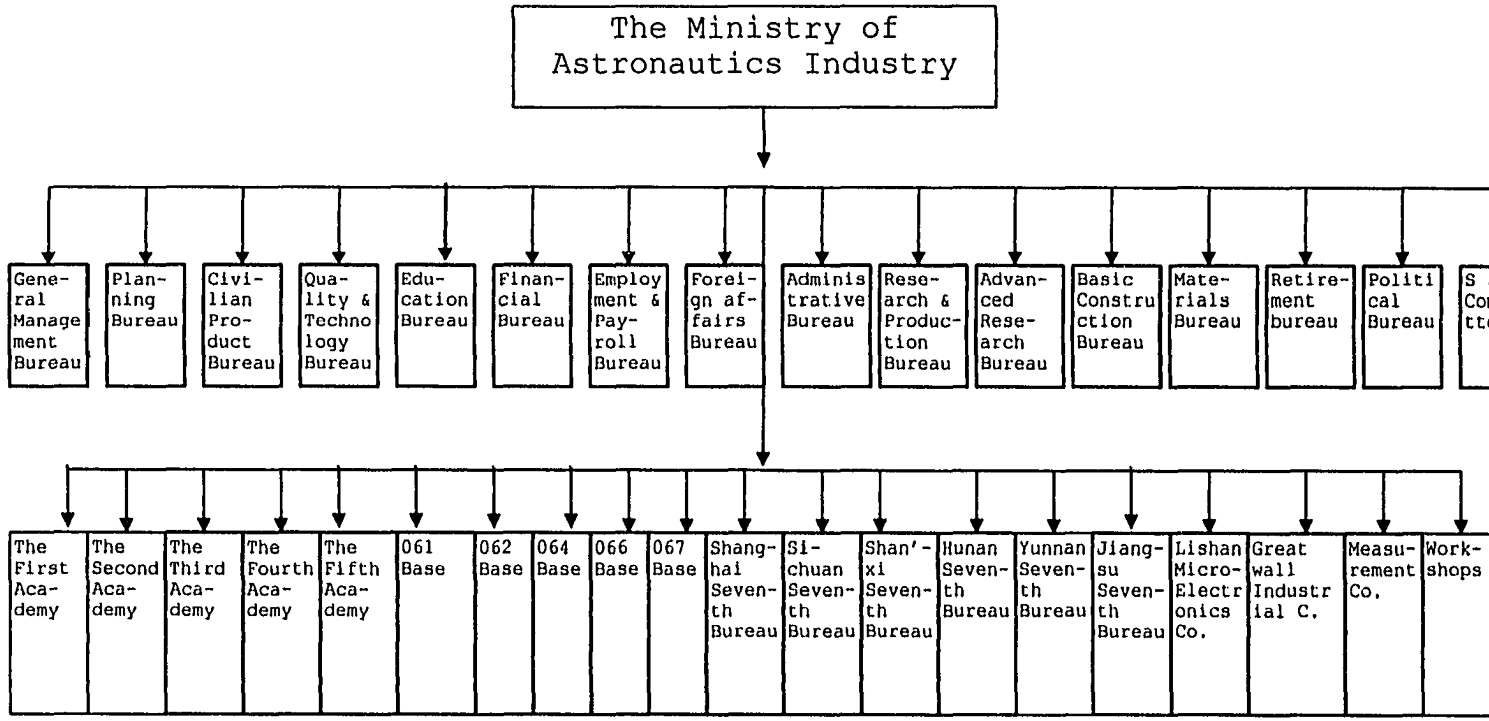

Figure 9.1 Organization Chart of

the Ministry of Astronautics Industry, 1982

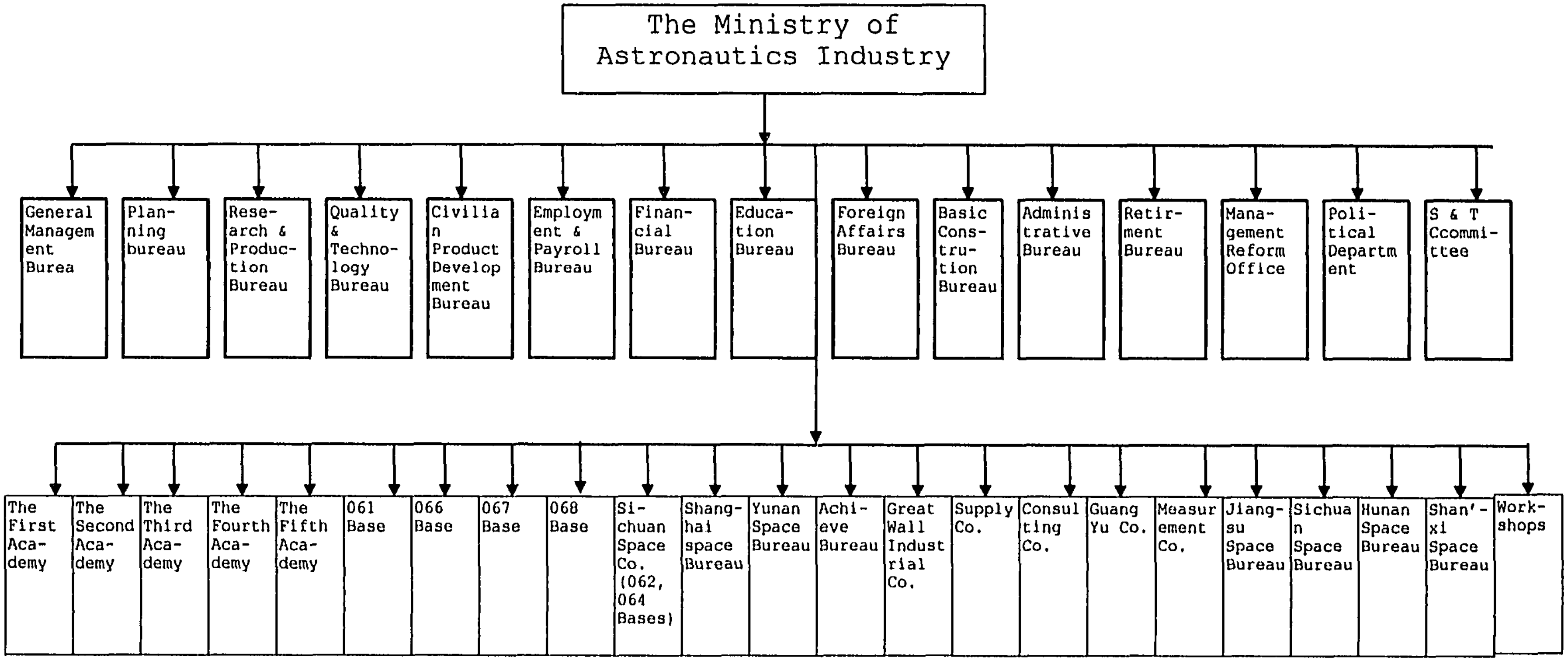

Figure 9.2 Organization Chart of the Ministry of Astronautics Industry, 1986

Certainly, the biggest impact of economic reform on the space program was its requirements that it generate income to support its efforts. This required the program to convert its technology to civilian uses in order to raise income through commercial efforts. To position themselves in both domestic and international markets, all institutions in the Ministry were given a commercial name.

In October 1977, the China Sophisticated Machinery Corporation emerged from the Eighth Machinery Bureau to function as a commercial arm of the Bureau. The Commission of National Industry, Ministry of Foreign Affairs and Ministry of External Trade jointly proposed this arrangement and it was approved by the State Council.

In December 1979, China Great Wall Industrial Corporation(CGWIC) emerged as the commercial window of the Ministry of the Seventh Machinery Industry. The CGWIC was given jurisdiction as a bureau of the Ministry. However, it was to function as a commercial entity responsible for producing civilian products, exporting, marketing and conducting other export-related activities for the Ministry.[11]

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[11] China Great Wall Industry Corporation, *Space In China, Launch Services & Space Technology,* (Hong Kong: Ad Aid Design and Production Company, 1992).

In 1983, in order to provide a visible sign that the institutions under the Ministry were opening to market forces, the First Academy was named Beijing Wanyuan Industrial Company, the Second Academy was named Beijing Chang Feng Industrial Company and the Third Academy was named Beijing Zhen Xing Industrial Company.

Ultimately thirteen institutions were given names that described their named and to be identified functions.[12] They were:

China Academy of Launch Vehicle Technology (formerly the First Academy),a major institute responsible for designing, prototyping and testing Long March boosters.[13] It is located in Nanyuan, Beijing.

China Chang Feng Mechanical and Electronic Technology Academy (formerly the Second Academy), a major institute responsible for designing, prototyping and testing air-defense missiles. Its headquarters are located at Yongding Road, Beijing.

The Sea Eagle Electronic-Mechanical Technology Academy of China (formerly the Third Academy), a major institute

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[12] Most of information, excluding the ones indicated, are compiled from The Ministry of Aerospace Industry, *China Astronautics and Aviation News*, (Beijing: The Ministry of Aerospace Industry, 1990-1993).

responsible for designing, prototying and testing sea-defense missiles. Its headquarters is located at Yungang, Beijing.

The Hexi Industry Corporation (formerly the Fourth Academy), a major institution responsible for designing, prototying and testing solid fuel missiles. Its headquarters are located in Xian and Huhehaote.

The Chinese Academy of Space Technology (formerly the Fifth Academy), a major institute responsible for designing and prototyping all Chinese made various satellites.[14] It is located at Baishiqiao, Beijing.

The China Space Civil Engineering Design & Research Institute (formerly the Seventh Academy), an institution responsible for designing space testing center and launch complexes. It has several bases to oversee the local construction for the space bases. It headquarters is located at Fengtai, Beijing.

The Shanghai Academy of Space Flight Technology (formerly the Eighth Academy), another major institution

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[13] China Academy of Launch Vehicle Technology, *China Academy of Launch Vehicle Technology,* (Beijing: China Academy of Launch Vehicle Technology, 1991).

[14] Chinese Academy of Space Technology, *Chinese Academy of Space Technology,* (Beijing: Chinese Academy of Space Technology, 1992).

which is responsible for designing, prototyping and testing Long March boosters. It is located in Shanghai.

The China Academy of Basic Technology for Space Electronics (formerly the Ninth Academy) It is responsible for conducting research in semiconductor technology. It is located at Nanyuan, Beijing.

The China Jiangnan Space Industry Company Group (Guizhou Base). It is a space-industrial complex in Guizhou province.

The Sichuan Aerospace Industry Corp. (Sichuan Base). It is a space-industrial complex in Sichuan province.

The China Sanjiang Space Group (Hubei Base). It is a space-industrial complex in Hubei province.

The Shaanxi Lingnan Machinery Company (Shaanxi Base). It is a space-industrial complex in Sichuan province.

The China Great Wall Industry Corp. It is a space trading company, defined as "a foreign trade company under the Ministry of Aerospace Industry of China, and is the exclusive organization in China responsible for launch service marketing, commercial negotiation, contract execution and performance with a legal person status.[15]"

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[15] China Great Wall Industry Corporation, *op cit.*

Meeting the Challenge of the Brain Drain

During this stage of the space program, retaining excellent people to work for the space program became a serious issue. In response to the call for economic development, the personnel were divided into two groups: those working on government supported projects and those carrying out commercial activities. Two areas that still receive government support consume 65% of the labor. One area is research and development for both defense and space industry purpose. The other area covers mission-related projects, such as projects to develop particular boosters and satellites. The rest, about 35% of the labor force, is engaged in civilian projects designed to generate commercial benefits. This approach of dividing the labor force into two groups has been implemented in each institution within the Ministry.[16]

It turned out that this administrative approach was an effective remedy for a new environment where the economic changes challenged the traditional operation of the space program. It fulfilled three functions. First, the Ministry managed to generate the necessary funds to support missions that they wanted to continue. Second, the new approach enabled the Ministry to keep high-quality personnel essential for the Ministry's long-run operations and to attract the young generation to join the space force. Third, it introduced an economic orientation, for better or for worse, to stimulate economically-relevant production in the space industry.[17]

While the approach to making the workforce more business focused seems to have worked, the Ministry still faced in 1987 a serious brain drain problem.[18] The following charts suggest that the Ministry needed to attract better educated and younger people.

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[16] Interviews with numerous engineers at Beijing Wan Yuan Industry Corporation and Chinese Academy of Space Technology, 1990-1992.

[17] China Aerospace Corporation, *China Aerospace Corporation*, (Beijing: China Aerospace Corporation, 1994).

[18] Ren Xinmin, et al, *Zhongguo Hangtian Fazhan Zhanlue Yantao, (Yi), (China Space Development Strategy (I))*, (Beijing: Astronautics Publishing House, October 1991), 142-170.

Table 9.1 The Number of the Personnel in

Chinese Academy of Space Technology from 1972-1987

No. of Personnel in 1972	No. of Personnel in 1975	No. of Personnel in 1980	No. of Personnel in 1987[19]
4,700	3,870	3,799	5,325

[19] Here, I use the 1987 date to illustrate personnel status in the middle of the 1980s, due to a lack of data in 1985 and 1986.

Table 9.2 Education Level of the Personnel in Chinese Academy of Space Technology in 1987[20]

Education level	Graduate or above	College	Secondary Technical School	High School	Middle School
No. People (% of total people)	193 (3.62%)	3,509 (65.9%)	1,019 (19.14%)	316 (5.93%)	288 (5.4%)

[20] Ibid.

Table 9.3 Age Distribution in Different Level of Technical Positions in Chinese Academy of Space Technology in 1987[21]

Age	40 years old and less No. of People (%)	41 years old and above No. of People (%)
Senior Technical Position	0 (0%)	652 (12.24%)
Middle Technical Position	227 (4.26%)	2,142 (40.23%)
Junior Technical Position	1,886 (35.42%)	418 (7.85%)
Total	2,113 (39.68%)	3,212 (60.32%)

[21] Ibid.

Table 9.2 shows that the majority of the personnel in the Chinese Academy of Space Technology held an undergraduate college degree. A minority held a graduate level degree. The feeling is that a first-rate technological organization needs more people with advanced levels of education. Certainly, this is a concern that the space community holds for the long-term health leading to technology competitiveness. Also, as Table 9.3 shows, we can see that 60% of the technical personnel in the Academy are more then 41 years old, indicating an aging of the population.

To deal with these challenges, the Ministry adopted three approaches. First, the Ministry established a special graduate program jointly with universities to produce more PhDs and graduate students. These graduate programs are space and aviation oriented and advised by many of the pioneers of the space program. Most the people we mentioned in chapter 4 who began the Chinese space program were recruited to advise doctoral and other graduate students. The degree candidates finish their degree requirements with on-the-job activities, working with real projects.

Second, in order to encourage the young generation to join the space program, the Ministry promoted a number of young engineers who are under thirty-five to senior positions, such as Chief Engineers of a missile or satellite project. For example, when Dr. Zhang Qingwei was promoted as senior engineer, he was only 29 years old. Later, he became the Chief Engineer of Long March IIE when he was about 32.

Third, the Ministry has aggressively recruited graduates from the top universities and tried harder to increase the government quota to have the graduates come to work for the ministry.[22]

Thirty Percent of Revenue from Commercial Activities

When the China space program approached its thirtieth-year anniversary in 1986, there were two big events that took place that shaped its future and challenged its ability to survive. First, there was a systematic defense industry conversion took place. The result was to reduce the central power of the COSTIND to the point that it only deals with defense-related R&D and industrial efforts. This means that

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[22] In China, the government is responsible for arranging the college graduates' distribution in different work areas. Although this role has been diminished during the economic reform because of the competing wages offered by different industries, the government reserves the right

the COSTIND is no longer to be responsible to financially and managerially support all the labor forces and projects, especially the part that generates commercial profits for the defense industries. Decentralized agencies and industries had to be able to plan and manage their future output and to support their labor forces. COSTIND would influence activities of the defense industry through its defense-related budgetary control rather than through a hierarchical management system. This resulted in a freer environment for the space agency on one hand and less support from the central government on the other.

Second, the State Council established a direction for the space agency to address the needs of Chinese society more directly. Space technology development should be more practical than symbolic. It should meet social needs, such as the production of satellites for different civilian applications, (for example, telecommunication, meteorology, weather forecasting, remote sensing and so on). Through these socially and economically pertinent activities, the space agency was expected to generate income to make it more self-sustaining.

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to distribute the graduates from top universities to where it plans to balance the labor force.

This major management reform in the space agency and space industry is called the "one-third system". Thus one-third of the income of the agency/industry comes from the government supplied R&D budget, another one-third from central government contracted projects and one-third from commercial undertakings. By identifying the income sources in this way, the technical and labor forces were also divided into three corresponding parts to conduct different projects.

As a result of the effort from the Ministry to generate income from commercial activities, it transformed itself from a government funded agency to an institution that generated 30% of its revenue by its own means. By the end of 1985, the Ministry set up the following missions for itself. It was: "Working on defense projects and products is our basic mission. Producing civilian products is our major mission." [23] This gave two signals. One is that the Ministry will continue to produce defense products. But, it will also focus on products that can generate economic benefits so that it can support itself. As it is well known, the China space agency and space industry did indeed

[23] Li Xu-er, *Wo Guo Daodan, Hangtian Shiye De Lishi Huigu (A Historical Review of China's Missile and Space Programs)*, A Keynote Speech at the Space Industry Conference held at People's Great Hall in Beijing, 1987.

follow these missions and survived by working out the one-third system during the difficult years of the 1980s.

Conclusion

As China returned to a normal state of affairs at the conclusion of the Cultural Revolution, the space program found itself facing some serious threats. Deng Xiaoping made it clear that society's new priorities were to get rich. Activities that did not contribute directly to economic well-being were not appreciated. Given this new sentiment, the space program faced no assurance of continuing support from government.

The post-Cultural Revolution years from 1976 to 1986 are rather complex from the perspective of the space program. From the late 1970s through the early 1980s, the program was able to live off the momentum developed during its heyday during the Cultural Revolution. From the perspective of Wilson's framework[24] – which holds that successful government programs need to have well-defined missions – it was evident that the missile and space program had three clearly defined missions to achieve at this time: 1) to develop ballistic missile deployment capabilities, 2) to be able to launch missiles from a submarine platform, and 3) to be able to put a satellite into geostationary orbit. The first two missions were achieved by 1982, and the last by 1984.

However, as the old missions were achieved and put to the side, leaders of the space program recognized that the definition of future missions was blurred. With the new priorities that emphasized economic exploits, what role did the space program have to play? Concerns about the future were particularly heightened when Deng Xiaoping announced in 1982 that China had no intention of engaging in a space race with the US or USSR to establish moon bases. Slowly, China's space leaders recognized that they would have to invent new missions for the space program, and these needed to reflect current social and economic realities.

Ultimately, the missions that emerged focused on commercializing the expertise that was embodied in China's space industrial complex. Some were directly space related (e.g., commercializing launch services, developing civilian satellites), while others were not (e.g., using space industry production lines to manufacture automobiles). While the creation of new commercially-focused missions gave

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[24] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It*, (New York: Basic Books,

the space program the direction it needed to operate, these new missions did not hold the excitement embodied in the old ones that addressed noble causes, such as strengthening national defense and bringing prestige to the country. Consequently, under the new regime, people working in the space program developed a weaker sense of mission than in earlier times.

Wilson's framework also stresses that well-functioning government enterprises should have a measure of autonomy and high levels of external support. As we saw in previous chapters, one of the distinguishing features of the space program from 1956 to 1978 was its strength in these areas. The autonomy it experienced during this time enabled its personnel to operate without feeling the turmoil experienced by the rest of society, and as to external support - all the people that counted fully supported the space effort.

