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Locating China's Place in the Global Defense Economy

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Summary

The position of an arms producing country or region in the global arms industry is dictated by the relative level of its indigenous capabilities for independent defense-related research and development (R&D) and manufacturing. Tier 1 countries such as the United States are considered to have a techonological edge, based on their ability to innovate, over Tier 2 modifiers and adapters such as China and India. Progress in the Chinese aerospace industry demonstrates its rapid trajectory from copier/reproducer of technologies to adaptor/modifier, and, in some cases, developer and designer. Do these trends mean that China is on the verge of becoming a Tier 1 arms producer?

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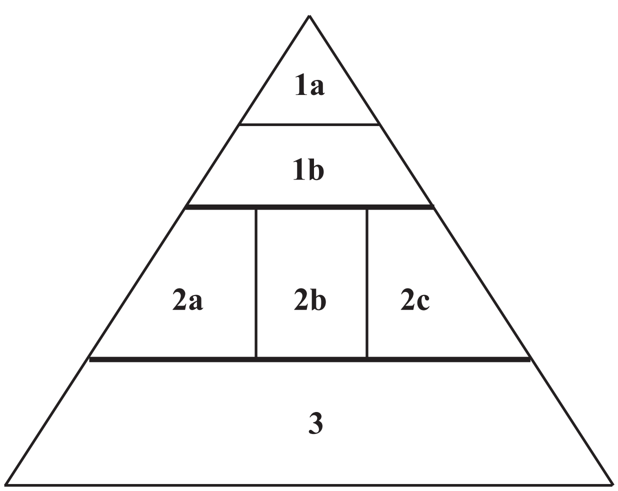
INTRODUCTION

This policy brief rests on the premise that the global arms industry is a hierarchical system, and that a nation's position as an arms producer in this hierarchy is dictated by the relative level of its indigenous capabilities for independent defense-related research and development (R&D) and manufacturing. Although there are no generally agreed upon criteria for how arms-producing nations may be compartmentalized, it is customary to divide the global defense industry into three or four tiers (Figure 1).

We define the first tier as comprising those states with the capacity for across-the-board development and manufacture of advanced conventional weaponry. This tier consists of just a handful of countries: the United States and the four largest European arms producers—Britain, France, Germany, and Italy. Given the U.S. preponderance of defense-industrial capabilities—especially when it comes to defense R&D, which in turn is powered by a huge military R&D budget (approximately $81 billion in FY2009, more than the rest of the world's defense R&D budgets combined)—it might be more fitting to describe the United States as a Tier 1a country, and the others as Tier 1b producer-states.

The second tier comprises a rather catholic group of countries. Tier 2a includes those industrialized countries possessing the capabilities for advanced but nevertheless niche defense production, such as Israel, Japan, and Sweden. The second sub-grouping (Tier 2b) consists of developing or newly industrialized countries containing modest military-industrial complexes, such as Brazil, South Korea, Taiwan, and Turkey. Finally, there are Tier 2c producers such as India that are developing industrial states with large, broad-based defense industries but nevertheless still lacking a sufficiently capable R&D and industrial capacities to develop and produce highly sophisticated conventional arms. At the bottom are Tier 3 states, which possess only very limited and generally low-tech arms-production capabilities, such as the manufacture of small arms or the licensed assembly of foreign-designed systems. Countries in this group would include Egypt and Nigeria.

Figure 1. The Hierarchy of Global Arms Industries



China has traditionally fallen into the category of a Tier 2c arms producer. China possesses one of the oldest, largest, and most diversified military-industrial complexes in the developing world. In particular, it is one of the few countries in the developing world to produce a full range of military equipment. At the same time, the Chinese military-industrial complex suffered from a number of shortcomings that inhibited translating breakthrough technologies and design into reliable weapon systems. As late as the late 1990s, China still possessed one of the most technologically backwards defense industries in the world; most indigenously developed weapons systems were at least 15 to 20 years behind that of the West. 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 weapon systems.

This could be changing, however. Progress in reforming the Chinese military-industrial complex over the past decade or so has been palpably evident, in terms of the quality and capabilities of new weapons systems and of the increased tempo of defense development. At issue, therefore, is how well is China's defense industry performing vis-à-vis other arms-producing states.

This comparative performance is particularly critical to assess for two reasons. For one thing, the "technological goalposts" when it comes to weapons development are constantly moving; as certain nations—particularly the United States—advance the state of the art in defense technology, they create new metrics for defining what is meant by "advanced" military systems. So the first question to ponder is whether or not China is keeping pace or closing the gap with the overall progress in military technological-industrial development.

