

China's Defense Industry on the Path of Reform

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Executive Summary

Key Findings

- With some notable exceptions (missiles and space), the Chinese defense-industrial base through the 1980s and most of the 1990s uniformly suffered from chronic shortages of capital, technology, and production know-how;
- The purchases of Russian military technology in the early to mid 1990s, such as Su-27 FLANKERs, Kilo-class submarines, and *Sovremenny*-class destroyers, were meant to fill critical mission-related gaps in Chinese military modernization, and should therefore be seen as a scathing indictment of the failures of the PRC defense-industrial base to fulfill its long-standing promises to the People's Liberation Army (PLA);
- Since the reforms of 1998, the Chinese defense industries have undergone a dramatic and successful transformation, surpassing the expectations of even the most forward-leaning analyst;
- There is now significant variation across the various sectors (aviation, aerospace, ordnance, shipbuilding, defense electronics) of the Chinese defense-industrial base;
- The relative progress of an individual defense-industrial sector appears to be best explained by its relative integration into the globalized production and R&D chain, which provides access to the latest production and manufacturing technologies and know-how;
- While missiles and aerospace have always been a “pocket of excellence,” the greatest progress appears to have been made in the shipbuilding and defense electronics sectors, both of which have benefited greatly from China's current position as a leading producer of commercial ships and information technologies;
- Those sectors that have lagged in relative terms (aviation and ordnance) have been hurt by a lack of similar spin-on benefits from partnerships between multinational corporations and domestic industry, though the defense-industrial reforms of 1998 and diffusion of innovation in the system have improved their performance;
- Integration with the global production and R&D chain has facilitated dramatic improvements in Chinese defense-industrial production and PLA modernization since the late 1990s;
- China's emergence as the world's IT workshop has played an important role in the PLA's C4I revolution, particularly the elements of the C4I system that rely on COTS (commercial off-the-shelf). This C4I revolution has significantly improved the Chinese military's operational and communications security.

Introduction

China's defense industry has undergone a dramatic transformation over the past decade. Fundamental reforms in central government organization and policy, the operations of defense enterprises, and the flow of international capital reveal a new paradigm on the part of the Chinese leadership. As a result of these changes, the historical critique of China's defense industry as clogged with redundancy and inefficiency, and lacking access to capital and advanced technology is no longer accurate.

Building upon the findings of a 2005 RAND report entitled *A New Direction for China's Defense Industry*, this report analyzes recent reforms in China's defense industrial base and their effectiveness. It adopts the sector-by-sector approach introduced in the RAND study in order to account for significant variation across the different sectors (aviation, aerospace, nuclear, shipbuilding, electronics, and ordnance).

The following chapters assess the tremendous progress since 1998 by arguing that four main factors have determined success and define the leadership's new approach to modernizing defense industry:

- More funds for weapons acquisition;
- "Spin-on" benefits from the commercial economy;
- Integration into the global research, development, and production chain, which provides access to foreign technology, know-how, and capital;
- Fundamental reforms building on the "Four Mechanisms" (四个机制) of "competition, evaluation, supervision, and encouragement" introduced in 1998.¹

These factors provide a framework for assessing the effectiveness of reforms and the extent to which they are enabling China to strengthen its indigenous capabilities. At the foundation of this framework is a principle put forward by the Sixteenth Party Congress in 2003: *Yujun Yumin* (Locating Military Potential in Civilian Capabilities; 于军于民). The principle calls for building a civilian sector capable of meeting the PLA's needs and the coordinated development of the civilian and defense economies.²

Chapter one argues that recent changes in the organization of the central government and defense enterprises reflect the new approach to building defense industry. This opening chapter also provides an updated overview of the major players and their relationships to reflect changes since the 2005 RAND study.

¹ For a detailed description of the Four Mechanisms, see Tai Ming Cheung, *Fortifying China: The Struggle to Build a Modern Defense Economy* (Ithaca: Cornell University Press, 2009), 130-132 and Evan Medeiros, et al, *A New Direction for China's Defense Industry*, Santa Monica, CA: RAND, MG-334-AF, 2004, vxiii.

² Cheung, 9.

Chapter two identifies the sectors that have seen the most significant improvements in their ability to produce high-tech equipment. The relative progress of individual sectors appear to be best explained by their degree of integration into the globalized R&D and production chain. Those sectors lagging have been hurt by lack of spin-on benefits from partnerships with multinational and foreign corporations.

Chapters three and four demonstrate the ways in which expanded access to resources from U.S. and Western companies are contributing to improvements in the capabilities of China's defense industry. Under the principle of *Yujun Yumin*, interactions with Western companies may lead to the transfer of capital, technology, and know-how to Chinese defense enterprises seeking to exploit dual-use applications. Chapter three examines these three types of support from Western companies, while chapter four looks specifically at the influx of international capital through the subsidiaries of defense enterprises listed on capital markets.

Chapter five assesses the extent to which the reforms have led to increases in the relative independence of the defense-industrial base. Indicators developed in the 2005 RAND study suggest that the level of dependence on foreign technology and know-how still remains high.

CHAPTER ONE: Organizational Infrastructure and Relationships among Major Players at Government and Enterprise Levels

Introduction

The year 2008 saw significant changes in the structure of China's defense industry. This chapter will provide an updated picture of the roles and relationships among the key players, both at the level of government ministries and defense enterprises.

The current organization indicates the leadership's new paradigm for building up China's defense industry. At the level of government ministries, reforms in 2008 demonstrate a commitment to injecting the "Four Mechanisms" (四个机制) of "competition, evaluation, supervision, and encouragement" into the oversight structure. The first section of this chapter looks at these changes, highlighting in particular the creation of the new Ministry of Industry and Informatization (MIIT; 中华人民共和国工业和信息化部) and the elevation of the General Armaments Department (GAD; 总装备部). Second, the state-owned defense enterprises show not only a focus on the "Four Mechanisms," but also expanded opportunities to leverage the spin-on benefits of the commercial economy and integrate China's defense industry into the global R&D chain. Overall, the current structure indicates a broad process of consolidation to boost efficiency and quality while implementing civil-military integration with the *Yujun Yumin* system (locate military potential in civilian capabilities).

Reform and Consolidation of Government Organizations

The New Structure under the MIIT

The government ministries and departments that oversee policy, leadership, and investment decisions for the defense industry have undergone several changes intended to eliminate redundancy while strengthening oversight and quality incentives.

After the first plenary session of the Eleventh National People's Congress in March 2008, the government created a new super-ministry, the Ministry of Industry and Informatization (MIIT; 中华人民共和国工业和信息化部). As part of a broader consolidation process, the MIIT assumed authority over the functions of several government departments: the industry and trade part of National Development and Reform Commission (NDRC; 国家发展和改革委员会); the State Administration of Science, Technology, and Industry for National Defense (SASTIND; 中国国家国防科技工业局, formally the Commission of Science, Technology and Industry for National Defense, or COSTIND); the former Ministry of Information

Industries (信息产业部); and the State Council Informatization Office (国务院信息化工作办公室).

Hong Jiansheng, the chief engineer of the Chengdu Aviation Industry Group—one of the major aviation subsidiary companies discussed in section III—commented that the new ministry allows the defense industry to meet the needs of the military more efficiently. Under the former structure, the Ministry of Information Industries and the NDRC “divided forces at the alley entrance” (分兵把口).³ This phrase describes the inefficiency of the previous structure and the need to consolidate authority and supervision, which is consistent with the “Four Mechanisms” concept.

In its position of consolidated authority, the MIIT not only represents an overall streamlining process, but also helps facilitate the exchange between civil and military resources consistent with the principle of *Yujun Yumin*. In fact one of its missions is to promote civil-military integration (军民结合) as well as the coordinated development of advanced technology and industry. The super-ministry has a broad range of functions, including managing the telecommunications industry and safeguarding information security. For example, the MIIT manages regulations related to the new software China is requiring be preinstalled on all computers sold in China after July 1 to filter out objectionable internet content, called Green Dam Youth Escort. As the later chapters will show, spin-on benefits from the commercial telecom and IT sectors have played an important role in the Chinese military’s operational and communications security. Hong Jiansheng’s assessment of the restructuring summarizes how the integration of these various sectors will strengthen China’s production capabilities: “[the new MIIT] promotes the fusion of informatization and industrialization, and particularly raises the level China’s equipment manufacturing....”⁴

A key office within the MIIT is the Civil-Military Integration Department (军民结合推进司), headed by Tu Senlin (屠森林).⁵ Its mission is to write policy and set standards pertaining to the “promotion of military-civilian dual use technology transfer and to implement an integrated system of standards.” For example, this office manages the licensing for civilian space launches.⁶ An October 2008 posting on the MIIT website gave guidance on stipulation 179 of the 2007 Science and Industry Law, stressing the

³ Wu Yan, “Guwuyuan Jigou Gaige gongye he xinxihuabu chengli,” (April 2008), information accessed at: scholar.ilib.cn/A-QCode~xxxtgc200804035.html on September 27, 2008.

⁴ Ibid.

⁵ “Junmin Jiehe Tuijinsi,” information accessed at: <http://jmjhs.miit.gov.cn> on September 27, 2009.

⁶ “Minyong hangkong fashe xiangmu xukezheng guanli zanxing banfa,” information accessed at: <http://jmjhs.miit.gov.cn/n11293472/n11295193/n11298643/11619789.html> on September 27, 2009.

importance of private commercial participation in China's S&T defense sector.⁷ This kind of partnership plays a critical role in helping the defense sector leverage spin-on benefits from the commercial economy and integrate into the global R&D and production chain, and it adds an additional layer of supervision consistent with the "Four Mechanisms."

Li Yizong (李毅中), who has been minister since MIIT's establishment, is well suited to implementing this strategy. He has spent the bulk of his career in the civil sector, and originally worked in the petrochemical industry, holding senior positions in the China Petroleum & Chemical Corporation (中国东联石化集团有限责任公司).⁸ Scholars such as Tai Ming Cheung speculate that Li's lack of defense credentials may make him more beholden to central rather than local influences.⁹

COSTIND, SASTIND, and GAD

The 2008 shift from COSTIND to SASTIND represents the latest iteration of a series of organizational changes since COSTIND's establishment in 1982. With each change, policy planners have sought to strengthen defense R&D and production capabilities by structuring the industry to be more consistent with market principles.

Initially COSTIND reported both to the Central Military Commission (CMC) and the State Council in its role overseeing the R&D and purchase of military equipment for the PLA. But in 1998 the government removed it from the control of the military and placed it exclusively under civilian authority beneath the State Council. It no longer held influence over procurement decisions or the operations of the defense enterprises. Instead, the government created GAD in 1998 to centralize the military procurement system. GAD became responsible for life-cycle management of the PLA's weapons systems from the R&D phase to retirement. Under the new system, COSTIND oversaw the administration of the defense firms, while GAD represented the PLA's interests. Through this organization, the government essentially sought to boost efficiency and

⁷ "Guanyu feigongyouzhi jingji yu guofang keji gongye jianshe de zhidao yijian," information accessed at: <http://jmhhs.miit.gov.cn/n11293472/n11295193/n11298643/11618138.html>. An excerpt from the document: "Guidance on the policy environment: within the scope of national policy, private enterprises should be treated equally without discrimination in terms of market access, job competition and participation in defense industrial reorganization and convergence."; "encourage and attract private companies to participate in competition and in cooperative projects involving military product R&D production assignment. Private companies can undertake weaponry subsystems and complete sets product manufacturing and development responsibilities, specifically the scope to undertake would be according to SASTIND issued weaponry, scientific research and product permitted list...."

⁸ Information accessed at: <http://liyizhong.miit.gov.cn> on September 27, 2009.

⁹ Cheung, 117.

eliminate corruption by separating the builders and the buyers.¹⁰ In effect the 1998 reforms represented a critical step in reforming the supplier-buyer relationship to adhere to standard market practices.¹¹

In 2008, the government created SASTIND from the former COSTIND and further demoted its authority. The main beneficiary of the government-level reforms has been GAD. While SASTIND focuses solely on industrial planning and regulatory aspects of the defense-industrial base beneath the MIIT, GAD has consolidated its control over defense R&D and procurement and gained increased political stature.

State Administration for Science, Technology and Industry for National Defense (SASTIND; 中国国家国防科技工业局)

The Chinese State Administration for Science, Technology and Industry for National Defense (SASTIND), organizationally subordinate to the Ministry of Industry and Information Technology (MIIT; 中华人民共和国工业和信息化部), was formed as part of a broad government restructuring process carried out in March 2008, during which the former Commission of Science and Technology in National Defense (COSTIND) was dissolved and largely reconstituted as SASTIND. The new SASTIND plays a reduced role in managing the defense industry as compared to its predecessor COSTIND. Under the new structure, SASTIND focuses solely on industrial planning and regulatory aspects of the defense-industrial base, while the General Armaments Department (GAD; 总装备部) consolidates control over research and development processes within the military.

Another notable change in the function of SASTIND compared to the former COSTIND is that the new administrative organization is no longer responsible for management of nuclear power. COSTIND's nuclear power management functions were transferred to the National Energy Administration, also created during the March 2008 reforms, and are now therefore administered separately under the National Development and Reform Commission (NDRC; 国家发展和改革委员会).

Chen Qiufa (陈求发), formerly assistant director of COSTIND, has been Party Secretary and Director of SASTIND since its formation.

¹⁰ Medeiros, 32-36.

¹¹ Cheung, 147.



Several images of Chen Qiufa (陈求发), SASTIND Director and Party Secretary

While SASTIND's role in the defense industry is reduced compared to the role played by COSTIND, SASTIND clearly continues to be active in guiding the development of China's defense industry, including the defense electronics industry. In June 2008, for example, Chen Qiufa, in his role as Director of SASTIND, presided over a groundbreaking ceremony in Chongqing for a new electronics components production facility being built by the China Electronics Technology Corporation (CETC; 中国电子科技集团公司). The facility, being constructed in the Chongqing Xiyuan Microelectronics Production Zone (重庆西永微电子产业园区) with support from the CETC 24th, 26th, and 44th research institutes, is intended initially to support programs for simulated electric circuits (模拟集成电路), composite integrated circuits (混合集成电路), sound surface wave devices (声表面波器件), scintillating crystal materials (闪烁晶体材料), piezoelectric ceramics and devices (压电功能陶瓷及器件), as well as opto-electronic detectors (光电探测器), semiconductor lasers (半导体激光器), and LED semiconductor illuminating devices (LED半导体照明). CETC established a subsidiary company, the CETC Chongqing Acousto-optoelectronics

Corporation (中电科技集团重庆声光电有限公司) to oversee preparatory and construction work for the project.¹²

In September 2008, SASTIND Director Chen Qiufa also toured several research and development organizations in Shaanxi Province to promote integration between the region's defense and civilian industries (军民的融合). Chen Qiufa and his entourage visited facilities at the AVIC I First Aircraft Design Academy (中航一集团第一飞机设计院), the Chinese Academy of Sciences Xi'an Institute of Optics and Precision Mechanics (中科院西安光机所), the Aerospace Science and Technology Group Corporation Fourth Academy (航天科技集团四院), and six key military industry units in Shaanxi, and exhorted personnel at each location to assume responsibility for their performance, act with a sense of urgency, and keep in mind the importance of civil-military integration.¹³

Seven university-level schools that were formerly under the jurisdiction of COSTIND are now managed by the MIIT:¹⁴

- Beijing Engineering University (北京理工大学)
- Haerbin Institute of Technology (哈尔滨工业大学)
- Haerbin Engineering University (哈尔滨工程大学)
- Nanjing University of Aeronautics and Astronautics (南京航空航天大学)
- Nanjing Engineering University (南京理工大学)
- Northwest Polytechnical University (西北工业大学)

Although it is not clear from MIIT guiding documents whether or not these schools are managed through SASTIND specifically, early 2009 visits to Beijing University of Aeronautics and Astronautics and Beijing Engineering University by Chen Qiufa in his

¹² Information accessed at:

<http://www.miit.gov.cn/n11293472/n11293832/n11293907/n11368223/11532810.html>
on 22 June 2009.

¹³ Information accessed at

<http://www.miit.gov.cn/n11293472/n11293832/n11293907/n11368223/11527620.html>,
accessed on 22 June 2009.

¹⁴ Information accessed at:

<http://www.miit.gov.cn/n11293472/n11293832/n11293907/n11368223/11532324.html>
on 22 June 2009.

role as SASTIND director indicate that SASTIND is at least involved in their administration.¹⁵

As of December 2008, SASTIND's leadership consisted of the following personnel:

- Party Secretary, Director: Chen Qiufa (陈求发)
- Party Member, Assistant Directors:
 - o Sun Laiyan (Vice-minister grade; 孙来燕)
 - o Yu Liegui (Vice-Minister Level; 虞列贵)
 - o Huang Qiang (黄强)
 - o Wang Yiren (王毅韧)
- Party Member: Hu Yafeng (胡亚枫)
- Disciplinary Organization Responsible Person: Li Donghai (李东海)

As of 2008, SASTIND included the following departments:¹⁶

- General Planning Department (综合计划司)
- Development Planning Department (发展计划司)
- Finance and Budgeting Department (财务与审计司)
- Science and Technology and Quality Department (科技与质量司)
- Economic Coordination Department (经济协调司)
- Military Component Complementarity and Supervision Dept.
(军品配套与监管司)
- Systems Engineering First Department (系统工程一司)

¹⁵

<http://www.miit.gov.cn/n11293472/n11293832/n11293907/n11368223/12265405.html>,
<http://www.miit.gov.cn/n11293472/n11293832/n11293907/n11368223/12250520.html>,
accessed 22 June 2009.