However, by the early 1980s, the signals were growing clear. If the space program wanted to survive, it could not depend on strong support from the government. Consequently, leaders in the space industry began the process of orienting its activities to meeting commercial demands. By the late 1980s, the space industry boasted 13 institutes - including the China Great Wall Industrial Corporation - that carried

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1989).

commercial names. Interestingly, by growing financially independent, the space industry was able to maintain a measure of autonomy - so long as it did not pose a financial drain to society, the government did not particularly care about what kinds of activities it wanted to pursue.

Finally, Wilson's framework holds that effective government enterprises must possess the know-how to carry out critical tasks. In the new economic order, it became difficult for the space program to attract the best talent. No longer could it rely on its prestige or support from powerful players to serve as a magnet for China's smartest youth. The sharpest young people sought careers in the private sector, where they could make higher incomes. In order to make its positions more attractive, the leadership of the space industry began promoting younger people to positions of responsibility, and aggressively worked with universities to identify and develop talented workers.

In the 1980s, the space community did an admirable job of adjusting itself to addressing the new realities of economic reform. However, after all is said and done, it was apparent that the space industry had lost a good deal of its glitter. From the perspective of Wilson's framework, its sense of vision had grown blurred, its external support had diminished, and its capacity to attract the talent needed to develop know-how had weakened.

CHAPTER 10

CONCLUSION, CHINA SPACE PROGRAM INTO THE FUTURE

As this dissertation has emphasized, the most remarkable feature of China's space program is that despite continual political, economic and social turmoil, it made remarkable achievements during the 1956-1986 period. Somehow, this Third World country was able to create a top-rank space program in the face of enormous obstacles.

This dissertation has identified two primary sources of strength of the space program that enabled it to experience great achievements. First, throughout the 1956-1986 period, the space program received constant, high-level government support. While Chinese society experienced all manner of social paroxysms in the form of the Anti-Rightist Campaign, the Great Leap Forward, the horrific famine of 1960-62, the Cultural Revolution, and the Economic Reform policies of Deng Xiao Ping, the space program was shielded by powerful champions such as Zhou Enlai, Lin Biao and even the Gang of Four. This is particularly evident when we consider that during the Cultural Revolution, when society ceased functioning normally, the space program achieved some of its most astonishing accomplishments.

Applying Vernon Van Dyke's framework to an analysis of China's space undertaking explains in part why China's leadership offered such strong support for the space program.[1] The earliest support for the program in the 1950s — which focused on the development of missile technology — was derived from the need for military security as well as a desire to convert a technology backward society into a modern one with good scientific and technological capabilities. In addition, China's leadership saw an opportunity to use the space program to regain some of China's ancient glory, lost following the Opium Wars of the mid-nineteenth century.

During the space program's next stage, which overlapped the Cultural Revolution (1966-1976), the space program did well largely because it enabled key political figures - notably Zhou Enlai, Lin Biao, and the Gang of Four - to address their special interests. The space program found itself in the enviable position where all the contending parties involved in the political struggles of the Cultural Revolution supported it, hoping that a close association with it would make them look good. Finally, during the Economic Reform stage, China's leadership supported the program so long as they saw that it addressed their goal to foster social and economic progress.

A second source of strength is tied to the capability of China's space agency and its employees. Each time the space program faced an obstacle — e.g., the removal of Soviet support, dealing with the craziness of the Cultural Revolution, shifting from a military to a commercial orientation — organizational adjustments were made to deal with the new challenges effectively. Beyond this, the employees working in the space program — from its highest leaders to its humblest technicians — demonstrated an intelligence and dedication that pushed the program forward even when its very survival was doubtful.

James Q. Wilson's framework helps explain the mechanism by which China's space program has adjusted to challenges it has faced.[2] By his reckoning, an effective government undertaking needs to satisfy three criteria: first, it needs to possess a well-defined mission; second, it needs to have

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[1] Vernon Van Dyke, *Pride and Power: The Rationale of the Space Program* (Urbana, IL: University of Illinois Press, 1964).

[2] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 1989).

a strong degree of external support; and finally, it needs to possess the know-how required to conduct its affairs. As this study has shown, the space program fared well on each of these criteria in 1956-1986.

Challenges in the 1990s and Beyond

The principal focus of this dissertation is on China's space program during its formative years: 1956-1986. Interestingly, the program may have encountered its most serious challenges during the years of relative stability and prosperity in the 1990s. Four key challenges face the program in the 1990s.

First, the emphasis on continuing economic reform is diminishing the clout and prestige of the space program. While it appears that the program has adjusted to the requirement that it commercialize its activities and become economically self-sufficient, changes in society's values — which now focus on growing rich — reduce the attractiveness of the space program both as a sign of national prestige and as a career option for bright young men and women. With diminished prestige, it becomes more difficult to channel scarce resources to an undertaking that lacks obvious economic pay-offs.

Second, the leaders of the space program must learn how to identify new missions that reflect China's evolving social and economic goals. There are two challenges here:

- The program must become more customer-focused so that it can address the needs of both internal and external clients. Internal clients include such organizations as the Ministries of Meteorology, Telecommunications, Geography, Oceans, and Education. If these organizations see the value of the space program to achieve their goals, then they will support it. External clients include foreign satellite companies and domestic private-sector clients. Again, if these clients see the value of the China space program, they will support it financially by paying for its services.
- The program must not allow itself to lose its technological capabilities. The fact is that the deliverables of the space program are, in some measure, public goods, and as such they need to receive government support. Leaders of the space agency must learn to articulate this aspect of the space program effectively in order to obtain needed government support. This requires that they develop a vision of where the space program should be headed. In the 1956-1986 time frame, there was no need for creative visioning, since the space

program simply followed the lead of the US and Soviet efforts. But today, the US and Soviet programs no longer offer relevant models that can be imitated.

Third, the commercial arm of the space program must operate in a more business-like fashion. Well-publicized failures of its launching and satellite services suggest that it should adopt standard global quality assurance practices. It should develop superior customer-relations skills to deal with both its domestic and international clients. It should become more sophisticated in project financing. It should strive to learn and employ management best-practices.

Fourth, the space agency must become more effective in entering into international cooperative arrangements. It has taken steps in this direction, as is seen in its initiative to establish the Asian Space Agency, its attempts to participate in European space activities, its desire to join the international space station project, and its entering into bilateral cooperative agreements with developing countries. However, China has not been very successful in the area of international cooperation in space. It faces four major obstacles to joining multinational projects, such as the space station:

- Post-Cold War politics make it difficult for China to enter freely into arrangements with Western powers. China's communism, human rights policies, and desire to play a leading role in East Asia frequently place it in a position where it directly confronts the United States, the world's leading space power. The chief concern Americans express about cooperating with China in the space arena is that transferred technology may be employed by the Chinese for military purposes.
- A typical precondition to entering into global cooperative arrangements is the requirement that a country shares the budget burden of the undertaking. However, China is a poor country and is severely limited in the size of any contribution it can make to a multinational space project. The Chinese have argued that they can make an "in kind" contribution by transferring some of their technology to projects. However, owing to the relative backwardness of Chinese space technology — at least in respect to US technology — this has not been viewed as a very convincing argument.
- Because China has been conducting its space program in isolation from the rest of the world, there are problems

of compatibility between Chinese space solutions and those of other countries that have worked together over the years. Thus even if the Chinese have developed a superior piece of equipment, it is not clear how it can be incorporated into larger systems developed by its space partners.

- China's foreign policy in an era of economic reform may make it difficult to enter into agreements that do not demonstrate a clear high return on investment. For example, while the space agency may favor the creation of an Asian Space Agency or entering into a partnership with Brazil to develop meteorological satellites, it may not receive support from other government players to pursue these interests concretely.

Final Word

China's remarkable achievements in space in 1956-1986 reflect its peculiar historical circumstances. On the one hand it perceived itself to be a great power. Its greatness was rooted in its historical accomplishments, its geographic and demographic size, and its confidence that it possessed human talent second to none. From the leaders' point of view, if China were to realize its great power stature in today's world, it would need to become a member of the international space "club." They set their eyes on the accomplishments of the dominant super powers at that time - the US and USSR. By studying lessons from these two model countries, they designed an approach to achieve world-class space capabilities. This is perhaps the single most pronounced lesson that a student of China's space history can gain.

On the other hand, at the time China possessed aspirations to be a space power, it was a third world country in turmoil! In large measure, this is what makes the story of China's space program so interesting. China was determined to join the space club even though this required the country to overcome tremendous economic, social and political obstacles. If the country were to perform at the same level as the US and Soviet players, they would have to reinvent the steps needed to acquire space capabilities to match their unique circumstances. And this they did.

Appendix

A CHRONOLOGY OF SPACE EVENTS IN THE PEOPLE'S REPUBLIC OF CHINA 1956-1986[1]

In 1956

On Jan. 25, the Supreme State Conference (SSC) was held in Beijing. Mao Zedong announced that "China should have a long term plan aimed at changing the backwards state of China's economy, science and civilization. It should allow China to step into the international community rapidly."

On Jan. 31, Zhou Enlai called for "advancing science and technology in China" at the Chinese People's Political Consultative Conference (CPPCC).

On Feb. 17, after a few months back from the U.S., Dr. Qian Xuesen made his historical proposal to the Central Government, entitled *A Proposal to Establish China's Defense*

Aviation Industry. It provided important technical guidelines to develop rockets and missiles in China.

In Mar., the State Council formulated *A Long Term Plan for Science and Technology Development Between 1956 - 1967.* This plan claimed China would develop independent missile technology and jet propulsion technology within twelve years.

In Apr., the Aviation Industry Committee (AIC) was established. It became a central organization responsible for the development of aviation and rocketry in China. Nie Rongzhen, a Vice Premier of the State Council, became the first Chairman of this Committee.

On May 10, Vice Premier Nie Rongzhen submitted a proposal to the Central Party Committee of the Chinese Communist Party (CPCCCP or CPC), entitled *An Initial Proposal to Establish Missile Technology Research in China.*

On May 26, the Central Military Committee of Chinese Communist Party (CMCCCP or CMC), chaired by Premier Zhou Enlai, approved Nie's proposal. The Aviation Industry Committee (AIC) began to establish the Fifth Bureau of the Ministry of Defense (the Fifth Bureau, also known as the Bureau of Missile Management of the Ministry of Defense,

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[1] Compiled from major Chinese publications, such as Xie Guang (1992), Liu Jiyuan (1989), Nie Li and Huai Guomou (1989), Zhang Jun (1986) and Nie Rongzhen (1984).

BMMMD) and the Fifth Academy of the Ministry of Defense (the Fifth Academy).

On July 2, the Fifth Bureau proposed acquiring Soviet assistance to the CPC. Assistance included research, manufacturing and maintenance for the missiles.

On July 17, Vice Premier Li Fuchun sent a letter to the Chairman of the Ministers Conference in Soviet Union. The letter contained a request for a missile technology assistance program.

On Aug. 30, Zhong Fuxiang and Qian Xuesen proposed acquiring foreign assistance to develop China's program from AIC. They also provided plans for management, near-term missions, personnel and manufacturing issues.

On Oct. 8, the Fifth Academy of the Ministry of Defense (the Fifth Academy) was fully established in Beijing. It occupied a former military hospital west of Beijing.

Zhong Fuxiang was appointed Director of the Fifth Bureau. Qian Xuesen was appointed First Deputy Director, Chief Engineer, and Lin Shuang was Deputy Director and Deputy Chief Engineer. Qian Xuesen also was Director of the Fifth Academy, and Bai Xueguang was his Deputy.

On Oct. 15, Nie Rongzhen sent a report to CPC, proposing a policy to build China's missile program. He suggested that this policy should be "mainly self-reliant, but should acquire some foreign assistance to employ technology developed in the Western countries." On Oct. 17, Mao Zedong approved this proposal. Later, this policy became the working principle for the Fifth Academy.

On Nov. 23, Nie Rongzhen approved the establishment of ten research laboratories by the Fifth Academy. These were the:

- General Design Laboratory (Ren Xinmin, Director)
- Air Dynamics Laboratory (Zhuang Fenggan, Deputy Director)
- Structural Strength Laboratory (Chu Shouer, Director)
- Engine Laboratory (Liang Shouye, Director)
- Propulsion Laboratory (Li Naiji, Director)
- Control System Laboratory (Liang Sili, Deputy Director)
- Control Components Laboratory (Zhu Jingren, Deputy Director)
- Radio Laboratory (Feng Shizhang, Deputy Director)
- Computing Technology Laboratory (Zhu Zheng, Deputy Director)
- Technological Physics Laboratory (Wu Deyu, Deputy Director)

On Dec.29, A Handing Over Ceremony for two Soviet P-1 missiles was held in Beijing.

In 1957

On Mar. 1, Nie Rongzhen, the Vice Chairman of the Central Military Committee, approved dismantling the Fifth Bureau of the Ministry of Defense, and merging it into the Fifth Academy.

On Mar. 18, Dr. Qian Xuesen announced the working principles for the Fifth Academy. The Academy's main missions were to design and manufacture surface-to-surface missiles, surface-to-air missiles and unmanned aerial vehicles. The imitated design for P-1 missile began.

On Apr. 2, the Fifth Academy signed a contract with the Beijing Aviation Institute (Bei Hang) to build a supersonic wind tunnel.

On June 1, the First Institute of the Ministry of Second Machinery Industry (the Second Ministry) was established and was responsible for designing missile research facilities.

On June 9, the Fifth Academy signed contracts with Qinghua University and the Beijing Aviation Institute to arrange for training courses and exchange programs for research.

On Oct. 15, a Chinese delegation, let by Nie Rongzhen, signed a historic pact with the Soviet Union. In this pact, the Soviet Union agreed to provide missile and aviation technology assistance to China. The Soviets promised to provide missile samples, technical documents and missile experts for the Chinese missile program. They also promised to increase the numbers of Chinese exchange students in the specialty of rocketry.

On Nov. 9, the Fifth Academy proposed to establish two sub-academies within the Academy.

On Nov. 11, Nie Rongzhen approved the Fifth Academy proposal to establish the First Sub-Academy, responsible for missile system and engine designs, and the Second Sub-Academy, responsible for missile control systems. The First Sub-Academy was located in Yungang, Beijing. The Second Sub-Academy was located in Yongding Road, Beijing.

On Nov. 16, Qian Xuesen was appointed Director of the Fifth Academy and Director of the First Sub-Academy. Wang Zheng was appointed Deputy Director of the Fifth Academy and Director of the Second Sub-Academy.

On Dec. 24, two P-2 missiles and their ground equipment were shipped to Yungang, Beijing.

In 1958

On Jan. 9, the Fifth Academy made *A Plan to Develop Jet-Propulsion and Missile Technology in Ten Years (1958-1967)*. The major projects in this plan were to build middle-range surface-to-surface, surface-to-air, coast-to-ship and inter-continental missiles, and research advanced solid fuel engine and satellite technology.

On Jan. 18, according to an agreement made between China and the Soviet Union on Oct.15, 1957, the Fifth Academy signed documents with a Soviet delegation to gain Soviet assistance to organize the First and the Second Sub-Academy and a missile assembling factory.

In Jan., Dr. Qian Xuesen, also Director of the Mechanics Institute at the Chinese Academy of Sciences (CAS), and Zao Jiuzhang, Director of the Earth Physics Institute at CSA, proposed that China should begin its satellite technology research. They were authorized to make a plan for the development of satellite technology. The effort was terminated toward the end of 1959 due to lack of experience, technology reserve and funds.

In Apr., construction began on China's first launch site in Jiu Qun, Gansu Province.

On May 17, at the Second Plenary Session of the Eighth Central Party Committee of the Chinese Communist Party, Mao Zedong said: " We must build an artificial satellite too."

On June 19, a meeting was held on sounding rocket and satellite projects. The panel members were Zhang Jingfu, Qian Xuesen, Wang Zheng, Wan Yi, Liu Yiuguang, Shun Jnren, Wang Shiguang and Chai Jintao. They decided that China should launch 50-70, 250 and 500 Kilometer high sounding rockets by 1959 and a 1,000 kilometer high sounding rocket by 1961.

On Sept. 19, the Fifth Academy regulated the following code names for rockets and missiles:

"Heping" (HP, Peace) for meteorological sounding rockets.

"Dongfeng" (DF, East wind) for surface-to-surface missiles.

"Hongqi" (HQ, Red flag) for surface-to-air missiles.

"502" for Soviet P-1 missile.

"1059" for Soviet P-2 missile.

"543" for Soviet C-75 surface-to-air missile.

"542" for Soviet C-2 coast-to-ship missile.

On Sept. 30, the Missile Assembling Factory was established in the Ministry of the First Machinery Industry (the First Ministry).

On Oct. 17, six P-2 missiles acquired from the Soviets were shipped to Beijing.

In Oct., the Commission of Science and Technology for National Defense (CSTND) was established. AIC was merged into this commission. Nie Rongzhen was appointed Chairman, and Chen Geng, Liu Yalou, Zhang Aiping, Wan Yi were Vice Chairmen.

In Oct., Mao Zedong, Liu Shaoqi, Zhou Enlai and Nie Rongzhen attended at an *Exhibition on Early Development of Space Science and Technology*.

On Nov. 27, two Soviet C-75 surface-to-air missiles and their facilities arrived in Beijing.

In 1959

On Jan. 6, six Soviet P-2 missiles arrived in Beijing.

On Feb. 24, another historic agreement was signed between the Chinese and the Soviets. In this agreement, the Soviets would provide technical assistance on the C-2 coast-to-ship missile, the II-15 ship-to-ship missile and the P-II M submarine missile projects.

On Mar. 31, the Fifth Academy appointed Liang Souye Chief Engineer for "1059" missile project.

On May 3, Qian Xuesen held a meeting on "Heping-1" (HP-1) sounding rocket. The First Sub-Academy of the Fifth Academy would be responsible for this project.

On June 20, the Soviet Central Party Committee sent a letter to the Chinese Central Party Committee, claimed to terminate some missile projects. The Soviets stated that it would have a negative impact on the negotiation of the Nuclear Non-Proliferation Treaty between the Soviets, Americans and the British.

On July 16, the Fifth Academy issued codes for the Soviet derived missiles. "1060" was for the Soviet P-II M submarine missile and "544" for the Soviet II-15 ship-to-ship missile.

On Sept. 10, the Fifth Academy appointed Zhang Lizhong Chief Engineer for project "543."

On Dec. 18, the Fifth Academy proposed *A Plan for Missile Research and Design from 1960-1967*. The plan proposed that China first build middle-range surface-to-surface, surface-to-air, air-to-air missiles, then continental, ship-to-surface, ship-to-air, air-to-surface, air-to-ship missiles and a satellite.

In Dec., the Central Party Committee decided to establish a research and manufacturing center for surface-to-air missiles in Shanghai.

<u>In 1960</u>

On Feb. 12, Qian Xuesen held a meeting about missile fuel made in China.

On Feb. 19, the first sounding rocket, "T-7M," made by Shanghai Electro-mechanics Institute, was launched successfully.

On Mar. 3, Xu Lanru was appointed Chief Designer, Ren Xinmin and Huang Weilu as Deputy Chief Designers.

On Mar. 7, the Fifth Academy decide to develop "Dongfeng-2" (DF-2), a middle-to-short range missile. Its design would advance the "1059" design.

On Mar. 18, Liu Yalou, Commander of the Air Force, was appointed Director of the Fifth Academy. Wang Bingzhang, Deputy Commander of the Air Force, was appointed Deputy Director. Qian Xuesen was appointed Deputy Director.

On Mar. 21, the first Chinese made test facility for liquid fuel missiles was completed.

On May 10, Liang Shouye was appointed Director of the Institute for Engine Burn Processes of the Fifth Academy.

On May 18, Liu Xun was appointed the Director of the First Sub-Academy.

On May 28, Mao Zedong examined the T-7M sounding rocket.