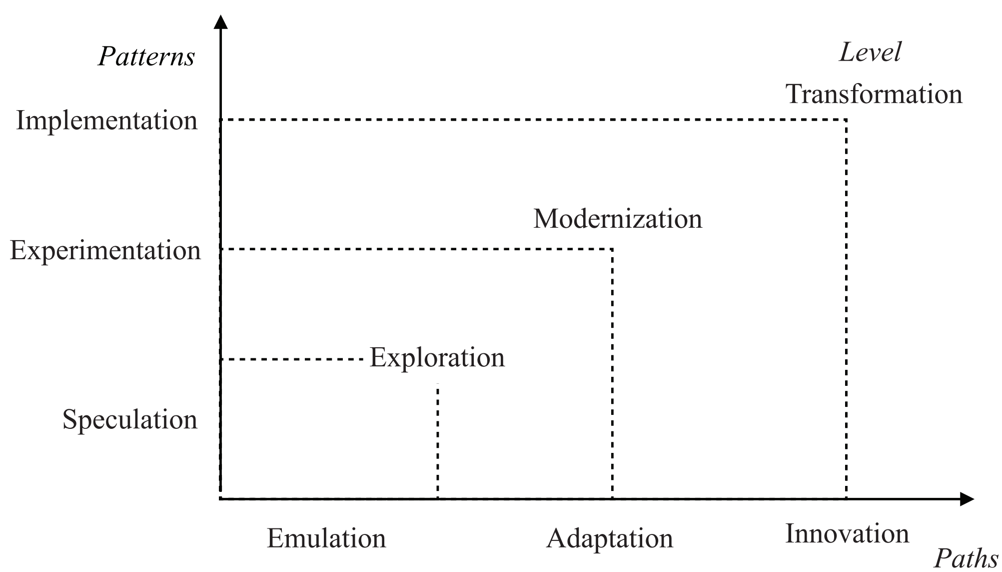
Second, a nation's status in the global hierarchy of arms-producing states is not permanent; positioning is relative, depending on the ongoing performance of a nation's defense industrial base. Consequently, countries can rise or fall along this scale. Russia is obviously on the fence as a future Tier 1 producer-state, while it could be argued that South Korea could eventually become a Tier 2a state, much like Japan. This point, in turn, brings us to the second question that this paper seeks to address: Is China on the verge of cracking the barrier and becoming a Tier 1 arms producer?

CONCEPTUALIZING DEFENSE INNOVATION TRAJECTORIES

Figure 1 only captures the current, static position of an arms-producing state within the global arms industrial hierarchy. It is consequently useful to conceptualize the trajectory of dynamic change within this hierarchy (Figures 2 and 3). Defense innovation trajectories can be projected by a synthesis of its three inter-related dimensions: 1) paths—emulation, adaptation, and innovation; 2) patterns—speculation, experimentation, and implementation; and 3) magnitude—exploration, modernization, and transformation. Military emulation paths involve importing new tools and ways of war through imitation of other military organizations. Adaptation is defined through adjustments of existing military means and methods, in which multiple adaptations over time may lead to innovation. Military innovation then involves developing new military technologies, tactics, strategies, and structures.

Similarly, the character of defense innovation evolves in three distinct but often overlapping phases: speculation; experimentation; and implementation. The speculation phase can be defined through novel ways for solving existing operational problems or acknowledging the potential of emerging technologies. As speculation turns into greater awareness, military services establish experimental organizations, battle laboratories, and units tasked with experimenting with new concepts, force structures, weapons tech-

Figure 2. Conceptualizing Defense Innovation Trajectories



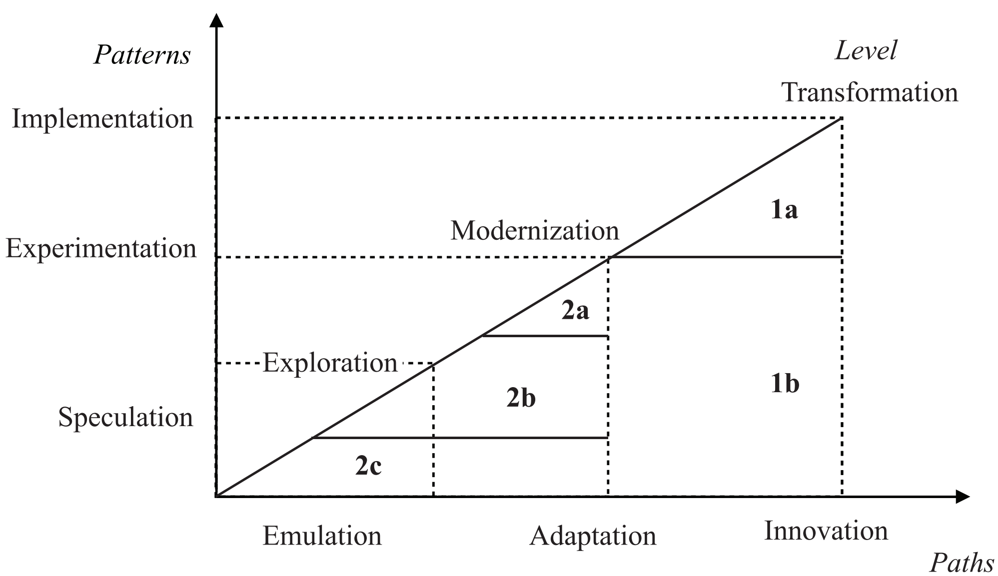
Source: Raska 2011; based on Mahnken 1999; Farrel, Terriff 2002; and Ross 2010.