¹⁶ Departments list provided by XXX

- Systems Engineering Second Department (系统工程二司)
- Systems Engineering Third Department (系统工程三司)
- Systems Engineering Fourth Department (系统工程四司)
- Secure Production and Secrecy Department (安全生产与保密司)
- Personnel and Education Department (人事教育司)

SASAC

The other government entity worth noting is the State Assets Supervision and Administration Commission (SASAC; 国务院国有资产监督管理委员会). SASAC is responsible for appointing and managing top executives for the state-owned enterprises, which include the 10 defense enterprise groups discussed in detail in the third section of this chapter. It provides policy guidance for the development and reform of the state-owned economy. In this capacity, SASAC plays a key role enabling the central government to inject the “Four Mechanisms” of competition, supervision, evaluation, and encouragement into the defense economy.

Acting as investor on behalf of the state, SASAC manages state-owned assets worth 10.6 trillion RMB.¹⁷ As an indication of its significance, it is the largest shareholder in the China Commercial Aircraft Company (COMAC), one of China’s most important aviation subsidiary companies (see section three for a detailed discussion).

A current policy dilemma faced by SASAC highlights the way in which policy planners are seeking to strengthen the extent of its supervisory powers over the sprawling defense sector. Despite the amount of assets under its authority, SASAC actually has limited control over state assets in subsidiary companies. According to SASAC data, 100 of the state-owned enterprises it manages have an estimated 17,000 subsidiaries beneath them. But SASAC has supervisory authority over only the SOEs, not these subsidiaries. Li Rongrong (李荣融), SASAC’s chairman and Party Secretary, has suggested changing a law in order to allow SASAC to control what it calls “key subsidiaries” of its state-owned enterprises.¹⁸

This initiative highlights a contradiction faced by policy planners in implementing the “Four Mechanisms.” Although increasing supervision is important for quality control, too

¹⁷ Li Rongrong (SASAC), “Chief of State Assets Agency Discusses Education Drive in Central Enterprises,” *Renminribao*, January 17, 2006.

¹⁸ “State-owned Companies Should Go Public,” information accessed at: http://www.china.org.cn/business/news/2008-10/31/content_16693472.htm on September 27, 2009.

much state control impedes competition. A challenge faced by policy planners as the process of reform and consolidation continues is how to balance state supervision and evaluation with the increased autonomy needed for competition in a market economy.

State-owned Defense Enterprise Groups

Overview

While the government ministries and agencies deal with strategic planning and policy related to the development of the defense economy more broadly, the state-owned enterprise groups (集团公司) are involved with management decisions within each sector. They act as holding companies with shares in subsidiaries, or subordinate enterprises (成员单位). They select leaders and review major capital expenditures, but do not intervene in daily operations.¹⁹ Based on the findings of the 2005 RAND study, which argued for a sector-by-sector approach to China's defense industry, this section provides an updated picture of the defense enterprises and their subsidiaries, research institutes, and facilities by sector.

Over the past decade, China has reorganized the structure of its defense enterprise groups and their subsidiary companies. Prior to 1999, five state-owned corporations ran each defense sector. But in 1999 the State Council implemented a change to increase competition and efficiency: it divided each of the five conglomerates into two state-owned enterprise groups. In 2002, the number of enterprise groups changed again after the State Council created the China Electronics Technology Group Corp (CETC). CETC brought the total number of these enterprises to eleven. In theory, having two enterprise groups not only aimed to bolster competition, but also to create a complementary structure in which one could concentrate more on defense and the other on the civilian sector.²⁰ But the subsequent discussion will show that this line often blurs in practice.

Recent developments in the defense enterprises demonstrate an enduring commitment to implementing the principle of *Yujun Yumin* and the new model for building up China's defense industrial base. As introduced in the report introduction, the determinants of success according to the new approach are:

1. More funds for weapons acquisition
2. Access to "Spin-on" benefits from the commercial economy
3. Integration into the global production and R&D chain, which provides access to foreign technology and know-how
4. Fundamental reforms building on the "Four Mechanisms" of "competition, evaluation, supervision, and encouragement"

¹⁹ Medeiros, 111.

²⁰ Cheung, 122.

The following discussion will identify these aspects of the new approach in the activities of the defense enterprises. Indications of points two and three are particularly apparent in the lateral and vertical movements of the top leaders in the enterprises, as well as in new projects and strategic initiatives.

While missiles and aerospace have traditionally excelled, shipbuilding and defense electronics are currently benefiting greatly from China's current position as a leading producer of commercial ships and information technologies in international markets. It appears that China's leaders are hoping to achieve similar results in aviation, a sector that has lagged behind for decades. Indeed key changes in aviation since 2008 indicate that the leadership hopes to improve the sector through following the model of expanding access to spin-on technologies and the global R&D chain.

The discussion will begin with aviation since this is the sector that has undergone the most change in the past year. The list below provides an overview of the defense enterprise groups:

Aviation

China Aviation Industry Corporation of China (AVIC; 中国航空工业集团公司)

Aerospace and Missiles

China Aerospace Science and Technology Corporation (CASC;
中国航天科技集团公司)

China Aerospace Science and Industry Corporation (CASIC; 中国航天科工集团公司)

Nuclear

China National Nuclear Corporation (CNNC; 中国核工业集团公司)

China Nuclear Engineering and Construction Corporation (CNECC;
中国核工业建设集团公司)

Shipbuilding

China State Shipbuilding Corporation (CSSC; 中国船舶工业集团公司)

China Shipbuilding Industry Corp. (CSIC; 中国船舶重工集团公司)

Electronics

China Electronics Technology Enterprise (CETC; 中国电子科技集团公司)

Ordnance

China North Industries Group Corporation (CNGC or NORINCO(G);

中国兵器工业集团公司/兵器工业集团公司)

China South Industries Group Corporation (CSG;

中国兵器装备集团公司/兵器装备集团公司)

Aviation

AVIC develops, manufactures, and markets military and commercial aircraft, as well as engines and airborne weapons. Although in 1999 the authorities divided the former China Aviation Industry Corporation (中国航空工业集团公司) into AVIC I and AVIC II, the two defense enterprise groups re-merged into a single entity in November 2008. AVIC now presides over 200 subsidiary companies, 20 listed firms, and 31 research institutes.

The reasons for the merger relate to a second development: the creation that same year of China Commercial Aircraft Company Ltd (COMAC; 中国商用飞机有限公司). CACC is overseeing the development and production of China's first indigenously produced large commercial passenger jet. The central government established COMAC to oversee the production of a large-scale commercial aircraft to compete with Boeing and Airbus. The creation of COMAC follows previous failed attempts to build an indigenous regional jet, but with the consolidation of resources under the new AVIC, COMAC is well positioned to deliver on a project of such national significance.

The creation of COMAC is a significant indication of the new model for modernizing China's defense industry in several ways. First, it highlights the overlap between civil and military programs as a commercial endeavor beneath the single umbrella of AVIC. Ostensibly a commercial jet program in China will provide opportunities for spin-on benefits to the field of military aviation, as well as integrate AVIC into global markets. If the program succeeds, it will provide the defense aviation sector with more capital. Chapters three and four build on this point by showing the ways in which AVIC has significantly improved its ability to access foreign capital and international capital markets.

The backgrounds of the leadership of AVIC and COMAC both reinforce these points. Li Zuoming (林左鸣) became the first general manager of the new AVIC. At the same time he also serves as the vice board chairman of COMAC. This dual position indicates the political importance of the COMAC project.

COMAC is also the hub connecting senior figures from a web of other major defense entities, at both the ministerial and enterprise levels. This is significant because COMAC is a civil, commercial entity, yet its top managers represent elite positions in the military aviation and missile sectors. Their movement between the civil and defense sectors is one indication of how *Yujun Yumin* manifests in the organization of the industrial base.

Jin Zhuanglong (金壮龙) is the general manager of COMAC. He began to climb the ladder of management positions in China's defense industry as the head of the 8th Department of Shanghai Academy of Spaceflight Technology (SAST; 上海航天局). SAST is a subsidiary of the one of the two defense enterprises in charge of China's missile and aerospace industry, CASC, discussed later in this chapter. From SAST he was appointed as the vice general manager and CCP leading group member of CASC. His history at CASC alone would be telling, but it goes further. Apart from the defense enterprise world, he also served on the ministerial side of the defense industry before coming to COMAC. In 2004 he was appointed as the secretary general of COSTIND, and in 2007 was promoted to deputy director and Party group member.²¹ Therefore, he comes to one of China's most significant commercial projects from leadership positions in both defense policy and the aerospace and missile sector.

Zhang Qingwei (张庆伟), COMAC's CCP leading group secretary, reveals a similar story. Zhang also worked at CASC and has been heavily involved with the Long March rocket project. He started his career at the Aviation and Aerospace Industrial Department Carrier Rocket Technical Research Institute Systems. In 1991 he was the assistant head engineer and later chief designer on the Long March-2 and -3 rockets. He ascended the ranks in the China Carrier Rocket Technical Research Institute, the China Aerospace Industry Corporation, and then became the general manager and CCP leading group member of CASC. In addition, he has also been involved with other projects of major national significance, including servings as the assistant chief commander on China's Manned Spaceflight Engineering Project (载人航天工程副总指挥).²²

Appendix A provides more detail on other major AVIC enterprises, their industrial foci, and commercial and/or foreign affiliation.

Aerospace and Missile Sector

The 1999 division of the China Aerospace Science Technology Corporation into two enterprises created a structure conducive to market competition and increased incentives for innovation and efficiency. The split resulted in two enterprises overseeing the missile and aerospace sector: the China Aerospace Science and Technology Corporation (CASC; 中国航天科技集团公司) and the China Aerospace Science and Industry Corporation (CASIC; 中国航天科工集团公司).

²¹ Biography of Jin Zhuanglong (金壮龙) available at: <http://www.comac.cc/n16/n1154/n1276/n15397/index.html> accessed on 24 May 2009.

²² Biography of Zhuang Qingwei (张庆伟) available at: <http://www.comac.cc/n16/n1154/n1276/n15382/index.html> on 24 May 2009.

CASC develops and manufactures ballistic missiles and space launch vehicles. It also specializes in providing launch services for civilian commercial satellites.”²³ CASIC’s primary focus is missile systems. Its business areas also include satellite R&D and delivery systems, and military and civilian applications of information technology.²⁴

Because the two defense enterprises are state-owned and managed, their competition is uniquely Chinese rather than what we might think of as pure market competition. The central government manages the competition in order for the industry as a whole to reap maximum benefit. As one Chinese official stated in 1999, “the competition between [CASC and CASIC will not be] competition in terms of their products, rather it [will be] competition in terms of their systems of organization and their operational mechanisms.”²⁵

In particular, one area of competition between the two enterprises has helped the sector leverage more spin-on benefits from the commercial economy, as well as integrate into global markets. CASC and CASIC’s subsidiaries compete for contracts in the commercial space launch vehicle (SLV) market. Through competing on the international SLV market, CASC and CASIC have incentives for innovation and efficiency. They also are in a position to leverage technological advances from commercial SLVs to develop and produce ballistic missile systems.²⁶ Chapter three will examine the international networks linking China’s aerospace and missile sector to capital, know-how, and technology in the global market, and it will provide further detail about the nature of the contracts CASC and CASIC subsidiaries each have with major European space companies, which have caused concern in the United States.

The backgrounds of the senior leaders at CASC and CASIC reveal two trends consistent with the metric of success according to the new paradigm for China’s defense industry. First, similar to aviation, CASC and CASIC’s leaders are involved with both the civil and military applications of space technology. Ma Xingrui (马兴瑞), CASC’s general manager since 2007, has an academic background. He received his masters in general mechanics from Tianjin University before getting his doctorate at Harbin Industrial University. Afterwards he was the associate dean and a professor at the China Space Technology Research Institute, where he also served as the chief designer and director of the SJ-5 (实践五号) satellite program.²⁷ CASIC general manager Xu Dazhe (许达哲) is currently vice chairman of the Beijing Association of Scientists, vice president of the China Quality Association, and president of the China Space Industry Quality

²³ CASTC Website; Cheung, 121; Medeiros, 53.

²⁴ Cheung, 121.

²⁵ Li Xiuwei, “Applying Technology to National Defense,” 1999, as referenced in Medeiros, 74.

²⁶ Medeiros, 72-74.

²⁷ Ma Xingrui biography, available at: <http://baike.baidu.com/view/1161548.htm>.

Association.²⁸ Second, leaders move between CASIC and CASC fairly often. Now at the helm of CASIC, Xu in 2000 was the general manager and CCP leading group vice secretary of one of CASC's largest subordinate enterprises, CALT. In December 2001 he was appointed as the deputy general manager of CASC and CCP leading group member.

CASC and CASIC are pillars of state control --massive, sprawling enterprises with hundreds of subsidiaries beneath them. This means that there is still considerable autonomy for the hundreds of companies carrying out the business operations for China's space programs. CASIC alone presides over more than 180 subordinate enterprises, including two research institutes, and eight holding companies. It has 100,000 employees, 40 percent of whom have technical specialties.²⁹ A chart of some of these subsidiaries is provided in the table in Appendix A.

Nuclear Sector

The two enterprise groups managing China's nuclear industry are the China National Nuclear Corporation (CNNC; 中国核工业集团公司) and the China Nuclear Engineering and Construction Corporation (CNECC; 中国核工业建设集团公司).

CNNC manages the R&D, production, and foreign cooperation related to nuclear power, nuclear materials, the generation of nuclear electricity, uranium exploration, nuclear instrumentation, and the application of nuclear technologies. Its scale is similar to the enterprises in the space sector: 100 subordinate companies and institutes, with 100,000 employees. It opened a Hong Kong office in February 2009. The significance of the Hong Kong office to the nuclear sector's integration in global markets will be discussed in more detail in chapters three and four.

CNECC constructs nuclear power plants and defense infrastructure facilities. Its business areas include nuclear engineering, surveying, manufacturing, foreign trade, real estate and software development. It serves as the prime contractor for domestic nuclear power projects. Specifically, it managed construction and engineering for China's nuclear power plants in Yagang, Lingao, Tiangang, and Qinshan.³⁰

Similar to trends observed in the other sectors, civil uses of nuclear power have provided significant opportunities for the defense sector to access spin-on benefits from nuclear technology and equipment, as well as to integrate into global R&D and production

²⁸ Xu Dazhe (许达哲) biography available at:

<http://www.casic.com.cn/n16/n1100/n2798/76163.html> accessed on 24 May 2009.

²⁹ Information accessed at: <http://www.casic.com.cn/n16/n1100/n2768/index.html> on 24 May 2009.

³⁰ Cheung, 120; and CNECC Website, available at: http://www.cnecc.com/zi_jt_jianjie.asp.

chains. This is made possible by the structure of the nuclear sector, with the two enterprises engaged in both civil and military uses of nuclear power.

Civil infrastructure projects serve as a particularly important channel for such a strategy. Although CNNC is the primary enterprise for managing international cooperation on nuclear power, CNECC's international construction business also provides for extensive exchange with foreign countries. For example, one of its subsidiaries, the China Nuclear Industry Zhongyuan Construction Company (中国核工业中原建设公司) is the primary contractor for Pakistan's Chashma power reactor in Pakistan. It also has construction contracts in Algeria and Jordan.³¹ Another CNECC subordinate, the 23rd Nuclear Industry and Construction Corporation (中国核工业第二三建设公司) has two France-China joint-ventures among its nine holding companies: Shenzhen Niukeli (Nuclear Power Ltd Corporation (深圳纽科利核电工程有限公司) and Shenzhen Shiyingda Pipeline Ltd Corporation (深圳施英达管道有限公司).³²

China's nuclear sector is also set up so there is extensive linkage between players involved in its civil and military projects. The CNNC has a relationship with the Chinese Academy of Sciences (CAS) and the Chinese Academy of Engineering (CAE). Twenty individuals from these academies serve dual posts as academicians with both CNNC and their home institutions (两院院士).³³

Thus the structure of the nuclear sector demonstrates several aspects of the new paradigm for building up China's defense industrial base. Consistent with *Yujun Yumin*, the two defense enterprises serve as umbrellas for civil and military nuclear projects, both domestic and international. This in turn opens the channel for defense enterprises to access spin-on technologies and international markets, a topic discussed in more depth in chapters three and four.

Shipbuilding

The two defense enterprises managing China's shipbuilding industry – the China State Shipbuilding Corporation (CSSC; 中国船舶工业集团公司) and the China Shipbuilding Industry Corporation (CSIC; 中国船舶重工集团公司) have benefited greatly from China's position as a leading producer of commercial shipping. Like the enterprises in

³¹ Subsidiary information accessed at: http://www.cnecc.com/new_show.asp?m=%BC%AF%CD%C5%B8%C5%BF%F6&id=10803 on 24 May 2009.