On May 30, Qian Wengi was appointed Chief Designer for "543" missile and Xu Qinbo as Deputy Chief Designer.

In May, It was decided that Shanghai would be the center to design and produce surface-to-air missiles.

On June 18, the Fifth Academy confirmed *A Plan to Develop Missile Technology from 1960-1967.* The goal of this plan was to achieve essential configuration technology in three years, to complete a system for missile design, production and manufacture in five years and to be completely independent in eight years.

On June 28, the Fifth Academy decided to test "1059" missiles about Oct., 1 and independently design 2,000 Km surface-to-surface missiles before 1962. The Central Military Committee approved this decision.

Zhang Lizhong was appointed Chief Designer for the "542" missile project.

In July, the National Defense Industry Conference held in Beidai He, and the conferees decided to terminate the "542" missile project and concentrate on "544' missile project.

On Aug. 12, the Soviets withdrew all their experts assisting the Chinese with their missile program.

On Aug. 14, Nie Rongzhen confirmed "mainly self-reliant" policy to the Fifth Academy for developing Chinese missile program.

Gu Guangshan was appointed Deputy Director of the Fifth Academy.

On Aug. 17, Li Tongli was appointed Chief Designer for the "544" missile project, and Xie Guangxuan as Chief Designer for the "1060" missile project.

On Sept. 13, the Central Military Committee approved a policy on developing nuclear warhead and missile programs. It said that "Nuclear and missile programs should be the priorities. However, the missile program is top priority."

In Sept., the Design Committees for the "Hongqi-1" (HQ-1), the "Dongfeng-1" (DF-1) and the "Dongfeng-2" (DF-2) missile projects were established.

In same month, T-7 meteorology sounding rocket was successfully launched.

On Oct. 21, the Central Military Committee approved a report from the Fifth Academy. In this report, the Fifth Academy decided to continue the missile program independently in case the Soviets withdrew all the assistance.

On Nov. 5, the first Chinese built "1059" missile was successfully launched and flew 550 Km to its target. This test was followed by two more successful tests on December 6 and 16.

During this year, Chinese leaders both from the Central government and the Central Military Committee inspected the Fifth Academy and its institutes. Included here were Mao Zedong, Luo Ruiqing, Peng Zhen, Yang Chengwu, Deng Xiaoping, Chen Yi, Bo Yipo, Liu Lantao, Lin Biao, Nie Rongzhen, He Long, Zhang Jingfu, Wang Bingzhang and Li Fuchun.

In 1961

On Jan. 12, CSTND held a conference for planning research on a various fuels.

On Jan. 27, the Fifth Academy merged two Design Committees for DF-1 and DF-2 into the Design Committee of the Dong Feng Family of Missiles.

From Feb. to May, CSTND and the Fifth Academy arranged many cooperative projects on fuels, materials, and sophisticated electronic components with other ministries for industry and government agencies.

On May 15, CSTND and the Commission of National Defense Industry (CNDI) decided to empower managerial functions of the Chief Designers.

On July 17, Nie Rongzhen gave a speech to administrators, managers and engineers in the Fifth Academy. He proposed a set of management principles for scientific research projects, which later had a great impact on Chinese scientific research management. His principles are reflected in *Fourteen Principles on the Management in the Scientific Research Institutions.*

On July 28, CSTND approved the design of the DF-2 surface-to-surface missile.

In July, He Long and Nie Rongzhen held a National Industry Conference. During the conference, a controversy developed as whether China should continue the nuclear and missile programs became a controversy. A strong confidence in these two program was expressed by the people from CSTND, the Fifth Academy and the organization that worked on the nuclear program. The majority of people in the conference supported these two program. Later, this position was supported by Mao Zedong and Zhou Enlai.

On Sept. 1, the Third Sub-Academy of the Fifth Academy was established. It was responsible for research and testing on air dynamics, liquid engine and collision pressure engines.

On Sept. 30, the Fifth Academy approved that the First Sub-Academy establish Strength Institute, Material Institute, and Testing and Measuring Institute.

On Nov. 14, the Central Military Committee decided to transfer the Jiuqun launch site to the Fifth Academy.

On Dec. 22, the Fifth Academy decided to establish the Office of Chief Designer for surface-to-surface missile projects, and for surface-to-air missile projects.

On Dec. 28, the Fifth Academy sent a report to establish technological management system on project designers. According to this report, every missile project would have a chief designer, deputy chief designer, executive designer, senior designer and designer.

In 1962

On Jan 6, the Chinese-made engine for the "543" missile was qualified by its first test.

On Jan 24, CSTND required the Fifth Academy to define the relationship between chief designers and administration, as well as their relationship with the Committee of Science and Technology.

Lin Shuang was appointed Chief Designer for surface-to-surface missile project. Qian Wenji was appointed Chief Designer for surface-to-air missile project.

On Feb. 2, the Fifth Academy established the Committee of Science and technology. Qian Xuesen was the Chairman.

On Feb 24, Zhou Wei was appointed Deputy Director of the Fifth Academy and Qian Wenji was appointed Chief Designer for HQ-1.

On Mar. 9, Sun Jixian was appointed Deputy Director of the Fifth Academy.

On Mar. 21, Chinese produced DF-2 was launched at Jiuqun site. After 69 seconds of flight, the missile crashed near the launch site.

On Apr. 9, Nie Rongzhen held a meeting about DF-2. He encouraged the people to work on, and requested a technical investigation.

On Apr. 21, according to Nie Rongzhen's request to empower technical management leadership, Qian Xuesen began to organize three technical leading groups. Lian Shonyi became the leader of the Planning Group. Chu Souer was the leader of the Surface-to-Surface Missile Group. Wu Shueping was the leader of the Surface-to-Air Missile Group.

On May 17, the Fifth Academy decided that it should concentrate on the DF-1 and the DF-2 surface-to-surface missiles, promoting the "543" surface-to-air missile design, and improving solid fuel engine research.

On June 8, after a hearing on missile research, Mao Zedong said that research on high technology weapons should improve.

On June 10, Wang Bingzhang was appointed Director of the Fifth Academy.

On June 30, Zhou Enlai inspected the "543" missile assembling factory.

On Sept. 18, Lin Shuang was appointed Chief Designer for the DF-2, and Chu Shouer Deputy Chief Designer. Qian Wenji was appointed Chief Designer for the "543" missile and Wu Zhang Deputy Chief Designer.

On Oct. 25, CSTND, the State Commission for Science (SCS) and the State Commission for Economy (SCE) held a joint conference. It was held to coordinate the material manufacture for the Fifth Academy's needs. During this conference, the contracts were signed for about 2,000 materials.

On Nov. 8, the Fifth Academy issued its managerial regulations, containing ten chapters and seventy principles.

On Nov. 21, Li Fuze was appointed Commander of Jiuqun Launch Site.

On Dec. 26, the Fifth Academy approved the Shanghai Academy for Electric Motor Design to continue the following projects: to research and test T-7A sounding rocket; to start research on solid fuel sounding rockets; to modify the "1059" to the HP-1, and to be prepared for satellite project.

On Dec. 29, Vice Premier Bo Yipo held a meeting to coordinate manufacturing components for the Fifth Academy. The participants included representatives from the State Commission for Planning (SCP), SCE, CNDI, CSTND and other Ministries for Industry. He requested that all the Ministries for Industry should arrange productions to meet the Fifth Academy requests.

In 1963

On Jan. 1, the Shanghai Academy for Electric Motor Design merged into the Fifth Academy.

On Jan. 11, Bo Yipo held a meeting among the Ministries for Industry. He required that all contracted manufactures should guarantee the supplies for the missile and nuclear programs. The Central Government Inspection Group was formed. It was authorized to report their inspection results directly to Mao Zedong.

On Jan. 28, Zhou Enlai inspected surface-to-air missile manufacturing in Shanghai.

On Feb. 15, thirteen inspection working groups, organized by SCE, went to five regions of China to inspect manufacturing progress on missiles and nuclear bombs.

On Feb. 19, Huang Weilu was appointed Deputy Chief Designer for the DF-2 project.

On Mar. 14, the Central Party Committee approved that missiles and nuclear bombs were priorities. The missile would be the top of priority.

On Apr. 2, the Committee of Science and Technology of the Fifth Academy held its first annual meeting, chaired by Qian Xuesen. During this meeting, the participants discussed the technical strategies for developing surface-to-surface missiles, surface-to-air missiles and coast defense missiles.

On June 7, the first Chinese-made "543" was launched successfully, and the second one on July 2.

On July 2, Chen Yi and Nie Rongzhen inspected the factory and sub-academies of the Fifth Academy.

On July 18, the Office of Deputy Chief Designer was established in Shanghai. Ying Juntian was appointed Deputy Chief Designer for the DF-2.

On Aug. 12, four T-7 meteorology sounding rockets were launched successfully.

On Oct. 5, Liu Lin was appointed Chief Designer for the "544" missile.

On Oct. 10, the Fifth Academy sent a report to CSTND. In this report, the Academy committed to complete the DF-2 (1,000 Km range) project by 1966, the "Dongfeng-3" (DF-3, 2,000-3,000 Km range) project by 1970, modified and advanced the "543" by 1968 and modified the "544" to coast-ship defense missile.

On Oct. 25, SCE and CNDI held a meeting to coordinate the contracts for the "543" missile. 3,820 out of 3,840 items initiated by the Fifth Academy were contracted out.

On Nov. 1, the Missile Force shot down a U-2 American reconnaissance plane with a C-75 missile.

Dec. 15, Nie Rongzhen asked the Fifth Academy to study the U-2 reconnaissance plane.

On Dec. 22 - 27, two T-7A meteorology sounding rockets were launched successfully and the payloads reached 130 Km altitude.

On Dec. 26, Beng Zen inspected the testing station in the Fifth Academy and a test demonstration on the DF-2 engine.

In 1964

On Jan. 6, SCP, SCE, CNDI and CSTND held a joint meeting in Beijing. In this meeting, *A Plan for Development of Missile Industry from 1964-1980* was produced.

On Jan. 15, the Fifth Academy produced *A Plan for Development of Missile technology from 1963-1980.*

On Feb. 6, Mao Zedong met Qian Xuesen and other scientists. As they talked about the anti-missile system project, Mao said that China should make the anti-missile missiles.

On Mar. 2, the Air Dynamics Professional Group was established in CSTND and Qian Xuesen chaired the group.

On Mar. 13, Advanced Weapon Systems Committee (AWSC) of the State Council, decided to establish two offices in CSTND. One is responsible for missile projects, and other is responsible for the nuclear bomb.

On Apr. 4, the Fourth Sub-Academy in the Fifth Academy was established.

On Apr. 22, Qian Wenji was appointed Chief Designer for the HQ-2, and Wu Zhan, Chen Huaijin and Li Yunzi as Deputy Chief Designers. Lin Suang was appointed Chief Designer for the DF-3, Chu Shouer, Ren Xinmin, Huang Weilu and Wu Deyu as Deputies.

On Apr. 29, CSTND proposed to the Central Party Committee that China launch its satellite in 1970 or in 1971.

Chinese HQ-1 missile was launched successfully.

On June 12, the Central Special Committee (CSC) of the Central Party Committee held a coordination conference for the joint test for a missile with a nuclear bomb.

On June 29, the DF-2 missile was launched successfully. There were seven other successful launches in July, Sept. and Oct..

On July 19, Shanghai Academy for Electric Motor Design successfully launched first biological experiment rocket, "T-7A."

On Nov. 23, the Ministry of the Seventh Machinery Industry (the Seventh Ministry) was established based on the Fifth Academy. It is also called the Ministry of Missile Industry. Wang Bingzhang was appointed as the Minister.

On Dec. 5, Liu Youguang, Qian Xuesen, Liu Bingyan and Gu Guangshan were appointed Vice Ministers for the Seventh Ministry.

On Dec. 30, the Seventh Ministry proposed to CSTND to begin research on anti-missile systems.

In this year, the Fifth Academy mandated regulations on testing and measurement, contract management, factory management and other regulations.

The following people inspected or visited the Fifth Academy and its institutions in this year: Beng Zen, Yang Chenwu, Deng Xiaoping, Li Fuchun, Bo Yipo, Zhu De, Dong Biwu and Nie Rongzhen.

In 1965

On Jan. 4, the Seventh Ministry adjusted the First, Second, Third and Fourth Sub-Academies in the Fifth Academy to became the First, Second, Third, and Fourth Academy in the Ministry.

On Feb. 3, Zhou Enlai held the Tenth Meeting of CSC. It decided to take on the responsibility for managing nuclear bomb and missile projects.

On Feb. 19, an office for building the 061 base was established.

On Mar. 20, Zhou Enlai held the Eleventh Meeting of the CSC. It discussed the issues regarding the "Dong Feng" missiles.

On Mar. 27, Cao Guanglin was appointed Vice Minister of the Seventh Ministry.

On Apr. 9, an Office for building the 062 base was established.

On Apr. 16, one DF-2 was successfully launched.

On Apr. 19, Chen Huaijin was appointed Chief Designer for the HQ-2 surface-to-air missile project, Li Po as Deputy.

On Apr. 23, Liang Shouye was appointed Chief Designer for the "Haiyin-2" (HY-2) land-to-ship missile project.

On Apr. 30, Lin Yi was appointed Director of the Third Academy of the Seventh Ministry. Lin Shuang was appointed Director of the Fourth Academy of the Seventh Ministry.

On May 4, Zhou Enlai held the Twelfth Meeting of CSC. It decided to speed research and production on surface-to-air, coast-to-ship missiles, anti-missile system and satellites.

On May 28, Xiao Karen was appointed Deputy Director of the Second Academy of the Ministry and Director of the Shanghai Bureau for the Second Electric Motor.

On June 19, two HQ-2 missiles were launched successfully.

On June 29, HQ-2 was successfully launched to a target.

On June 30, an Anti-Missile Research Institute was established in the Seventh Ministry.

In June, the 063 Base began construction in Ningxia Province.

On Aug. 6, the Seventh Ministry proposed *A Plan for Science and Technology Development for National Defense from 1966-1972.* In this plan, it would complete a finalized design for the "Dongfeng-2A" (DF-2A) in 1966, the DF-3 in 1969, the "Dongfeng-4" (DF-4) in 1971, the "Dongfeng-5" (DF-5) in 1973. It also planned other projects, such as the "Hongqi", the "Haiyin" and the "Heping" family of missiles.

On Aug. 9 -10, Zhou Enlai held the Thirteenth Meeting of the CSC. The issues addressed included the "Hongqi," the "Haiyin" and the anti-missile system projects.

On Sept. 20 -30, CSTND entrusted the Chinese Science Academy to host a conference on the system design for the first satellite.

On Nov. 21, four "T-7A" meteorology sounding rockets were launched successfully to the altitudes ranging from 65 Km to 98 Km.

On Nov. 27, Dec. 4 and Dec. 11, three HQ-1, made by the Shanghai Second Bureau of Electric Motor Design, were launched to their targets. However, one was not successful.

On Dec. 29, Zhou Enlai held the Fourteen Meeting of CSC.

In 1966

On Jan. 6, a series of eight flight tests for the DF-2A were completed, which had begun on Nov.13, 1965. Seven of these test flights were successful. The tests provided the data and experience necessary for a combined system test for nuclear warhead missile.

On Jan. 17, the Seventh Academy was established.

On Jan. 29, a model of "Hongqi-3" (HQ-3) was launched successfully.

In Jan., the 651 Academy (Satellite Academy) was established within the Chinese Science Academy.

The Seventh Ministry began research on a recoverable satellite.

On Feb. 20, CSC decided to list "Hongqi-61" (HQ-61) on the Central Government Plan.

On Mar. 2, the first model of HQ-61 was launched successfully.

On Mar. 11, Zhou Enlai held the Fifteenth Meeting of CSC. They discussed relevant issues about combined nuclear bomb and missile test.

On Mar. 18, CSTND decided to equip the Chinese armed forces with the HQ-1 missiles.

On Mar. 23, CSTND approved a research project on an air-to-ship missile, and named it "Fenglei-1" (FL-1).

On Apr. 10, a DF-2 was launched successfully.

On May 14, a DF-3 experienced a launch failure.

On May 16, the Central Party Committee launched the Cultural Revolution in China.

On May 18, two HQ-2 were launched successfully.

On May 31, CSTND, the Seventh Ministry and Chinese Science Academy held a meeting on issues for Chinese satellites. The panel members were Lou Sunchu, Wang Binzhang, Qian Xuesen, Zhang Jinfu and Bei Lisheng. They decided the first Chinese satellite would be launched in 1970. The carrier would be a modified DF-3, named "Changzheng-1" (CZ-1), and the satellite named "Dongfanghong-1"(DFH-1).

On June 30, Zhou Enlai inspected the Jiu Qun launch site, and observed a launching of a "1059" missile.

On July 15, one "T-7A" sounding rocket for biology research was launched successfully with a male dog, "Xiaobao." The second launch, with the female dog "Shanshan" on July 18, was also successful.

In July, the Seventh Ministry began to work on the "Dongfeng-6" (DF-6), a continental missile.

On Aug. 9, DF-2A flight tests began, and five were launched successfully before testing ended on Sept.15.

On Aug. 18, CSTND approved research for the "Heping-2" (HP-2) solid fuel sounding rocket.

On Sept. 25, the Sixteenth Meeting of CSC was held.

In Sept., the people in the Seventh Ministry divided into two political groups. One named the "915 group," established on Sept.15, and the other the "916 group," established on Sept.16. Research, design and manufacture work in the Ministry went into a chaos due to political struggle between these two groups.

On Oct. 7, a DF-2A was launched successfully.

On Oct. 12, HY-2 was renamed as HY-1. HY-3 was renamed as HY-2. The original code HY-1 for "542" was omitted.

On Oct. 27, the combined nuclear warhead and missile test was successful. Before the test, Zhou Enlai requested that the test should be "serious and conscientious, thoughtful and careful, reliable and secured, no risk at all." Later, this request became a motto for the research and testing of the high technology weapon and civilian engineering systems in China.

On Nov. 9, eight out of nine "Shangyou-1" (SY-1) missiles were launched successfully.

On Dec. 17, six HQ-2 were launched successfully.

On Dec. 26, a DF-3 was launched successfully.

On Dec. 28, a HY-1 failed a launch test, and there was another failure on Jan.6, 1967.

In Dec., CSTND approved to research and design on the DF-6.

In 1967

On Jan. 22, People's Daily issued a headline article entitled *Proletariat Unite, Seize Power from Capitalists in Power.* The people's political groups in the Seventh Ministry took control of the Ministry.

On Jan. 28, CSTND approved the "Heping-3" (HP-3) sounding rocket research project.

On Mar. 17, Zhou Enlai, Li Fuchun, Nie Rongzhen and Ye Jianying held a meeting in Zhongnanhai. They met the representatives from the defense industries, and announced that the power of the ministries belongs to the Central Government. Nobody would be allowed to seize the power, and the seized power should be returned to the Ministries. Meanwhile, they announced that a martial law would be issued to stabilize the Ministries working for defense industries.

On Mar. 23, CSTND approved research and production of the "Feng lei-1" (FL-1) air-to-ship missiles.

On Mar. 26, CSTND contracted a project on building missile-nuclear submarine to the Ministry of the Sixth Machinery Industry (the Sixth Ministry).

On Mar. 27, CSTND approved the DF-61 project, a solid fuel surface-to-surface missile.

On Apr. 2, the HQ-3 failed a launch test, but flew successfully on May 9.

On May 17, CSC held the Eighteenth Meeting. The meeting discussed about the issues of ground launch facilities.

On June 17, a HP-3 meteorology sounding rocket was launched successfully.

On June 27, the Central Military Committee approved the establishment of the Chinese Space Technology Academy (CSTA).