nologies, and warfare methods. With the broadening and deepening experimentation processes a consensus emerges, and the military leadership and services decide to adopt, adapt, and refine selected experimental operational concepts, warfare methods, organizational force structures, or new generations of weapons systems and technologies. The implementation phase then includes a range of indicators: the establishment of new military formations; doctrinal revision to accommodate new ways of war; resource allocation supporting new concepts; development of formal transformation strategy; establishment of innovative military units; new branches and career paths; and ultimately, field training exercises with new doctrine, organizations, or technologies.

By linking defense innovation paths and patterns, it is possible to ascertain the pace, direction, and magnitude of defense-industrial innovation in three distinct levels: 1) exploration; 2) modernization; and 3) transformation. Exploration includes both speculation and emulation, with initial attempts to develop new areas of technological expertise; military modernization involves continuous upgrades or improvements of existing military capabilities through the acquisition of new imported or indigenously developed weapons systems and supporting assets; transformation can be characterized in the context of a disruptive defense innovation.

In this context, one can measure the level and sophistication of a country's defense-industrial

Figure 3. Taxonomy of Global Defense Industries



Source: Bitzinger and Raska 2011; based on Mahnken 1999; Farrel and Terriff 2002; Ross 2010; and Krause 1992.

First-tier: Innovators	1A	***Critical Technological Innovators*** Having a state-of-the-art technological edge in weapons research and development	United States and Western Europe (United Kingdom, France, Germany, Italy)
	1B		
Second-tier: Adapters	2A	***Adapters and Modifiers*** Small but advanced defense industry	Australia, Canada, Czech Republic, Norway, Japan, Sweden, Israel, South Korea, Singapore, South Africa, Taiwan, and Turkey
	2B		
	2C		
Third-tier: Emulators		***Copiers and Reproducers*** Low-technology arms producers	Egypt, Syria, Mexico, North Korea, Nigeria

Source: Krause 1992; and Bitzinger 2003.

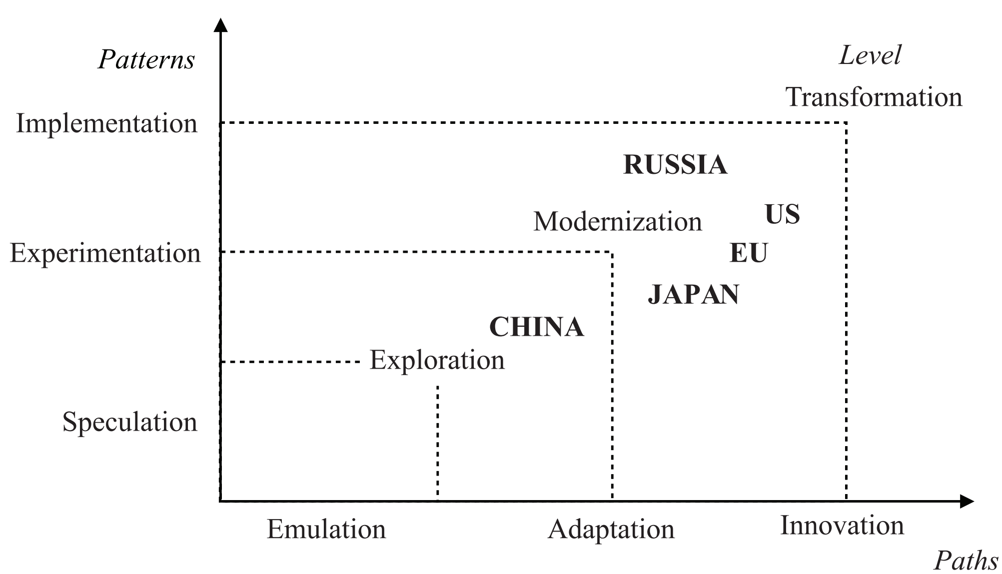
base and broadly define the relative level of indigenous capabilities for independent defense-related R&D and manufacturing. The global defense industry then consists of Tier 1 “critical innovators” at the technological frontier; Tier 2 “adapters and modifiers” of advanced military technologies; and Tier 3 “copiers” and “reproducers” of existing defense technologies (Figure 4).