³² “Zhongguo he gongye diersan jianshe gongsi,” information available at: http://www.cnecc.com/new_show.asp?m=%BC%AF%CD%C5%B8%C5%BF%F6&id=10801 accessed on 24 May 2009.

³³ “Liangyuan Yuanshi” accessed at <http://www.cnncc.com.cn/tabid/104/Default.aspx> on 24 May 2009.

other defense industry sectors, both enterprises are engaged in both commercial and military shipbuilding. The PLA Navy looks to CSSC as its primary supplier of warships, including destroyers, frigates, submarines, and auxiliary space instrumentation and replenishment ships.³⁴ In addition, CSSC produces civilian ships for domestic and international customers. Although CSIC focuses on civilian shipbuilding, it also has a military division.

The structure of China's shipbuilding industry is conducive to injecting the "Four Mechanisms" into the sector. Similar to the relationship between CASC and CASIC in the missile and aerospace sector, China's two shipbuilding enterprises compete for international commercial contracts. In addition, the shipbuilding industry in China has a decentralized organizational structure that grants the hundreds of shipyard groups (subsidiaries of CSIC and CSSC) a significant amount of autonomy. At the same time, this autonomy is balanced by state supervision since the allocation of PLA military contracts is managed by the central government.³⁵

The leader of CSSC's extensive experience in the commercial shipping sector helps to integrate the civil and military arms of the enterprise. Tan Zuojun (谭作钧) was appointed as the general manager and vice leading CCP group secretary in July 2008. Formally the vice president of CSSC, Tan came to the enterprise from several management positions in shipping companies based in Hong Kong. Prior to CSSC, he managed Hong Kong's China United Shipbuilding Company Ltd. (香港华联船舶有限公司), and the Hong Kong Feili Shipping Ltd Company (香港飞力船务有限公司). His location in Hong Kong, a business hub for international shipping, gave him substantial experience with foreign markets and companies.³⁶

Several initiatives within CSSC demonstrate its global ambitions for its commercial shipping business. CSSC aims to become recognized as the top shipbuilder in the world through a plan called the "5-3-1 goal:" "CSSC shall put itself in the rank of the top five and the top three shipbuilding groups in the world respectively in 2005 and 2010, with the ultimate goal of becoming number one."³⁷ One of CSSC's largest subsidiaries, the Jiangnan Shipbuilding Group (JSG; 江南造船集团有限责任公司), is modernizing and expanding its capacity by relocating its Jiangnan and Qiuxin Shipyards from Shanghai to Changxing Island.³⁸ Its new shipyard will expand CSSC's capacity from 800,000 to 4.5 million deadweight tons (DWT) per year by 2010. CSSC's website boasts that this

³⁴ Cheung, 121.

³⁵ See Medeiros chapter on shipbuilding industry structure, 115-123.

³⁶ Tan Zuojun (谭作钧) biography available at: <http://www.cssc.net.cn/leader-c.htm> accessed on 24 May 2009.

³⁷ Information available at www.cssc.net.cn accessed on 24 May 2009.

³⁸ Information available at: <http://www.jnshipyard.com.cn/gsgk.php> accessed on 24 May 2009.

facility will become the largest shipyard in the world. Press releases say that it will deliver its first ship in 2009.³⁹

CSSC is integrated into the global R&D and production chain through several different subsidiary channels. First, as mentioned earlier, many of its shipyard groups have international contracts and joint-ventures. As one example, the Zhonghua-Hudong Shipbuilding Group (沪东中华造船集团有限公司), located on Chongming Island, Shanghai, has contracts that span over thirty countries.⁴⁰ CSSC's trading companies are a second channel that links it with the international market. The China Shipbuilding Trading Corporation (CSTC; 经营船舶外贸进出口业务) imports and exports on behalf of CSSC. While there are a few other ship trading companies, CSTC is the only entity authorized by the State Council to conduct trade in military vessels."⁴¹ Third, CSSC's research institutes have substantial interaction with foreigner buyers. CSSC's two principle research institutes are the Marine Design & Research Institute of China (MARIC; 中国船舶及海洋工程设计研究院) and the Shanghai Ship Design and Research Institute (SDARI; 上海船舶研究设计院). MARIC is the larger of the two. It often contracts with foreign entities to purchase or produce designs of naval ships, merchant vessels and offshore structures.⁴² The table at Appendix A provides further details about CSSC and CSIC's subsidiaries.

Details of interactions with foreign companies are discussed in more depth in Chapter Three.

Electronics and Information Technology

Similar to the shipbuilding sector, the electronics and information technology industry has benefited significantly from China's position as a leading producer in the commercial economy. The changes in structure and policy in this sector in the past several years exemplify many aspects of the new model for the defense industry.

The demand for defense-related electronics and information computer technology (ICT) products increased in the 1990s under the new strategy of people's war under modern conditions. The leadership recognized that electronics and ICT would prove critical to the "informatization" (信息化) of the military industrial base. Contrary to some interpretations of this term in the West, the strategy of informatization is not equivalent to a Chinese Revolution in Military Affairs, but rather means to enhance existing military systems using ICT capabilities.⁴³ Access to advanced technology in this area contributes

³⁹ "Jiangnan Shipyard to Break Records," available at:

http://www.cssc.net.cn/english/news_show.php?id=2413 accessed on 24 May 2009.

⁴⁰ "Shanghai Huarun dadong chuanwu gongcheng youxian gongsi jieshao," available at: <http://www.hrdd.com.cn/doking.html> accessed on 24 May 2009.

⁴¹ Medeiros, 116.

⁴² MARIC website and Medeiros, 119.

⁴³ Medeiros, 250.

to the PLA's ability to transmit and process information and its growing C⁴ISR (command, control, communications, computers, and intelligence, surveillance, reconnaissance) capabilities.⁴⁴

Consequently in 2002, the State Council created an eleventh defense enterprise to represent the defense electronics sector, the China Electronics Technology Enterprise (CETC; 中国电子科技集团公司).⁴⁵ The decision elevated the place of the sector and signified its importance to national strategy.

CETC's policies reflect the principle of *Yujun Yumin* and tap the military potential of the civilian sector. In 2005, CETC put forward the "3-3-3 Transform and Ascend Strategy" (三三三转型升级战略). The strategy calls for a proactive approach to the development of three markets simultaneously: military, civilian, and foreign.⁴⁶

CETC policy also demonstrates the leadership's goal of injecting the "Four Mechanisms" into the defense industry. In 2007, CETC adopted the "Plan to Leap Ahead in Core Competitive Power" (核心竞争力跃升计划). According to the plan, CETC called for strengthening the competitive power of products in the areas of information engineering, electric energy in weapons manufacturing, and the modern electronics service industry.⁴⁷

CETC's creation signified a move toward strengthened supervision in the electronics and IT sector. CETC formed a new supervisory entity with responsibility for 47 state-owned enterprises and the research institutes previously under the authority of the former Ministry of Industry Information.⁴⁸

A handful of private high-technology companies that spun off from state research institutes play an important role in developing dual-use IT technologies for the defense industry. They are the main players responsible for integrating the sector into the global R&D and production chain and providing spin-on technologies for military use. Their connections with the PLA run deep. Not only is the PLA a favored customer and source of staff, its numbered research institutes also provide funding.⁴⁹ The central companies in this category are: Huawei Technologies Ltd (华为技术有限公司), Great Dragon Telecommunications Equipment Co. Ltd (巨龙信息技术有限公司), Zhongxing Telecommunications Equipment Co. Ltd (中兴通讯股份有限公司), and Datang

⁴⁴ Ibid.

⁴⁵ Cheung, 211 and 213.

⁴⁶ Information available at: <http://www.cetc.com.cn/web/Column.asp?ColumnId=11> accessed on 24 May 2009.

⁴⁷ Ibid.

⁴⁸ Enterprise profile, CETC Website, <http://www.cetc.com.cn/web/Column.asp?ColumnId=1>.

⁴⁹ Medeiros, 213 and 241.

Telecom Technology Co. Ltd (大唐电信科技股份有限公司). Chapter Three will examine how these companies interact with multinationals and foreign companies in the telecommunications and electronics industries.

As we saw in the leadership in the other sectors, the general manager of CETC, Wang Zhigang (王志刚), brings a diverse background to his post that enables him to facilitate transfers between civil and military under CETC's authority. He was trained as an engineer and worked at China Software Corporation before the appointment to CETC.

Fan Youshan (樊友山) is the CCP leading group secretary and assistant general manager.⁵⁰ Before coming to CETC, Fan served as the assistant general manager of China North Industries Group (CNGC; 中国兵器工业集团公司), one of the two enterprises overseeing the ordnance industry. His movement from ordnance to CETC is significant because electronics and IT are linked with modernizing all the other defense industry sectors. Indeed, CETC often is involved in projects across sectors. For example, it managed the majority of the R&D and equipment manufacturing for the ground-based command and control communication systems for the Shenzhou space mission in fall of 2008.⁵¹

Overall, trends in CETC's leadership and policies reflect core parts of the new model for managing China's defense industry. Given CETC's importance to advancements in all areas of China's military industrial base, it is not surprising that China's leadership is committed to reform and consolidation in this sector.

Although a more extensive list of enterprises and research institutions in the electronics sector are summarized in Appendix A, three notable examples representing some of the broader defense economy trends include: CETC International (中电科技国际贸易有限公司), the China Electronics Corporation (CEC; 中国电子信息产业集团公司), and the China National Electronics Import and Export Corp. (中国电子进出口总公司).

CETC International's operations are in the fields of electronics and information systems integration. The company conducts some business as a franchise seller of electronics products domestically but indicates on their website and in online job candidate search postings that they are focused primarily on the international market.⁵²

⁵⁰ CETC leadership chart available at <http://www.cetc.com.cn/web/Column.asp?ColumnId=8> accessed on 24 May 2009.

⁵¹ CETC significant projects available at: <http://www.cetc.com.cn/web/Column.asp?ColumnId=11> on 24 May 2009.

⁵² Information available at: <http://www.yingjiesheng.com/job-000-289-449.html> and <http://www.cetc.com.cn>, accessed 22 June 2009.

Its main business areas demonstrate the trend of combining both civil and military product development within one company. According to its website, CETC International offers:

Command and control systems: CETC International is China's only company that provides top-level design, production, integration and implementation of command and control systems for the international market.

Radar systems

Electronic warfare and intelligence systems: Its website boasts that "CETC has rich research and development and production experience in the field of electronic warfare."

Communications systems and equipment systems

Anti-terrorism and public security systems: able to deliver complete anti-terrorism resolution schemes, combining command and control, communications, opto-electronics, radar, and signal interpretation

Opto-electronic equipment: including electronic visual sensing equipment, EagleEye 2000 infrared thermal imaging device, Visual observation terminal, FJR-4 non-cooled thermal imaging device, FJR-5 non-cooled thermal imaging device (未冷却的热象仪)

Surveying equipment: including AV1487A/B microwave integrated sweeper, AV1485RF integrated signal production device, AV3629A high performance RF integrated Vector network analysis device, AV4446 digitized oscilloscope, AV4062 spectrometer

Electronic materials and components: including optoelectronic components, interface units, electric cables, and new types of electronic materials

Specialized computer equipment and network systems equipment: including semiconductor equipment, vacuum device design equipment, electronic component design equipment, joint install equipment (装联设备), processing design equipment, purification equipment, reliability testing equipment

Electronic design equipment: including software, peripherals, general software, specialized software, network systems and equipment, computer application systems, and other computer and network equipment

Broadcast television systems and equipment: broadcast systems and equipment, television systems and equipment, visual audio frequency program control and broadcast control equipment, satellite broadcast and satellite television equipment, wired television equipment

Integrated products and services: electronic medical equipment, traffic and postal electronics equipment, light industry and agricultural industry electronics equipment, environmental protection and meteorology equipment, construction, resources, mining, and machine industry electronic equipment

Other products and services: includes electricity sources and batteries, print control and integrated circuits, and frequency control devices.⁵³

The China Electronics Corporation (CEC; 中国电子信息产业集团公司) represents similar trends as CETC International in the integration of civil and military product lines. The largest state-owned IT group in China, CEC's total company assets totaled 54 billion RMB and income from sales was 61 billion RMB in 2006.⁵⁴ Group companies develop and manufacture 2G and 3G mobile phones, network products, LCD, DVD, digital media products, home theatre system, and digital cordless phones.⁵⁵ The company and its subsidiaries are also engaged in defense-related electronics equipment R&D, including development of radars, tracking stations (telemetry, remote control, and monitoring), telecommunications stations, and onboard space electronics.⁵⁶

In addition, CEC also has attempted to implement the "Four Mechanisms" to reduce inefficiency and streamline production. As of early 2008, CEC oversaw 13 listed subsidiary companies and approximately 700 non-listed companies. Key subsidiaries include Amoi Electronics Co., Ltd., Shenzhen SED Electronics Group Co., Ltd., Shenzhen Sangfei Consumer Communication Co., Ltd., Wuhan Zhongyuan Electronics Group Co., Ltd., Nanjing Panda, Great Wall Computer Company, and ChinaSoft (other subsidiaries indicated below). In March 2008, CEC president Xiong Qunli announced a major business restructuring and adjustment plan that would reduce the number of its subsidiaries by 50% over three years. According to the announcement, more than 90 companies had already been eliminated. CEC plans to withdraw its investment in minor, non-profitable services, and concentrate on its four main business areas: 1) integrated circuits, 2) core appliances, 3) software and systems integration of electronics and related military electronics products, and 4) 3C products (mobile communications and home appliances).⁵⁷

The China National Electronics Import and Export Corp (CEIEC; 中国电子进出口总公司)⁵⁸ is a large state-owned foreign trade enterprise affiliated with the

⁵³ Information available at: <http://www.yingjiesheng.com/job-000-289-449.html>, accessed 24 June 2009.

⁵⁴ Information available at: <http://baike.baidu.com/view/588943.html>, accessed on 29 June 2009.

⁵⁵ Information available at: <http://74.125.95.132/search?q=cache:UIBK8IclDwcJ:www1.cec.com.cn/english/ce44.asp+site:www1.cec.com.cn+china+electronics+corporation&cd=4&hl=en&ct=clnk&gl=us&client=firefox-a>, 29 June 2009.

⁵⁶ Information available at: <http://www.fas.org/nuke/guide/china/contractor/cec.htm>, accessed on 29 June 2009.

⁵⁷ Information available at: <http://www.chinatechnews.com/2008/03/20/6520-cec-will-eliminate-400-subsidiaries-within-year/>, accessed 29 June 2009.

⁵⁸ According to its website (www.ceiec.com.cn), contact information for the Defence Electronics Department of CEIEC: Electronics Building, A23 Fuxing Road. Beijing 100036; 86-10-68296510; 86-10-68296510 ; defence@ceiec.com.cn.

China Electronics Corporation (CEC). Established in 1980, the company is China's largest import-export corporation for electronics products.⁵⁹ The group currently oversees 65 solely funded, proprietary subsidiaries (in China and abroad), over 200 solely funded, domestically united or equity participation companies and joint ventures, and seven offices abroad. At the end of 2007, total company assets totaled 8.2 billion RMB, and total annual sales were 13.2 billion RMB.⁶⁰

CEIEC's business areas span both civilian and defense electronics. Its website indicates the following principle business areas: import and export of technology, commodities of different categories; government agreement trade, contract of international engineering projects, overseas labor co-operation, co-production, joint venture operation, processing with supplied materials, samples and blueprints and compensation trade, international tendering of electro-mechanical products procurement by either overseas loan or domestic funds and other international procurement tendering, setting up maintenance and post-sale service centers for overseas electronics manufacturers, sales agent, consignment sale of spare parts; software development and financial leasing, packaging and transportation, exhibition and advertising, market information and legal consultancy service in the field of foreign trade.⁶¹

The corporation's six business departments include one department devoted exclusively to defense electronics. The CEIEC Defense Electronics Department advertises products in the areas of C3ISR systems, communications, sensors, electronic warfare, security and anti-terrorism.⁶²

- CSR/EW
 - o C3ISR Air defense system
 - o C3ISR Naval defense system
 - o C3ISR army system
- Communications
 - o Radio HF/VHF/UHF
 - o Microwave and troposcatter
 - o Satellite

⁵⁹ Information available at: <http://www.ceiec.com.cn/english/type/Info.aspx?code=010>, accessed 29 June 2009

⁶⁰ Information available at: <http://www.ceiec.com.cn/english/type/info.aspx?code=01002>, accessed 29 June 2009.

⁶¹ Information available at: <http://www.ceiec.com.cn/english/type/info.aspx?code=01002>, accessed 29 June 2009.

⁶² Information available at: <http://www.ceiec.com.cn/english/type/dept.aspx?code=02002>, accessed 29 June 2009.