On Sept. 29, a HY-2 was successfully launched.

On Oct. 12, a meeting was held on the anti-missile system in Beijing.

On Oct. 21, a HY-1 was launched successfully.

On Oct. 27, the second launch of HY-2 was successful.

In Nov., CSTND held a meeting on the continental missile project.

On Dec. 24, three HQ-3 test missiles were launched successfully.

On Dec. 28, a "Heping-4" (HP-4) meteorology sounding rocket was launched successfully.

In Dec., CSTND held a working meeting for the first satellite.

In 1968

On Jan. 4, the Nineteenth Meeting of CSC decided that the DF-4 project was a high priority.

On Jan. 17, the Central Military Committee approved employing "Yuanwang" measurement fleet for testing the launch of the DF-5 continental missiles.

On Jan. 22, according to the request from the Seventh Ministry, the Navy decided to modify the "31" missile submarine for underwater launching of the "Jiulong-71" (JL-71) missiles.

On Feb. 20, the Chinese Space Technology Academy (CSTA) within CSTND was established, Qian Xuesen was appointed Director.

In Apr., the Seventh Ministry held a meeting on the JL-71 project.

On May 10, the 066 Base was established in the Seventh Ministry.

On Aug. 8, a "T-7A" three stage sounding rocket, with one solid-fuel stage, was launched successfully. It reached an altitude of 311 Km.

On Oct. 12 and 15, two HY-2 missiles were launched successfully.

On Dec. 18, the first DF-3 was launched successfully.

<u>In 1969</u>

In Jan., the Fifth Academy began to research and design a sea navigation satellite, the "Dengta-1" (DT-1).

Zhou Enlai met with representatives from the Central Bureau of Meteorology, and announced that China should have its own meteorology satellite.

On Apr. 11, the Central Military Committee approved the "Hongqi-4" (HQ-4) surface-to-air missile as a high priority.

On May 30, the Central Military Committee approved finalizing the design of the DF-3 and equipping the DF-3 missiles to the Strategic Forces.

On July 29, CSTND held a meeting to coordinate the projects of a navigation system for the DT-1 satellite.

On Aug. 14, Zhou Enlai met the Shanghai Mayor, Ma Tianshui, and agreed that Shanghai would have its own research and design systems for missiles and satellites.

On Oct. 31, CPCCCP, SC and the CMC approved Shanghai to design and produce the satellites and continental missiles.

On Nov. 16, the first flight test of the DF-4 failed.

On Dec. 14, the research and design on the HQ-3 was transferred to the Shanghai Base.

<u>In 1970</u>

On Jan. 2, the First Academy of the Seventh Ministry transferred all technical know-how of the DF-5 project to the Shanghai Base.

On Jan. 30, one DF-4 was successful launched.

On Feb. 21, CSTND announced that the Shanghai Base would be responsible for the design and manufacture of (electronic) reconnaissance, telecommunication and meteorology satellites.

On Mar. 14, CMC approved the "Yingji-1" (YJ-1) air-to-ship missile project.

On Mar. 31, the HY-2 coast-to-ship missile completed its finalized design tests. Out of seven launches total, six successfully reached their targets.

On Apr., 2, Zhou Enlai held a technical hearing about the preparation of the DFH-1 satellite and the CZ-1 rocket.

On Apr. 14, Zhou Enlai held a meeting of the Central Special Committee to review preparation of the DFH-1 satellite and the CZ-1 rocket.

On Apr. 23, Mao Zedong approved launch of the DFH-1 satellite.

On Apr. 24, China successfully launched it's first satellite, the DFH-1 boosted by a CZ-1 rocket.

On May 1, Mao Zedong, Zhou Enlai and other Central government leaders met the managers and technicians who participated in the research, design, manufacture, testing and launching of China's first satellite.

On May 19, the Seventh Ministry held a meeting about the "Jiulong-1" (JL-1) missile project.

On June 5, Zhou Enlai held a meeting of CSC about the "Jianbin-1" (JB-1) reconnaissance satellite.

On July 23, Lin Biao, Huang Yongsheng, Wu Faxian, Li Zuopeng, Qiu Huizuo and Ye Qun inspected the manufacturing facility in the First Academy of the Seventh Ministry.

From Aug. 15 to Sept. 19, CSTND held a meeting to form the Fourth Five-Year Plan for missile programs. The committee chose a very ambitious plan to develop the missile and anti-missile programs according to the Ling Biao group.

In Aug., a "Fanji-1" (FJ-1) anti-missile device was successfully tested.

In Oct. 4, a HP-5 meteorology sounding rocket was successfully launched.

On Nov. 9, CSTND asked the Seventh Ministry to hold a meeting about the DFH-2 geostationary telecommunication satellite.

On Nov. 23, a DF-4 flight test failed.

On Nov. 27, CSTND proposed to research and design the "Shuguang-1" (SG-1) manned flight module. It would carry two astronauts for eight days, and fly first in 1974.

On Dec. 20, a HQ-61 flight test was successfully launched.

In 1971

On Jan. 6, the State Council and the Central Military Committee decide that the anti-missile and the anti-satellite systems would have the highest priorities among the state-controlled items.

On Jan. 14, Zhou Enlai held a meeting of CSC. It decided to terminate a special manufacturing line for the DF-2.

On Jan. 18, CSTND established the Recoverable Technology and Sounding Rocket Institute in the Eighth Academy of the Seventh Ministry.

On Jan. 25, a test launch of the HY-3 failed.

On Feb. 10, the Warhead Research Institute was established in the First Academy of the Seventh Ministry.

On Feb. 22, a test launch of the FJ-1 failed.

On Mar. 2, during the CSC meeting, Zhou Enlai asked for a summary of the lessons learned from launch failures and successes.

On Mar. 3, a "Shijian-1" (SJ-1) satellite was successfully launched, on board a CZ-1.

On Mar., 25, the Leading Group of the Sixth Ministry decided to finalize the design and to begin manufacture of the HY-2 missiles.

On Apr. 13, the first JL-1 missile was launched successfully.

In Apr,. a test flight of the HQ-61 failed.

On May 24, the Seventh Ministry proposed a plan for the JB-1 reconnaissance satellite.

On June 30, a DF-3 missile was launched successfully.

On Aug. 14, the Seventh Ministry proposed a preliminary plan for the DF-6 missile project.

On Aug. 15, the State Council approved CSTND to establish Institute of Space Medico-Engineering in Beijing.

In Aug., a test flight of the HQ-4 missile failed.

In Sept. 10, the first DF-5 missile was launched successfully.

On Nov. 15, an underground launch of the DF-4 was successfully.

On Nov. 27, a "Heping-6" (HP-6) sounding rocket was launched successfully.

In 1972

On Jan 17, the second test flight of the FJ-1 missile was successful.

On Mar. 18, the State Council transferred manufacture of the "Hongqi" family of missiles to the Ministry of the Third Machinery Industry (the Third Ministry).

On Apr. 3, CSTND decided that China would launch it's JB-1 satellite in 1973.

On Apr. 29, the Seventh Ministry renamed the "Jiulong-1" as the "Jiulang-1" (JL-1), according to Mao Zedong's suggestion.

In Apr., design work for the "Shijian-2" (SJ-2) space physics research satellite began.

In May 9, the construction of the 061 Base was completed.

In May 15, a test flight of the FJ-1 failed.

In June, CSTND approved to the Seventh Ministry to begin to design the "Tingjin-1" (TJ-1) and the "Tingjin-2" (TJ-2) rockets.

In July 31, the first underwater launch of the JL-1 was successful.

In Aug. 10, a Shanghai built "Fengbao-1" (FB-1) continental missile was launched successfully.

In Sept. 12 to 13, leaders from the Central Party Committee and the Central Government visited the First Academy of the Seventh Ministry.

On Oct. 23, three JL-1 were launched from underwater, and two out of these were successful.

In Nov., a HQ-61 test flight failed.

On Dec. 29, Wang Yang was appointed Minister of the Seventh Ministry, and Li Guangjun as Vice Minister.

In 1973

From Apr. 19 to May 5, five HP-6 sounding rockets were launched, with four successes.

In May 16, in a meeting of CSTND, Zhou Enlai announced that China would adopt a specific space policy. The policy would allow China to possess limited missile and satellite programs with limited budgets, and China would not compete with superpowers in space.

In July 24, the State Council and the Central Military Committee decided to transfer CSTA to the Seventh Ministry from CSTND. It would be the Fifth Academy of the Seventh Ministry.

On Sept. 18, a launch of the "Changkong-1" (CK-1) reconnaissance satellite failed due to the malfunction of it's "Fengbao-1" (FB-1) booster rocket.

From Dec. 10 to 18, three HP-5 sounding rockets were launched successfully.

In 1974

On Jan. 4, an underwater test launch of a model of the JL-1 was successful.

On Jan. 29, the 061 Base was established in Guizhou Province. Bai Fen was appointed Director of the Base.

On Feb. 11, the Seventh Ministry held a conference. It established priorities for rocket research and production. These priorities included five missile projects and three satellite projects. Five missile projects were the DF-3, the DF-4, the DF-5, the JL-1 and the FJ-1. The satellite projects were the JB-1, the DT-1 and the DFH-2. The ministry also established the goals to construct four bases in three to four years. These four bases were the 062 Base, the 063 Base, the 067 Base and the 068 Base.

On Mar. 28, the Seventh Ministry decided to terminate the DF-6 project.

On Mar. 30, SCP held a coordinating conference for the telecommunication satellite project. Participants were the Ministry of Post and Telecommunication (MPT), the Ministry of the Fourth Industry (the Fourth Ministry), CSTND, the Department of Communication in the Ministry of Defense, the Ministry of Broadcasting Affairs (MSA) and the Seventh Ministry.

On May 6, the Ministry held a meeting discussing the approaches to the "Fanji-3" (FJ-3) project. FJ-3 was an anti-missile device.

In June, an anti-missile test against a HQ-3 missile was successful.

On July 12, the second launch attempt of a CK-1 failed due to the a FB-1 booster failure.

On Oct. 7, the State Council and the Central Military Committee approved a shoulder carried anti-aircraft missile project named the "Hongyin-5" (HY-5).

On Oct, 22, CSC held a meeting on the first launch of a JB-1 satellite.

On Oct. 24, CSTND and the Seventh Ministry proposed to CSC that the SG-1 manned module project should be delayed.

On Nov. 5, the first launch of a "Jianbin-1" satellite was not successful due to failure of the CZ-2 launcher.

In 1975

On Feb. 6, the 068 Base was established. Gao Fengyi was appointed Director.

On Feb. 17, CSP and CSTND proposed to CPC launching the first geostationary telecommunication satellite in 1978. In this proposal, they suggested that the Seventh Ministry develop the satellite and the launcher. The institutions in CSTND would be responsible for the development a network for tracking, measuring and control.

On April 1, CPC and Mao Zedong approved the proposal for the telecommunication satellite. This was under a code "331" project.

On June 10, the State Council and CMC approved a nuclear missile project of the DF-4.

On July 26, the third launch attempt of a CK-1 satellite on a FB-1 booster was successful.

On Aug. 4, the State Council and CMC approved the final design of the DF-3 nuclear missile.

On Oct. 15, Mao Zedong approved launching the second JB-1 satellite.

On Nov. 26, the second launch of a JB-1 was successful. China became the third country in the world to possess recoverable satellites.

On Dec. 12, the first flight test of a "Haiying-2A" (HY-2A) was successful.

On Dec. 16, the fourth launch of the CK-1 satellite was successful.

<u>In 1976</u>

On Mar. 12, a hydrogen-oxygen engine test was successful.

On Apr. 21, the Seventh Ministry decided that the highest priorities in 1976 were: the DF-5, the DF-4, the DF-3, the JL-1, the FJ-1, the DFH-2 and the JB-1.

On May 14, Wang Hongwen, Zhang Chunqiao held a hearing about satellite launching issues. They decided that China should launch three reconnaissance satellites in 1976 for political and military reasons. They decided that the Shanghai Base would launch two satellites. The other one would be launched by the Seventh Ministry.

On May 15, the first test flight of a DF-4 was successful. On Aug. 25, the second test flight was also successful.

In June, three "Tingjin-1A" (TJ-1A) sounding rockets for scientific research purpose were launched successfully.

On July 15, CSTND held a meeting for coordinating the "331" project. It decided to launch telecommunication satellite board on the "Changzheng-2B" (CZ-2B), a modified DF-5. The first and second stages kept the design of the DF-5, while the third stage would use hydrogen and oxygen engine.

On Aug. 30, the fifth CK-1 satellite was launched successfully.

On Oct. 6, the Cultural Revolution was ended.

On Nov. 10, the sixth CK-1 satellite failed due to engine failure on the FB-1 rocket.

In Nov., four TJ-1A sounding rockets were launched successfully.

In Dec. 7, the third JB-1 satellite was launched.

In 1977

On Feb. 7, Hua Guofeng, Ye Jianyin and leaders of CMC held a hearing to set priorities for rockets and satellites.

In Sept., CSTND decided to set up three priorities for 1980-1984. These were to launch the DF-5 to the Pacific Ocean, to launch the JL-1 from underwater and to launch the DFH-2 telecommunication satellite.

On Oct. 20, CPC appointed Song Renqiong Minister of the Seventh Ministry.

From Dec. 4 to Dec. 24, the Seventh Ministry held it's annual planning for 1978. It decided that three priorities proposed by CSTND would be the priorities of the Seventh Ministry in 1978.

On Dec. 28, the Seventh Ministry decided to rename the CZ-2B as the "Changzheng-3" (CZ-3).

In 1978

On Jan. 26, the fourth JB-1 satellite was launched successfully.

On Jan. 31, the Seventh Ministry decided to resume the chief designer system. The following were appointed:

For the DF-5, Chu Shouer,

for the DF-4 and the DF-3, Li Yimin,

for the JL-1, Huang Weilu,

and for the CZ-3, Xie Guangxuan.

On Feb. 14, Hua Guofeng held the first meeting of the Central Special Committee in 1978. Yi Jianyin, Deng Xiaoping and Wang Dongxin attended the meeting. The committee approved the plans for development of missiles and satellites in 1978, and confirmed the priority settings for the missile and satellite projects.

On Apr. 16, a FB-1 was launched successfully. Since the first one launched in Sept.1971, there were nine launches attempted with six successes.

On Apr. 22, Wang Chun, Li Changan, Duan Yi, Min Sinwen and Yang Peixian were appointed Vice Ministers of the Seventh Ministry.

On May 12, CSTND and CNDI held a meeting to coordinate the manufacture of electronic components for the priority projects.

On May 28, Zhen Dianxiang was appointed Vice Minister of the Seventh Ministry.

On May 30, the Seventh Ministry mandated *Regulations on Establishing the Chief Designer System and Responsibilities.*

On June 29, Hua Guofeng held the second meeting of CSC in 1978. It discussed adjusting the anti-missile system and space technology development projects.

On Aug. 1, Deng Xiaoping held a hearing on the development of space technology. He stated that China would not be involved in a space race and would not go to the Moon soon. China should focus on the development of satellite technology because it is more useful to China's economic growth. A policy was issued, which states that defense industries should not only produce weapons but civilian goods.

On Sept. 12, the State Council and the Central Military Committee decided to adjust the defense industry system. The factories making defense products would be under the jurisdiction of central and local governments. This decision built a foundation for the defense industries to produce civilian goods.

On Dec. 25, Zheng Tianxiang was appointed Minister of the Seventh Ministry.

CSTND held a meeting to coordinate manufacture of electronic components for the priority projects. This meeting set up rules for the products, and required that the products for the priority projects should be specialized in workshops, workers, materials, machines, inspections, serves and records.

In this year, CSTND held a series of meetings for coordinating the three high priority projects.

In Dec., a delegation from the Chinese Society of Astronautics led by Ren Xinmin and Ma Jie visited NASA in the U.S.

In 1979

On Jan. 3, Zhang Aiping required that the Seventh Ministry complete preparations for launching the DF-5 before Dec. 31, 1979.

On Jan 5, the Seventh Ministry held a working meeting for projects in 1979. It decided to adopt a principle of "to produce both military and civilian products, and to support defense research by producing civilian goods." It also decided to switch the system from government supply to half-government supply and then to an economic auditory system.

On Jan 10, Liu Youguang was appointed the First Vice Minister of the Seventh Ministry, Lu Ping, Zhang Jun, Lin Shuang, Liang Ji, Lu Zhime, Li Minshi and Zhang Lianfu as Vice Ministers.

On Jan. 25, CSC announced that it decided to launch the DF-5 in 1980.

On Jan. 26, the first test-firing of the hydrogen and oxygen rocket engine was successful.

In Jan., Deng Xiaoping and President Cart signed an agreement on space technology cooperation between China and the U.S. In the agreement, China would buy American made telecommunication satellites. However, this agreement did not proceed.

On Feb. 8, Shanghai government approved to rename the FB-1 as the "Xin Changzheng-1" (XCZ-1) and conventional three stage rocket as the "Xin Changzheng-3" (XCZ-3).

On Mar. 13, the Eighth Industry Bureau appointed Zu Yuchi Chief Designer for the HY-5, and Xiao Lin as Deputy.

On Mar. 16, the State Council appointed Yang Chaoshi Director of the Third Academy.

On Mar. 26, a meeting of CSC decided to launch the DF-5 missile in 1980.

On Apr. 20, CSTND approved terminating research on the anti-missile system.

On Apr. 25, the Seventh Ministry appointed Huang Weilu Chief Designer for the "Dongfeng-21" (DF-21) and "Jiulang" missiles. Chen Deren, Dai Shizheng and Cui Guoliang were made his Deputies.

From May to November, six launches of the JL-1 were successful.

On June 16, the State Council and the Central Military Committee approved reorganizing the Eight Industry Bureau as the Ministry of the Eighth Machinery Industry (the Eighth Ministry). This organization would be responsible for tactical missile development.

In June, a delegation from NASA visited the Shanghai Base.

On July 4, the Seventh Ministry appointed Wang Yongzhi Chief Designer of the "Dongfeng-22" (DF-22), Xian Zhenyei, Zhang Guoting, Xu Yangwang, Xu Chengwei and Nan Xingyu as his Deputies. Dai Shuzhi was appointed Deputy Designer for DF-5.

On July 11, the Lishang Micro-Electronic Corporate was established.

On July 16, the Central Military Committee approved the Eighth Ministry' plan to import a manufacturing line for producing tactical weapons. Later, this plan did not succeed.

On July 28, an attempted launch of three satellites from a single rocket failed due to problems with the FB-1 launcher.

On Aug. 15, Ma Yun was appointed Director of the 066 Base.

On Aug. 20, Zhang Yunpo was appointed Director of the 067 Base.

From Aug. to Sept., two test flights of FJ-1 were successful. However, anti-missile research was terminated following these tests.

On Aug. 28, Shun Jiandong was appointed Chief Designer of "DFH-2," and Qian Ji and Qi Faren as his Deputies.

On Sept. 8, Huang Weilu was appointed Deputy Designer of the nuclear missile submarine program.

On Sept. 12, the hydrogen and oxygen rocket engine fired successfully.

On Sept. 13, Jiao Royu was appointed Minister of the Eighth Ministry.

On Sept. 17, Zhao Hualiu was appointed Director of the 064 Base.

On Sept. 21, Sun Jinliang was appointed Chief Designer of the XCZ-3, Gong Dequan, Zhang Xiliang and Den Chongduan as his Deputies.

In Oct., the Chinese Society of Astronautics was established. Qian Xusen was elected Honorary President, Ren Xinmin was President.

On Nov. 6, CSC approved that the Shanghai Base could begin work on "Changkong-2" (CK-2) satellite research.

On Nov. 22, another test firing of the hydrogen and oxygen rocket engine was successful.

