The People’s Republic of China has, since the 1950s, strived to become self-supporting in the development and production of armaments. The results of these endeavors, however, have been decidedly mixed. Since the late 1990s, China has engaged in a number of reforms intended to overhaul its defense industry, making it both more efficient and economically and technologically self-sustaining, as well as increasing its capacities to design, develop, and manufacture cutting-edge weaponry. Efforts to inject market forces into the local process of arms manufacturing—such as making defense firms more responsible for their own profits and losses, creating a professional management system, increasing inter-firm competition, introducing competitive bidding, and spurring corporative rationalization and consolidation—have, however, met with limited success, given the Chinese leadership’s reluctance to truly “marketize” the arms industry.

The Chinese defense industry has made considerable advances in its manufacturing capabilities, but this has been largely due to increased military spending, commercial-to-military technology spin-on, and the continued reliance upon transfers of military technologies from Russia (including licensed production) and of dual-use technologies from the West. It is also worth noting that Russian arms still comprise the most advanced armaments in the Chinese military’s arsenal. Overall, it appears that Beijing’s operational strategy regarding its defense sector is still to muddle through, with only minor structural tinkering.
Introduction

Great powers, it can be said, have great arms industries. A country cannot be overly dependent on foreign arms producers and still be considered a great power, as supplier restraints or technology holdbacks can create critical gaps in military capabilities, thus undermining its freedom of action and exposing its armed forces to vulnerabilities that can be exploited by its adversaries. Therefore, a great power should strive to be self-supporting in the development and production of armaments.

At the same time, the ability to undertake advanced arms manufacturing is often seen as an indicator of “having arrived” as a great power, and it confirms a nation’s new, enhanced status. Consequently, many aspiring great powers usually devote considerable effort and resources to developing local arms industries. Japan did so after the Meiji Restoration in 1868, as do many would-be great or regional powers—e.g., China, India, and Iran—today.

The People’s Republic of China has, since the 1950s, strived to become self-supporting in the development and production of armaments. The results of these endeavors, however, have been decidedly mixed. Even with sizable economic inputs, access to foreign technologies, and considerable political will, China, up until the late 1990s, experienced only limited success when it came to the local design, development, and manufacture of advanced conventional weapons. Most systems were at least a generation or two behind comparable military equipment being produced at the time in the West or in the Soviet Union, and problems with quality and reliability abounded. In addition, overcapacity, redundancy, inefficient production, and, above all, a weak research and development (R&D) base all conspired to impede the development of an advanced indigenous arms production capability. Overall, these circumstances left China in the unenviable position of

1 The analyses and opinions expressed in this paper are strictly those of the author and do not represent the official position of the S. Rajaratnam School of International Studies.
pursuing great power status with a decidedly “Third World” arms industry.

Not surprisingly, therefore, reforming the local defense industry in order to upgrade its technology base and manufacturing capabilities and to make armaments production more efficient and cost-effective has long preoccupied the Chinese leadership. The fact that most of these efforts had little positive impact on the country’s military technological and industrial capabilities only encouraged Beijing to experiment with additional reforms in the hopes of finally getting it right. The most recent round of defense industrial base restructuring and reorganization began in the late 1990s, and basically entailed a concerted effort to inject more market-oriented concepts into the Chinese military-industrial complex. Now, 10 years on, we have an opportunity to assess just how successful these reforms have been.

The Chinese Military-Industrial Complex in the Late 1990s

China possesses one of the oldest, largest, and most diversified military-industrial complexes in the developing world.\(^3\) The modern

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Chinese arms industry has its roots in the 1950-53 Korean War and the initiation of some 41 “key projects” for weapons production during the 1950s. By the late 1990s, the Chinese defense industrial base was an agglomeration of approximately 1,000 enterprises, each comprising multiple factories, research units, trading companies, and schools and universities, 200-plus major research institutes, and employing some three million workers, as well as 300,000-plus engineers and technicians. In particular, China is one of the few countries in the developing world to produce a full range of military equipment—from small arms, to armored vehicles, to fighter aircraft, to warships and submarines—in addition to nuclear weapons and intercontinental ballistic missiles.