- Sensors
 - o Radar
 - o E/O
 - o Sonar
- Electronic warfare
 - o Radar EW
 - o Communications EW
 - o EO EW
- Security and anti-terrorism
 - o Public communication monitoring system
 - o Perimeter monitoring system
 - o VIP protection
 - o Emergency response system

Ordnance

China's ordnance industry develops and produces tanks, armored vehicles, artillery, missiles, bombs, light arms, individual combat systems, ammunition, optics, electronics, photo-electronics, fire control, night-vision, anti-chemical material, as well as civilian vehicles. The two enterprise groups managing China's ordnance sector are the China North Industries Group Corporation (CNGC) (中国兵器工业集团公司) and China South Industries Group Corporation (CSG) (中国兵器装备集团公司), which were formed from the China Ordnance Industry Corporation during the 1999 reforms.

Also referred to as NORINCO(G), CNGC is the largest manufacturer of weapons in China. It employs 300,000 people and has 103 subsidiary companies and 35 research institutes.⁶³ It undertakes the R&D of high technology weapons for all the military services, including technologies for precision strikes, amphibious assaults, long-range suppression, air defense, and night vision.

Similar to the other major defense enterprises, CNGC also places a significant emphasis in its policy statements on civil-military integration. In March, GAD's vice-minister Vice Admiral Li Andong went to CNGC's Inner Mongolia 1st Machine Manufacturing Corporation and Inner Mongolia Heavy Industry Corporation to inspect production. During his visit he stressed the importance of civil-military integration and "realizing the

⁶³ Information available at: <http://www.cngc.com.cn/Intro1.aspx> accessed on 29 June 2009.

fusion of the civil and military sectors." In turn, Zhang Guoqing [identify] emphasized civil-military integration and said that CNGC must speed up weapon restructuring according to the demands of scientific development.⁶⁴

CNGC played a key role in several engineering and design projects for the Olympic games. CNGC's Liaoning's Huafenghua Corporation and the Third Research Institute of CASIC (one of the two enterprise groups managing China's missile sector) collaborated on the technology for lighting the Olympic torch. CNGC's Beijing Beifang Vehicle Corporation produced launch installations for the fireworks during the opening ceremony, as well as the model GA06 armored anti-riot vehicles, which equipped Beijing special force police teams. Specialized vehicles are one of CNGC's most important products.⁶⁵

The China South Industries Group Corporation (CSG) places an emphasis on its commercial civilian products despite the fact that its product list includes small arms and explosives. Also called the China Weaponry and Equipment (Group) Corporation, CSG was formed out of CNGC. It makes motorcycles, automobiles, energy machinery, optics, medicines, and electronics. These products drive CSG's extensive international business relationships, including over 50 foreign joint ventures and strategic partnerships with several overseas car manufacturers.⁶⁶

In addition to the individual relationships and contracts held by CNGC and CSG, NORINCO (中国北方工业公司) is the primary mechanism through which China's ordnance industry integrates into the global R&D and production chain. Under the leadership of president Zhao Gang (赵刚), it serves as the main import-export company for both CNGC and CSG. CNGC and CSG each own 50 percent of the company's shares. (It is important to distinguish NORINCO from NORINCO(G), which is the other name sometimes used for CNGC.)

NORINCO specializes in defense products for domestic and international markets, including technologies for precision strikes, amphibious assaults, long-range strikes, air defense, informatized night vision, riot prevention, and light arms. It also has international contracts in chemical engineering, sports equipment, vehicles, and electronics.

NORINCO's website boasts that it is among the 225 largest contractors in the world and claims that its mission is to "unceasingly promote the integration of China's international

⁶⁴ "Zonghuangbeibu fubuchang li andong zhongjiang daobaotou kaocha," available at: <http://www.cngc.com.cn/NewsDetail.aspx?id=15129> accessed on 23 March 2009.

⁶⁵ "Zhongguo bingqi gongye jituan gongsi quanfangwei fuwu aoyun", *Renminribao*, August 8, 2008, available at: <http://scitech.people.com.cn/GB/7633961.html>.

⁶⁶ Information available at: <http://www.chinasouth.com.cn/index/about.asp?id=1> accessed on 27 September 2009.

and domestic markets in order to attain a multifaceted market structure” and “on a foundation of integrated industry and trade strengthen competitive power.”

NORINCO’s integration into global markets is not always benign. From 2001 to 2007 the United States imposed sanctions on NORINCO imports after a U.S. Customs sting operation revealed a deal to smuggle 2,000 Chinese-government-made AK-47s into the U.S. It was the largest arms seizure in U.S. history.⁶⁷

Chapter Three’s discussion of NORINCO’s foreign contracts and exchanges provides further detail on the way in which the entity helps integrate the ordnance sector into the global system.

Profiles of CNGC, CSG, and NORINCO’s main subsidiaries can be found in Appendix A.

Summary

The structural changes and developments in each sector of China’s defense industry illustrate a broad process of consolidation and reform at both the government ministerial and defense enterprise levels. Through these changes, the leadership in Beijing aims to build a modern military industrial base capable of competing in the world market for weapons sales and meeting the force requirements of the People’s Liberation Army (PLA) as it assumes a more forward military posture.

Specifically, the reforms and consolidation process represents a new model for success built on the principle of *Yujun Yumin* and the concept of injecting the “Four Mechanisms” into the military industrial base. At the government level, the most significant change is the creation of the new “super ministry,” with the Ministry of Industry and Informatization (MIIT) and the elevated position of the General Armaments Department (GAD). Developments at the level of enterprises and subsidiaries manifest these strategies in expanded autonomy and competition for the enterprises and their subsidiaries, and increased opportunities for commercial business in the global market.

The following chapter will assess each sector to gauge which ones are benefiting from these structural changes and to evaluate their relative strengths and weaknesses.

⁶⁷ Michael S. Serrill, “Anatomy of a Sting,” *Time*, June 24, 2001.

CHAPTER TWO: Net Assessment of China's Defense-Industrial Sectors

Introduction

The Chinese defense industry has undergone a broad-based transformation since the late 1990s. Historically, China's defense industry has been plagued by a lack of capital, technology, and incentives. Redundant personnel, lack of R&D experts, limited know-how and communist management practices impeded innovation and attempts to manufacture "leap-frog" technologies. The moribund nature of China's defense industry resulted in backward weapon systems and an overreliance on foreign technologies.

After reforms began in the late 1990s, China's defense industry started to shed this historical legacy, resulting in substantial improvement. In fact, then head of the General Armaments Department Li Jinai stated in 2003 that "there has been a marked improvement in national defense scientific research and in building weapons and equipment. The past five years has been the best period of development in the country's history." Reforms included shedding thousands of jobs, increasing funding, and bifurcating each defense industrial ministry into two independent enterprises to foster competition. This was followed by a directive to commercialize and reform the business practices of the defense industry to make it competitive in a market economy. Defense industrial executives now had to respond to profit and loss statements and seek new ways to make their companies profitable outside of the defense sector. Moreover, as the civilian economy, especially the electronics sector, began to improve, the defense industry was able to exploit the "spin-on" benefits of civilian technologies. Indeed, the opening of the Chinese economy to foreign investment and technology provided new opportunities, legal and illegal, to transfer technology and know-how to Chinese weapon programs.

The result of these ongoing reforms is that analysts can no longer make blanket claims about China's defense industry across the board but instead must evaluate each sector individually. Each sector has responded in different ways to these reforms and has faced different challenges. While China's pockets of excellence continues in the space, missile, and nuclear fields, the relative success of other sectors appears to depend greatly on the extent to which the sector is integrated into the global R&D and production chain. Those sectors that are well-integrated, such as shipbuilding, have made enormous strides. Those sectors that are not well-integrated, such as ordnance and aviation, have lagged world standards. And at least one sector, defense electronics, appears to be a hybrid, exhibiting significant improvement in capability areas that can exploit China's emergence as the world's information technology workshop, such as COTS systems like switches and routers, but continuing to lag in other areas, such as radiation-hardened mil-spec electronics with no commercial analog.

The New Defense-Industrial Spectrum

Traditional "Pockets of Excellence"

Nuclear weapons and missiles, including the derivative capabilities in space launch, have long been so-called “pockets of excellence” in the Chinese system, enjoying a string of programmatic successes even during the chaos and irrationality of the Mao era.

Nuclear

With the successful detonation of an atomic weapon in 1964, China entered the ranks of the nuclear powers. At the time of the 1964 blast, Beijing clearly stated its motivation for developing nuclear weapons, citing the “nuclear blackmail” of the United States during the 1954 and 1958 crises in the Taiwan Strait. As documented in Lewis and Xue’s *China Builds the Bomb*, the nuclear weapons program enjoyed top-level government priority and therefore virtually unlimited access to resources, combined with an unusually capable cadre of Western-trained nuclear physicists. Because of the extraordinary commitment of personnel, facilities and funds, the nuclear program must be treated analytically as an outlier, with limited utility for understanding the current progress of individual defense-industrial sectors, though Feigenbaum persuasively argues that the programmatic leadership from the nuclear and missile sectors did make a significant subsequent contribution to the leadership of other key S&T and defense-industrial programs.⁶⁸

Missiles

As with nuclear weapons, China’s missile sector enjoyed early and consistent successes, attributable to substantial state investment and the contributions of a small group of remarkable scientific leaders, most notably Qian Xuesen.⁶⁹ China’s missile academies systematically developed and tested missiles with increasingly longer range, culminating in the successful launch of an intercontinental ballistic missile in 1982. Since the onset of the tensions with Taiwan in the early 1990s, the Chinese missile industry has built upon its historical legacy by producing large numbers of increasingly accurate short-range ballistic missiles (e.g., DF-15), new classes of intermediate-range missiles to support anti-satellite kinetic kill vehicle programs and anti-carrier attack operations (e.g., DF-21), land-attack cruise missiles, a revolutionary class of road-mobile ICBMs (e.g., DF-31 and DF-31A), and a space launch and TT&C network sufficiently robust to support not only commercial satellite launch but also a manned space program. While the missile sector does enjoy tremendous institutional inertia from its early status as a top government resource priority, more recent successes have been driven in part by the revenue base generated by commercial space lift transactions.

Globalized Defense-Industrial Sectors (“Leaders of the Pack”)

Shipbuilding

⁶⁸ Evan Feigenbaum, *China's Techno-Warriors: National Security and Strategic Competition from the Nuclear to the Information Age*, Stanford, CA: Stanford University Press, 2003.

⁶⁹ Iris Chang, *Thread of the Silkworm*, New York: Basic Books, 1996

China's shipbuilding industry is the exemplar of the globalized defense-industrial sectors, reflecting the progress possible when a sector is fully integrated into the global R&D and production chain and can take advantage of the full range of foreign technology and know-how. As the 2005 RAND study argues,

China's shipbuilding industry has gradually modernized since Deng Xiaopings's reform and openness policies. It rapidly engaged international markets in the 1980s and, as a consequence, gained consistent access to foreign shipbuilding equipment, capital, and know-how. China is now the world's third-largest shipbuilder. As its commercial-shipbuilding business expanded, its naval-production capabilities benefited as well. China's shipbuilding industry now produces a wide range of increasingly sophisticated naval platforms using modern design methods, production techniques, and management practices. China's shipyards are now producing more-advanced naval vessels more quickly and efficiently than in the past. These improvements are best reflected in the serial output of several new classes of military ships in recent years. These innovations and heightened production rates are a first for China's shipbuilding sector and are likely to continue in the coming years.⁷⁰

Since 2004, Chinese military shipbuilding has continued to make impressive gains, launching new classes of ships and producing serial numbers of existing classes.

Unglobalized Defense-Industrial Sectors ("Laggards")

Aviation

On the spectrum of defense-industrial sectors, China's aviation industry has historically been a disappointment, experiencing long delays in the production of its fourth-generation aircraft (e.g., J-10) and being forced in the mid-1990s to import advanced Russian aircraft (e.g., Su-27 and Su-30MKK) to fill crucial gaps in capabilities. Unlike the shipbuilding sector, China's aviation sector has not become part of the global R&D and production chain. Despite AVIC's early success with McDonnell-Douglas in producing an FAA-certified aircraft (MD-80) in Shanghai and years of component production for foreign manufacturers as offsets for aircraft purchases, Chinese airlines continue to prefer to purchase commercial passenger aircraft produced by Airbus and Boeing abroad, and Beijing's ministries have not been able to leverage these purchases to transfer R&D and production to the mainland. Moreover, the industry continues to be burdened with the structural problems outlined in the 2005 RAND study:

For years, China's aviation industry suffered under the weight of a large, bloated, technologically unsophisticated, and highly inefficient collection of R&D institutes and factories that failed to produce modern military

⁷⁰ Medeiros.

aircraft in a timely manner. In the past five years, limited signs of increasing progress in this sector have begun to emerge. China's first indigenously designed and produced combat aircraft (JH-7/FB-1) has recently entered service, and China is on the verge of producing a domestically developed, fourth-generation aircraft (known as the J-10/F-10), albeit with substantial foreign design assistance. It has also made significant progress toward producing turbofan engines for its newest fighters. Important gaps in China's aviation design and production capabilities remain, however. China has not yet mastered serial production of such complex aviation platforms as fourth-generation fighters, nor is it able to produce heavy bombers or large transport aircraft. And it has yet to field an indigenously designed helicopter.⁷¹

Since 2004, the J-10 is finally in serial production, but the sector's primary structural problems continue unabated, despite great fanfare surrounding the latest attempt to build an indigenous regional commercial passenger jet. Indeed, the painful dependence of the Chinese military aviation sector was again brought into stark relief by the comments of the head of a Russian military export company after his meetings with Chinese counterparts in December 2008, when he publicly complained about AVIC's overproduction of Su-27 aircraft in violation of their co-production agreement.⁷²

Bifurcated Sectors (“The Hybrids”)

Defense Electronics and Information Technologies

The Chinese defense electronics and IT sector has always been a special case, reflecting both the successes of the shipbuilding sector and the problems plaguing other sectors. On the one hand, the sector has benefited greatly from China's status as the world's IT workshop, reaping the best of the state-of-the-art commercial technologies, such as switches and routers, to support the COTS elements of the PLA's C4ISR modernization. On the other hand, the lack of a commercial analogue for high-end military defense electronics, such as radiation-hardened electronics components with wide temperature ranges, has driven the Chinese to aggressively pursue illegal technology acquisition around the world.

Despite this bifurcated situation, the Chinese military is in the midst of a C4I revolution, characterized by the wholesale shift to digital, secure communications via fiber optic cable, satellite, microwave, and encrypted high-frequency radio. The pace and depth of these advances cannot be explained by traditional Chinese defense-industrial dynamics, but instead spring from a paradigm shift known as the “digital triangle,” which resembles a classic techno-nationalist strategy, with high-level bureaucratic coordination and significant state funding. The three vertices of the “digital triangle” are (1) China's booming commercial information technology companies, (2) the state R&D institute and

⁷¹ Medeiros.

⁷² “Serdyukov IP Agreement Not Seen Stopping Chinese Copying,” *Kommersant*, 12 December 2008.

funding infrastructure, and (3) the military. The linkages between these three vertices are longstanding, as telecommunications and information technology in China were originally under military auspices, and the commercial relationships with state and military research institutes remain important.

Vertice One: Chinese state IT companies. Most of the major Chinese IT and electronics companies grew directly out of the state sector, spinning off from telecommunications R&D and production units run by the military or the electronics and information technology ministries. These state capitalist companies, such as Huawei, Datang and Zhongxing (ZTE), are designated “national champions,” benefiting from a wide range of state subsidies and advantages. On the one hand, these companies are also genuinely commercial in orientation, seeking to capture domestic and eventually international market share. On the other hand, they still maintain clear ties to the Chinese military, which has become both a research partner and valued customer for their IT products. If we compare these firms with traditional defense industries, the new IT companies carry none of the oft-cited structural burdens, enjoying (1) new facilities in dynamic locales, (2) a lean, high-tech work force motivated by market-based incentives and stock options, and (3) infusions of near state-of-the-art foreign technology, thanks to the siren song of China’s huge IT market, which encourages foreign companies to transfer cutting-edge technology for market access. However, the Chinese IT sector, backed by state R&D funding and national labs, has moved beyond the mere importation of Western technology to co-development with foreign firms and even indigenous development of near state-of-the-art technology. The result is significant levels of military access to cutting edge COTS information technology, fueling a C4I revolution in the armed forces. Moreover, these IT “national champions” are now aggressively pursuing markets abroad, particularly in regions such as Africa that have been conspicuously avoided by Western firms.

Vertice Two: The state research institute and R&D funding system is the strong foundation of China’s defense electronics and IT industry. For defense-related work, this includes numbered research institutes under the China Electronic Technology Group Corporation (CETGC), the PLA General Staff Department, and other defense-industrial entities, funded with money from the Ministry of Science and Technology’s 863 Program and other national S&T funding programs. While there is nothing unique about this techno-nationalist approach, which looks similar to programs in Japan and elsewhere, the state R&D funding acts as a subsidy to the commercial companies mentioned in Vertice One.

Vertice Three: the People’s Liberation Army. Through this “digital triangle” system, the military supports the civilianization of military technical research, becoming an R&D partner and privileged consumer of products.