On Nov. 26, the first DF-5 missile produced by the 062 Base was launched successfully.

On Dec. 7, CSTND held the second meeting on the "seven special services" products. It decided to use "seven special services" products on DF-3, DF-4, DF-5, JL-1, CZ-2, and CZ-3.

On Dec. 10, the State Council approved the Seventh Ministry formation of the Chinese Great Wall Industry Corporate (CGWIC). It would be a profit-making organization for space technology exports.

On Dec. 12, the Central Military Committee and the Central Special Committee approved the Seventh Ministry research on reconnaissance satellite.

On Dec. 14, Li Anchang was appointed President of the Chinese Great Wall Corporate.

On Dec., Liu Chunshi was appointed Director of the Fifth Academy.

In 1980

On Jan. 5, the Seventh Ministry held a meeting to examine the results of the plan for 1979 plan and create a new plan for 1980.

On Jan. 10, three "Haiying-2B" (HY-2B) were launched, and two were successful.

On Feb. 2, two flight tests of the "Yingji-8" (YJ-8) were made. One flight was successful and the other failed.

On Feb. 8, the Shanghai Base merged into the Seventh and the Eighth Ministries.

On Feb. 12, Hua Guofeng chaired the first meeting of CSC in 1980. It approved plan for launching the DF-5.

On Feb. 29, Shong Jian was appointed First Deputy Designer for DF-21 and JL-1, with Li Xuer and Wu Minchang as Deputies.

On Mar. 8, Nie Rongzhen proposed to Deng Xiaoping that the Seventh and the Eighth Ministry be merged.

On Mar. 9, Zhang Aiping, the Chairman of CSTND issued the order to launch the DF-5 to the Pacific.

On Mar. 19, CSTND decided to adjust the research schedule on anti-missile projects.

On Apr. 15, the HY-5 test was successful.

On May 9, the Xinhua News Agency announced that China would launch missiles from the Chinese mainland to the Pacific ocean from May 12 to June 10.

On May 18, a Chinese-made DF-5 inter-continental missile was launched to targeted area at the ocean. The range of the launch was 9079 Km. Since this launch, China possessed inter-continental missile technology.

On May 21, China launched its second inter-continental missile. The missile flew 7617 Km down range.

That same day, the Xinhau News Agency announced that China had successfully launched inter-continental ballistic missiles into the Pacific Ocean.

On May 31, Zhong Shan was appointed Chief Designer of the "Hongqi-7" (HQ-7) project, and Fang Huiyi as the First

Deputy Designer. Liang Shouyi, Zhang Zhiyin and Wu Minchang were appointed Deputy Designers.

On June 7, CSC approved to research on a mobile DF-21, which is a middle and short range missile.

On June 30, the Seventh Ministry sent a delegation to participate in the 16th Propulsion Conference in the U.S.

On July 7, Li Zhankui was appointed Deputy Designer of the DF-5.

On July 11, the Seventh Ministry sent a delegation to the U.S. to participate in the AIAA Annual Conference.

On July 26, the State Council approved the Chinese Society of Astronautics joining the International Aeronautical Federation.

On Aug. 2, one DF-4 was launched successfully, and another was launched successfully on Oct.13.

On Aug. 25, the Seventh Ministry held a meeting to finalize the design of the DF-5 missile.

On Sept. 22, the 31st International Aeronautical Federation accepted the Chinese Society of Astronautics as a member organization with voting power.

On Nov. 6, fifteen people were appointed Chief Engineers of the Seventh Ministry. The chiefs were Chu Shouer, Huang Weilu, Xie Guangxuan, Lu Qingjun, Song Jian, Li Xuer, Li Boyong, Sun Jiadong, Zhuang Fenggan, Yang Jiaxi, Wang Xiji, Yang Nansheng, Lu Yunjiu, Jin Jianzhong and Liang Sili.

On Nov. 25, a finalization testing for the HY-2A was successful. Five out of six launched hit their targets.

On Dec. 31, CSTND decided to terminate the DT-1 satellite project.

Also, Zhao Ziyang, Wan Li, Fan Yi and Zhang Aiping approved terminating the projects on astronomy and the Earth resource satellite in the Chinese Science Academy. They decided that the satellite projects should be given to the Seventh ministry.

In Dec., China became a member of the Committee on Peaceful Uses of Outer Space in the United Nations.

<u>In 1981</u>

On Jan. 2, the first flight testing of Jl-1 failed.

On Jan. 5, the first flight testing of YJ-8 failed.

On Jan. 12, Ren Xinmin met Mr. Fukue and his delegation from the Committee of Space, Science and Technology of Congress in Beijing.

On Feb. 13, Wang Siji was appointed Chief Designer of the "Jian bin" family of satellites, with Kong Xiangcai as the Deputy. Yang Jiasi was appointed Chief Designer of the "Shijian" family satellites, with Min Kuirong as the Deputy.

On Apr. 6, Sun Jinliang was appointed Chief Designer of the XCZ-3, with Deng Chongxia as the Deputy.

On May 7, Xu Yiren was appointed Chief Designer of the "Hongqi-2A" (HQ-2A), Xu Pingao, Liu Supen and Ren Lafu as the Deputy Designers.

From May to Dec., the YJ-8 flight was tested. Two launchers were successful and three were failures.

On June 9, Li Xuer and Song Jian were appointed Vice Ministers of the Seventh Ministry.

On June 17, the second flight test of the JL-1 was successful.

On June 18, the Seventh Ministry held a meeting to discuss technological options for an anti-missile system.

On Sept. 7, the Eighth Ministry was merged into the Seventh Ministry.

On Sept. 20, China successfully launched three satellites with a FB-1. Three satellites were SJ-2, "Shijian-2A" (SJ-2A) and "Shijian-2C" (SJ-2C). It meant that China became the fourth country in the world having the technology for launching multiple satellites with a single rocket.

On Sept. 26, Yan Zichu was appointed Deputy Designer of the DF-3 and the DF-4.

On Oct. 8, the Committee of Science and Technology of the Seventh Ministry of Industry was established. Chu Shouer was appointed Chairman.

On Oct. 14, Ji Shaokai and Guo Yunzhong were appointed Vice Ministers of the Seventh Ministry.

On the same day, a test of the hydrogen and oxygen engine for the CZ-3 was successful.

On Dec. 24, the State Council and the Central Military Committee approved an improved long-range DF-3 named "Dongfeng-3A"(DF-3A).

In 1982

On Jan. 8, the Seventh Ministry sent CSTND and the Central Special Committee a proposal for the development of strategic missiles and space technology. For the strategic missile program, it proposed to finalize the first generation strategic missiles and to develop the second generation with mobile launch, liquid and solid fuel technology. For the satellite program, China would work on the "Jianbing", DFH-2, "Dongfanghong-2A" (DFH-2A), "Dongfanghong-3" (DFH-3) and "Fengyun-2" (FY-2). For the launcher program, China would work on "Changzheng-1C" (CZ-1C), "Changzheng-2D" (CZ-2D) and "Changzheng-4" (CZ-4).

On Jan. 20, the State Council and the Central Military Committee decided to finalize the design of HY-2A missile.

On Mar. 20, Liang Shouye was appointed Chief Designer for the coastal missile defense system. Liu Congjun, Bao Keming, Lu Shiguang, and Wu Baochu were appointed Deputies.

Chao Bozhen was appointed Chief Designer for the HY-2B project, Sheng Shijin as the Deputy.

Lu Shiguang was appointed Chief Designer for "Yingji-6" (YJ-6), and Yao Shaofu, Li Shipei and Sheng Shijing as his Deputies.

Bao Keming was appointed Chief Designer for the YJ-8, and Wang Zhuquan, Wang Shusheng and Yuan Yingjian as his Deputies. Bao Keming was also appointed Chief Designer for the YJ-1, and Yao Shaofu, Wang Miaoyong and Yuan Yinjian as his Deputies.

On Mar. 23 to 24, the members of the People's Congress and the Political Consultation Congress, a delegation of about 110, visited the Seventh ministry. They participated in a hearing on the development of strategic missiles and space technology.

On Mar. 31, the Chinese Measuring and Controlling Equipment Corporate (CMCEC) was established.

On Apr. 9, the Central Party Committee decided to reform government institutions. The Seventh Ministry was renamed as the Ministry of Astronautics Industry (MAI), and Zhang Jun was appointed Minister. The Vice Ministers were Li

Xuer, Ming Xingwen, Song Jian and Cheng Lianchang. Ren Xinmin was Director of the Committee of Science and Technology of the Ministry. Chu Shouer, Huang Weilu, Jiang Shoupan and Sun Jiadong were made his Deputies.

On May 10, Wang Wenchao was appointed Deputy Designer for the DF-21 and the JL-1 projects. Li Xian was appointed Deputy Designer for the HQ-7 project.

On May 15, Wang Juexian was appointed Chief Designer for the "Tansuo-2" (TS-2) missile project. On June 6, He Jinghuan, Dai Xiaolin and Huang Chunping were appointed as his Deputies.

On May 20, the DF-22 missile's engine first firing test was successful.

From June 4 to Aug.10, the finalization tests for the HY-2 were successful. Five out of six reached their targets.

On June 16, Tang Jingan was appointed President of CGWIC. Shi Changjie was President of CMCEC.

On the same day, Dai Xiaolin was appointed Deputy Designer for the DF-3, the DF-4 and the TS-2 projects. Huang Chunping was appointed Deputy Designer for the TS-2.

On June 26, CSTND held a meeting on the design of the DF-3A project.

On July 27, the first flight of the HQ-7 missile was successful.

On July 28, a Chinese delegation participated in the Second Conference on the Peaceful Uses of Outer Space in the UN. Sun Jiadong, as the Leader of the Delegation, delivered a speech on the development of space technology in China.

On Sept. 9, the Fifth JB-1 satellite was launched successfully, and recovered on the 14th.

On Sept. 13, the flight testing for the HQ-7 rockets was successful. Six rockets launched reached their targets.

On Oct. 1, the Xinhua News Agency announced that China would launch missiles into the Pacific on Oct.7.

On Oct. 6, Chen Weiming was appointed Director of the 066 Base.

On Oct. 7, a JL-1 was launched from underwater. It was not successful due to failure of the control system.

On Oct. 12, the second launch of the JL-1 was successful.

On Nov. 16, the first launch of the YJ-8 was not successful due to altimeter problems.

On Nov. 25, the flight test for the finalization of the HQ-2A was successful.

In 1983

On Jan. 13, the finalization test flight for the HY-5 was successful.

On Jan. 20, Zhang Liangfu was appointed Director for the First Academy. Chu Shouer was Director of the Committee of Science and Technology in the First Academy.

Cha Zhiren was appointed Director for the Second Academy. Huang Weilu was Director of the Committee of Science and Technology in the Second Academy.

Bao Keming was appointed Director for the Third Academy. Liang Shouye was Director of the Committee of Science and Technology in the Third Academy.

Xin Qiuhen was appointed Director for the Fourth Academy. Yang Nansheng was Director of the Committee of Science and Technology in the Fourth Academy.

Shun Jiadong was appointed Director for the Fifth Academy. Wang Xiji was Director of the Committee of Science and Technology in the Fifth Academy.

On Jan. 21, the Beijing Wanyun Corporation (BWC), the Beijing Changfeng Corporation (BCC) and the Beijing Zhengxin Corporation (BZC) were established.

On Feb. 9, CSTND issued the research plan on the "Dongfeng-23" (DF-23) missile project.

On Feb. 28, the Sichuang Provincial Government agreed to establish the Sichuang Astronautics Bureau (SIAB).

On Mar. 8, MAI decided to establish the Henan, the Hunan, the Jiangsu, the Guizhou, the Shanxi and the Yunnan Astronautics Bureaus (HEAB, HUAB, JAB, GAB, SHAB, YAB).

On Mar. 16, at a Defense Industry Conference, Zhang Aiping called for: shorten confronting line, setting up priorities, focusing on R&D, speeding up replacement, reconstructing manufacturing processes, renewing designs, improving manufacturing quality and reducing costs.

On Mar. 19, Yao Shaofu and Yi Sheng were appointed Deputy Designers for the coast defense missile system.

Yao Shaofu was appointed Chief Designer for the YJ-8 project. Sheng Shijin was appointed Chief Designer for the YJ-1 project.

On Mar. 26 and Apr. 1, the members in the Central Military Committee and the people from the Departments in the People's Liberation Army (PLA) visited MAI.

On May 25, the first test firing of the third stage of the CZ-3 booster was successful.

In May, Song Jian, the Vice Minister of the Ministry, discussed the issues of the cooperation with Vice Administrator of NASA.

In June 3, Wang Xiji was appointed Chief Designer for the JB-1 satellite, Kong Xiangcai as his Deputy.

Yang Jiasi was appointed Chief Designer for the "Shijian-3" (SJ-3) satellite, Chen Yiyun as his Deputy.

Min Guirong was appointed Chief Designer for the "Jianbin-1A" (JB-1A) satellite project.

On June 4, Wu Beiheng was appointed Chief Designer for the HQ-7 project.

On the same day, CSTND held a meeting for coordinating the JB-1A satellite projects.

On June 15, a Chinese delegation, led by Cheng Lianchang, was invited to the U.S. by the Administrator of NASA. The delegation visited NASA centers and watched a space shuttle launch.

On June 16, MAI held a ceremony for beginning to use an Italy telecommunication satellite.

On June 20, Fang Xinhu was appointed Deputy Designer for the DF-22 project.

On June 21, Mong Zhizhong was appointed Chief Designer for the "Fengyun-1" (FY-1) satellite, and He Zhenghua as his Deputy. Song Zhongbo was appointed Chief Designer for the CZ-1C launcher, Qian Zhenye as his Deputy.

On June 23, Sun Jingliang was appointed Chief Designer for the CZ-4 (also as known XCZ-3) and Deputy Designer for the CZ-3. Cao Yangbao and Deng Chonggu were appointed Deputies for the CZ-4.

On June 24, the first flight test for the YJ-1 was successful.

On June 29, the State Council and the Central Military Committee approved to final design of the DF-4 weapon system.

On July 13, Cong Shuguo was appointed Acting Director for the 064 Base.

From July 20 to Aug.16, four YJ-8 were tested, and three reached their targets.

In July, the leaders in the State Council and the Central Military Committee inspected the assembly and testing facility of the CZ-3 booster and the telecommunication satellite.

On Aug. 3, Zhu Yongqi was appointed Chief Designer for the surface-to-air weapon systems.

On the same day, Shu Shijian was appointed Acting Director for the Shanghai Astronautics Bureau (SHHAB).

Huang Chunping was appointed Chief Designer for the DF-22 Project.

On Aug. 6, Liu Baoyong was appointed Deputy Designer for the DF-21 and JL-1.

Wang Shanghu was appointed Deputy Designer for the HQ-7. Chen Deren was appointed Chief Designer for the DF-23, Wang Wenchao, Chen Shinian, Li Xiangang, Chui Guoliang and Wu Junhua as his Deputies.

On Aug. 19, the Sixth JB-1 satellite was successfully launched.

On Aug. 23, Yuan Liangqi was appointed Acting Director for the 062 Base in Sichuan Province.

On Sept. 15, Huang Huai was appointed Deputy Director for HQ-7.

On Sept. 19, MAI held a meeting about managerial issues for the Shanghai Base.

On Oct. 21, Wang Zuquan was appointed Deputy Designer for the YJ-8 project.

Xu Chunyin was appointed Chief Designer for the "Hongqi-65" (HQ-65), and Wang Qiyang, Zheng Dezhai as his Deputies.

In Oct., the 34th International Astronautics Federation elected Yang Jiaxi as the Vice Chairman of the Administration Bureau, and Chu Shouer as the Vice Chairman of the Education Committee.

In Nov. 15, Wang Yongzhi was appointed First Chief Designer for the DF-22 project.

Li Yiming was appointed First Chief Designer for the DF-3A project, and Dai Xiaoling and Yan Zichu as his Deputies.

Xie Guangxuan was appointed Chief Designer for the CZ-3, Fan Shihe, Sun Jingliang, Wang Zhiren and Gong Dequan as his Deputies.

Yao Shaofu was appointed Chief Designer for the YJ-8 project, and Wang Zuquan, Wang Shusheng, Yuan Yingjian as his Deputies.

Lu Shiguang was appointed Chief Designer for the YJ-6, and Li Shipei and Sheng Shimian as his Deputies.

Liang Jingcai was appointed Chief Designer for the HQ-61, and Mao Zongwei as his Deputies.

On Dec. 5, the HQ-2A weapon system design was finalized.

On Dec. 6, manufacture of the HQ-2 missile was canceled.

On Dec. 17, CSTND held a meeting on telecommunication satellite management issues.

<u>In 1984</u>

On Jan. 3, flight testing of the YJ-6 was successful. All four missiles launched reached their targets.

On Jan. 24, the State Council and the Central military Committee approved the final HY-2B missile design.

On Jan. 29, the DFH-2 telecommunication satellite was launched successfully. The satellite did not reach it intended orbit due to an abnormal second firing of the third stage engine. However, the launch provided important testing information.

On Feb. 7, the Beijing Satellite Telecommunication Ground Station transmitted China's first satellite TV broadcasting signal successfully.

On Feb. 10, Wang Zhuang was appointed Deputy Designer for the JB-1A satellite.

On Feb. 18, the Science and Technology Leading Group (STLG) in the State Council decided that all research and manufacture of satellites would be transferred to MAI. Therefore, research on the astronomy and resource satellites in the Chinese Science Academy would transfer to MAI.

On Feb. 25, Zhang Jun, Minister of the MAI, and his delegation visited Italy and Germany. They signed the agreements with both countries to cooperate on space technology ventures.

On Feb. 27, the State Council and the Central Military Committee approved research on the "Dongfeng-11" (DF-11) tactical surface-to-surface missile.

On Feb. 28, Sun Jiadong was appointed Chief Designer for the DFH-2 satellite, and Qi Faren as his Deputy.

Min Guirong was appointed Chief Designer for the JB-1A satellite.

On Mar. 2, Zhang Shaofeng was appointed Director of GAB.

On Mar. 12, the Chinese Guangyu Industry Trade Corporation (CGITC) was established in Shengzheng.

On Mar. 28, Liu Jiyuan was appointed Vice Minister of MAI.

In Mar., the hydrogen and oxygen engine of the CZ-3 was successfully tested six times.

In Apr. 8, the second DFH-2 satellite was launched successfully. On Apr. 27, it began to transmit TV program signals.

On Apr. 15, the Administrator of NASA sent a letter of congratulations to Zhang Jun, the Minister of MAI, in recognition of China's successfully launching its first telecommunication satellite.

On Apr. 18, the Central Party Committee, the State Council and the Central Military Committee sent their congratulations to CSTND and MAI.

On Apr. 19, Nie Rongzhen sent a letter of congratulation to Zhang Aiping for the successful launch of the telecommunication satellite.

On Apr. 21, Wang Daoli was appointed President of CGITC.

On Apr. 30, a reception for the successful launch of the telecommunication satellite was held in the People's Great Hall. The highest leaders of China's Central Government attended this reception.

From May 10 to June 10, MAI held an exhibition of its technological achievements.

On June 12, photos taken form the JB-1 satellite were declassified and provided to users.

On June 13, Chen Xinsheng was appointed Chief Designer for the "Hongqi-63" (HQ-63) weapon system, Wang Qiyang, Min Sen and Zhao Shanyou as his Deputies.

On June 15, the design of the HQ-2A was finalized.

On June 27, the HQ-63 was renamed the "Hongqi-6" (HQ-6).

On Aug. 1, Liu Jiyuan, Vice Minister of MAI, and his delegation visited France.

On Aug. 9, three HQ-7 were flight tested successfully.

On Aug. 10, MAI decided to develop a mobile HY-5 missile system.