At the same time, the Chinese military-industrial complex has suffered from a number of shortcomings that in turn inhibited translating breakthrough technologies and design into reliable weapons systems. As late as the end of the 20th century, China still possessed one of the most technologically backward defense industries in the world; most indigenously developed weapons systems were at least 15 to 20 years behind those of the West—basically comparable to the 1970s—or (at best) early 1980s-era technology—and quality control was consistently poor. China’s defense research and development (R&D) base was regarded to be deficient in several critical areas, including aeronautics, propulsion (such as jet engines), microelectronics, computers, avionics, sensors and seekers, electronic warfare, and advanced materials. Furthermore, the Chinese military-industrial complex has traditionally been weak in the area of systems integration—that is, the ability to design and develop a piece of military equipment that integrates hundreds or even thousands of disparate components and subsystems and have it to function effectively as a single unit.

Consequently, aside from a few “pockets of excellence” such as ballistic missiles, the Chinese military-industrial complex appeared to demonstrate few capacities for designing and producing relatively advanced conventional weapons systems. Especially when it came to combat aircraft, surface combatants, and ground equipment, the Chi-
nese generally confronted considerable difficulties when it came to moving prototypes into production, resulting in long development phases, heavy program delays and low production runs. The J-10 fighter jet—China’s premier fourth-generation-plus combat aircraft—took more than a decade to move from program start to first flight, for example, and more than 20 years before it entered operational service with the People’s Liberation Army (PLA) Air Force.7 Even after the Chinese began building a weapons system, production runs were often small and fitful. According to Western estimates, during much of the 1990s the entire Chinese aircraft industry of around 600,000 workers manufactured only a few dozen fighter aircraft a year, mainly 1960s- and 1970s-vintage J-8IIs and J-7s (the latter a license-produced MiG-21).8 According to the authoritative *Jane’s Fighting Ships*, China launched only three destroyers and nine frigates between 1990 and 1999—a little more than one major surface combatant per year. Moreover, the lead boat in the Song-class submarine program—China’s first indigenously designed diesel-electric submarine—was only commissioned in 1999, eight years after construction began.9

Consequently, despite years of arduous efforts, the inability of China’s domestic defense industry to generate the necessary technological breakthroughs for advanced arms production meant that Beijing continued to rely heavily—even increasingly—upon direct foreign technology inputs in critical areas. The J-10 fighter, for example, is believed to be heavily based on technology derived from Israel’s cancelled Lavi fighter jet program. These foreign dependencies are especially acute when it comes to jet engines, marine diesel engines, and fire-control radar and other avionics. For example, endemic “technical difficulties” surrounding the JH-7 fighter-bomber’s indigenous engine resulted in significant program delays, forcing the Chinese to approach the British in the late 1990s about acquiring additional Spey engines in order to keep the aircraft’s production line going; additionally, current

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versions of the J-10 are being outfitted with a Russian engine, until the Chinese aviation industry is able to perfect an indigenous replacement.\textsuperscript{10} The new Song-class submarine uses a German-supplied diesel engine, while both the Ming- and Han-class submarines were reportedly upgraded with a French sonar and combat system. Chinese surface combatants incorporate a number of foreign-supplied systems, including Ukrainian gas turbine engines, French surface-to-air missiles, Italian torpedoes, and Russian ship-based helicopters.

Finally, and perhaps most significantly, over the past decade—and particularly since the turn of the century—the PLA has increasingly favored imported weapons platforms over locally built counterparts. From this, one may infer that the Chinese military remains dissatisfied with the quality and capabilities of weapons systems coming out of domestic arms factories, or that local arms manufacturers are unable to produce sufficient numbers of the kinds of weapons that the PLA wants in the near future. In the early 1990s, for example, despite the fact that China already had four fighter aircraft programs either in production or development—the J-7, J-8II, JH-7, and J-10—the PLA nevertheless decided to buy several dozen Su-27 fighters. This purchase was later supplemented by an agreement to license-produce 200 Su-27s and then a subsequent purchase of approximately one hundred more advanced Su-30 fighter-bombers. The PLA Navy (PLAN) is currently acquiring 12 Kilo-class submarines and four Sovremenny-class destroyers (armed with supersonic SS-N-22 anti-ship cruise missiles), even though Chinese shipyards are building the Song and several new types of destroyers. In addition, China has reportedly purchased precision-guided munitions, active-radar-guided air-to-air missiles, AWACS, and transport aircraft from Russia, as well as acquiring several hundred S-300 and SA-15 surface-to-air missiles. Consequently, China has become one of the world’s largest arms importers, and between 1998 and 2005 Beijing signed new arms import agreements worth some US$16.7 billion; in 2005 alone, purchasing US$2.8 billion worth of foreign weapons systems.\textsuperscript{11}