FROM EMULATION TO ADAPTATION: AN AEROSPACE CASE STUDY

World spending on space set a historic record in 2010 with civil and defense government spending combined at US$71.5 billion, and projected to remain at around US$70 billion until 2015. 90 percent of world expenditures for civilian space sector are concentrated in six countries orregions: The United States, Europe, Russia, China, Japan, and India. However, the global diffusion of space-based technologies and related knowledge broadens the international competitive pressures to develop innovative space capabilities. According to a study by Euroconsult, more than 50 countries are currently investing in domestic space programs. With more nations joining the “space club,” there is a growing awareness that space is vital to national security, as space assets may be increasingly vulnerable to a range of threats that may deny, degrade, deceive, disrupt, or destroy them. As countries continue to collaborate in space, competition is growing more intense. Dominant actors are increasingly challenged by lower tiers of space leaders, and the competitive gaps among all nations are narrowing.

China is one of the most ambitious countries in the emerging global space race. Over the last two decades, China has invested in advancing its civil and military space platforms and capabilities supported by extensive organizational infrastructure, R&D facilities, and a more capable defense industrial base. With space investments exceeding US$2 billion in 2010, China became the second largest spender on space in Asia after Japan (US$3.8 billion), and is narrowing the gap. In 2010, China conducted as many launches (15) as the United States, second only to Russia (31). While many aspects of China’s vast space programs remain classified, Beijing has publicized its technical prowess and space ambitions in areas such as launch vehicles, launch schedules, satel-

Figure 4. China’s Aerospace Industry in Comparative Perspective



Source: Bitzinger and Raska 2011.

lites, human space flight, as well as command and control, anti-satellite technologies, and sensor capabilities.

In 2003, China became the third nation to complete a successful manned space mission by launching the Shenzhou-5 (Divine Vessel) carried by the Long March-2F rocket. Since then, China has carried out two additional manned missions: Shenzhou 6 (SZ-6) in October 2005 and the Shenzhou 7 (SZ-7) spaceflight in September 2008. By 2025, China envisions the completion of a 60-ton orbital space station, and possibly the fielding of a reusable launch vehicle. In this regard, China is believed to have embarked on a full-scale technology development program on a new heavy-lift Long March rocket—the LM-5 series, designed to overcome the limitation of existing SLVs in terms of cost and reliability. The LM-5 is expected to be launched in 2014 from the newly constructed Wenchang Space Center in Hainan.

There is no clear separation between Chinese civil and military space programs and industries. Beijing does not clearly delineate its satellite functions in terms of military, civilian, or commercial use. China's Long March (LM) or Changzheng (CZ) series of rockets have evolved from the Dongfeng ballistic missiles programs. The DF-4 IRBM provided the baseline design and rocket propulsion for the first Long March launch vehicle (LM-1 or CZ-1) launched in 1970 and carrying the first Chinese satellite into a low earth orbit. Since then, China has developed a number of versions in the LM series.

While China's aerospace industry shows patterns of gradual and phased, albeit progressive, qualitative transition from a copier and reproducer of Soviet ballistic missile technologies (first generation) from the late 1950s to early 1980s, to adapter and modifier of their follow-on designs (second generation) throughout the mid and late 1980s, its independent R&D capabilities for critical technological innovation in the aerospace sector currently lag behind the United States, Russia, and the European Union, particularly in the areas of cryogenic engines and propulsion systems, flight control systems, payload, and space structures.

CONCLUSIONS

Other case studies in naval shipbuilding and fighter aircraft show similar trajectories of progress from copier/reproducer to adaptor/modifier, and, in some cases, impressive indigenous development and design. In other words, China has made progress over the past decades, especially since the mid-1990s, in moving from the "speculation/emulation/exploration" zone to being solidly within the "experimentation/adaptation/modernization" zone. The question is whether China is starting to move into the final zone of being a true innovator/transformer.

This dynamic will likely be determined not only by domestic efforts within China's indigenous defense technology and industrial base, but also by global trends. Certainly China is investing considerable resources into modernization and upgrading its defense industry. This aggressive effort is starting to pay some dividends, such as the J-20 fighter jet and DF-21D anti-ship missile. At the same time, China is perhaps benefitting from a slowdown in the weapons development and production processes in Tier 1b and Tier 2a countries. This "strategic pause" gives rise to speculation that over the next decade or so China may be permitted to catch up to the global near state of the art in certain areas.

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