Jane's Intelligence Review

Space invaders - China's space warfare capabilities

As China invests in its space warfare programme, its ability to target incoming ballistic missiles or enemy satellites becomes ever more potent. *Richard D Fisher Jr* and *Sean O'Connor* examine the programme and its growing capabilities.

Interest in China's space programme is at an all-time high. In June, the secretive Chinese military-linked hacker group Unit 61398 was accused by US security technology group Crowdstrike of systematically attacking the computer systems of US and European government partners in the space and satellite industry in order to steal information.

This came just weeks after a tense stand-off between China and the United States, after US authorities charged five Chinese military officers from Unit 61398 with hacking into US firms to steal trade secrets. China summoned the US ambassador in Beijing and warned the affair would damage "mutual trust".

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Historical precedents

Taking place across two distinct historic phases, China's ambitions to conduct low earth orbit warfare have been intertwined with its ambitions to develop ballistic missile defence capabilities. The first phase began as a likely response to Soviet and US anti-ballistic missile (ABM) programmes; on 6 February 1964, then Chinese leader Mao Zedong ordered the country's chief strategic missile engineer Qian Xuesen to begin developing missile defence, later named Project 640.

Project 640 saw the development of prototypes of the 80-kilometre range 10-tonne two-stage FanJi-1 (FJ-1: Counter Strike-1), which was successfully tested in September 1978. Prototype test models of a higher altitude FJ-2 also occurred, before it was cancelled in 1973, while development work on a more capable three-stage FJ-3, for anti-satellite (ASAT) missions, also took place.

Although initial tests with associated large phased array radars (LPARs), ABM systems, and other components achieved varying degrees of success throughout the 1970s, Project 640 was cancelled by then leader Deng Xiaoping on 9 March 1980 for economic reasons.

Almost a decade later, a second Chinese effort to develop an ASAT system began. Originally under the aegis of the research and development-focused 863 Programme for high-technology development, leadership is likely to have passed to the People's Liberation Army's (PLA) General

Armaments Department (GAD) of the Central Military Commission (CMC), which controls China's space programme.

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Defensive, offensive

To support space-based intercepts, China has invested heavily in ground- and space-based sensors. Currently, China operates four identified LPAR installations, near Huian, Korla, Longgangzhen, and Shuangyashan, although the system designators are unknown. The Korla, Longgangzhen, and Shuangyashan LPARs employ slanted octagonal arrays to provide a greater field of view. Unlike the others, the Korla array is mounted on a turntable and supports several areas.

A map showing China's LPAR network. (IHS)

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LPARs support offensive and defensive capabilities, via their ASAT or ballistic missile early warning (BMEW) functions, respectively. They can also support the development of offensive systems, and space tracking is an additional possibility for the LPAR network.

On the eastern coast, the Longgangzhen and Huian LPARs are situated to monitor the Taiwan Strait region, and depending on system capabilities, high-altitude activity as far afield as the Second Island Chain.

Alternatively, with an over-the-horizon-surface wave network in place as well as emerging Radar Ocean Reconnaissance Satellite and ocean-monitoring capabilities, the Longgangzhen LPAR could represent a possible system designed to track outbound DF-21D anti-ship ballistic missiles, and provide them with midcourse guidance commands. Such a capability would increase the potency of China's assertion over vital shipping lanes, which it contests with several neighbours including the Philippines.

The Huian LPAR may represent an electronic attack device rather than a true LPAR, as in June 2014 *IHS Jane's* reported on its potential role in directing electronic interference directed at Taiwan's BMEW capability, the Surveillance Radar Programme.

In contrast with Project 640, the revived ASAT/ABM programme of the late 1980s has stressed complementary development of ASAT and ABM technologies but with a likely emphasis on early fielding of ASAT weapons.

ASAT and ABM technologies are similar in that dual-role systems may perform intercepts outside the atmosphere for both missions. Single-purpose ABM systems, however, are orientated towards different classes of threat systems and do not all possess this exoatmospheric capability. ABM systems tailored to intercept slower moving, shorter-range missile classes are designated as anti-tactical ballistic missile (ATBM) systems to denote their inability to engage faster moving, longer range intercontinental ballistic missiles (ICBMs).

Midcourse or terminal-phase ABM systems are designed to intercept ballistic missiles during midcourse flight while outside the atmosphere, or during the terminal phase following atmospheric re-entry in the vicinity of their target.