\textsuperscript{10} Medeiros, et al., \textit{A New Direction for China's Defense Industry}, pp. 170–71.
Compounding these technological deficiencies were a number of structural and organizational/cultural deficiencies that impeded the design, development, and manufacture of advanced conventional weapons. Overall, arms production in China has largely been an inefficient, wasteful, and unprofitable affair. One reason was overcapacity: Quite simply, China possessed far too many workers, too many factories, and too much productive capacity for what few weapons it produced, resulting in redundancy and a significant duplication of effort, inefficient production, and wasted resources. The Chinese aircraft industry, for example, was estimated in the late 1990s to possess a workforce nearly three times as large as it required.12 Within the shipbuilding industry, output during the same time period was only 17 tons per person per year, compared to around 700 tons per person in shipyards in more advanced countries.13

By the mid-1990s as well, at least 70 percent of China’s state-run factories were thought to be operating at a loss, and the arms industries were reportedly among the biggest money-losers. As a result, most defense firms were burdened with considerable debt, much of it owed to state-run banks (who were obliged to lend money to state-owned firms); at the same time, arms factories were owed money by other unprofitable state-owned companies, which was nearly uncollectible.14

The creation of China’s “Third Line” defense industries—namely, the establishment of redundant centers of armaments production in the remote interior of southern and western China—in the 1960s and 1970s only added to overcapacity, underutilization, and unprofitability of the Chinese military-industrial complex. Estimates are that from 1966 to 1975, Third Line construction consumed perhaps two-thirds of all industrial investment. Even by the late 1990s, approximately 55 percent

13 Rao Gangcan, Development and Outlook in Newbuilding Technology in China (manuscript), 1998, p. 17.
of China’s defense industries were located within the Third Line, yet most of these industries were much less productive than coastal area factories and continued operate in the red.15

Another structural impediment affecting the Chinese military-industrial complex was the emergence of a highly compartmentalized and vertically integrated defense industrial base. Such a stove-piped and stratified environment, in turn, had several repercussions for the local defense industry. It restricted the diffusion of advanced, militarily usable civilian technologies to the defense sector. It limited communications between R&D institutes which designed the weapons and the arms factories that produced these systems, between defense enterprises when it came to collaborating on weapons projects, and even between the defense industry and its major consumer, i.e., the PLA, when it came to requirements and specification. It also exacerbated redundancy and the duplication of effort within the arms industry, as each defense enterprise tried to “do it all,” resulting in the maintenance of expensive but underutilized manufacturing processes, such as dedicated second- and third-tier supplier networks, and the establishment of in-house machine shops for parts production, instead of outsourcing such manufacturing to other firms.

Finally, China’s military-industrial complex long functioned under an organizational and managerial culture that, in a manner typical of most state-owned enterprises (SOEs), was highly centralized, hierarchical, bureaucratic, and risk-averse. This, in turn, retarded innovation and R&D, and furthermore added to program delays. In a study on Chinese capacities for innovation, two Western analysts argued that “Chinese managers have neither the will, nor the expertise, nor the freedom to take the risks and make the adjustments associated with innovations.”16 Consequently, production management was often highly centralized and “personality-centric,” with most critical project decisions being made by a single chief engineer. At the same time, lower-level managers tended to be “conformist, adhering to standard rules

16 See Yuko Arayama and Panos Mourdoukoutas, China Against Herself: Innovation or Imitation in Global Business? (Westport, CT: Quorum, 1999), p. 11.
and procedures rather than to personal judgments based on their professional experiences.” Hence, they were usually reluctant to make “learning mistakes” or to act on their own initiative to deal with problems that might arise on the factory floor, thereby inhibiting experimentation and innovation.

