This collection of policy briefings provides a comprehensive overview of the present state of the Chinese defense economy at a time of rapid change and accelerating advancement in its innovation capabilities and performance. This review has three aims: 1) locate China’s defense innovation dynamics within broader historical, technological, and methodological frameworks of analysis; 2) assess the performance of the Chinese defense economy’s six principal sub-sectors; and 3) compare China’s approach to defense industrialization with major counterparts in the Asia-Pacific region.

The briefings are based on more extensive papers written for a conference on “China’s Defense and Dual-Use Science, Technology, and Industrial Base” organized by the University of California’s Institute on Global Conflict and Cooperation (IGCC) in July 2010. The conference is part of a research project led by IGCC and funded by the U.S. Defense Department’s Minerva Initiative on “The Evolving Relationship Between Technology and National Security in China.” This project examines China’s drive to become a world-class defense and dual-use technological and industrial power and the security, geo-political, economic and technological implications of this transformation.

THE FINDINGS

These briefings offer a number of insights into the state of development of the Chinese defense economy at the end of the 2000s and longer-term trends.

The Chinese defense science, technology and innovation (DSTI) system is making a concerted effort to build a strong and capable indigenous innovation capacity, but progress is at an early stage and focused predominantly on incremental and sustaining types of activities. Architectural and disruptive forms of innovation that would lead to important defense technological breakthroughs are likely to be beyond China’s reach for another 5-10 years, although there may be exceptions in select high-priority areas that enjoy access to ample funding, foreign knowledge and technologies, and leadership support.

The technological development of the Chinese defense economy since the onset of major sector reforms in the late 1990s has been impressive. This progress can be measured through a diverse array of hard performance indicators such as corporate profitability, patents, product and R&D output, and educational standards. If this momentum can be maintained, the Chinese defense economy will be able to considerably narrow the still wide technological gap it faces with the world’s advanced defense S&T powers over the next decade.

China has demonstrated that it can engage in radical defense innovation leading to significant technological breakthroughs if the country’s security is considered to be in acute danger. This was achieved in the 1960s and 1970s with the development of nuclear weapons and strategic missiles. If China’s leaders were to become as seriously alarmed again, this could see another concerted drive to attain breakthroughs in critical defense technological capabilities. This may have occurred since the 1990s with the development of long-range precision ballistic missile capabilities.

China’s present approach appears to be the selective targeting of a few critical areas for accelerated development while the rest of the DSTI system pursues a more moderate pace of transformation. But as the country grows more prosperous, more technologically capable, and its secu-
rity interests become more global and complex, this focused strategy is likely to be broadened. The defense electronics, aviation, shipbuilding and select portions of the space industries are leading the way in the Chinese defense economy’s transformation, especially in civil-military integration (CMI), access and linkages with global production and innovation networks, the building of innovation capabilities, and ability to adapt to market competition. The nuclear and ordnance sectors are laggards with poor levels of CMI and weak innovation capabilities.

To fully understand China’s defense innovation potential requires the examination of a broad range of tangible and intangible science, technology and innovation indicators. This includes not only hard performance measures such as R&D budgets, corporate investment, the output of patents, publications, and products, and the size of the science and technology (S&T) workforce, but also soft process-related factors such as leadership, organizational flexibility, marketing, entrepreneurial skills, risk cultures, and governance factors.

The Chinese defense economy has been investing heavily in the construction of a comprehensive and high-quality innovation apparatus since the late 1990s that is intended to nurture the ability to conduct disruptive technological innovation. This involves the establishment of large numbers of research laboratories, training a large pool of new generations of scientists and engineers, and forging a robust regulatory regime of standards, regulations, and rules designed to impose discipline, oversight, and raise quality control in a previously haphazardly-run system. These structural and process reforms are likely to bear fruit over the next decade and will play an influential role in advancing the DSTI system’s innovation performance.