Information on Chinese military capabilities is rarely published by official Chinese sources, and much comes from individuals on the Chinese internet. The famous Chinese blogger KKTT, who has a good track record of revealing many new details about Chinese strategic systems, notes that under the 863 Programme, the 863-409 sub-programme stressed missile interceptors, while the 863-805 sub-programme focused on sensors and a kinetic kill vehicle (KKV). One result has been the China Aerospace Science and Industry Corporation (CASIC) 35-kg KKV, which forms the payload for the dual-role interceptor missile, designated "SC-19" by the US Department of Defense.

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Testing systems

Currently only two countries have operational ABM systems: Russia and the US, with India pursuing the capability and China quickly closing the gap. ABM systems have the potential to alter the strategic balance as they could render an opposing country's attack capability redundant. If fewer missiles are likely to penetrate the missile shield, then opponents may be tempted to develop more destructive warheads or sophisticated counter measures.

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In addition to its 2007 ASAT mission, the SC-19 was used in two confirmed anti-missile tests in 11 January 2010 and 27 January 2013. In both tests the interceptor missile appears to have been launched from the Korla Missile Test Complex, with target missiles launched from Jiuquan Space Launch Centre.

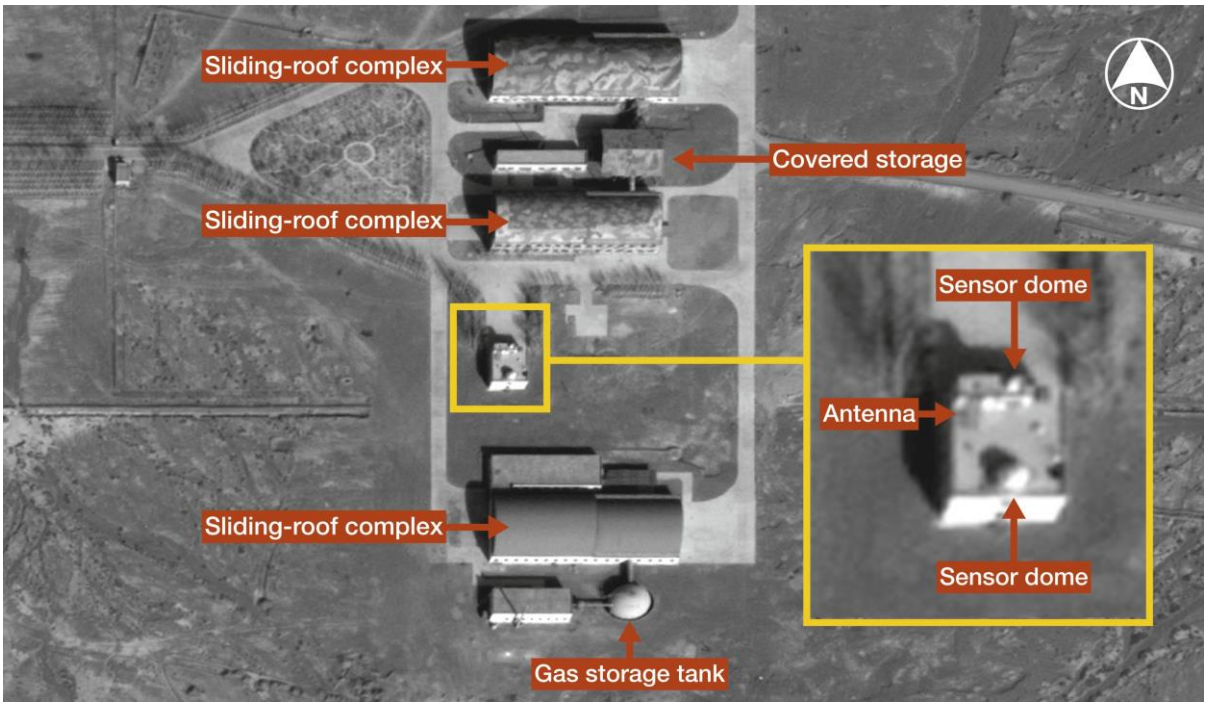
A later US Department of State cable published by Wikileaks described the 2010 test, noting that a CSS-X-11 ballistic missile launched from the Jiuquan Space Launch Centre was intercepted at approximately 240 km in altitude, suggesting an exoatmospheric midcourse intercept that "furthered Chinese ASAT and ballistic missile defence technologies". The January 2013 test appeared to mirror the 2010 test, although some have suggested that an ASAT system test also occurred on the same date.