Overall, regarding China’s problems with armaments production in the 1990s, a U.S. aerospace industry representative perhaps summed it up best:

Part of the problem with Chinese [aircraft] manufacturing...is that industrial management in China still relies on 1950s Soviet styles. This involves “batch-building” a full order of aircraft in advance based on state-planned and dictated order for parts and materials. As a consequence of this system, there are no direct lines of accountability for quality control, and no cost-cutting discussions or steps available to mid-level management. There is no competitive bidding for contracts, workers are redundant, and schedules continually slip because state planning doesn’t have a fixed required-delivery date for products...Young managers stay risk-averse and are reluctant to change or improve the system.18

Reforming China’s Defense Industry, 1997 to the Present

To be sure, the Chinese have long been aware of the deficiencies in their defense industry and have undertaken several rounds of reforms to improve and upgrade their defense R&D and production processes. The intention of this overall restructuring effort was to spur the defense SOEs to act as true industrial enterprises and therefore (1) be more responsive to their customer base (i.e., the PLA), and (2) reform, modernize, and “marketize” their business operations.

These goals in particular are central to the PLA’s new modernization strategy—as laid out in China’s 2004 Defense White Paper—of “generation leap,” that is, to skip or shorten stages of R&D and of generations

17 Ibid., p. 73.
of weapons systems. This process, in turn, entails a “double construction” approach of mechanization and “informatization” in order to concurrently upgrade and digitize the PLA. Part of this strategy also depends on China’s “latecomer advantage” of being able to more quickly exploit technological trails blazed by others, as well as avoiding their mistakes and technological dead-ends.¹⁹

In the early 1990s, in an effort to “corporatize” the defense industrial base, the Chinese transformed their military-industrial complex from a series of machine-building ministries into large SOEs. The Ministry of Aerospace, for example, was broken up into the Aviation Industries of China (AVIC, aircraft) and the China Aerospace Corporation (CASC, missiles and space), while the Ministry of Atomic Energy was converted into the China National Nuclear Corporation (CNNC). Other “super-SOEs” within the defense industry included the China Ordnance Industry Corporation (COIC, ground combat systems, often referred to as Norinco) and the China State Shipbuilding Corporation (CSSC, naval systems). At the same time, control of individual production facilities, research units, and trading companies were transferred to these new corporations.

The most recent round of defense industry reforms began a decade ago, in September 1997, when the 15th Communist Party Congress laid out an ambitious agenda for restructuring and downsizing the state-owned enterprise sector (including the defense industries) and for opening up SOEs to free-market forces—i.e., supply-and-demand dynamics, competitive products, quality assurance, and fiscal self-responsibility. In March 1998, the Ninth National People’s Congress further refined this agenda by announcing plans to reorganize the government’s defense industry oversight and control apparatus and establish new defense enterprise groups.

One of the most important decisions to come out of the 1998 NPC was the creation of a new PLA-run General Armaments Department (GAD), which would function as the primary purchasing agent for the PLA, overseeing defense procurement and new weapons programs. As a 2005 RAND report put it, the GAD is part of a process “to create a system that will unify, standardize, and legalize the [Chinese] weapons

procurement process.”20 In particular, the GAD is supposed to ensure that local arms producers meet PLA requirements when it comes to capabilities, quality, costs, and program milestones.

