

**Prepared Statement of
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The United States House Committee on Science, Space, and Technology
Space Subcommittee**

Are We Losing the Space Race to China?

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Mr. Chairman, thank you for the opportunity to participate in today's hearing on an issue that is important to U.S. interests in peace and stability in the Asia-Pacific region. It is an honor to testify here today. The evolving capacity of the People's Republic of China (PRC) to leverage space assets presents a number of challenges for the United States, allies, and friends in the Asia-Pacific region. In my presentation this morning, I will focus my remarks on PRC investment into militarily relevant space technologies and offer a basic outline of its research, development, and acquisition system. Under an evolving policy of military-civilian fusion, the line dividing civil and military space is becoming increasingly blurred.

The PRC has embarked upon an ambitious dual-use, civil-military space program that is predominantly driven by the desire to stand among equals in the international community. However, as in most space programs around the world, there is a prominent military application. The Chinese People's Liberation Army (PLA) is gradually developing a capacity to project military power vertically into space and horizontally beyond its immediate periphery. Senior civilian and military leaders view the aerospace sector – the space and missile industry -- as one aspect of a broad international competition in comprehensive national strength and science and technology (S&T).

The PRC is improving its ability to research, develop, and field innovative capabilities and advanced weapon systems. Increasingly sophisticated space-based systems expand PLA battlespace awareness and support extended range conventional precision strike systems. Space assets enable the monitoring of naval activities in surrounding waters and the tracking of air force deployments into the region. The PLA is investing in a diverse set of increasingly sophisticated electro-optical (EO), synthetic aperture radar (SAR), and electronic reconnaissance assets. Space-based remote sensing systems also provide the imagery necessary for mission planning functions, including automated target recognition technology that correlates pre-loaded

optical, radar, or infrared images on a missile system's computer with real time images acquired in flight. A constellation of small electronic reconnaissance satellites, operating in tandem with SAR satellites, could provide commanders with precise and timely geolocation data on mobile targets. Satellite communications also offer a survivable means of linking sensors to strike systems, and will become particularly relevant as PLA interests expand further from PRC borders. Existing and future data relay satellites and other beyond line of sight communications systems could transmit targeting data to and from theater command elements. An increasingly diverse and reliable family of launch vehicles is available to support various missions and payloads. In addition, the PLA is developing mobile or air launched solid-fuelled launch vehicles for placing small tactical satellites into orbit during crisis situations.

The PLA also is modernizing its ground-based surveillance and tracking system in order to meet demands presented by its expanding presence in space and defend against perceived air and space challenges. Supported by an improved surveillance and tracking system, the PLA has demonstrated a rudimentary ability to engage flight vehicles in space, such as polar orbiting satellites and medium range ballistic missiles. The PLA appears to be investing resources into ground-based radar systems capable of providing queuing quality data for engaging targets in space. The PLA also has invested in electronic countermeasure technologies that could degrade an adversary's satellite communications, navigation satellite signals, or SAR satellites operating within line of sight of an emitter.

Overview of Military Space Organization and Requirements

Guided by the Chinese Communist Party Central Committee Political Bureau, the Central Military Commission (CMC) and State Council establish national space and counterspace requirements. Within a broad and fragmented party and state policy framework, a diverse set of end users develop space-related requirements for CMC/State Council approval, based on organizational roles and missions. The end user of a particular system most likely drafts detailed requirements documentation based upon short (e.g., five year) to long term (e.g., 15 or more years) plans. Civilian organizations, such as the State Oceanic Administration, appear to develop requirements for satellite programs in support of their unique missions.

The PLA's requirements development system remains opaque. However, second level departments within the newly established CMC Joint Staff Department (JSD) and PLA Strategic Support Force (PLASSF) presumably develop and coordinate operational requirements for militarily relevant space-based surveillance, communications, and navigation systems. More specifically, the JSD probably develops operational requirements for navigation, weather, and mapping satellites. The SSF most likely is responsible for dedicated military EO and possibly SAR satellites, and possibly space-based electronic reconnaissance systems and possibly satellite electronic countermeasures. The CMC JSD would establish requirements for dedicated military

communications satellites. Operational requirements presumably are coordinated with the PLA Navy, Air Force, Rocket Force, and the five theater commands.

The CMC Equipment Development Department (EDD) supports the CMC/State Council in the development and acquisition of technical solutions to satisfy operational requirements. Like its predecessor, the General Armaments Department, the EDD develops, coordinates, and oversees defense acquisition and technology policies for the CMC. It also oversees large national-level space engineering projects, such as the manned space program. However, the former GAD's space launch mission appears to have transferred to the newly established PLASSF. The PLASSF likely is responsible for development of launch vehicle requirements, as well as space surveillance and control. The PLASSF also likely manages China's National Space Command and Control Center. The CMC Science and Technology (S&T) Commission functions as the CMC's principle advisory group addressing China's long term military technology policies. The commission manages working groups, comprised of leading authorities from across China's civilian and military S&T community, which establish technology development priorities. The State Council's China National Space Administration coordinates and executes international space cooperation agreements.