The “digital triangle” dynamic is further facilitated by two critical technology trends: (1) the growing use of COTS technology, such as computer network switches and routers, for military communications, which allows the PLA to directly benefit from the globally competitive output of China’s commercial IT companies; and (2) the rise of China as a locus for global fabless integrated circuit production, which potentially permits the PLA

access to the advanced microelectronics that lay at the heart of modern military sensors and weapons systems. Of these two trends, COTS, particularly in telecommunications equipment, has provided the greatest early dividends to the PLA, as evidenced by the expansion of its fiber optic computer networks. Defense microelectronics, particularly military-specific components with no natural counterpart in the civilian economy, has advanced more slowly. At the same time, however, the increasing sophistication of China's commercial semiconductor fabrication facilities ("fabs") provides the base production capacity necessary for the military to implement design ideas in a secure, domestic environment.

CHAPTER THREE: Role of Western and U.S. Companies in Contributing to Improvements in the Capabilities of the PRC Defense Industry

Introduction

Under the principle of *Yujun Yumin* (Locate Military Potential in Civilian Capability), leaders in China's defense industry seek to harness advances from the commercial sector for its defense industrial base. Consequently, interactions between Chinese defense enterprises, their subsidiaries, and foreign companies may facilitate the transfer of resources that are critical to expanding China's indigenous military capabilities.

This chapter examines three channels through which Western companies are contributing to improvements in the capabilities of the PRC defense industry: the transfer of technology, know-how, and capital. These three types of transfers occur primarily through collaborative research and training centers, joint ventures and investments, and other strategic partnerships in which information and resources are shared.

Such technology transfer is increasingly occurring through the relationships between state-owned defense enterprises and their subsidiaries. Often the subsidiaries engage in commercial activity, perhaps through a Hong Kong office, but remain linked through the organizational superstructure introduced in Chapter One to the ten state-owned defense enterprises. This structure facilitates the flow of technology, know-how, and capital back to the military industrial base.

Technology Transfer

The U.S. Department of Defense's 2009 annual report to Congress on Chinese military power offers an idea of the kinds of technologies the leadership in Beijing hopes to exploit for dual-use purposes. Quoting the State Council's *National Medium-and Long-Term Program for Science and Technology Development* (2006-2020), the DOD report states that the "major specialty items" to be targeted for research and innovation include: core electronic components, high-end universal chips and operating system software, very large-scale integrated circuit manufacturing, broadband wireless mobile communications, high-grade numerically controlled machine tools, large aircraft, high-resolution satellites, manned spaceflight, and lunar exploration.⁷³

Exchanges in the commercial sector between Western and Chinese companies provide China with access to a range of these technologies, relevant to each of the defense sectors. In aviation, the major companies operating in the Chinese market, Boeing and Airbus, maintain that while their operations conform to export control standards, technology and know-how transfer is necessary to uphold safety and quality standards in China. Since 1993 Boeing has trained thirty-seven thousand Chinese aviation professionals in pilot techniques, operations, engineering, executive management,

⁷³ Department of Defense, Office of the Secretary of Defense, Annual Report to Congress: Military Power of the People's Republic of China, 2009, 39.

manufacturing, and quality control. On a smaller scale, U.S. companies may also be facilitating technology transfer to China's aviation industry by moving production of aircraft and component parts to the mainland. The chart at Appendix A shows many subsidiaries of AVIC that manufacture and maintain aircraft engines and other component parts for international contracts. For example, in April 2008 the Shenyang Aircraft Company reached an agreement with the U.S. manufacturer Cessna Aircraft Company to take over production of its new plane, the Model 162 SkyCatcher light sport aircraft (LSA).⁷⁴ In addition to technology transfer, this arrangement also has implications for the transfer of know-how and capital.

The electronics and IT sector also presents U.S. policymakers with an export control challenge. Despite the implications for technology transfer, Western telecommunication and ICT companies are making billions through their relationships with Chinese private firms. The 2005 RAND study found that many multinationals—such as Ericsson, Microsoft, and Network Solutions—transferred core technologies as a means of gaining market position.⁷⁵ Shaping export control policies to preserve U.S. competitiveness in the Chinese market while limiting the transfer of sensitive technologies requires a difficult balancing act.

The issue is compounded by the fact that the central players in China's IT sector cooperating with multinationals appear removed from the defense industry, but below the surface many maintain deep ties with the PLA, which acts as a funding source, a research partner, and an elite customer.⁷⁶ A prime example is Huawei Technologies Ltd (华为技术有限公司). Founded by a former director of the PLA General Staff Department's Information Engineering Academy, Huawei has offices in the United States, Germany, Sweden, and Russia and many partnerships with foreign technology firms around the globe.⁷⁷ Within China, Huawei collaborates with Lucent, Motorola, Intel, IBM, AT&T, Texas Instruments, and Sun Microsystems through joint labs and other technological cooperation.⁷⁸ Huawei, its relationship with the PLA, and other similar companies will be discussed in more detail in the section on capital.

In shipbuilding, the structure of the industry is such that commercial and military projects are carried out in the same shipyard facilities and research centers. As a result, the defense sector has access to advanced technology available through commercial shipbuilding contracts. Two research institutes in particular play a key role in facilitating technology transfer in shipbuilding: the Marine Design & Research Institute of China (MARIC; 中国船舶及海洋工程设计研究院) and the Shanghai Ship Design and

⁷⁴ "Zhongguo shenfei jiangwei Cesna shengchan zhengji," November 28, 2007, available at: <http://www.tzsy.cn/english/news/domestic/200804/30-5845.html> accessed March 2009.

⁷⁵ Medeiros, 242.

⁷⁶ Ibid, 249.

⁷⁷ Cheung, 217.

⁷⁸ Medeiros, 242.

Research Institute (SDARI; 上海船舶研究设计院). These are two large CSSC research institutes that often contract with foreign entities to purchase or produce designs of naval ships, merchant vessels and offshore structures.⁷⁹ SDARI has extensive business exchanges with United States, Russia, Japan, the UK, Germany, and Singapore. Furthermore, MARIC and SDARI, both are affiliated with a UK-based company called Avena that provides shipbuilders around the world with software and database programs. Avena's Tribon technology is used by fifteen major shipyard companies under CSIC and CSSC.⁸⁰

MARIC's participation in international exhibitions highlights another avenue for China to learn about technologies used by the world's leading shipbuilding companies. A MARIC senior engineer—Li Xiaopeng—sits on the membership committee of the annual International Conference on High Performance Marine Vessels. The conference took place this year in Shanghai in association with the China International Boat Show.⁸¹ For a full list of the international committee and members organizing this conference, see Appendix B.

International trade shows and exhibitions also provide a platform for defense groups to attract foreign buyers and capital by showcasing their own achievements. All of the sectors are active on this front. For example, in February, NORINCO participated in the IDEX 09, a major international defense exhibition held in Abu Dhabi, and in November 2008 it took part in Pakistan's International Defense Exhibit (IDEAS 2008).⁸² As part of a larger campaign to promote international sales, NORINCO unveiled its TY-90 Yitian air defense system for armored trucks and personnel carriers at the IDEX exhibition, the first time the system had been displayed internationally since its announcement in 2005.⁸³

Transfer of Know-How

Although the line separating technology and know-how transfer may sometimes blur, the primary distinction is that know-how transfer involves lessons in how to build and perform, including management, process, organization, and additional practices for boosting efficiency and quality. Access to advanced technology alone proves less valuable than knowing how to make it indigenously.

⁷⁹ MARIC website and Medeiros, 119.

⁸⁰ "Tribon M3 Supports the Complete Shipbuilding Process. From Concept to Delivery." Avena brochure, available at: www.avena.com.

⁸¹ Call for Papers, HPMV China 2009, 9th International Conference on High Performance Marine Vessels, April, 17-18, 2009 (Shanghai, China): <http://www.chinaboatshow.com/file/first%20announcement%202009.pdf>.

⁸² "Beifang gongye canjia 2009 nian Abu Dhabi," available at: http://www.norinco.com/c1024/chinese/newscenter/content_69.html. A list of the other Chinese and international exhibitors can be found at: http://www.idexuae.ae/Exhibiting/Exhibitor_List.aspx; http://www.norinco.com/c1024/chinese/newscenter/content_64.html.

⁸³ "China Adds Precision Strike Capabilities," *Defense Technology International*, April 11, 2009, available at: <http://www.defensetech.org/archives/004792.html>.

One primary way through which this transfer of know-how can take place is development and training programs for executive managers and technical training assistance for workers.

Boeing and Airbus have set up numerous technical and training assistance centers in China. As discussed in the previous section on technology transfer, both companies view such programs as critical to upholding safety and quality standards. Boeing sponsors senior executive programs in China and the US, including a special program with AVIC. The Boeing-Masters in Business Administration (MBA) program trains managers from NDRC (National Development and Reform Commission), CASGC (China Aviation Supplies Import and Export Group Corporation), CAAC and Chinese airlines. Boeing is also affiliated with academic institutions in China through agreements with Tsinghua University in Beijing, Southeast University in Nanjing, and the Hong Kong University of Science and Technology. These partnerships focus on developing new wireless communications technology.⁸⁴ Airbus also is involved on this front. Established in 1998, the Airbus Training Center China Aviation Supplies Import & Export Corporation trains maintenance engineers, pilots and crew. It has two simulators.⁸⁵

In addition, AVIC spokesman Ding Zhiyong announced this winter that AVIC seeks vice presidents for its main subordinate enterprises who have experience in multinational companies, especially in market, research, and production.⁸⁶

Apart from aviation, commercial exchanges between Chinese and European aerospace companies have caused concern in the United States over their potential for strengthening PRC defense capabilities. The China Aerospace Science and Technology Corporation (CASC; 中国航天科技集团公司) participates in a number of international exchanges and partnerships. In 2007, it hosted the International Space University Summer Session, which featured senior executives from 25 countries on panels covering space technology and management.⁸⁷ In March 2008 CASC general manager Ma Xingrui (马兴瑞) hosted delegations from Eutelsat, EADS Astrium, and Thales, all European space navigation companies.⁸⁸ Other recent contacts between CASC and foreign entities include: a visit with the vice chairman of Deloitte; the CEO of Sweden Space Company, Lars Pearson;

⁸⁴ Information available at:

<http://www.boeing.com/companyoffices/aboutus/boechina.html>.

⁸⁵ Airbus in China website, available at:

http://www.airbus.com/en/worldwide/airbus_in_china.html.

⁸⁶ Joe McDonald, "Chinese Aircraft Maker to Recruit Foreign Managers," *Associated Press*, February 25, 2009, available at:

<http://www.forbes.com/feeds/ap/2009/02/25/ap6092185.html>.

⁸⁷ Ibid.

⁸⁸ "Ma Xingrui zongjingli huijian ruidian kongjiang gongsi zongcai," available at:

http://www.spacechina.com/gjhz_zyhd_Details.shtml?recno=52008.

and Razza Hussein of Pakistan's Space and Upper Atmosphere Research Commission (SUPARCO; 巴基斯坦空间和外大气层研究委员会).⁸⁹

China had the opportunity to observe and learn from Europe's satellite technology in the aftermath of the earthquake in the spring of 2008. Eutelsat and Thales both provided China with the use of their technology and satellite resources to assist with rescue efforts.⁹⁰

In the nuclear sector, there is growing international cooperation and commercial activity related to the civil use of nuclear power. Chapter One introduced this issue by discussing the way in which construction and infrastructure projects by CNECC enable China to collaborate with many other countries. In May 2008 CNECC representatives met with Bechtel's vice chairman, Adrian Zaccaria and John Polcyn, a former vice president of Bechtel and currently president of AECL Technologies, in Gaithersburg, Maryland.⁹¹ Under a 1998 agreement between the Department of Energy and the PRC State Planning Commission, Chinese nuclear scientists have a multitude of exchange programs with U.S. national labs, universities, and nuclear facilities.⁹² And in 2006, former Secretary of Energy Samuel Bodman signed a Memorandum of Understanding approving Westinghouse's bid to sell four AP1000 nuclear power reactors to China.⁹³

The electronics and ICT sector is another area in which Western companies have set up training and development centers in China to support their outsourcing and investment projects. One of the major players in the sector is the U.S.-based Cisco Systems Inc. In April 2008, Cisco announced a new corporate strategy with China. Several aspects of the initiative are notable for the way in which they facilitate technology and know-how transfer that will help China to "informatize" its existing systems. Cisco signed a memorandum of understanding with China's National Development and Reform

⁸⁹ "Wuyanhua huijian meiguo keren," available at: http://www.spacechina.com/gjhz_zyhd_Details.shtml?recno=58731 accessed 24 May 2009.

⁹⁰ *Hangkong keji jituan guoji hezuo huoban yuanwei zaiqu tigong bangzhu*, May 23, 2008, available at: <http://news.sohu.com/20080523/n257047073.shtml> accessed on 24 May 2009.

⁹¹ "Zong jili jingzhanying fang mei huijian meiguo baikede jituan gongsi zongcai" May 12, 2008, available at: http://www.cnecc.com/new_show.asp?m=%BC%AF%CD%C5%B8%C5%BF%F6&id=4987; "Jituan gongsi zongjingli jingzhanying," available at: http://www.cnecc.com/new_show.asp?m=%BC%AF%CD%C5%B8%C5%BF%F6&id=5007. Bechtel's relationship with China extends beyond the nuclear sector. It has three offices in mainland China located in Beijing, Shanghai, and Shenzhen, and an office in Hong Kong, and owns a subsidiary company called Pacific Engineers & Constructors, Ltd (泰興工程顧問股份有限公司).⁹¹

⁹² Kan, 48.

⁹³ Ibid.

Commission (NDRC). The NDRC is linked to China's defense industry because portions of it are subsumed under the authority of the new Ministry of Industry and Informatization (MIIT) as part of the 2008 reforms. According to Cisco's website, this collaboration will focus on "manufacturing and service outsourcing, next-generation Internet, venture investment, training and development, as well as environmentally-focused research and development including energy efficiency, emission reduction and network-based green urban development."⁹⁴

Cisco also facilitates know-how transfer on the level of senior management practices. Beijing University's Guanghua School of Management has a Strategic Partnership with Cisco in executive leadership development. The Guanghua Cisco Leadership Institute in China has programs on strengthening business practices through ICT and a research center in leadership and competitiveness.⁹⁵ This trend of senior executive training programs is evident in the other sectors and among many different Western companies operating in China. Alcatel-Lucent University (阿尔卡特朗讯大学) located in the southwest suburbs of Shanghai in Qingpu district offers training in advanced technology as well as management development.⁹⁶

In the ordnance sector, NORINCO has several exchange programs with the United States. For example, Zhi Yulin, Senior Vice President and President of Norinco's Internal Compliance Committee and CEO of several of Norinco's subsidiaries, visited Athens, Georgia in February 2009. They spoke to a group of business leaders at the Athens Country Club and also visited with the Center for International Trade and Security at the University of Georgia, which has received about \$1 million USD in funding from NORINCO. NORINCO also has established a partnership with the University of Georgia in which it brings students for study in China.⁹⁷

Transfer of Capital

While Chapter Four assesses access to international capital markets, this section looks at how joint ventures and direct investments by Western companies provide subsidiaries of China's defense enterprises with access to foreign capital.

Announces Next Stage of Corporate Strategy for China," *Cisco Press Release*, April 16, 2008, available at: http://newsroom.cisco.com/dlls/2008/prod_041608.html.

⁹⁵ "Cisco Announces Cooperation with Peking University to Create Guanghua Cisco Leadership Institute," *Cisco Press Release*, April 16, 2008, available at: http://newsroom.cisco.com/dlls/2008/prod_041608c.html.

⁹⁶ "Qiye Daxue" (Enterprise University) on Alcatel-Lucent Shanghai Bell website in Chinese, available at: http://www.alcatel-sbell.com.cn/live/college/alcatel_college_1.jsp?flrd1=enterprise-university&flrd2=introduce&subfldr_id=495&fldr_id=495.

⁹⁷ Thomas Wilkins, "NORINCO Comes to Georgia to Increase U.S. Trade," *China Stakes*, February 16, 2009, available at: <http://www.chinastakes.com/Article.aspx?id=1003>.

As an example of the extent to which the defense enterprises rely on the United States as an important customer, NORINCO's exports to the U.S. jumped to nearly \$70 million less than two years after sanctions against the company were lifted in 2007.⁹⁸ Yet the ordnance sector is a relatively minor player compared with the commercial activities of the other sectors. While aviation is making significant strides with the help of major contracts from Airbus and Boeing, the electronics and IT sector continues to dominate the playing field as a major recipient of foreign capital from investments and contracts with partners around the world.