On Aug. 12, the JL-1 (formerly DF-21) was launched successfully. Another one was successfully launched on the 22nd.

On Aug. 24, Zhang Lixian was appointed as Director of the 066 Base.

On the same day, Ren Xinmin was appointed Chief Designer for all China's satellite systems. Ming Guirong was appointed First Deputy Designer for the resource satellite system. Qi Faren was First Deputy Designer for the telecommunication satellite system.

On Sept. 1, Zhang Guoxin was appointed Chief Designer for the DF-11, and Wang Zhenhua and Wang Guangchun as his Deputies.

On Sept. 10, the YJ-6 finalization flight test was mostly successful. Four out of six reached their targets.

On Sept. 12, the seventh JB-1 was successfully launched.

On Sept. 21, Shu Shibi was appointed Director of SHHAB.

On Sept. 22, Xing Qiuhen was appointed Director of the Fourth Academy in MAI.

On Sept. 24, Shang Zengyu was appointed Deputy Designer for the DF-3A.

On Oct. 1, to celebrate the 35th anniversary of the foundation of the P.R.China, MAI exhibited the DF-3, the DF-4, the DF-5, the JL-1, the HQ-2, the YJ-8 and the HY-5.

On Oct. 6, Bao Keming was appointed Vice Minister of MAI.

On Oct. 8, Liu Congjun was appointed Director of the Second Academy, and Huang Weilu as Director of the Committee of Science and Technology.

Sun Jiadong was appointed Director of the Fifth Academy.

On Oct. 9, Yi Sheng was appointed Director of the Third Academy, and Laing Shouye as Director of the Committee of Science and Technology.

On Oct. 12, Li Boyong was appointed Director of the First Academy.

On Oct. 20, Cong Shuguo was appointed Director of the 064 Base.

On Oct. 27, the first flight test of the DF-3A failed.

On Nov. 1, Shen Zhongfang was appointed Chief Designer for the mobile HY-5 weapon system, and Zhang Zhihong, Xu Wenbin and Zhai Xingfu as his Deputies.

On Nov. 16, the second flight test of the DF-3A failed.

From Dec. 18 to 27, the testing of the "Hongying-5A" (HY-5A) was mostly successful. Ten out of seventeen were reached their targets.

On Dec. 19, the HY-2 coast-to-ship missile design was finalized for manufacturing.

In 1985

On Jan. 10, the Hong Yin-5 low temperature test was successful.

From Jan. 26 to Feb. 27, Li Xuer, the Minister of Astronautics Industry, led a delegation to Britain and France. An agreements on space technology cooperation with the two countries were signed.

On Feb. 1, Hu Zhigang was appointed the Director of Hunan Astronautics Management Bureau.

On Mar. 29, the first flight of Ying Ji-8 was partially successful. Because one out of three was reached the target.

On Mar. 31, the Chinese Association for Astronautics Industry Management was established. Cheng Lianchang was appointed Chairman. Ji Shaokai, Li Mingshi and Lu Chenzheng were Vice Chairs.

In Mar., the Chinese Long March-3 launcher and Dong Fang Hong-2 telecommunication satellite were exhibited at the Zubo Exhibition in Japan.

On Apr. 3, Chu Shouer, Liang Shouye, Lu Qingjun, Zhang Lianfu, Lu Yuanjiu and Xie Guangxuan proposed to the Central Party Committee that China should commit to producing space technology that supports economic development. On Apr. 23, Deng Xiaoping commented: "This is a very important issue".

On Apr. 9, Qi Faren was appointed the Chief Designer for Dong Fang Hong-2 satellite, Fan Benrao and Min Shiquan as the Deputies.

On Apr. 13, Li Xuer was signed as the Minister of Astronautics Industry.

On Apr. 22, the State Council and the Central Military Committee approved final design of the Hong Yin-5 missile system.

At same day, the Hong Qi-6 test failed. Another Hong Qi-6 was tested on May 15 successfully.

On May 9, Wang Decheng was appointed Chief Designer for the Dong Feng-5 and Long March-2C program. Lian Ziheng and Li Zhankui were appointed as his Deputies.

On May 18, the Ministry decided to dismantle the Astronautics Industry Measuring and Controlling Equipment Cooperative. It decided to establish a new company named the Beijing Computer Measuring and Controlling Equipment Company.

On May 25, two Hong Yin-5A missiles were successfully tested.

On that same day, Yu Shouzhi was Deputy Designer for Ying Ji-1.

On May 28, the first Hong Qi-7 was launched successfully.

On May 30, Chen Shouchun, head of the Chinese delegation, at the Space Technology Conference in Geneva announced that China will put the Long March family of boosters on the international space boosters market.

On May 31, the first test for Dong Feng-21 stabilization was successful.

On July 2, the Hong Yin-5A high temperature test was successful and completed stabilization testing.

On July 4, the Chinese Astronautics Industry Supply and Trade Corporation was established.

On July 6, the 062 and the 064 Bases were merged. After merging, the new organization was named Sichuang Astronautics Industry Corporation of the Ministry of Astronautics Industry.

From July 6 to 20, Wang Ganjun, a Chinese American Astronaut visited China.

From Aug. 27 to Sept. 21, three Hong Qi-7 were launched and two were successful.

From Sept. 1 to 28, six Ying Ji-8 missiles were successfully launched.

On Sept. 28, three Ju Liang-1 tests were launched. But, none of them was successful.

On Oct. 6, during the 36th International Astronautics Federation, the International Academy of Astronautics accepted the following Chinese scientists as Academicians: Ren Xinmin, Chu Shouer, Cai Jintao, Liang Shouye, Yang Nansheng, Sun Jiadong, Yang Jiaxi, Lu Yuanjiu and Zhuang Fenggan.

On Oct. 21, the first Jian Bin-1 land-mapping satellite was launched successfully.

On Oct. 25, the decision was made to finalize the design of the Hong Yin-5A.

On Oct. 26, Li Xuer, the Minister of Astronautics Industry, once again formally announced that China will send Long March family into international market.

On Oct. 28, the CSTND held a meeting to coordinate the first meteorology satellite project, Feng Yun-1. The Commission decided to launch the satellite on a Long March-4 booster by June 1988.

On Oct. 30, Shun Jiadong was appointed the Minister of Astronautics Industry.

In Oct. the First Academy began designing the M-9 missile.

On Nov. 23, the design of the Ying Ji-6 was finalized.

On Dec. 4, Ming Guirong was appointed Director of the Fifth Academy.

On Dec. 9, the Ministry held a meeting to discuss strategies for military and civilian productions.

On Dec. 27, stability flight testing for the Dong Feng-3A was successful. As was the later test on Jan. 13, 1986.

In Dec., Mu Hong was signed as the Chief Designer for the Hong Qi-6 missile project, Wang Qiyang, Liu Guoxong and Ming Seng as his Deputies.

In 1986

On Jan. 11, modified Ying Ji-8 was named Ying Ji-8A, and its new code will be YJ-8A. The Ying Ji-8D will be coded the YJ-8D.

On Jan. 22, an agreement was signed between the Ministry of Astronautics Industry and the Swedish Space Company to launch a Swedish satellite on board a Chinese Long Marcher in 1988.

On Jan 25, Wang Hongzhi was appointed Director of the Jiangsu Astronautics Management Bureau.

On Feb. 1, the Dong Fang Hong-2 telecommunications satellite was launched successfully.

On Feb. 15, Ye Raoqing was appointed Chief Designer for the Hong Yin-5A, and Shao Gongzheng and Wang Zhongyi as his Deputies.

On Feb. 20, the Central Party Committee, the State Council and the Central Military Committee sent congratulations to whom successfully launched the telecommunications satellite.

On Mar. 31, the State Council approved the Proposal to accelerate the development of space technology. It decided to support space technology development during the Seventh Five-Year Plan.

In Mar., the Ministry made its Collections of the Regulations in the Ministry of Astronautics industry from 1979-1985.

On Apr. 14, Yuan Lianqi was appointed President of Sichuang Astronautics Industry Corperation.

On Apr. 20, the CGWIC signed a contract with American Rerd Company to launch two satellites for this company. One would be launched in Dec., 1987 and the other would be launched in 1988.

On Apr. 28, Sao Aimin was appointed Deputy Designer for the Ju Liang-1 and Dong Feng-21 projects.

In Apr., COSTIND decided to name the solid strategic missile as Dong Feng-31.

In May 7, Duan Yingkui was appointed President of Science and Technology Consulting Company.

On May 9, Wang Decheng was appointed Chief designer for Dong Feng-5, Li Zhankui as his Deputy.

In May 19, the Guangyu Industry Trade Corporation was renamed as the Guangyu Industry Trade Groups and it expanded its business activities.

On May 23, the Hongyi-5 weapon system was tested and eight of ten launches were successful.

On May 31, Wang Jianmin was appointed Chief Designer for the Ying Ji-82 missile project, Kang Hongtao, Zhou Zhongling, Song Youshan, Tang Guofu and Zhi Tongsheng as his Deputies.

On June 20, Li Xiangrong and Chu Xiangshen were appointed Deputy Designers for the Long March-4A.

On June 25, COSTIND approved the design and manufacture of the Long March-3A booster.

In June, Shi Jingmiao was appointed Deputy Designer for Long March-3.

On July 1, the Central Party Committee, the State Council and the Central military Committee decided to refer the Ministry of Astronautics Industry to the leadership of the State Council. Before this, it was under the leadership of the COSTIND.

On July 4, the Hong Qi-61 surface to air missile weapon system was successfully tested.

On July 7 to 26, a Chinese Astronautics delegation, led by Liu Jiyun, visited some Eastern Europe countries.

On July 12, the design of the Dong Feng-5 nuclear missile system was finalized.

On July 17, the flight testing of Hai Ying-3 was successful.

On Aug. 18, the State Council and the Central Military Committee approved the Feng Yun-1 meteorological satellite project.

On Sept. 4, the State Council and the Central Military Committee approved the proposal for launching foreign satellites. It required that the launchers should be commercialized during the Eighth Five-Year planning period.

On Sept. 27, flight testing of the Ying Ji-1 was successful.

On Sept. 30, the CGWIC signed an agreement with American Western Telegraph Company to launch its 6S satellite.

On Oct. 6, the second Jian Bin-1 land mapping satellite was successfully launched.

On Oct. 8, the Ministry of Astronautics Industry held a reception for the Thirty-Year Anniversary of Chinese Space Activity.

On Oct. 22, Liu Dexin was appointed Director of Shangxi Astronautics Management Bureau.

On Nov. 3, flight testing of the Hong Qi-2B was successful and eight of nine reached the targets.

On Nov. 4, Asian Defense Technology Exhibition was held in Beijing. Some launchers, surface to air missiles, coast defense missiles, and surface to surface missiles were exhibited.

On Nov. 8, the Dong Feng-15 missile was renamed the M-9 missile. The Dong Feng 15 is a surface -to-surface missile with a 600 Km range.

On Nov. 15, during the 26th International Academy of Astronautics, Huang Weilu was selected as the Academician.

On Nov. 18, the Central Party Committee and the State Council approved A Plan for Developing High Technology in China (863 Plan.)

On Nov. 19, the stabilization flight testing of Hong Qi-61 was successful.

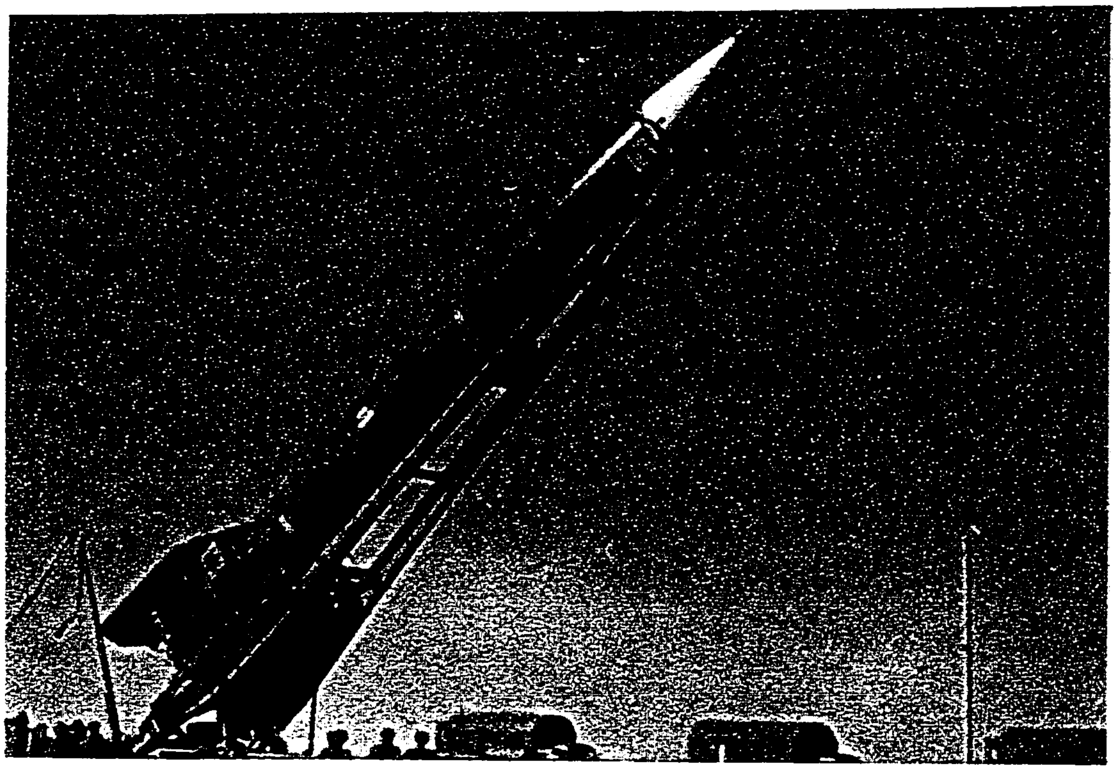
On Dec. 15, Wang Yongzhi was signed as the Chief Designer for the First Academy.

On Dec. 16, the State Council and the Central Military Committee approved the final design for the Dong Feng-5 nuclear weapon system.

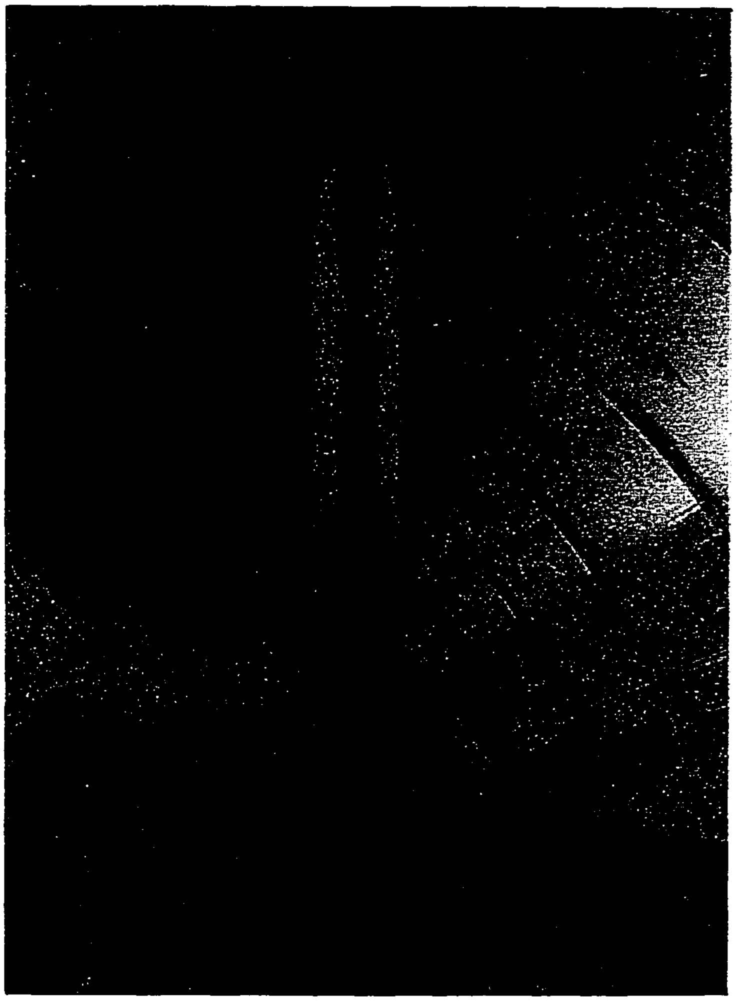
Picture 1, Zhou Enlai, Premier, visited China's space program more than 50 times during the Cultural Revolution.
Zhou Enlai, the second from right, and Qian Xuesen, the first from left up frond.

Picture 2, Marshal Nie Rongzhen and Dr. Qian Xuesen at launching site at Jiuquan in 1965.
Nie, at center of the front row and one on the right of the flag pole. Dr. Qian is on the left of Marshal Nie.