Another key element of current defense reforms was the creation in July 1999 of 10 new defense industry enterprise groups (DIEGs) (see Table 1). These DIEGs were supposed to function as true conglomerates, integrating R&D, production, and marketing. Breaking up the old SOEs was also intended to encourage the new industry enterprise groups to compete with each other for PLA procurement contracts, which it was hoped would pressure them to be more efficient and tech-

### Table 1. China Defense Industry Restructuring, July 1999

<table>
<thead>
<tr>
<th>Old Corporate Entity</th>
<th>New Enterprise Groups</th>
<th>Major Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation Industries of China (AVIC)</td>
<td>China Aviation Industry Corp. I (AVIC I)</td>
<td>Fighter aircraft, bombers, transports, advanced trainers, commercial airliners</td>
</tr>
<tr>
<td></td>
<td>China Aviation Industry Corp. II (AVIC II)</td>
<td>Helicopters, attack aircraft, light trainers, UAVs</td>
</tr>
<tr>
<td>China Aerospace Corp. (CASC)</td>
<td>China Aerospace Science &amp; Technology Corp. (CASC)</td>
<td>Space launch vehicles, satellites, missiles</td>
</tr>
<tr>
<td></td>
<td>China Aerospace Science &amp; Industry Corp. (CASIC)</td>
<td>Missiles, electronics, other equipment</td>
</tr>
<tr>
<td>China Ordnance Industry Corp. (COIC)/Norinco</td>
<td>China North Industries Group Corp.</td>
<td>Tanks, armored vehicles, artillery, ordnance</td>
</tr>
<tr>
<td></td>
<td>China South Industries Group Corp.</td>
<td>Miscellaneous ordnance, automobiles, motorcycles</td>
</tr>
<tr>
<td>China State Shipbuilding Corp. (CSSC)</td>
<td>China State Shipbuilding Industry Corp. (CSIC)</td>
<td>Destroyers, frigates, commercial ships</td>
</tr>
<tr>
<td>China National Nuclear Corp. (CNNC)</td>
<td>China National Nuclear Corp. (CNNC)</td>
<td>Nuclear energy development, nuclear fuel and equipment</td>
</tr>
<tr>
<td></td>
<td>China Nuclear Engineering &amp; Construction Group Corp. (CNECC)</td>
<td>Construction of nuclear power plants, other heavy construction</td>
</tr>
</tbody>
</table>

nologically innovative. At the same time, the government’s role in the
daily operations of the defense industry was to be greatly reduced, and
these new enterprise groups were given the authority to manage their
own operations as well as take responsibility for their own profits and
losses.

Another crucial aspect of these new reform initiatives was the
declared intent to significantly downsize the Chinese military-industri-
al complex, including eliminating (through retirement, attrition, or
even layoffs) as much as one-third of the defense sector’s workforce.
The aircraft industry, for example, intended to downsize by 200,000
workers. The rationalization of the defense industry was also supposed
to include factory closings and consolidation as a result of government-
encouraged mergers, as part of the policy of “letting the strong annex
the weak.”

At the same time, Beijing prodded local defense industries to move
more into civilian production as a means of acquiring dual-use tech-
nologies that also could be used to support armaments production.
This strategy actually goes back to the late 1970s and the enunciation of
Deng Xiaoping’s so-called 16-character slogan: “Combine the military
and civil/comboine peace and war/give priority to military products/
let the civil support the military.” However, whereas earlier efforts at
civil-military integration (CMI) tended to revolve mostly around con-
version—that is, switching military factories over to civilian use—
China’s approach to CMI after 1997 entailed a critical shift in policy
toward promoting integrated dual-use industrial systems capable of
developing and manufacturing both defense and military goods—or as
one Western analyst put it, “swords into plowshares . . . and better
swords.”21 This new strategy was embodied and made a priority in the
defense industry’s 10th Five-Year Plan for 2001-2005 (and presumably
continued under the current 11th FYP), which emphasized the dual
importance of both the transfer of military technologies to commercial
use and the transfer of commercial technologies to military use. There-
fore, this called for the Chinese arms industry to not only develop dual-
use technologies but to actively promote joint civil-military technology

21 Paul H. Folta, From Swords to Plowshares? Defense Industry Reform in the PRC
cooperation. Consequently, the spin-on of advanced commercial technologies both to the Chinese military-industrial complex and in support of the overall modernization of the PLA was made explicit policy.

