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China's [Secret] Civil-Military Megaprojects

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Synopsis

China's emerging weapons systems, including recently deployed anti-ship ballistic missiles (DF-21D) and fighter jet prototypes (J-20, J-31), have drawn considerable interest. The country's future military-technological aspirations are evolving further in select science & technology megaprojects.

Commentary

CHINA HAS aimed to overcome deficiencies in areas critical to its national security ever since it initiated the National High Technology Programme ("863") in March 1986 - the most important civilian-military R&D programme next to the "Two Weapons, and One Satellite" science and technology development plan of 1956-67.

The 863 Programme featured a concurrent development of dual-use technologies applicable in both civilian and military domains. The programme had initially focused on developing seven strategic priority areas: laser technology, space, biotechnology, information technology, automation and manufacturing technology, energy, and advanced materials. In the mid-1990s, China expanded these areas in size, scope, and importance, shifting its trajectory toward cutting-edge technological products and processes. The 863 Programme is ongoing, funding projects such as the Tianhe-1A supercomputer.

Three secret national megaprojects

More importantly, the 863 Programme has paved the way for China's current "indigenous innovation" strategy, embedded in the 2006 National Medium to Long-term Plan (MLP) for the Development of Science and Technology (2005-2020). The MLP became China's most ambitious comprehensive national science and technology plan with special long-term total funding estimated at Rmb 500 bn (US$75bn).

Central to the MLP are 16 National Megaprojects - vanguard S&T programmes - "priorities of priorities" - designed to transform China's science & technology capabilities in areas such as electronics, semiconductors, telecommunications, aerospace, manufacturing, pharmaceuticals, clean energy, and oil and gas exploration. The megaprojects include both civilian and military areas, with 13 listed and three "unannounced" areas classified.

The 16 Megaprojects have been a source of considerable controversy and debates both in China and abroad, given the continuing structural, technological, and manufacturing challenges that inhibit disruptive innovation in Chinese defence science & technology system. The debate has also focused on the three classified

megaprojects. Prof. Tai Ming Cheung, leading scholar on China's defence industries at the Institute on Global Conflict and Cooperation at the University of California San Diego, suggested three prime candidates for the military megaprojects:

Shenguang Laser Project for Inertial Confinement Fusion:

The Shenguang (Divine Light) laser project explores the inertial confinement fusion (ICF) as an alternative approach to attain inertial fusion energy (IFE) – a controllable, sustained nuclear fusion reaction aided by an array of high-powered lasers. The lasers essentially heat and compress pellet-sized targets typically containing two hydrogen isotopes deuterium and tritium, sending shock waves into the centre and releasing energy that heats the surrounding fuel, which may also undergo fusion. Shenguang aims to achieve such "burn" - fusion ignition and plasma burning by 2020, while advancing research in solving the complex technological challenges associated with controlling the nuclear reaction.

Shenguang's target physics, theory and experimentation, began as early as 1993. By 2012, China completed the Shenguang 3 (Divine Light 3) a high-powered super laser facility based in the Research Centre of Laser Fusion at the China Academy of Engineering Physics – the research and manufacturing centre of China's nuclear weapons located in Mianyang. In this context, Shenguang has two strategic implications: it may accelerate China's next-generation thermo-nuclear weapons development, and advance China's directed-energy laser weapons programs.

Second Generation Beidou Satellite Navigation System:

The second prime candidate for China's 'unlisted' megaprojects is likely the Beidou-2 Satellite System (BDS), formerly known as the Compass Navigation Satellite System (CNSS). According to Jane's, by the end of 2012, China had 16 operational Beidou satellites in orbit - six geostationary satellites, five Medium Earth Orbit spacecraft, and five satellites in Inclined GeoStationary Orbits covering the Asia-Pacific region. By 2020, Beidou 2 envisions a full-scale system of at least five geostationary and 30 non-geostationary satellites providing a global coverage in two modes: free "open" services available to commercial customers with 10-metre location-tracking accuracy, and restricted "authorised" services providing positioning, velocity and timing communications estimated at 10 centimetre accuracy for the Chinese government and military.

Beidou 2 satellites, developed by the China Academy of Space Technology, are also designed with effective protection against electromagnetic interference and attack. Notwithstanding its wide commercial utility, the BDS will enable the PLA to significantly enhance its global navigation, tracking, targeting capabilities, providing guidance for military vehicles, ballistic and cruise missiles, precision-guided munitions, as well as unmanned aerial vehicles. Most importantly, the BDS eliminates China's dependency on the US GPS and Russia's GLONASS satellite navigation systems that could be deactivated in select areas in times of conflict.

Hypersonic Vehicle Technology Project:

While data on China's hypersonic research remains scarce, there are signs that China is developing conceptual and experimental hypersonic flight vehicle technologies such as hypersonic cruise vehicles (HCV) capable of manoeuvring at Mach 5 speeds (6,150+ km/h), and flying in near-space altitudes. Andrew Erickson, Associate Professor at the US Naval War College, analysed China's Shenlong (Divine Dragon) spaceplane project, including its apparent test flight in 2011 and noted subsequent profusion of Chinese research articles on the subject.

Similarly, Mark Stokes from the Project2049 Institute identified new research institutes focusing exclusively on the design and development of hypersonic test flight vehicles, including the 10th Research Institute also known as the Near Space Flight Vehicle Research Institute, under the China Academy of Launch Technology (CALT) - China's largest entity involved in the development and manufacturing of space launch vehicles and related ballistic missile systems. The Qian Xuesen National Engineering Science Experiment Base in Beijing's Huairou district is also one of China's key HCV research centres.

Global competition

Taken together, China's long-term strategic military programmes are deeply embedded in China's advancing civilian science and technology base, which in turn is increasingly linked to global commercial and scientific networks.

Technology transfers, foreign R&D investment, and training of Chinese scientists and engineers at research institutes and corporations overseas are part of China's "indigenous innovation" drive to identify, digest, absorb, and reinvent select technological capabilities, both in civil and military domains.

In the process, China is benchmarking emerging technologies and similar high-tech defence-related programmes in the U.S., Russia, India, Japan, Israel and other countries. China's key challenge, however, remains internal - translating its scientific potential and technological advances into operational capabilities.

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