In aviation, Airbus and Boeing have a number of joint ventures with AVIC subsidiaries. In 2006, a joint venture between AVIC and Airbus led to the opening of the Airbus (Beijing) Engineering Centre (ABEC; 空客(北京)工程技术中心有限公司). The center posts extensively on Chinese job search portals advertising that it is hiring engineers, in particular those whose qualifications include international experience.⁹⁹ The Harbin Hafei Airbus Composite Joint Venture Manufacturing Center in Harbin manufactures components for the Airbus A350 XWB program and the Airbus A320. The Chinese partner companies for this center are all AVIC subsidiaries: Harbin Aircraft Industry Group Company Limited (HAIG; 哈尔滨飞机工业集团有限责任公司), Hafei Aviation Industry Company Limited (HAI), Avichina Industry & Technology Company Limited (AVICHINA; 中国航空科技工业股份有限公司) and Harbin Development Zone Heli Infrastructure Development Company Limited (HELI; 哈尔滨开发区合力基础设施发展有限公司). HAIG holds the largest share in the company with 50 percent, followed by Airbus at 20 percent and the others each having 10 percent. Operations are slated to start in September 2009.¹⁰⁰

Boeing also is a source of significant capital to the aviation sector. It created Boeing China, Inc. in Beijing and Boeing Capital in Hong Kong.

In aerospace, the relationships between Chinese and European space companies has not only caused concern over the implications for technology transfer, but also because of the tremendous capital flowing into China's space programs from these contracts. France's Eutelsat (通信卫星公司) in particular made news in February 2009 by signing an agreement with CASC to launch one of its satellites into orbit using China's Long March

⁹⁸ Thomas Wilkins, "NORINCO Comes to Georgia to Increase U.S. Trade," *China Stakes*, February 16, 2009, available at: <http://www.chinastakes.com/Article.aspx?id=1003>.

⁹⁹ Examples include:

<http://www.54yjs.cn/html/mingqixiaoyuanzhaopin/beijing/20080401/29285.html>,

¹⁰⁰ "Airbus signs a joint venture contract to establish a manufacturing centre for aircraft composite parts in Harbin, China," Airbus press release, January 30, 2009, available at: http://www.airbus.com/en/presscentre/pressreleases/pressreleases_items/09_01_30_joint_venture_harbin_china.html.

rocket. The launch will take place before 2010. Eutelsat also serves as a major satellite capacity supplier to the U.S. government.¹⁰¹

Moving down a level from CASC, business developments related to one of CASC's subsidiaries, the China Academy of Space Technology or the 5th Academy (CAST; 中国空间技术研究院), highlight the way in which China relies on international networks, spanning both commercial and defense, to strengthen its space programs.

CAST undertakes R &D related to manned and unmanned spacecraft. It has a number of civilian commercial projects with foreign governments and companies. Past projects include the China-Brazil Earth Resources Satellite Program (中巴地球资源卫星), and a contract in 2002 worth \$5.69 million USD with the French company Alcatel Space (now owned by Thales) for the development of telecommunications satellites in 2002.

A recent CAST contract with Alcatel marked a major victory for China's domestic satellite industry. In 2002 CAST signed a contract with Alcatel to develop Sinosat-2, a direct broadcast satellite for operation by Sino Satellite Communications Ltd (Sinosat; 鑫诺卫星通信有限公司). Sinosat is a fixed satellite communications company owned by the state and based in Beijing. Sinosat-2 was to be the largest and most complex spacecraft ever developed by the Chinese. But the satellite's antennas failed to deploy after its launch in the fall of 2006.¹⁰² In May 2007, China successfully launched the Sinosat-3 into orbit on the Chang Zheng-3A (Long March) rocket, which was built by CALT.

Looking closer at Sinosat—the Beijing-based company that operates Sinosat-3 for CAST—reveals a web of connections between China's civilian and military space industries, extending from the mainland to Hong Kong, Bermuda, and Singapore. Sinosat specializes in satellites for television and radio, but its top executives come from the defense industry. Its cofounder and president Cheng Guanren previously worked in the Ministry of Aerospace (MOA) and the China Great Wall Industry Corporation (CGWIC), along with several of his deputies. Other senior managers come from Hong Kong Satellite Holding, CAST, APT Satellite in Hong Kong (Apstar; Asia Pacific Telecommunications), and the General Armament Department (GAD).¹⁰³

Hong Kong's Apstar also seems to be a hub connecting individuals in several different key defense companies. Cheng Guangren simultaneously serves as the managing director

¹⁰¹ Andy Pasztor, "China to Launch Satellite for France's Eutelsat," *Wall Street Journal*, February 25, 2009.

¹⁰² Craig Covault, "Sino Setback - Advanced Chinese Space Technology Initiative Is Off To A Disastrous Start," *Aviation Week*, December 3, 2006, available at: <http://www.spaceref.com/news/viewnews.html?id=1175>.

¹⁰³ "Xinnuo Sanhao" and "Guanli Tuandui," available at: <http://www.sinosatcom.com/system2.htm> and <http://www.sinosatcom.com/about8.htm>.

of Apstar. Chai Yong, a Sinosat vice president, previously worked at Apstar.¹⁰⁴

The international networks connecting CASC subsidiaries with private companies in Hong Kong, Asia, and Europe are significant because they demonstrate the way in which private capital flows lead back to government entities overseeing both military and commercial outfits. The line between state and private blurs, allowing commercial capital from around the globe to wind up with state defense enterprises in charge of China's missile industry. Such a strategy is consistent with the implementation of the *Yujun Yumin* system.

CASC is not alone in this trend. In addition to CASC's partnerships, another entity representing an international hub for defense groups in China's space sector is China Galileo Industries Ltd (中国伽利略卫星导航有限公司). China Galileo was formed in 2004 to serve as a contractor to execute an agreement with the European Union. Known as the Sino-European Galileo Plan Technology Cooperation Agreement" (中欧伽利略技术合作协议), the contract provided for China Galileo and its affiliates to develop the civilian use of the EU's Galileo global navigation satellite system (GNSS).¹⁰⁵

The state enterprises behind China Galileo are CASIC, CAST, and CETC. In addition, China Galileo also includes the China Satellite Communications Corporation (SATCOM; 中国卫星通信集团公司) and the National Remote Sensing Center of China.¹⁰⁶

Again, these state entities use commercial contracts to acquire more funding, which eventually leads back to the state entities managing China's defense industry. And the examples here are just a sampling of the dense international networks and partnerships involving state and private entities in China's space sector.

We see this same trend in the shipbuilding sector, where the largest shipyard corporations in China—those managing multibillion-dollar international contracts—construct PLA Navy vessels alongside their civilian projects. Examples include the relationship between A.P. Moller Maersk Group and Guangzhou Shipyard International Co. Ltd (GSI). GSI falls under one of China's largest Shipyard groups, Shanghai and Chengxi Shipyard Co, Ltd (SSCS; 上海船厂船舶有限公司). SSCS works with shipping companies in over 40 countries. Its foreign contracts are worth an estimated RMB 22 billion, while its domestic orders are RMB 5.1 billion.

¹⁰⁴ Information available at: http://www.apstar.com/apt_company/index.asp.

¹⁰⁵ "Zhongou galilue jihua hezuo xiangmu jinru shizhixing caozuo jieduan," October 9, 2004, available at: http://news.xinhuanet.com/st/2004-10/09/content_2068470.htm.

¹⁰⁶ "Chinese firms join Galileo project," *China Daily*, March 10, 2005, available at: <http://www1.cei.gov.cn/ce/doc/cenl/200503100648.htm> and <http://www.chinagi.com.cn/index.asp> accessed on 24 May 2009.

The import-export arm of CSSC serves as an important channel through which international capital flows back to the defense industry. The China Shipbuilding Trading Corporation (CSTC; 经营船舶外贸进出口业务) imports and exports on behalf of CSSC.¹⁰⁷ It has offices throughout China (Shanghai, Dalian, Tianjin, Guangzhou, Xi'an, Kunming, Wuhan, Jiujiang and Chongqing) as well as in Hong Kong, Hamburg, Los Angeles, Bangkok, Islamabad, Moscow, London and Athens.”¹⁰⁸

Western companies contracting with China on civil nuclear energy projects also serve as a significant source of capital for the state-owned enterprises managing the nuclear industry. Recently CNNC gained a new foothold to international markets when it expanded its operations to Hong Kong. In February 2009 it opened the China Nuclear International Ltd Corporation (中核国际有限公司). Its offices are located in Hong Kong's Gangwang Zihua Tower. The new corporation grew out of a merger between the Hong Kong Main Market Corporation (香港主板上市公司) and the Pu Technology Group Corporation (浦技术集团公司) after the China Nuclear Overseas Uranium Holding Company Ltd became the number one shareholder.¹⁰⁹ Similar to trends observed in the other sectors, the dense networks of Hong Kong-based corporations serve as conduits for capital to flow back to the state entity, CNNC.

As introduced in the previous section, the U.S.-based construction company Bechtel has a relationship with CNNC. Its investment activities in China actually extend beyond the nuclear sector however. One of Bechtel's largest contracts in China is the CSPC Nanhai Petrochemicals Project for CNOOC and Shell Petrochemicals Company Ltd. It involves the construction of 11 chemical plants. Located in Huizhou, Guangdong Province, the project is one of the largest foreign investment projects in China and is valued at USD\$4.3 billion.

Investment from Western companies is also contributing tremendous amounts of capital to China's electronics and IT sector. As discussed in previous chapters, advancements in this area are vital to the informatization of China's military operations and communications systems. On the surface, the central players in China's IT sector that are cooperating with multinationals appear removed from the defense industry, but in fact many maintain deep ties with the PLA, which acts as a funding source, a research partner, and an elite customer.¹¹⁰

¹⁰⁷ At the time of writing this report, CSTC's website was under construction and not accessible. The website is: <http://www.cstc.com.cn/>.

¹⁰⁸ "China State Shipbuilding Corporation," *globalsecurity.org*, available at: <http://www.globalsecurity.org/military/world/china/cssc.htm> accessed on 24 May 2009.

¹⁰⁹ "Zhongheguojiyouxiangongsi zai xianggang kaiye," February 17, 2009, available at: <http://www.sasac.gov.cn/n1180/n1226/n2410/n314244/6172387.html> and <http://www.dsti.net/View/93006.htm> accessed 28 September 2009.

¹¹⁰ Medeiros, 249.

As an example of the lucrative deals in this sector, the French multinational company Alcatel-Lucent signed a deal worth USD \$1.7 billion with China Mobile and China Telecom in April 2009.¹¹¹ The company specializes in communications technologies. It is the largest supplier of 3G mobile network technology in China. Alcatel-Lucent Shang Bell—the China flagship of Alcatel-Lucent’s China practice—was the first high-tech foreign investment share-holding company in China.

In addition to the investments of foreign multinationals operating in China, Chinese electronics companies are also drawing in billions of dollars by opening up to foreign investment and exporting products around the world. Both the government and the military tout Huawei as a national champion, and the company is currently China’s largest, fastest growing and most impressive telecommunications equipment manufacturer. Established in 1988, Huawei is the main supplier to telecom giants China Telecom and China Unicom, and one of the world’s ten largest producers.¹¹² The company’s sales have grown dramatically, increasing from \$350m in 1996 to more \$23.3 billion in 2008.¹¹³ Its main products include switching systems, intelligent networks, SDH transmission networks, wireless, datacoms, broadband integrated services (B-ISDN), power supplies, and free-space optical systems. Company sources claim that “only” 1% of sales involved military customers, though this likely deflated number still represents more than \$30 million per year in equipment sales and service.¹¹⁴

Huawei has also become the most successful Chinese exporter of equipment, entering international markets in 1996. The company is rapidly penetrating Africa, Russia, India, and many other areas ignored by Western telecoms. While foreign sales still make up a relatively small percentage of its total sales, exports are its fastest growing account. Out of total sales of US\$1.5 billion in 1999, only US\$100 million (7%) came from international markets. This amount increased to US\$300 million in 2000, representing 12 percent of the total sales figure of US\$2.5 billion. This number - continued to rise, reaching 20% of sales in 2001 and 40% of sales by 2005. Huawei’s foreign strategy has been helped by sales offices in 45 countries. In Asia, Huawei has won major public contracts in countries such as Thailand and Pakistan. Huawei also enjoys extensive partnerships with U.S. companies in Alabama, Alaska, Arizona, California, Georgia, Hawaii, Illinois, Iowa, Kansas, Maryland, Massachusetts, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Texas, and Wyoming.

¹¹¹ Hoskins, Robert, “China Mobile, China Telecom and Alcatel-Lucent Sign \$1.7 Billion Framework Agreements for 2009,” *Broadband Wireless Exchange Magazine*, April 27, 2009, available at: <http://www.bbwxchange.com/pubs/2009/04/27/page1369-5742640.asp> accessed 28 September 2009.

¹¹² Gilley, “Huawei’s Fixed Line to Beijing.”

¹¹³ Information available at: http://www.huawei.com/corporate_information/financial_highlights.do accessed on 28 September 2009.

¹¹⁴ Interviews in Beijing suggest that the real number is between 5-6%.

To increase its internal strength and expand its shares in developing foreign markets, Huawei is also rapidly expanding its relationships with foreign companies, a partial list of which includes Texas Instruments, Motorola, IBM, Intel, Agere, ALTERA, Sun, Microsoft, and NEC. According to an Indian IT headhunter, Huawei is particularly adept at poaching people from Cisco/India, paying the highest salaries in the region. Huawei is also the one of the only telecom JV's in Russia, partnered with a company (Beto) that used to be involved in missile production. The company also maintains close sales and research relationships with countries in Eastern Europe, including Lithuania and Bulgaria. Recent interviews suggest that the company is having some financial difficulties, mainly as a result of expanding too quickly and pursuing a global array of product lines rather than specializing in niche areas.¹¹⁵

Similar to Huawei, Great Dragon Telecommunications Equipment Co. Ltd (巨龙信息技术有限公司) has also attracted considerable foreign capital. Originally established in 1993 as Xi'an Datang Telephone Company, the company was renamed Datang Telecom Technology Co., Limited in 1998 when it listed on the Shanghai Stock Exchange. The company is the commercial outgrowth of the former China Academy of Telecommunications Technology (CATT), one of China's leading telecommunications R&D institutions for more than 40 years. Like Huawei, Datang invests heavily in indigenous research and development, and maintains partnerships with both domestic and foreign R&D partners. The company has a joint venture relationship with Siemens (Germany) to produce third-generation cellular systems with the Chinese TD-SCDMA standard. Its foreign partners include Compaq, Nortel and Siemens.

Datang began as a switching supplier, and is now moving to develop products in the data communications and transmission equipment markets. Datang's flagship product is the SP30 backbone switch, which it has sold to 22 provincial PTAs. In the transmission market, the company's presence is still fairly minimal, though its SDH and WDM products have been gaining market share domestically. Datang is also looking to foreign markets, opening offices in Brazil, Vietnam and Kazakhstan. For the future, Datang is moving into the ATM market and adding IP functionality to its core switching products. The company is also very focused on its third-generation wireless business, in particular its TD-SCDMA project with Siemens. On 11 April 2001, Datang and Siemens of Germany jointly released TD-SCDMA, promising full development of the system for the China market.¹¹⁶¹¹⁷ At the same time, the company is hedging its bets by producing equipment for both GSM and CDMA technology.

Datang Telecommunications Technology Co. Ltd (大唐电信科技股份有限公司)

¹¹⁵ Interviews with industry experts, Beijing, 2001-2003.

¹¹⁶ "China's 3G Mobile Technology Debuts," *China Daily*, 12 April 2001.

cooperated with Canadian company Sierra wireless in developing a new wireless network card, the Aircard 901. Datang also has partnerships with Oracle, including BEA Systems, Inc prior to its acquisition by Oracle, and NEC (Japan).¹¹⁸

Great Dragon [Julong] Information Technology (Group) Co., Ltd has a similar model to Huawei and Datang. In an effort to centralize China's nine largest telephone exchange manufacturers, Great Dragon Information Technology (Group) Co., Ltd. was established on 2 March 1995 by the National Engineering Technology Research Center and the China Post and Telecommunications Industry General Corporation.¹¹⁹ Like Huawei, Great Dragon reinvests 10% of its profits back into R&D. It also enjoys foreign R&D cooperation with companies in the U.S., Russia, Japan, Canada, Israel and Columbia. Great Dragon's flagship product, the HJD-04, was the first indigenously produced commercial phone switch. Its chief architect, Wu Jiaying, is president of the company, as well as director of the State Digital Switching Systems Engineering Technology Research Center, located at the PLA Information Engineering Institute in Luoyang, Henan Province. The PLA origins of this system suggest a deeper linkage between Julong and the PLA than previously assumed.

Apart from the HJD-04 product line, Julong also manufactures routers, connectors, transmitters, SDH and DWDM systems, wireless local loop systems, high-speed Ethernet switches, telephone systems, and mobile, network and digital communications devices. In recent years, Julong has begun targeting foreign markets, resulting in sales to Bangladesh, Pakistan, Vietnam, Cuba (a telecommunication network for Cuba's Youth Island and an additional US\$300 million contract with Cuba for an undisclosed project), North Korea, Colombia and Russia (digital routers for telecommunication networks owned by the Russia Telecommunications Company). For the future, Julong plans on developing ATM systems, as well as IP and broadband products, high-speed routers, integrated access servers, PBX systems, wireless access products, intelligent network management systems, and optical exchanges. Overall, however, Julong is reportedly the weakest of the four tigers financially, as it has failed to develop a follow-on technology with the same appeal as the HJD-04.¹²⁰

Originating from the No.691 electronics factory under the China Aerospace Industry Corporation, Zhongxing Telecom (ZTE; **中兴通讯股份有限公司**) has grown to become one of China's top equipment producers. In 2000, ZTE generated revenue of RMB 10.2

¹¹⁸ Information available at: <http://www.datang.com/index.asp> accessed on 28 September 2009.