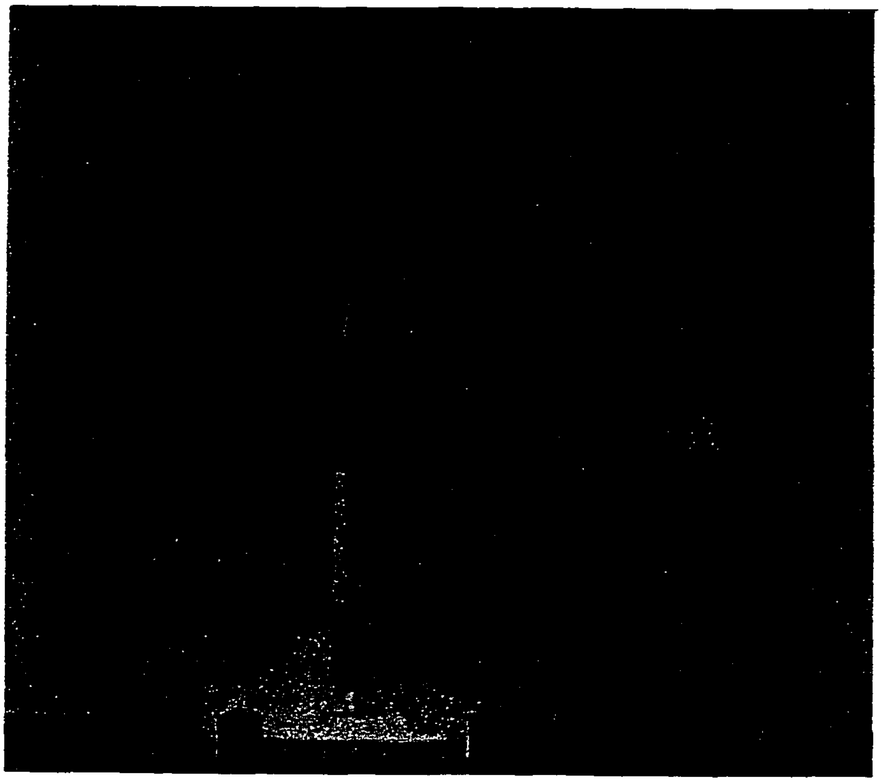
Picture 3, From left, early China's space program developers -- Dr. Ren Xinmin, Dr. Qian Xuesen, Dr. Chu Shouer and Dr. Huang Weilu



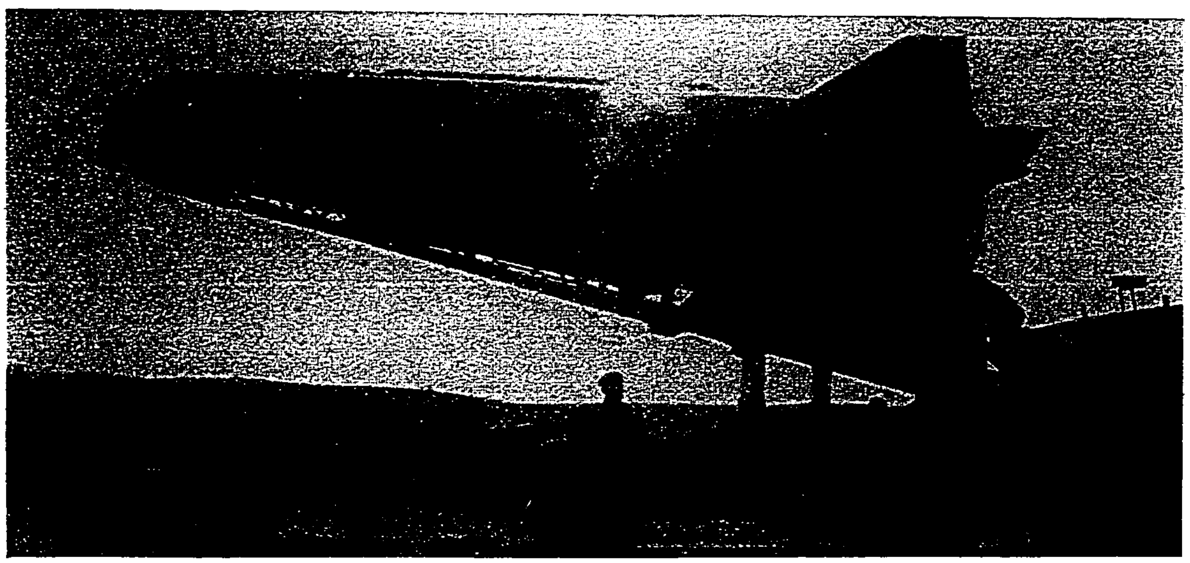
Picture 4, Chinese simulated P-II missile



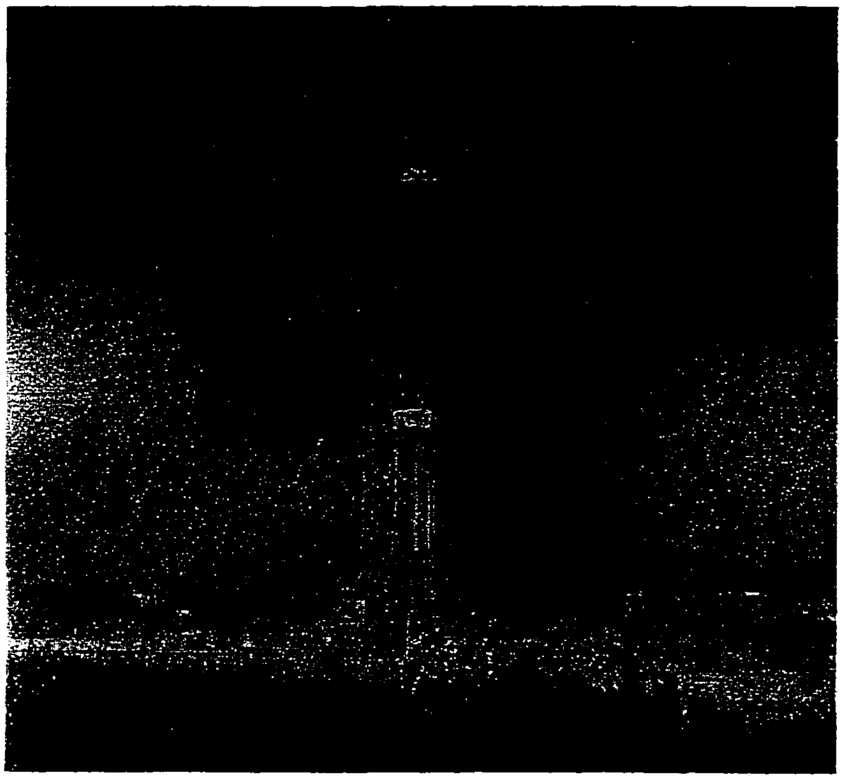
Picture 5, Chinese Dong Feng 1



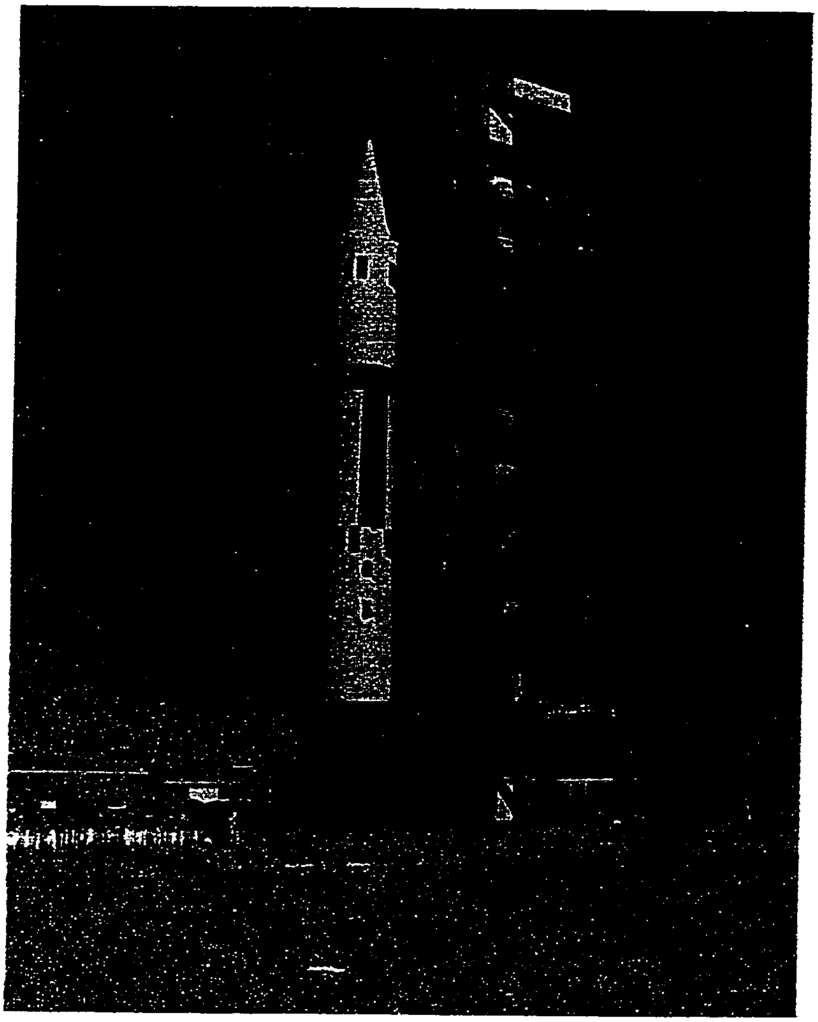
Picture 6, Chinese Dong Feng 2 was launched with a nuclear head on 27 October 1966



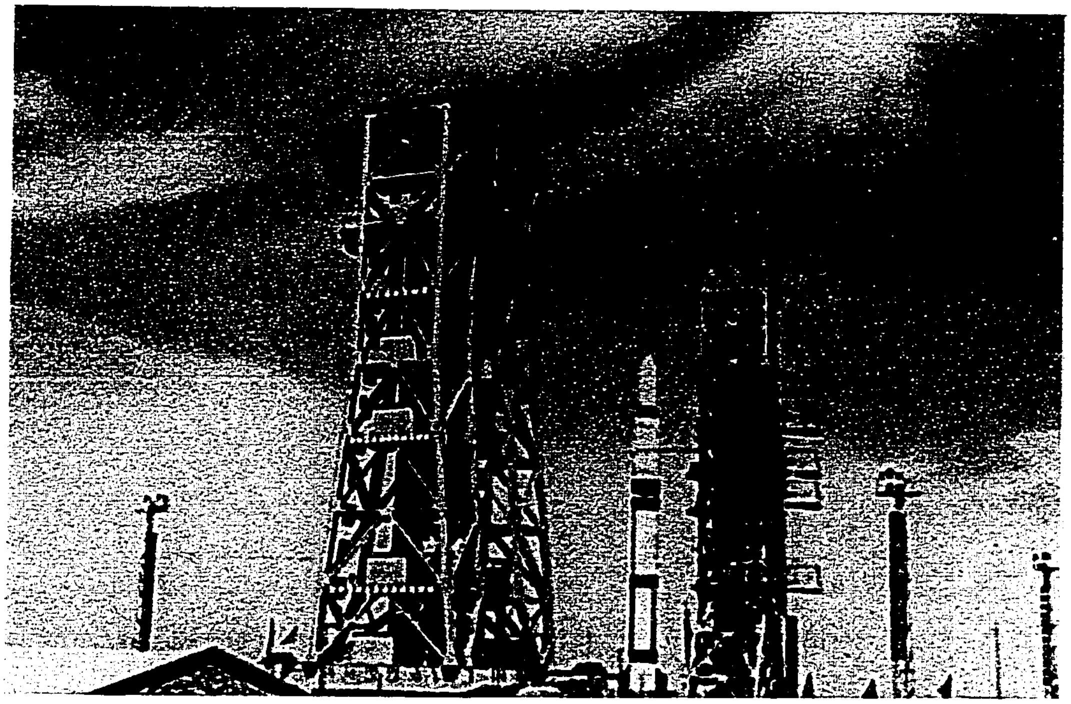
Picture 7, Chinese Dong Feng 3



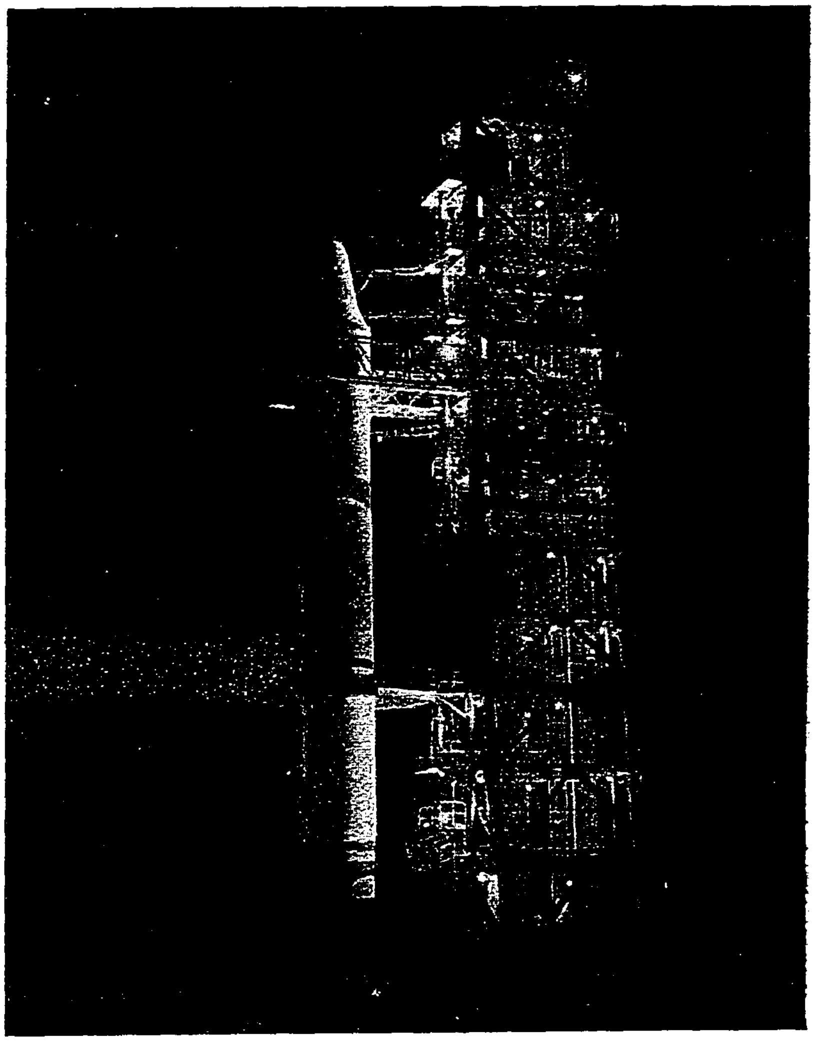
Picture 8, Chinese Dong Feng 4



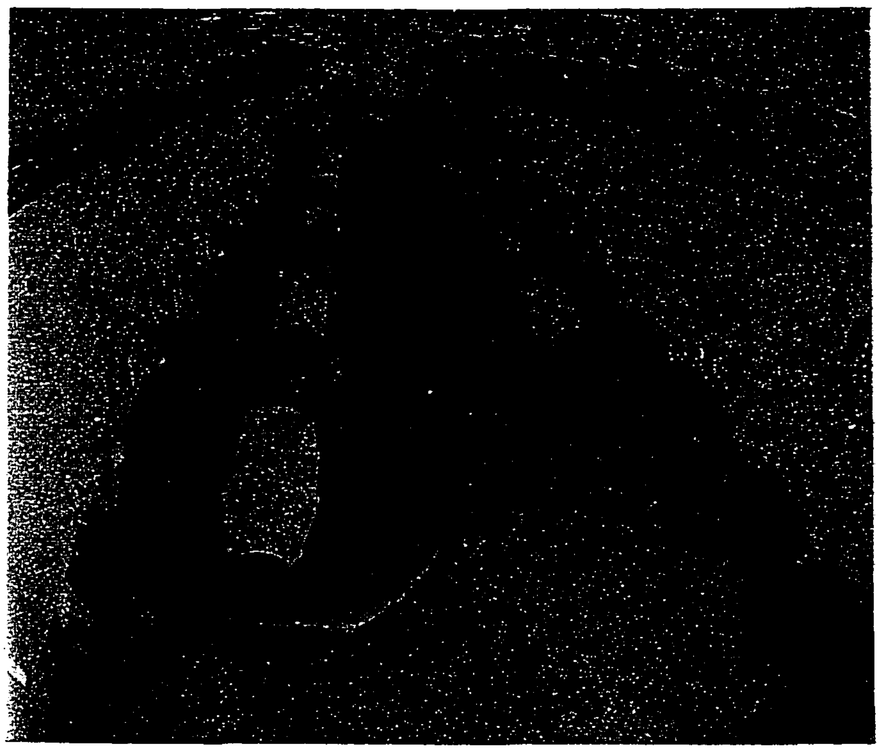
Picture 9, Chinese Dong Feng 5



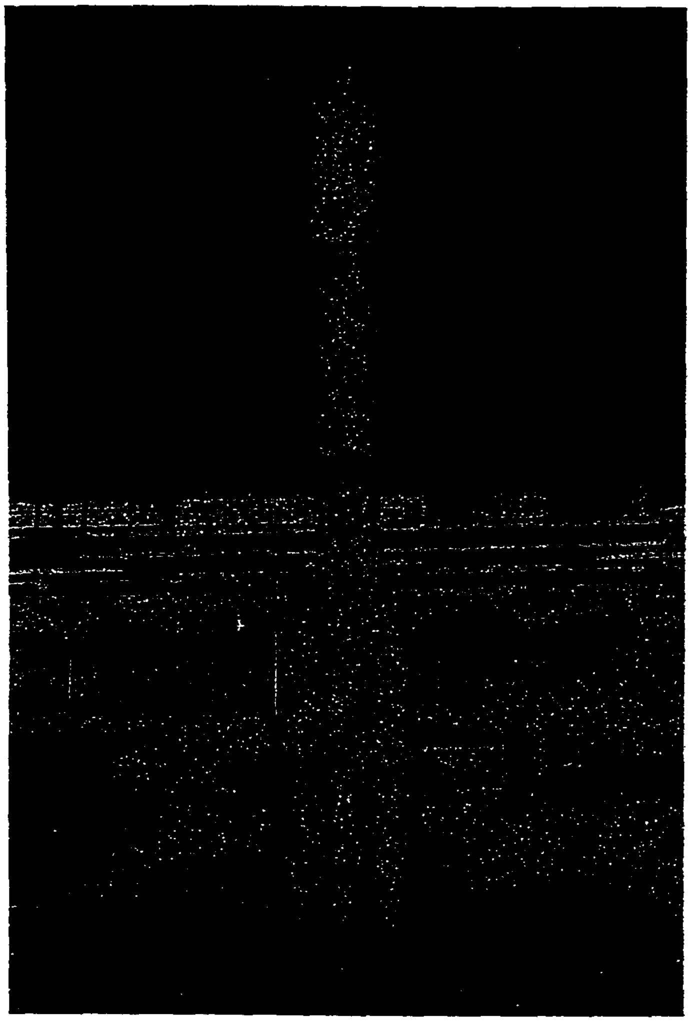
Picture 10, On 24 April 1970, Chinese Chang Zheng 1 (Long March 1) launched the first satellite, Dong Fang Hong 1 (East is Red 1)



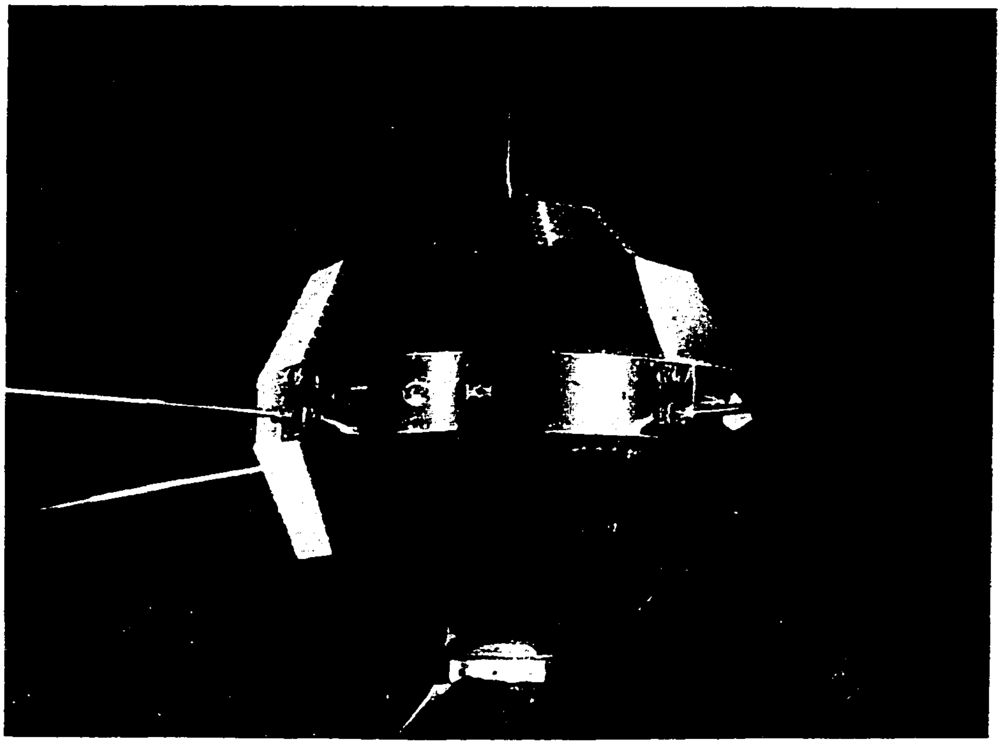
Picture 11, Chinese Long March 2C



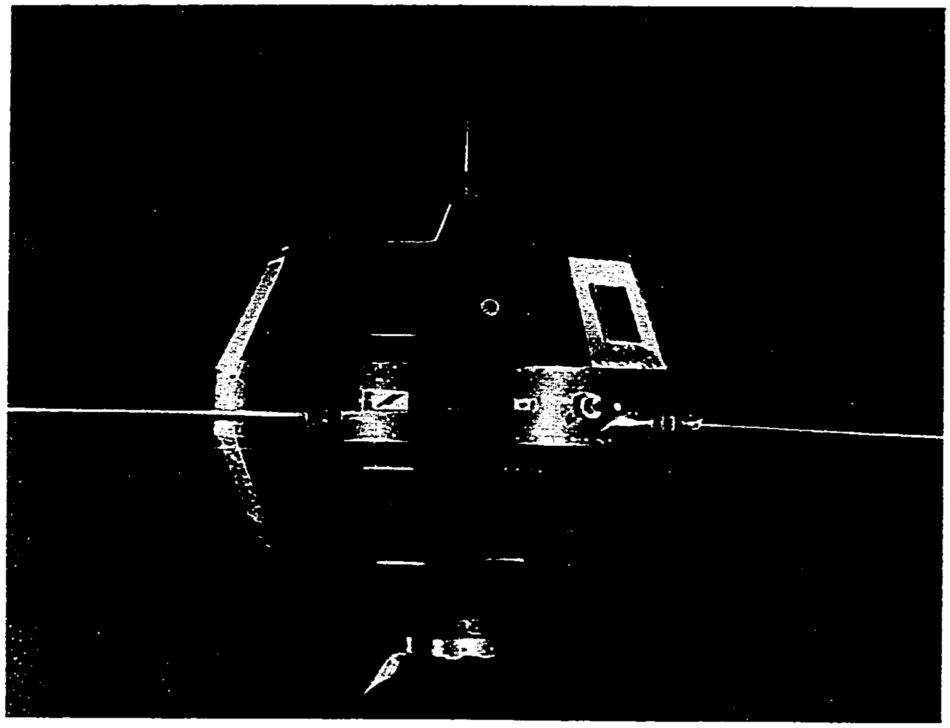
Picture 12, Chinese Long March 3 in the assembly workshop