The key areas of China’s new focus on dual-use technology development and subsequent spin-on include microelectronics, space systems, new materials (such as composites and alloys), propulsion, missiles, computer-aided manufacturing, and particularly information technologies. Over the past decade, Beijing has worked hard both to encourage further domestic development and growth in these sectors and to expand linkages and collaboration between China’s military-industrial complex and civilian high-technology sectors. In 2002, for example, the Chinese government created a new industry enterprise group, the China Electronics Technology Corporation, to promote national technological and industrial developments in the area of defense-related electronics. Under the 10th and 11th Five Year Plans, many technology breakthroughs generated under the so-called “863” science and technology program, initiated in March 1986, have been finally slated for development and industrialization. Defense enterprises have formed partnerships with Chinese universities and civilian research institutes to establish technology incubators and undertake cooperative R&D on dual-use technologies. Additionally, foreign high-tech firms wishing to invest in China have been pressured to set up joint R&D centers and to transfer more technology to China.

In this regard, China’s military shipbuilding appears to have particularly benefited from CMI efforts over the past decade. Following an initial period of basically low-end commercial shipbuilding—such as bulk carriers and container ships—China’s shipyards have since the mid-1990s progressed toward more sophisticated ship design and construction work. In particular, moving into commercial shipbuilding began to bear considerable fruit beginning in the late 1990s, as Chinese shipyards modernized and expanded operations, building huge new dry-docks, acquiring heavy-lift cranes and computerized cutting and welding tools, and more than doubling their shipbuilding capacity. At the same time, Chinese shipbuilders entered into a number of technical cooperation agreements and joint ventures with shipbuilding firms in Japan, South Korea, Germany, and other countries, which gave them access to advanced ship designs and manufacturing technologies—in
particular, computer-assisted design and manufacturing, modular construction techniques, advanced ship propulsion systems, and numerically controlled processing and testing equipment. As a result, military shipbuilding programs collocated at Chinese shipyards have been able to leverage these considerable infrastructure and software improvements when it comes to design, development, and construction.\textsuperscript{22}

China’s nascent space industry has also spurred the development and application of dual-use technologies that are basically commercial in nature but which serve military purposes as well. This includes telecommunications satellites, as well as China’s rudimentary Beidou navigation satellite system and its Ziyuan-1 and Ziyuan-2 earth observation satellites. In addition, many of the technologies being developed for commercial reconnaissance satellites, such as charge-coupled device cameras, multispectral scanners, and synthetic aperture radar imagers, have obvious spin-on potential for military systems.

Finally, the PLA has clearly profited from piggy-backing on the development and growth of the country’s commercial IT industry. The PLA is working hard to expand and improve its capacities for command, control and communications, information-processing, and information warfare, and it has been able to enlist local IT firms—many of which have close ties to China’s military-industrial complex and were even founded by former PLA officers—in support of its efforts. Consequently, the PLA has developed its own separate military communications network, utilizing fiber-optic cable, cellular and wireless systems, microwave relays, and long-range high frequency radios, as well as local area computer networks.

\section*{A Disappointing Track Record}

Nevertheless, Chinese efforts since the late 1990s to reform its military-industrial complex have been disappointing. If the intention of creating new industrial enterprise groups was to inject greater competition into China’s military-industrial complex—and therefore spur innovation and greater responsiveness to PLA systems requirement—then

\begin{flushright}
\textsuperscript{22} Medeiros, et al., \textit{A New Direction for China’s Defense Industry}, pp. 140–52.
\end{flushright}
these restructuring efforts have largely been a failure. The General Armaments Department, for example, has yet to implement competitive bidding and market pricing into the overall arms procurement process; in particular, competitive bidding is still not apparently used when it comes to major weapons programs, as any purchases over 2 million yuan (less than US$250,000) are exempt.23

There is also little evidence to suggest that recent institutional reforms have strengthened PLA oversight of armaments manufacturing, particularly when it comes to quality control. RAND notes that the military has long had a Military Representative Office (MRO) system in place in many factories to watch over production, but even it admits that this system is woefully understaffed and ineffective when it comes to overseeing armaments production and quality control, and that the effectiveness of current reform efforts are “far from clear.”24

Moreover, at one time it was expected that the Chinese would create large, trans-sectoral, cross-competing defense conglomerates, similar to the South Korean chaebols or, more specifically, to horizontally integrated mega-defense companies such as Lockheed Martin or Britain’s BAE Systems. Such a strategy would have entailed a much more complicated restructuring of the defense industry, crafting enterprise groups that would have competed with each other to produce a broad array of weaponry. Instead, all Beijing did was break up each of its former defense corporations into two smaller groups.