The SC-19 is not the only system under development. In September 2010, an unsuccessful terminal-phase test involved an HQ-9 air defence missile or one of its derivatives. A document published in 2000 by CASIC describing solid-propellant engine development for various missile programmes gave the HQ-9B ATBM variant designation.

The 64N6E-derived battle management radar for the HQ-9, identified in September 2013 by *IHS Jane's* , would increase ATBM search-and-track capabilities of the HQ-9B by introducing new search modes and a dedicated ATBM operating mode. Additionally, the US Department of Defense credits China with developing the HQ-19 system, described by Chinese sources as equivalent to the Terminal High Altitude Area Defense ATBM system deployed by the US.

Furthermore, the 2000 CASIC document refers to the development of the HQ-26, an ABM said to be similar to the US Raytheon SM-3, which demonstrated an ASAT interception on 21 February 2008; and the HQ-29, a suspected analogue to the PAC-3 Patriot missile system's Extended Range Intercept Technology ATBM, which is intended to intercept shorter-range ballistic missiles with lower velocities.

Chinese ABM development is on par with US efforts technologically, only lagging behind in deployment. China could meet or exceed US ABM deployment levels within the next decade, but ATBM deployment remains harder to evaluate without more information regarding ATBM capabilities built into Chinese surface-to air missile systems such as the HQ-9.



DigitalGlobe imagery from February 2014 shows the lower half of a possible laser test complex at the Korla ASAT facility. In the image, the sliding roof complexes are closed. (DigitalGlobe/IHS)

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Laser weapons

In addition to missiles, China has pursued laser weapon systems since the 1960s. Project 640 included a sub-programme designated Project 640-3. According to a 1998 Defense International report, Project 640-3 researched lasers in an ABM capacity and was overseen by the Shanghai Institute of Optics and Fine Mechanics.

After Project 640 was discontinued, laser weapons research continued, eventually falling under the 863 Programme. Research efforts regarding high-energy lasers increased in the 1980s, although a transition to an ASAT rather than an ABM system is likely as research efforts included free-electron lasers and chemical oxygen-iodine lasers, whose potential outputs would satisfy the requirements for an ASAT system.

Laser systems can perform three functions: dazzling, blinding, or destruction. Most require precision and sophisticated deformable optics that minimise power loss due to atmospheric transit.

Dazzling is commonly associated with imaging satellites: ASAT lasers target a satellite's sensor apparatus temporarily preventing normal operation. Blinding focuses energy onto a sensor or component to cause permanent damage, and destruction requires the most technologically advanced systems and the largest power outputs. Laser ranging to support other kill systems is also a possibility.

On 28 September 2006, Defense News reported that China had fired a "high power laser at a US spy satellite" as a "test of the Chinese ability to blind the spacecraft". US officials downplayed

suggestions that satellites had been damaged, with some analysts simply suggesting that the Chinese were simply laser "range finding". Despite this, the Department of Defense consistently claims that China is pursuing directed-energy weapons for the ASAT and/or ABM role in its annual reports to Congress.

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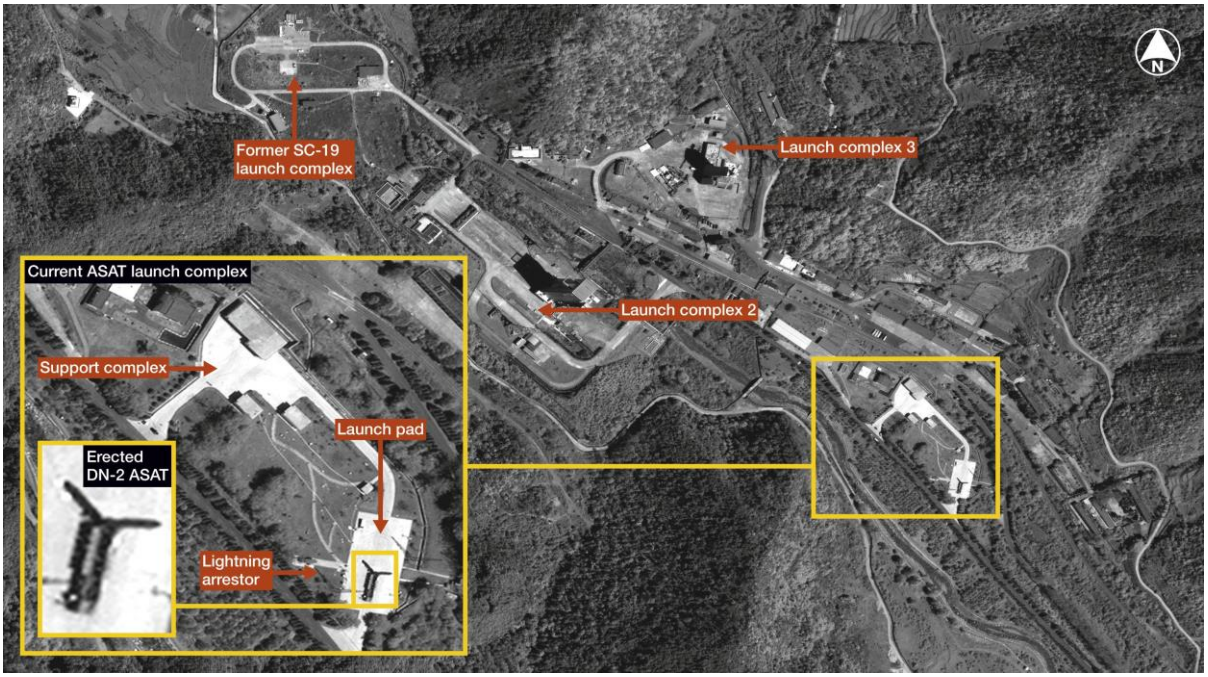