Space Research, Development, and Production

Presumably influenced in part by the U.S. Planning, Programming, and Budgeting System (PPBS) and Soviet design system, basic principles for China's space-related R&D were established in the 1960s and, with some exceptions, appear to have changed little over time. How much China spends on civil-military space R&D remains unclear. Based on CMC/State Council planning, programming, and budget guidance, however, space-related R&D may consist of four phases. A phased approach calls for multiple variants of the same basic space system to be in the R&D cycle at any one time.

Preliminary research is focused on initial development of basic technologies that eventually could be applied to multiple programs. A strong preliminary research program helps reduce engineering R&D time and risk. Preliminary research can also focus on technologies applicable to a specific system, for instance, a movable spot beam antenna for a communications satellite or a new launch vehicle propulsion system. Funded in part through national-level technology development efforts such as the 863 Program, the EED, CMC S&T Commission, and other end users function as important supervisory bodies for projects in this phase.

During the *concept development and program validation phase*, an end user, working in conjunction with defense industry, identifies key technologies, determines the feasibility of a program, and assesses alternatives that could meet basic operational and technical requirements. The concept and program validation phase draws heavily on results from preliminary research

projects. PLA equipment research academies, technical bureaus, and research institutes appear to play a major role during this phase. Major programs likely require CMC/State Council-level approval before investing in engineering research and development (R&D).

During the *engineering R&D phase*, two civilian defense industrial enterprises -- the China Aerospace Science and Technology Corporation (CASC) and China Aerospace Science and Industry Corporation (CASIC) support the CMC/State Council and end users in the R&D and production of space and counterspace systems. CASC and CASIC research academies specialize in certain space-related core competencies, such as heavy lift launch vehicles, tactical solid fueled launch vehicles, and satellites. A research academy is roughly analogous to a US defense corporate business division. CASC/CASIC academies are organized into design departments (or systems engineering institutes); research institutes focusing on sub-systems, sub-assemblies, components, and materials; testing facilities; and manufacturing plants.

CASC is China's primary supplier of satellites and large launch vehicles, while CASIC appears to serve as a lead systems integrator for tactical microsatellite and space intercept systems. Other defense industrial enterprises, such as the China Electronics Technology Corporation (CETC), may supply sub-systems, such as space-based electronic reconnaissance receivers or data links. Increasingly accountable for profit and loss reporting, trends indicate growing competition between research academies in securing R&D and manufacturing contracts.

Engineering R&D programs are managed through a dual command system that divides administration and technical responsibilities. Administrative responsibilities reside with a program manager, while technical aspects of a program are the responsibility of the chief designer and his/her design team. The program manager, or literally *general commander*, ensures timeliness standards are being met, quality is assured, schedules testing, and manages the program budget. Program managers of major satellite and launch vehicle projects often are dual hatted as deputy directors of CASC research academies.

Members of the technical design team appear to have concurrent positions within an academy's design department and research institutes. For example, chief designers of major satellite programs hold concurrent positions within CASC's China Academy of Space Technology (CAST) General Design Department and Shanghai Academy of Space Technology's Institute of Satellite Engineering. Chief designers are also assigned for space launch vehicles, including those delivering anti-satellite kinetic kill vehicles. To ensure requirements are met, PLA end users maintain industrial representative offices within CASC and CASIC design departments, research institutes, and factories.

During the *design finalization phase*, end users and industrial program managers evaluate whether or not a design satisfies operational and technical requirements. For major programs, a

design finalization committee is comprised of members of the CMC and State Council (Premier or Vice Premier). A joint CMC-State Council standing office appears to support the design certification committee.

Concluding Remarks

In short, PRC space-related ambitions are driven by political, economic, and military considerations. With a broad mandate granted by party and state authorities, the PLA plays a leading role in developing operational requirements for civilian and militarily-relevant space systems, overseeing technology development that could satisfy operational requirements, and managing the national space launch, tracking, and control system. Under a national policy of military-civilian fusion, the line dividing civil and military space is becoming increasingly blurred.

China adopts an incremental, phased approach to space-related R&D. In supporting CMC/State Council-approved acquisition projects, the CMC JSD, EED, PLASSF, and other end users rely on the space and missile industry for engineering R&D. Engineering R&D is characterized by an industrial dual chain of command that divides administrative and technical responsibilities. China's space and missile industry – CASC and CASIC – stands out as perhaps the most technically successful defense enterprises in China today. While basic approaches to R&D appear to have changed little over the decades, innovative organizational changes within the PLA and space industrial structure could enable significant advances over time. Among these include establishment of formal and informal organizations intended to facilitate collaboration between the PLA, civilian authorities, defense industry, and academia for purposes of diffusing space technology.

In closing the technological gap with the United States, the PRC's capacity to field increasingly sophisticated space systems is largely a reflection of its organizational efficiency and an expanding pool of capable engineers. Chinese space development also has benefitted from foreign successes. In addition to formal bilateral space cooperation relationships with Russia and other space-faring nations, each industrial academy oversees an information collection and dissemination institute that diffuses publicly available technical data from around the world. PLA operational requirements, technology development, and engineering R&D are also likely informed by intelligence collected through traditional clandestine human sources and signals intelligence (including cyber espionage).

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