With few exceptions, too, China’s new DIEGs still do not compete with each other when it comes to defense materiel. Of the two new enterprise groups replacing the old Aviation Industries of China (AVIC), for example, all fighter aircraft production is concentrated within one DIEG, while all helicopter and trainer jet production is centered in the other. The nuclear industry will be split into separate enterprises for either construction or nuclear energy development, while the Norinco appears to have been subdivided into one enterprise group mostly concerned with armored vehicles and ground ordnance, while the other is almost entirely civilianized, specializing in automobile and motorcycle production. In fact, Beijing appears to have intended that these new

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defense industries do not vie directly with each other. For example, the two new aerospace (missile) enterprise groups do not compete in terms of products, but rather “in terms of their systems of organization and their operational mechanisms.” Naval construction is about the only defense sector that appears to be truly competitive in that both major shipbuilding companies (CSSC and CSIC) vie with each other for PLAN contracts.

Rationalization of the defense industry has also been much slower than expected. Details are sketchy, but according to one Western estimate, no more than 20 percent of the labor force in the overall defense sector has been laid off. AVIC, for example, has downsized by only 10 percent overall, and this was likely accomplished through retirement and job-leavers. At the same time, there have been few incidents of arms factories being closed or merged. Much of the defense industry appears to still suffer from excess capacity, therefore, both in terms of workforce and redundant manufacturing capacity.

It is also unclear how independent these new defense enterprises will be of government control or how responsible they will ultimately be for their own profits and losses. Beijing made it clear from the beginning that arms production is a strategic industry too critical to national security to be privatized, and that it will keep the new DIEGs under much stricter supervision than other types of reformed SOEs. At the same time these same rules will work in favor of the arms industries, as Beijing will likely feel pressured to continue to prop up unprofitable defense enterprises in order to preserve key arms programs.

Above all, the reform initiatives implemented so far do not directly address those impediments affecting technology absorption and upgrading of China’s defense industry—that is, the lack of advanced technical skills and expertise, compartmentalization and redundancy within the industrial base, and a bureaucratic/risk-averse corporate culture. As a result, it is doubtful that these reforms will go very far in injecting market forces that would, in turn, drive the modernization of

27 Ibid.
the Chinese military-industrial complex and affect China’s ability to develop and manufacture highly advanced conventional weapons systems. It is also doubtful whether there really exists much of a latecomer advantage when it comes to extremely esoteric high-tech sectors such as arms production, where the technological demands are very high and the economic payoffs are very low. Even RAND noted that while “the technological gap between China’s military aviation industry and that of the United States and other major aviation producers will likely narrow in coming years, [it] will still remain significant unless China makes fundamental changes in contracting and enterprise management.”

**Chinese Arms Production: Success In Spite of Failed Reforms?**

Interestingly, despite making little progress in reforming itself, the Chinese defense industry appears to be booming. Production and sales are up—19 percent and 14 percent, respectively, in 2001 (the last year for which we have reliable data)—and China’s military-industrial complex technically broke even in 2002 after eight straight years of losses. The missile and shipbuilding sectors have been particularly profitable in recent years.

It is also increasingly evident that the Chinese have in recent years greatly added to their military capabilities in terms of power projection, standoff precision-strikes, and improved C4ISR (command, control, communications, computing, intelligence, surveillance, and reconnaissance). China’s defense industry has begun manufacturing and delivering to the PLA several new types of advanced weapons systems, including the fourth-generation J-10 fighter, an upgraded version of its JH-7 fighter-bomber, the HQ-9 long-range surface-to-air missile (akin to the U.S. Patriot air defense missile), the improved Song-class diesel-electric submarine, and the Type-052C destroyer (which incorporates low-observable features and a type of Aegis-type phased-array air defense radar into its design). Moreover, the quality and capabilities of

28 Crane, et al., *Modernizing China’s Military*, p. 180
some Chinese weaponry has also apparently improved. Recent versions of the Song-class submarine, for example, are outfitted with a skewed propeller for improved quieting and are capable of carrying an encapsulated antiship cruise missile that can be launched underwater.