DigitalGlobe imagery from April 2013 shows the Xichang Satellite Launch Centre (XSLC). The DN-2 ASAT transporter erector launcher is visible. (DigitalGlobe/IHS)

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Space combat platforms

As well as these air- and ground-based platforms, China may also be developing co-orbital weapons. These "assassin" satellites would reside in orbit awaiting orders to attack other satellites. International oversight regarding the weaponisation of space is currently weak, with the Outer Space Treaty primarily focusing on the basing of nuclear weapons, or other forms of weapons of mass destruction, in space.

In a 21 November 2009 report on PLAAF strategy development, Chinese academic Jiang Feng, of the China Strategy Institute, told Hong Kong newspaper Wen Wei Po that the PLAAF was developing "assassin satellites, laser interceptor satellites …[and]… a new model orbital bomber".

A dual use co-orbital "assassin" or repair satellite was tested during the last week of September 2013. Following its launch on 20 July 2013, a satellite equipped with a space robotic arm - either the Shiyan-7 (SY-7: Experiment-7) or the SJ-15 manoeuvred close to a third payload, the Chuangxin-3 (CX-3: Innovation-3), and then to a separate satellite, the Shijian-7.

The robot-arm-equipped satellite probably made contact with one of the target satellites, demonstrating its "dual use" potential; the ability to manoeuvre and contact a satellite could be used to damage critical components.

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Outlook

The introduction of BMEW, ASAT, and ABM capabilities represents a significant change to Beijing's military capabilities. Despite the potential to negate US missile threats, few capabilities offer a substantial threat to US forces, and the largest impact will be felt regionally through the potential interference with Taiwanese BMEW systems, or the increasing Chinese assertion over shipping lanes.

A limited ABM force is capable of protecting the industrial and population centres in eastern China from attack by longer-range Indian systems that are currently under development. If China is able to effectively negate the Indian missile threat, one regional impact may be that it feels emboldened to greater assist its own allies or Indian adversaries, such as Pakistan, in times of regional tension.

Advances in Chinese ABM technology are unlikely to pose a significant threat to US or Russian ICBMs, although the deterrence environment is somewhat altered as a single ICBM or a limited strike involving a small number of weapons is no longer guaranteed success. Rather, a much larger engagement will be required.

The New Strategic Arms Reduction Treaty, signed in 201o, has limits of 700 deployed missiles and bombers, meaning that such an engagement remains within Russian and US capabilities. A larger engagement, detected by Chinese BMEW LPARs, would probably signal the beginning of a major nuclear exchange. Dispersed and silo-based missile forces, likely on alert due to increased tensions, could be used in a launch-on-warning posture to ensure retaliation.

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DUAL-USE PLATFORMS

China's future spaceplanes are historically rooted in military requirements dating back to the short-lived 863-204 programme, which proposed spaceplanes to meet China's initial manned space access requirements.
Although quickly superseded by what would become the Shenzhou manned SLV, space plane development continued. First revealed in 2007, Russian sources have told *IHS Jane's* that China has tested its Shenlong small spaceplane. This was most likely a sub-orbital test in late 2011 or early 2012. Shenlong is similar in size to the US Boeing X-37B and could be developed into a slightly larger space plane that could carry passive or active military payloads.

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