¹¹⁹ Of the nine core firms under Great Dragon Telecom, four are former Ministry of Posts and Telecommunications factories: Luoyang Telephone Equipment Factory, Chongqing Communications Equipment Factory, Hanzhou Communications Equipment Factory, and the Changchun Telephone Equipment Factory. The remaining five factories are former Ministry of Electronics Industry switch producers: Huilong Electronics Company, Beijing Wire Communications General Factory, Shenzhen Xinnuo Telecommunications Company, China Zhenhua Group, and Dongfeng Machinery Factory.

¹²⁰ Interviews with industry experts, Beijing, 2001-2003.

billion. It has numerous foreign joint venture labs. Zhongxing has also developed a significant number of research exchange institutions with both domestic and foreign partners, managing joint laboratories with Texas Instruments, Motorola, Beijing University of Post and Telecommunication, and the University of Electronic Science and Technology (aka MII#29).

In terms of specific telecoms sectors, Zhongxing has expanded beyond its original focus on switching systems to manufacture access, transmission and data communication products. In 2000, it held a 30 percent share of the domestic communications market, including a 20 percent share of the switches and access servers market. In terms of foreign sales, Zhongxing's seven regional offices extend its products and services to over 70 countries and regions. Its switches, GSM (Global System for Mobile Communication) devices, videoconferencing systems, intelligent network and other products are running in over 30 countries in Asia, Africa, Eastern Europe, and Latin and North America. It has successfully built systems in the US, the former Soviet Union, and Hong Kong, and it has high-profile projects in the developing world, including a joint venture in Congo and a \$95 million project to supply ZXJ10 switches in Pakistan. For the future, Zhongxing is focusing on mobile communications technology, developing both GSM900 and CDMA equipment.

Foreign R&D cooperation by CETC International—a CETC subsidiary—is also bringing capital to the defense electronics sector. In October, 2008, CETC International signed an agreement with Pakistan Ambassador to China Masood Khan, according to which CETC International will be responsible for setting up “a joint information and electronic complex covering civilian, information technology and defense electronic domains in Pakistan,” which will be called National Electronic Complex of Pakistan (NECOP). The electronics complex is intended to contribute to the development of Pakistan's indigenous R&D capabilities.¹²¹ One article suggests that this project will likely function as a prelude to further deals for Chinese companies in South East Asia, as NECOP will also serve as a regional production and technical assistance center for CETC.¹²² The total amount of the contract has been estimated at \$300 million USD.¹²³

Summary

The examples of partnerships and exchanges that can facilitate transfers of technology, know-how, and capital from Western and U.S. companies to China's defense industry are meant to be representative rather than exhaustive lists. They indicate the complexity of the challenges U.S. policy makers face in regulating and monitoring U.S. commercial

¹²¹ Information available at: <http://www.daily.pk/local/other-local/7940-pakistan-and-china-to-jointly-set-up-national-electronics-complex.html>, accessed 22 June 2009.

¹²² Information available at: <http://www.daily.pk/local/other-local/7940-pakistan-and-china-to-jointly-set-up-national-electronics-complex.html>, accessed 22 June 2009.

¹²³ Information available at: <http://www.defence.pk/forums/defence-industry-technology/15249-pak-china-jointly-establish-national-electronics-complex.html>, accessed 22 June 2009.

involvement with Chinese firms. Western and U.S. companies have tremendous incentives to invest and collaborate with their Chinese partners. This is particularly evident in aviation, where safety standards must be a priority. Capital incentives also exert a strong pull, as exhibited by the U.S. software companies that agreed to transfer technology in exchange for market position. But the structure of the Chinese defense industry makes it difficult to restrict transfers of technology, know-how, and capital to Chinese military entities without crippling U.S. business with commercial firms. Under the *Yujun Yumin* system, and the often gray line separating civilian and military entities, it is exceedingly difficult to distinguish between commercial partnerships that are benign and those that may contribute to strengthening PRC military capabilities.

CHAPTER FOUR: Access to International Capital Markets

Introduction

In addition to relationships with foreign companies, China's defense industry is also benefiting from access to international capital markets and foreign investment. Each sector represented by the ten defense enterprises has at least one subsidiary listed on the Shanghai, Shenzhen, or Hong Kong stock exchanges. This chapter identifies all of these subsidiary companies to illustrate the networks contributing international capital to China's defense industry. Through investments and contracts from around the world, these listed subsidiaries provide their parent enterprises with additional sources of funding for operations and the development of new weapons systems.¹²⁴

Before examining this trend, it is first important to describe the foreign investment environment in China's domestic security market. All of the defense companies discussed in this section offer either A or H shares on China's stock exchanges. Companies incorporated in mainland China but listed on the Hong Kong stock exchange offer H shares. They are the share type most favorable to foreign investors because they come with minimal restrictions and are easily converted into U.S. dollars. By contrast, A shares have only been open to foreign investors since 2002. In December 2002 a joint measure by the China Securities Regulatory Commission (CSRC) and the People's Bank of China (PBOC) came into effect that allowed foreign investors to buy A shares in China's domestic securities market through Qualified Foreign Institution Investors (QFIIs).¹²⁵ The distinction between A and H shares is significant to this chapter because we know that defense companies offering H shares are particularly open to foreign investment.

Out of all of the defense groups, AVIC has the greatest number of publically listed companies with twenty-two.¹²⁶ But perhaps more significant, AVIC has three listed companies offering H shares on the Hong Kong stock exchange while the majority of the other defense enterprises primarily offer A shares. It is no surprise that AVIC has such a presence on the market given the growth in commercial aviation as discussed in previous chapters.

Another trend reflects the principle of *Yujun Yumin* for the way in which the spin-on and spin-off technologies are leveraged to gain international capital for the defense enterprises. Although some listed subsidiaries deal in defense-related products, the majority have thriving commercial businesses dealing in products for domestic and

¹²⁴ Medeiros, 43.

¹²⁵ Steve Yeo, "The PRC Qualified Foreign Institutional Investors Market," *China Economic Review* 14, no. 4 (2003), 443-450.

¹²⁶ The list of AVIC's listed subsidiaries is compiled from the AVIC website and from a Chinese blog, "*Zhongguo 10 dajungong jituan suo A gu shangshi gongsi*," posted January 22, 2007, available at: http://qfhw.blog.hexun.com/7441974_d.html accessed 28 September 2008, which was cross-checked with other sources including Google Finance data for accuracy.

overseas civilian markets. For instance, a CASIC subsidiary in telecommunications, the ZTE Corporation, represents a staggering USD 53.5 billion and 38.16 billion in market capital, as listed on the Shenzhen and Hong Kong markets respectively. At the same time, another CASIC firm, Aerospace Communications Holding Corp Ltd., deals in both defense systems and telecommunications, with its defense-related business increasing by 12.14 percent, from 2007 to 2008.¹²⁷

This chapter takes a closer look at these trends to illustrate how the ten defense enterprises are leveraging access to international capital markets and foreign investment as a means of strengthening China's growing military industrial complex.

Aviation

The chart below provides a list of all of the companies listed on the Shanghai, Shenzhen, and Hong Kong markets that are subsidiaries of AVIC. Together these twenty-two subsidiaries under AVIC represent approximately USD 94.9 billion in total market capital. Some of the largest of these companies such as Xi'an Aircraft International, sell on international markets in Europe, the United States, and throughout Asia. Xi'an Aero-engine PLC (中航工业西安航空发动机(集团)有限公司) has joint-ventures with the U.S. aviation engine company Pratt & Whitney, Rolls Royce, and Germany's Balcke Durr.¹²⁸ Tianma Microelectronics Co., Ltd. (深天马) has a global market presence through its offices Tianma USA and Tianma Euro.

While many operate in products related to civilian aircraft, several are more explicit about their involvement with dual-use application. For instance, on its website, the Guizhou Liyuan Hydraulic Co., Ltd. (贵州力源液压股份有限公司) discusses its use of spin-off defense technologies.¹²⁹

The international capital gained by these subsidiaries helps AVIC to support the development of civil aircraft programs as well as new weapons systems. This financing trend is relatively recent. Other examples from the past few years include the Chengdu Aircraft Corporation, which has relied on Pakistani funds to subsidize the development of the FC-1/Super-7 light fighter. The Guizhou Aviation Corporation, markets designs of new weapons systems to attract investors.¹³⁰

The three companies offering H shares on the Hong Kong market are important because they are perhaps the most open to foreign investment: AviChina Industry & Technology

¹²⁷ "Hangtian tongxin konggu jituan gufen youxian gongsi 2008 niandu baogao zhaiyao," available at: <http://www.p5w.net/today/200904/t2273937.htm> accessed 9 April 2009.

¹²⁸ Information available at: http://www.xaec.com/system/_owners/main/_webprj/main_3/aboutxihang/aboutxihang.jsp?wbtreeid=132 accessed on 28 September 2009.

¹²⁹ Information available at: <http://www.liyuanhydraulic.com/cindex.htm> accessed on 28 September 2009.

¹³⁰ Medeiros, 42.

Co., Ltd. (中国航空科技工业股份有限公司), CATIC Shenzhen Holdings Ltd. (深圳中航集团股份有限公司), and CATIC International Holdings Ltd (中国航空技术国际控股有限公司).

Given the national significance and the political emphasis placed on China's quest to build its own large-size commercial jet as discussed in chapter one, it seems that the trend towards using international capital markets as a source of financing new programs will continue.

AVIC's listed subsidiaries are:

English Name	Chinese Name	Specialty	Market Capital (USD in billions) and name of stock exchange	Other Notes
Xi'an Aircraft International Co., Ltd.	西安飞机国际航空制造股份有限公司	Parts and components for large and medium sized aircraft	30.77B (Shenzhen)	Sales to China, Europe, America
Nanfang Space Navigation Co., Ltd.	南方航科技股份有限公司	Motorcycles, civil aircraft components, engine components	3.17B (Shenzhen)	International partners include Honeywell, Tyco, Alstom, Schlumberger; sells on international market
Hubei Aviation Precision Machinery Technology Co. Ltd.	湖北中航精机公司	Precision products for domestic and overseas markets	1.52B (Shenzhen)	
Hafei Aviation Industry Co., Ltd.	哈飞股份	Main products: Z9, HC120, H425 helicopter series, Y12 aircraft series,	5.89B (Shanghai)	

		helicopter series, parts and accessories		
Jiangxi Hongdu Aviation Industry Co., Ltd.	洪都航空	Aerospace products and parts	7.01 B (Shanghai)	
Jiangxi Changhe Automobile Co., Ltd.	昌河股份	Automobile engines and parts for domestic and overseas markets	3.42B (Shanghai)	
Harbin Dongan Auto Engine Co., Ltd	东安动力	Automobile engines	4.94B (Shanghai)	
Sichuan Chengfa S&T Co., Ltd.	四川成发科技股份科技有限公司	Parts and components	2.39B (Shanghai)	Sells to Asia, Europe, and America
AviChina Industry & Technology Co., Ltd.	中国航空科技工业股份有限公司	Helicopters, jets, automobiles;	8.27B (Hong Kong)	

CATIC Shenzhen Holdings Ltd.	深圳中航集团股份有限公司	LCDs, luxury watches and clocks, cable TV equipment	1.87B (Hong Kong)	
CATIC International Holdings Ltd.	中国航空技术国际控股有限公司 (红筹股)	Aluminum and stainless steel products for building façade; helicopters; electric and steam power products	1.4B (Hong Kong)	
Guizhou Guihang Automotive Components Co. Ltd.	贵州贵航汽车零部件股份有限公司	Automobile and motorcycle components	3.88B (Shanghai)	Exports to the US, Italy, Libya, and Germany
Guizhou Liyuan Hydraulic Co., Ltd.	贵州力源液压股份有限公司	Hydraulics	6.68B (Shanghai)	According to website, it draws on defense industry technology ¹³¹
Dongan Heibao Co., Ltd	东安黑豹	Automobile manufacturing	1.59B (Shanghai)	
Shenzhen Catic Real Estate Co., Ltd.	中航地产	Real Estate and property management	2.53B (Shenzhen)	

¹³¹ Information available at: <http://www.liyuanhydraulic.com/cindex.htm> accessed on 28 September 2009.

Shenzhen Fiyta Holdings Ltd.	飞亚达	Watches	964.86M (Shenzhen)	
Hubei Aviation Precision Machinery Tech	中航精机	Precision Products	1.59B (Shenzhen)	
China Aviation Optical-Electrical Tech.	中航光电科技股份有限公司	Electrical connectors, optical components, and cable assemblies	4.73B (Shenzhen)	
Sichuan Chengfei Integration Tech Corp	四川成飞集成科技股份有限公司	Automobile cover molds, numeric control processing services	1.66B (Shenzhen)	
Tianma Microelectronics Co., Ltd.	深天马	Microelectronics LCDs LCMs, integrated circuit technologies	2.94B (Shenzhen)	Global offices: Tianma USA, Tianma Euro, Tianma Shanghai and Shenzhen
AVIC Sanxin Co., Ltd.	三鑫股份	Glass engineering and electronics	2.63B (Shenzhen)	
Xi'an Aero-engine PLC	中航工业西安航空发动机(集团)有限公司	Manufacture and maintenance of engines sold to domestic and overseas	9.44B (Shanghai)	Joint-ventures with the U.S. aviation engine company Pratt & Whitney, Rolls Royce,

	司	markets		and Germany's Balcke Durr. ¹³²
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See footnote for the sources used to compile the chart data.¹³³

Aerospace and Missiles

As in the aviation sector, the aerospace and missile sector is relying increasingly on international capital markets to subsidize defense programs. As the chart below illustrates, the listed subsidiaries connected to CASIC and CASC deal primarily in civilian products such as telecommunications, electronics, and information and network technologies.¹³⁴

Despite CASIC's having only seven listed subsidiaries on the market, together these firms represent a sum total market capital of USD 82.49 billion. By contrast, CASC's four listed companies total an estimated USD 25.01 billion.

The vast majority of CASIC's international market capital (52.50B and 38.16B on the Shenzhen and Hong Kong stock markets respectively) comes from a single telecommunications and software company called the ZTE Corporation (中兴通讯). If ZTE's corporate strategy is any indication, the trend towards seeking international capital will only increase. In the years ahead, the company proclaims it will "emphasize market internationalization and rely on the internationalization of capital"(市场国际化为重点，资本国际化为依托).¹³⁵ Current figures suggest ZTE is already making headway in this direction: 57.8 percent of its total income in 2007 (RMB 340 million) came from international business.¹³⁶

There is little question that ZTE's thriving commercial business will help China's defense industries. ZTE's ties with its parent enterprise, CASIC, are extensive. Many of its senior

¹³²

航空发动公司简介，http://www.xaec.com/system/owners/main/webprj/main_3/about_xihang/aboutxihang.jsp?wbtreeid=132.

¹³³ The data for this chart and the others given in this chapter was compiled using three main sources. The list of defense enterprise subsidiaries came from a combination of the enterprise website and a Chinese blog, "Zhongguo 10 dajungong jituan suo A gu shangshi gongsi," posted January 22, 2007, available at:

http://qfhw.blog.hexun.com/7441974_d.html accessed 28 September 2008, which was cross-checked with other sources including Google Finance data for accuracy.

¹³⁴ See data from chart and Medeiros, 103.

¹³⁵ Ibid.

¹³⁶ Information available at: http://www.zte.com.cn/pub/cn/about/corporate_information accessed on 28 September 2009.

leaders either once were at CASIC or hold concurrent posts.¹³⁷ In addition, ZTE supplies the PLA with optical network systems.¹³⁸

A second trend evident here and in all sectors is cross-over between military and civilian products in some of the companies. While the majority deal primarily in civilian products, the Aerospace Communications Holding Company has a growing business in defense products. Between 2007 and 2008, business from defense products increased by RMB 66 million, 12.14 percent.¹³⁹ At the same time, several other companies specialize in civilian products and services. Consistent with CASC's specialization in launch services for civilian commercial satellites, two of its listed subsidiaries deal in related areas. CASC's Long March Launch Vehicle Tech Co., Ltd. offers launch services and China Spacesat Co., Ltd. researches and manufactures satellites.

Overall the diversity of services and products—civilian and defense—represented by the aerospace firms listed on the market indicates the many channels through which international capital flows to the two parent companies, CASIC and CASC.

The publically listed CASIC companies are:

English Name	Chinese Name	Specialty	Market Capital (USD in billions) and stock market name	Other Notes
Aisino Corporation	航天信息	Electronic and telecommunication equipment, finance and tax products, information security technology, information technology, network technology, bioengineering, chemical	15.05B (Shanghai)	Relationships with Tsinghua University, University of Science and Technology of China, Fuzhou University, Lenovo and

¹³⁷ Cheung, 220.

¹³⁸ Ibid, 219.