The shipbuilding industry has made particular progress in modernizing its design and manufacturing capabilities and in spinning-on commercial shipbuilding technologies to its naval construction side. Chinese shipbuilding is domestically and globally competitive (at least, at the low end of the technology scale), and it also appears to be profitable—so much so that it is the only sector in the defense industry that is actually adding productive capacity, i.e., new shipyards and more workers. This in turn has permitted a significant expansion in naval ship construction since the turn of the century, and since 2000, China has begun construction of least six new destroyers, seven frigates, and eight diesel-powered submarines—more than double the rate of naval ship construction during the 1990s.

Nevertheless, most progress in expanding armaments production, both quantitatively and qualitatively, seems to have come about despite defense industry reforms—or at least the more recent attempts at reform—rather than because of them. Many of the so-called successes in generating new-generation weapons systems actually have their genesis in design and development decisions made years, even decades, ago—that is, long before the reforms of the late 1990s were inaugurated. These weapons programs were already in the pipeline and on schedule anyway to enter production in the late 1990s and the first decade of the 21st century, and while the most recent reform efforts may have helped to accelerate or expand production of these weapons systems, they certainly did not play any key role in their initiation. For example, the success of the Chinese shipbuilding industry appears to be more the result of decisions made back in the early 1980s to commercialize the shipbuilding sector, to open up the industry to foreign technology inputs, and to compete on the global market.

In addition, it is perhaps premature to make overly optimistic and sweeping statements about recent progress in modernizing the Chinese defense industrial base. In particular, the continuing lack of transparency on the part of the Chinese forces Western analysts to rely too much on scanty, often anecdotal, evidence and inference. Some new weapons
systems and platforms may appear to be more modern and more capable, but absent sufficient and reliable information (which is perhaps collectable only by covert means), one can only speculate at any true increase in the capabilities and quality of weapons systems presently coming off Chinese assembly lines. We also continue to lack detailed and consistent economic data regarding the Chinese defense industry (such as sales, profits, capacity utilization, productivity, etc.) when it comes to assessing the success of defense sector market reforms.

Moreover, rising defense spending also likely had as much to do with the recent expansion in Chinese arms production as any reform efforts. Chinese military expenditures have nearly quadrupled in real terms since the mid-1990s; China’s official 2007 defense budget is 350 billion yuan, or US$45 billion—an increase of nearly 18 percent over the previous year and thus continuing a trend of double-digit real increases (that is, after taking inflation into account) in Chinese military spending that goes back more than a decade. PLA annual spending on equipment has increased from US$3.1 billion in 1997 to an estimated US$12.3 billion in 2006—a four-fold increase in real spending; at this rate, the 2007 equipment budget would total around US$15 billion (and this does not include likely extrabudgetary funding for foreign arms purchases, which is running at around US$1.5 billion to US$2 billion a year). It could be argued, therefore, that simply throwing more money at the problem has had the most impact on the local defense industry—that is, in increasing procurement spending and therefore production, and by providing more funding for R&D.

Finally, it is also important to note that the sharpest edges of the pointed end of the PLA spear are still mostly foreign—and particularly Russian—sourced, that is, Su-27 and Su-30 fighters, Sovremennyy-class destroyers, Kilo-class submarines, S-300 surface-to-air missiles, etc. They are, with few exceptions (such as indigenous tactical ballistic missile systems or nuclear submarines), still the most critical force multipliers when it comes to calculating Chinese military power.

Overall, it appears that Beijing’s operational strategy regarding its defense sector is still mainly to muddle through with arms production, with some minor structural tinkering, a healthy increase in defense spending, and a continuing reliance on “pockets of excellence.” While past reform efforts have resulted in some technological and structural
improvements in weapons R&D and manufacturing, China’s military-industrial complex remains in many respects an inefficient and less-than-optimal production model. This will continue to exert a drag on the Chinese military modernization process and make it harder for the PLA to close technology and capability gaps with its rivals.