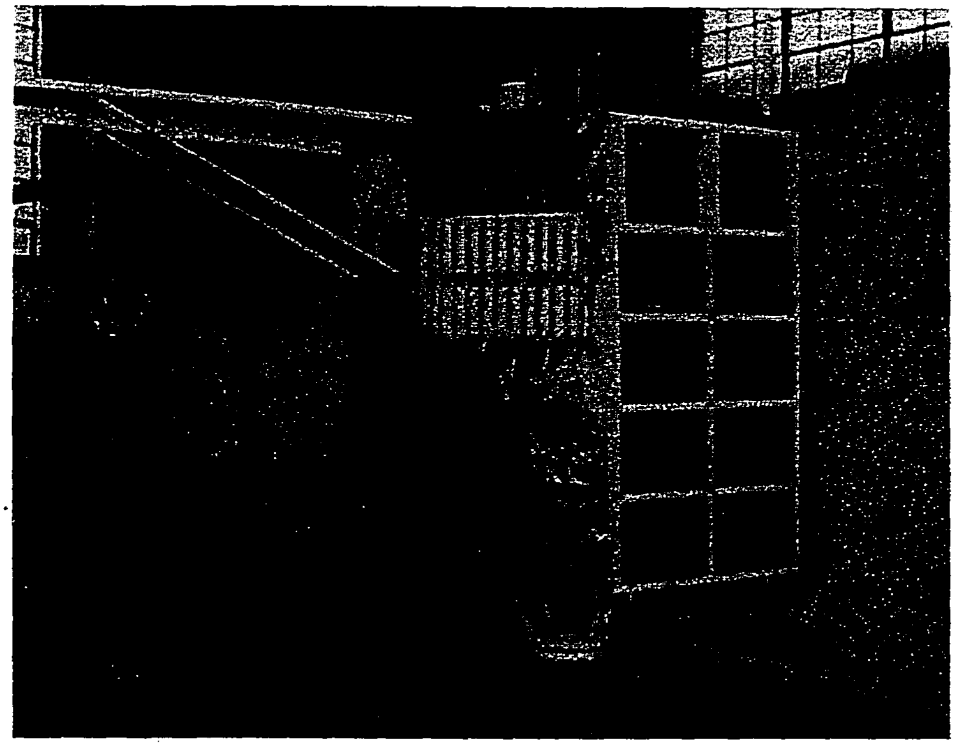
Picture 13, Chinese Long March 2E



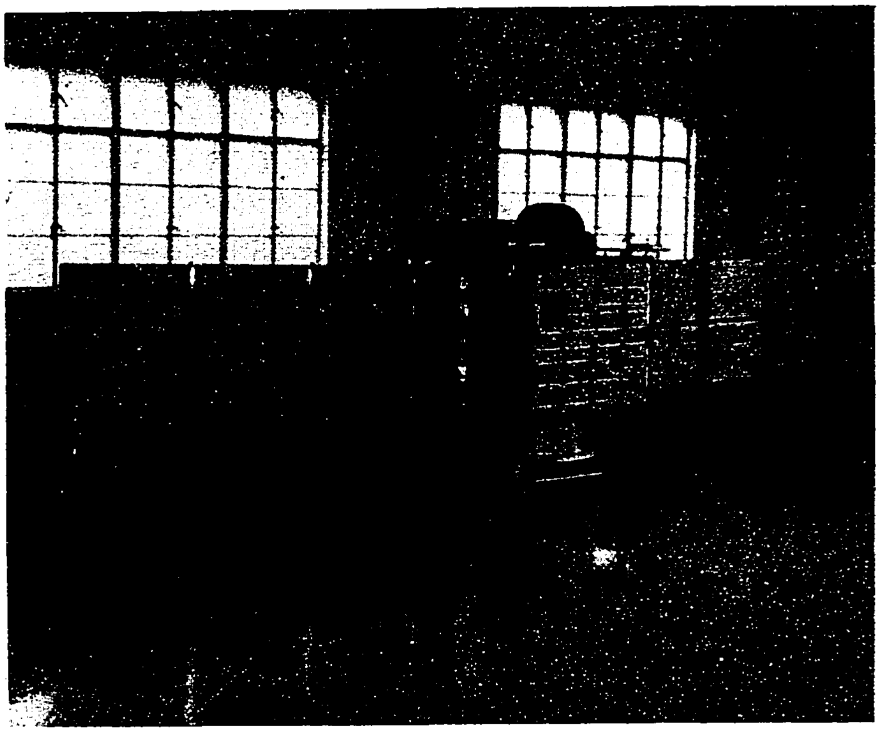
Picture 14, Chinese first satellite, Dong Fang Hong 1
(East is Red 1)



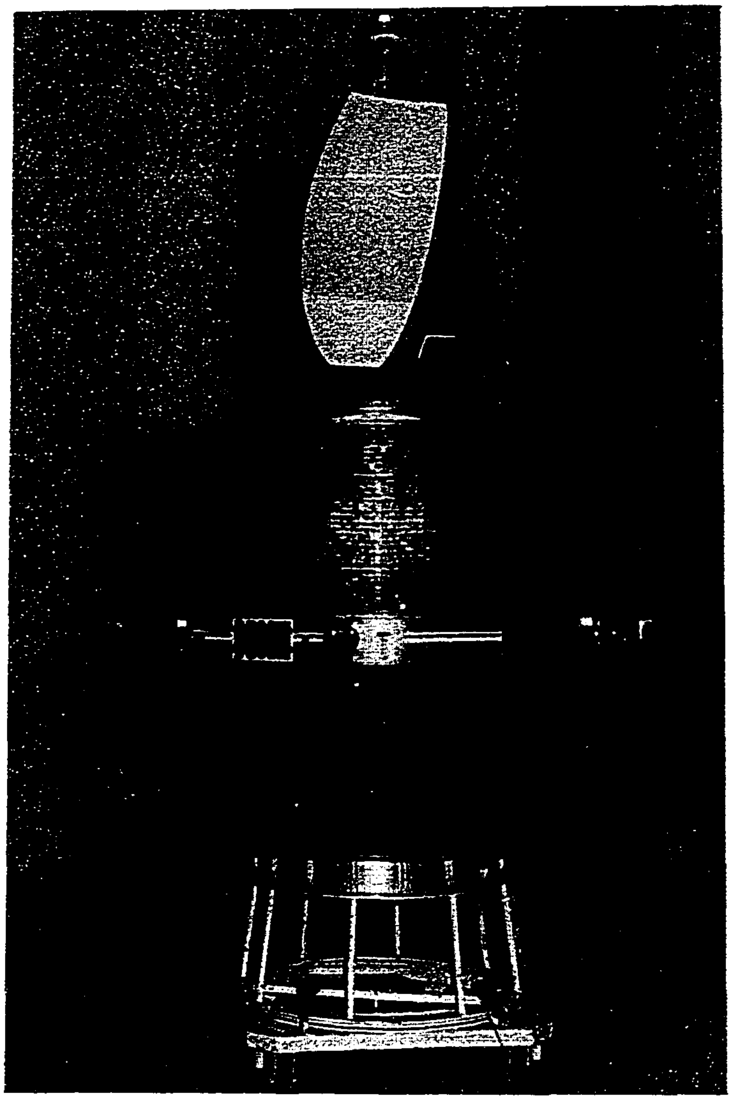
Picture 15, Chinese satellite, Practice 1



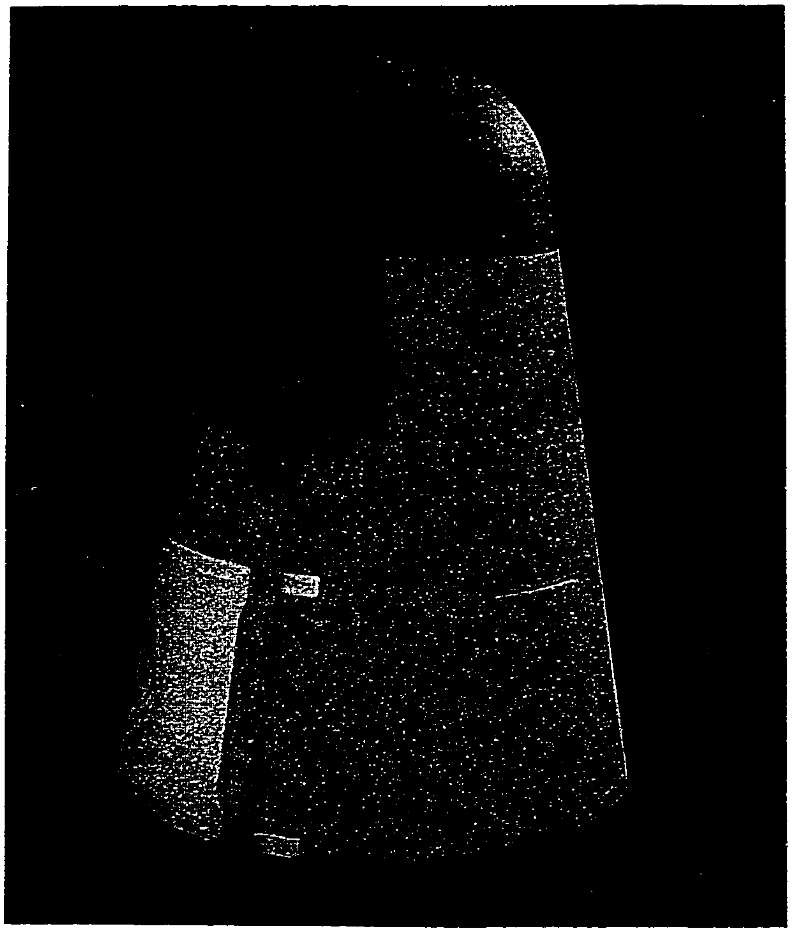
Picture 16, Chinese satellite, Practice 2



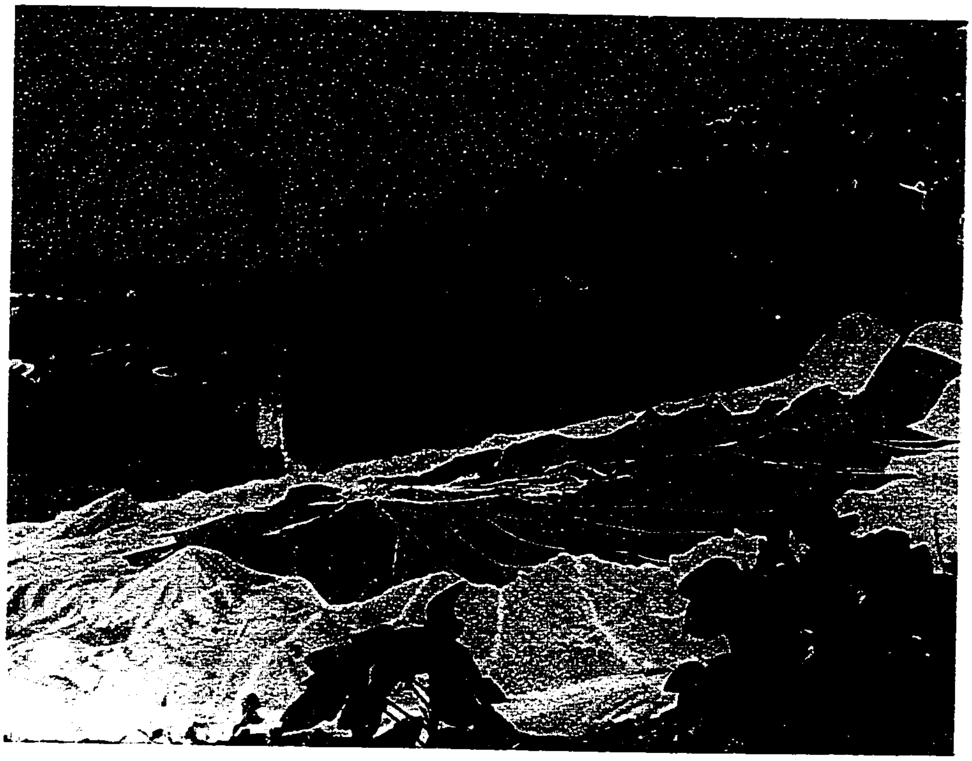
Picture 17, Chinese meteorology satellite, Feng Yun 1



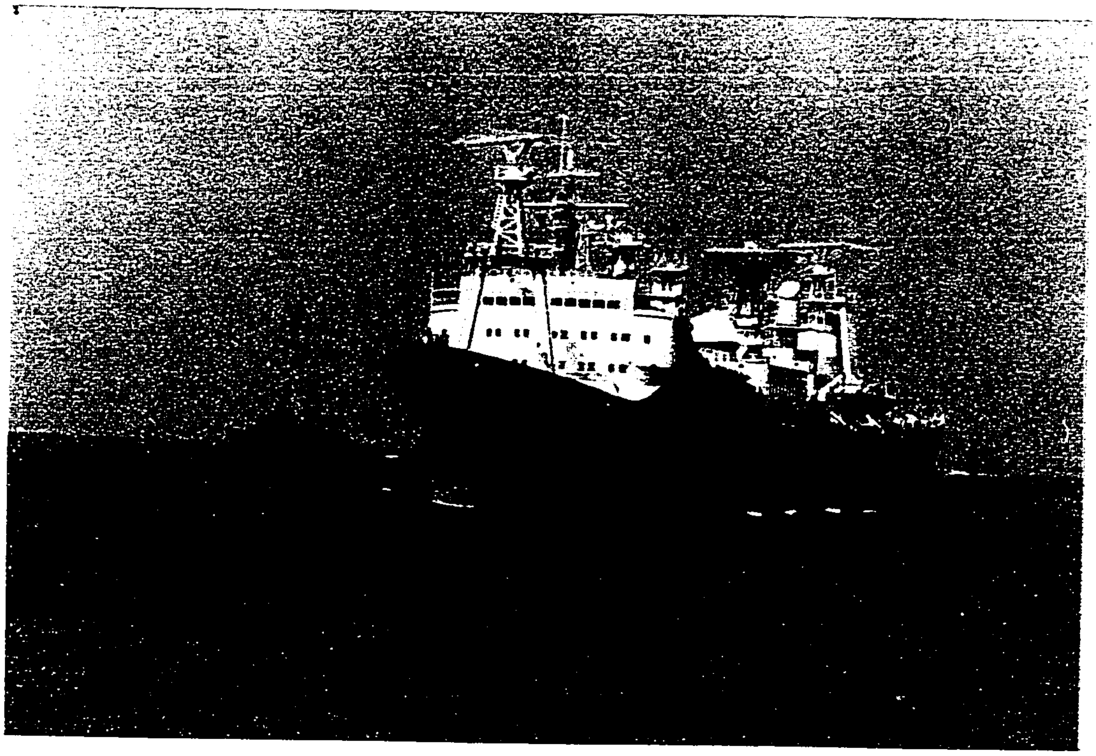
Picture 18, Chinese Telecommunication Satellite,
Dong Fang Hong 2



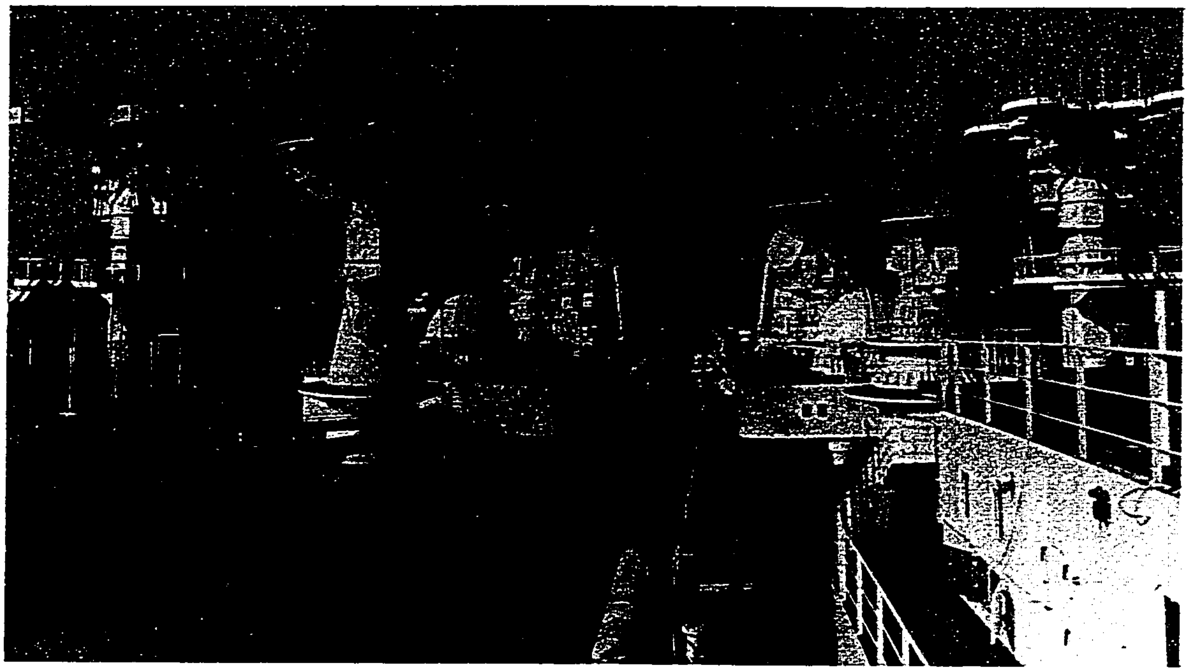
Picture 19, Chinese recoverable satellite, Jian Bin 1



Picture 20, Scene of the landing site of a recoverable satellite



Picture 21, Chinese launching and satellite tracking ship, Yuan Wang 1



Picture 22, Tracking system on Yuan Wang 1

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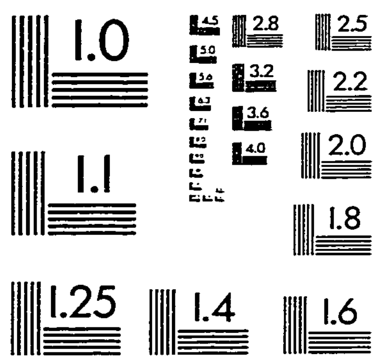
IMAGE EVALUATION TEST TARGET (QA-3)



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