¹³⁹ “*Hangkong tongxin konggu jituan gufen youxian gongsi*,” April 9, 2009, available at: <http://www.p5w.net/today/200904/t2273937.htm> accessed 28 September 2009.

		engineering		multinationals Intel, IBM, Cisco, Siemens, Atmel, Star, and Epson
Aerosun Corporation	航天晨光	Special-purpose vehicles, RTP (Reinforced Thermoplastic Pipe), bellows expansion joints and hoses, pressure vessels for industries such as metallurgy, petrochemical, electric power	3.02B (Shanghai)	
Aerospace Communications Holding Corp Ltd.	航天通信	Telecommunication equipment, military communications, short-range defense systems, technology R&D, manufacturing	3.16B (Shanghai)	Business from defense-related products increased by RMB 66 million, 12.14 percent, from 2007 to 2008. ¹⁴⁰
Beijing Aerospace Changfeng Co. Ltd	航天长峰	Medical equipment and engineering	2.19B (Shanghai)	Participates in international medical equipment exhibitions
Aerospace Hi-Tech Holding Group Co., Ltd.	航天科技	Electronic products	3.04B (Shenzhen)	
Guizhou Space Appliance Co. Ltd	航天电器	Electronic components for the military	3.53B (Shenzhen)	Parts used in 2007 Chang'e-1 lunar probe
ZTE Corporation	中兴通讯	Telecommunications software, wireless network systems	52.50B (Shenzhen) 38.16B (Hong Kong)	Of its total income in 2007 (3RMB 340 million), 57.8 percent

¹⁴⁰ “*Hangkong tongxin*,” April 9, 2009.

				came from international business.
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The publically listed CASC companies are:

English Name	Chinese Name	Specialty	Market Capital (USD in billions)	Other Notes
Shanghai Aero Auto Electromechanical	上海航天汽车机电股份有限公司	Solar power equipment and automobile parts	9.13B (Shanghai)	
Shaanxi Aerospace Power Hi-Tech Co. Ltd.	长征火箭技术股份有限公司	Industrial equipment such as intelligent gas meters, pumps, electrical motors, hydraulic press devices and electromechanical equipment sold on domestic and overseas markets	2.09B (Shanghai)	
Long March Launch Vehicle Tech Co., Ltd.	长征火箭技术股份有限公司	Launch vehicle systems, satellite and spaceship telemetry and control subsystems, ground stations for satellite remote sensing, satellite navigation, microelectronics	7.02B (Shanghai)	
China Spacesat	中国东方红卫星股份有限公司	Research,	6.77B	

Co., Ltd.	司	manufacture of satellites	(Shanghai)	
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Nuclear

Of all of the defense sectors, the nuclear industry has the least involvement with international capital markets. The China Nuclear Engineering and Construction Corporation (CNECC; 中国核工业建设集团公司) has no publically listed subsidiaries. China National Nuclear Corporation (CNNC; 中国核工业集团公司) only has one, SUFA Technology Industry Co., Ltd. (中核苏阀科技实业股份有限公司), with offerings on the Shenzhen stock market. SUFA makes various kinds of industrial valves for domestic and overseas markets. Its registered capital is USD 3.52 billion.

Shipbuilding

The number of listed subsidiaries under each parent defense enterprise can be a misleading indicator of access to international capital markets. Although AVIC has twenty-two, and both CSSC and CSIC combined only have four listed subsidiaries, other factors suggest that foreign capital is indeed contributing to significant growth in China's shipbuilding industry. The first indicator is the sheer volume of capital represented by these subsidiaries.

Beneath CSSC—the main supplier of the PLA Navy—China CSSC Holdings Ltd (中国船舶工业股份有限公司) alone has 41.40 billion in market capital. This figure is staggering considering that the vast majority of the listed defense-related subsidiaries are between one and eight billion. Furthermore, Guangzhou Shipyard International Co., Ltd. (广州广船国际股份有限公司) offers H shares on the Hong Kong stock exchange. As discussed earlier, H shares suggest the company is more open to foreign investment since they are simpler for foreigners to buy and carry less restrictions.

As discussed in earlier chapters of this report, the coastal locations of China's largest shipyard corporations, combined with the dual-use nature of much of the technology make the shipping industry particularly conducive to reaping the benefits of foreign markets and capital.¹⁴¹

CSSC's listed subsidiary companies are as follows:

English Name	Chinese Name	Specialty	Market Capital (USD in billions)	Other Notes
China CSSC	中国船舶工业股份有限公司	Shipbuilding including	41.40B	Operates in markets in

¹⁴¹ Medeiros, 128.

Holdings Ltd		cargo ships and oil tankers: ship maintenance: modification, steel hull engineering, hull appliances; ship equipment	(Shanghai)	Europe, the Americas, and Asia
Guangzhou Shipyard International Co. Ltd	广州广船国际股份有限公司	Shipbuilding; medium-class landing ships	10.90B (Shanghai) 5.93B (Hong Kong)	Sells to A.P.Moller Maersk Group and others in Europe; Works with MARIC; GM Tan Zuojun graduated from Touro law school in New York
Jiangnan Heavy Industry Co. Ltd	中船江南重工股份有限公司	Steel structures, ship parts and machinery; subsidiaries do electronic equipment in ships	6.1B (Shanghai)	

See footnote for sources for chart data.¹⁴²

¹⁴² See sources for aviation industry chart, as well as individual shipping subsidiary websites, information available at:

<http://www.csscholdings.com/s/1/t/1/p/1/c/12/d/18/list.jspy> ; <http://www.jnhi.com/gsjj.php>; <http://www.coscol.com.cn>; <http://www.coscol.com.cn/chinese/news.asp>; <http://www.jes-intl.com/about.html> accessed on 28 September 2009.

The second enterprise overseeing the shipping industry, CSIC, has only one listed subsidiary, Fengfan Co. Ltd. (风帆股份有限公司). It specializes in batteries for communication systems, broadcasting and TV, as well as alloy and lead products.¹⁴³

Electronics

Foreign investment is pouring into this sector, especially in software and telecommunications. But similar to the trend observed in the shipping industry, there are actually only two listed subsidiaries directly under CETC (see chart below). This means that the bulk of foreign investment in China's electronics sector may not have a direct link back to a parent defense enterprise extending onto the stock exchange, but connects through a more diffuse network.

Companies such as Panda Electronics exemplify this trend because it belongs under the state-owned enterprise, the Chinese Electronics Corporation. Offering shares on both the Shanghai and Hong Kong Stock Exchanges, Panda represents a major magnet for foreign investment. In fact, it was the first electronics company in China to offer H shares.¹⁴⁴ Huawei is another example.

Another electronics company that has received significant foreign investment is China Communications Services Corporation Limited (CCS). In 2006 Cisco invested USD 50 million in CCS.¹⁴⁵ CCS is another company with H shares on the Hong Kong Stock Exchange.

CETC's listed subsidiaries are:

English Name	Chinese Name	Specialty	Market Capital (USD in billions)	Other Notes
Anhui Sun Create Electronics	中国电子科技集团公司第38研究所 (安徽 四创电子股份有限公司)	Radar equipment, broadcasting products, including digital satellite receivers, satellite high-frequency	1.45B (Shanghai)	

¹⁴³ Information available at: <http://www.sail.com.cn> accessed on 28 September 2009.

¹⁴⁴ Information available at: <http://www.panda.cn/SJTCMS/html/pandagroup/about/about2.asp> accessed on 28 September 2009.

¹⁴⁵ "Cisco Makes Strategic Investment in China Communications Services," CISCO press release, December 16, 2006, available at: http://newsroom.cisco.com/dlls/2006/fin_121306.html accessed 28 September 2009.

		heads and satellite antennas		
Shanghai East China Computer Company Ltd	中国电子科技集团公司第32研究所 (上海华东电脑股份有限公司)	Computers, electrical and communication equipment, system integration software	1.33B (Shanghai)	

See footnote for sources of chart data.¹⁴⁶

Ordnance

The majority of the three publically listed companies under the parent enterprises China South Industries Group Corporation (CSG) specialize in the manufacture of automobiles and related parts, while those beneath the China North Industries Group Corporation (CNGC) have a more diverse product base. Combined they represent a total market capital value of USD 50.29 billion.

CSG subsidiaries export cars and products related to the automobile industry to countries around the world. In addition to China's domestic car market, they also sell on markets in the United States, Europe, Africa, and Asia. For example, Changan Auto Co., Ltd.

(长安汽车), which has a partnership with Ford, sells its cars to places such as Pakistan and the United States; China Jialing Industrial Co Ltd has an office in the United States and throughout Asia.

In contrast to the automobile focus of the CSG subsidiaries, those beneath CNGC span parts for solar battery modules and construction to intelligent robots. The China North Optical Electrical Co., Ltd. (中兵光电科技股份有限公司 formerly the Beijing North phoenix Intelligence Technology Co., Ltd or 北京北方天鸟智能科技股份有限公司) is the one CNGC listed company that deals directly in military products, including UAVs and seeking systems. It is also the largest of the companies with a listed capital value of USD 8.86 billion.

Despite the presence of these ordnance subsidiaries on China's stock markets, the sector overall appears to be less open to foreign investment than some of the others discussed in this chapter. Currently no companies connected to CSG or CNGC offer H shares on the Hong Kong Stock Exchange.

The publically listed subsidiaries of China South Industries Corporation are:

¹⁴⁶ Also see information available at: <http://www.shecc.com> and <http://www.shecc.com/gsj.s.asp> accessed on 28 September 2009.

English Name	Chinese Name	Specialty	Market Capital (USD in billions)	Other Notes
Chana (Changan) Auto Co., Ltd.	长安汽车	Manufactures cars	RMB 21.2B	Partnership with Ford; exports to Egypt, Guatemala, Pakistan, Syria, and the US
Chengdu Tianxing Instrument & Meter Co. Ltd.	成都天兴仪表股份有限公司	Automobile and motorcycle components	RMB 1.81B (Shenzhen)	
China Jialing Industrial Co Ltd	中国嘉陵	Motorcycles, all terrain vehicles, electrical components	2.97B (Shanghai)	Representative offices in the US, Indonesia, Vietnam, and Columbia

The publically listed subsidiaries of China North Industries Corporation are:

English Name	Chinese Name	Specialty	Market Capital (USD in billions) and stock exchange	Other Notes
NORINCO Internation Co., Ltd.	北方国际	Construction contracts for infrastructure, municipal facilities, power plants, industrial buildings; manufacture and sale of aluminum materials	3.53B (Shenzhen)	Asia, Africa, Europe deals
Changchun Yidong Clutch Co., Ltd.	长春一东	Manufacture and sale of automobile spare parts	1.29B (Shanghai)	

Hubei New Huaguang Information Materials Co., Ltd.	湖北新华光信息材料股份有限公司	Optical glass and solar battery modules	2.32B (Shanghai)	Exports to Europe, America, Asia
Inner Mongolia North Hauler Joint Stock	北方股份	Automobiles, parts, components, equipment for mining use	1.64B (Shanghai)	
China North Optical Electrical Co., Ltd.	中兵光电科技股份有限公司	Military products: UAVs, INS/GPS devices, air-borne environmental control systems, air-borne/vehicular/ship-borne stabilized sighting systems, low-cost seeker systems, inertial devices, remote suppression series and fire control systems; civilian products: GIS)	8.86B (Shanghai)	
Lingyun Industrial Co., Ltd.	凌云工业股份有限公司	Automobile parts primarily for domestic market	3.43B (Shanghai)	Clients include Beijing Jeep, FAW-Volkswagen, Jetta
Jinxi Axle Co., Ltd.	晋西车轴	Train axles for rail transportation systems	3.23B (Shanghai)	
Baotou Beifang Chuangye Co., Ltd.	北方创业	Railway transportation vehicles and components	1.82B (Shanghai)	

Summary

After a slow start, Chinese defense-industrial companies are gaining more funding from international capital markets. An emerging trend reveals that more companies are offering H shares on the Hong Kong market, which are favorable to foreign investors. While most

companies still have A shares on Chinese domestic markets, a 2002 regulation enables foreign investment in A shares through QFIIs.

In the aviation sector, AVIC is expanding its access to international capital markets and foreign investment relative to the other sectors. It is in the sectoral leader in H-share offerings (3) and total listed subsidiaries (22). This additional capital is primarily used to support development of the indigenous commercial jet project. China's shipbuilding industry also is a major player in the international capital markets through mammoth holding companies and at least one subsidiary offering H shares.

CHAPTER FIVE: China's Defense-Industrial Reforms As a Path to True Independence?

Entering the "Critical Stage" of Defense-Industrial Reforms

The Chinese defense industry since the late 1970s has undergone a profound transformation, evolving from a relatively inefficient and backward set of legacy organizations from the Mao period to a relatively dynamic and capable network of R&D and production units increasingly integrated into the global economy. Looking to the future, however, China's senior political, industrial, and military leaders have called the next 20 years the "critical stage" (关键阶段) in China's modernization of its defense-industrial base.¹⁴⁷ A key feature of this "critical stage" involves increasing the relative independence of defense industry. Though domestic innovation is playing a larger role in the industry's successes, major policy documents and speeches by senior S&T and industry sector leaders make clear that China's level of dependence on foreign technology and know-how is still too high.

To achieve this independence and to progress to a higher level of production sophistication, Beijing is pursuing a multi-pronged reform and modernization strategy. The 2005 RAND study offered seven indicators for observation:

- Reports of traditional producers losing major contracts through a competitive bidding process and evidence that production has been transferred to the winning bidder
- Credible reports of substantial rewards or penalties for producing superior or inferior products
- Closure of poorly performing plants, while better performing plants continue to operate
- Significant contract awards to nontraditional suppliers, including non-state enterprises
- Divestitures and acquisitions driven by decisions taken by enterprise management, not ministries
- Privatization of defense manufacturers
- Substitution of domestic production for imports

There has been little evidence of the first three indicators, though analysis of procurement patterns suggests that the competitive bid process has become the norm. This revolutionary change will likely be aided by the March 1998 subordination of COSTIND under the Ministry of Industry and Informatization and the corresponding empowerment of the General Armaments Department, which is responsible for running the competitive bid process. More interesting evidence exists of progress on the fourth, fifth, and seventh indicators. In terms of significant contract awards to nontraditional suppliers, including non-state enterprises, the biannual China Defense Logistics Exhibition was notable for

¹⁴⁷ Medeiros.

the number of non-state enterprises in attendance, strongly suggesting the proliferation of a network of new private sector enterprises supporting the defense establishment. Divestitures and acquisitions driven by decisions taken by enterprise management, not ministries are a major focus of SASAC's reform efforts within the defense-industrial base, particularly as it prepares individual defense-industrial corporations for possible foreign market listings and international capital investment. The sixth indicator, privatization of defense manufacturers, seems the most remote of any of them, given the system's penchant for secrecy and concern about maintaining domestic control of strategic infrastructure.

APPENDIX A. CETC Institutes and Factories

See Included CD.

APPENDIX B. High-Performance Marine Vessels Conference

HPMV CHINA 2009

9th International Conference on High Performance Marine Vessels
17 –18 April, 2009 Shanghai, China

Organizing Committee

Honorary Chairmen: Mr.Wang Rong-Sheng, President, CBITA

Mr. Huang Ping-Tao, President, CSNAME

Co-Chairman:

Mr. Trevor Blakeley, Chief Executive, RINA

Mr. Zhou Zhen-Bai, Vice President, CBITA, and President, SASI

Vice Chairman:

Prof. Yun Liang, Consultant of SDAC, CSNAME

Mr. Miao Guo-Ping, Shanghai Jiaotong University

Secretary General:

Mr. Yang Xin-Fa, Secretary General, SASI

Vice Sec. General:

Mr. Zheng Ming, Rear Admiral, Vice Director of SDAC, CSNAME

International Committee

Chairman:

Mr. Trevor Blakeley, Chief Executive, RINA

Ms.Hu An-Kang, President of Marine Design & Research Institute, China

Vice Chairman:

Prof. Yun Liang, Consultant of SDAC, CSNAME

Prof. D. Savitsky (Stevens Institute of Technology, USA)

Members:

Dr. N. Bose (Memorial University of Newfoundland, Canada)

Prof. L. Doctors (University of New South Wales, Australia)

Prof. A. Fjorentino (Federico II University, Italy)

Prof. C. Kuo (Strathclyde University, UK)

Prof. H. Miyata (University of Tokyo, Japan)

Prof. P. Wilson (University of Southampton, UK)

Prof. K. V. Rozhdestvensky (Saint-Petersburg State Marine Technical
University, Russia)

Prof. Dong Zu-Shun (Naval Engineering University of PLA, China)

Prof. Wu De-Min (Harbin Engineering University, China)

Prof. Tan Jia-Hua (Shanghai Jiaotong University, China)

Prof. Yang Song-Lin (Jiangsu University of Science and Technology)

Vice Senior Engineer Li Xiao Ping (Marine Design & Research Institute,
China)

Mr. Hu Jing-Tao, President of Shanghai Merchant Ship Design & Research
Institute, China)

Prof. Xu Wei (Chang Jiang Ship Design Institute, China)

Prof. Zhang Jia-Long (Shanghai Ship and Shipping Research Institute, China)

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