Over the past decade, China has climbed to the apex of the military technological and industrial order in the Asia-Pacific region and its technological capabilities today match or exceed Japan, South Korea, and India. However, the Asia-Pacific region lags far behind the United States and Europe, and this defense technological gap appears to be widening with the gradual decline of the Japanese defense industry and the chronic inability of India to overcome deep-seated structural obstacles. China will become the dominant regional military technological power over the next decade, which will be a key pillar in its growing economic and military shadow over this region.

China’s defense industrialization is based on a platform-centric model that appears increasingly outdated in the information era as leading defense powers in the U.S. and Europe have embraced network-centric models of technological development. China has recognized the need to increase technological collaboration and learn from these advanced countries and is vigorously pursuing cooperation and trade, especially with the European Union (EU) as well as Russia. While the EU is cautious in its technology interactions with China because of pressure from the United States, powerful economic motivations means that EU-China high technology cooperation is growing rapidly, especially in areas such as shipbuilding, aviation and space.

LIMITATIONS IN UNDERSTANDING CHINA’S DEFENSE SCIENCE, TECHNOLOGY AND INNOVATION

A key purpose of the July 2010 conference was to provide a detailed assessment of the Chinese defense economy at the end of the 2000s so that future reviews have a baseline for comparison. IGCC will be conducting annual assessments of the Chinese defense economy over the next few years.

Another important objective was to examine the state of the international field in understanding Chinese DSTI. While China’s economic, military and technological might is on the rise and its impact is becoming increasingly felt, understanding of the workings of its DSTI system as well as the broader defense economy is fragmentary, backward rather than forward looking, and lacking in analytical rigor. The poor state of this field is due to several factors:

Methodological deficiencies: The field lacks sophisticated and comparative frameworks of analysis. Much of the work is descriptive and anecdotal in nature and often examines what is happening in
China through a narrow analytical prism and with a lack of comparative perspective.

**Large information gaps:** Serious holes exist in the gathering and utilization of information sources on Chinese science and technology in both the civilian and defense arenas. First, the academic and policy communities have limited direct access to the Chinese defense economy. Second, the collection and collation of Chinese language sources is undertaken in an uncoordinated and non-systematic manner with researchers usually working in isolation.

**Paucity of expertise:** A serious lack of expertise exists in the study of Chinese DSTI issues as well as in the broader examination of Chinese science and technology. A major reason is because China’s S&T and DSTI capabilities were so backward until the last decade that the topic attracted limited policy and scholarly interest. Moreover, the small pool of specialists in this area is aging and many of these analysts work in the government and defense establishments that are separated from the academic and policy communities. Scholars and analysts in the United States with published track records examining Chinese S&T and DSTI issues could comfortably fit into a SUV.

The implications of these weaknesses are several-fold. First, Western understanding is not up-to-date with developments and trends in Chinese DSTI. The field of study is struggling to keep pace with current developments in China, which means that there is considerable difficulty in assessing critical technological patterns. The ability to foresee technological surprises and breakthroughs is poor.

Second, there is difficulty in making sense and understanding the significance of what is actually taking place in Chinese DSTI. Considerable confusion exists, for example, as to the nature of CMI that is taking place in China and whether it is more in terms of military-to-civilian spin-off or civilian-to-military spin-on processes. Attention and understanding is also poor towards the nature of innovation activities taking place in the Chinese DSTI system.

Third, while much of the analysis on Chinese DSTI developments can describe what is going on, the ability to “connect the dots” and provide the context, meaning, and identification of the critical issues that are at play is lacking. The result is assessments that are often little more than snapshots and lack broader context outside of their specific sector or functional areas of examination.

A key goal of this Minerva project is to address these serious analytical weaknesses and to cultivate and train a new generation of specialists able to carefully and insightfully assess the sources of innovation and the pathways of technological development in China’s rise as a leading defense technological champion, which will be one of the most consequential dynamics in defining the country’s future place in the global economic, military, geo-strategic and technology order.