STUDY OF INNOVATION AND TECHNOLOGY IN CHINA

POLICY BRIEF

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China's Defense Research, Development, and Acquisition in the Ordnance Sector: A Multiple Launch Rocket System Case Study

Cortez A. COOPER III, Daniel ALDERMAN, and Mark COZAD

The objective of this study is to illuminate research, development and acquisition (RDA) stages and processes in China's ordnance industry through a case study of large-caliber, long-range multiple launch rocket systems (MLRS). These systems provide a unique opportunity to explore RDA processes related to foreign acquisitions and technology transfers, indigenous innovation capabilities, and linkages between ordnance industry companies and between the ordnance and space industries. An evaluation of the status of progress in Chinese MLRS RDA rests to some extent on export marketing advertisements; but broader Chinese advances in the specific technologies involved, from guidance systems to rocket aerodynamics to launch platforms, provides grounds for an assessment that China's long-range MLRS programs have moved from duplicative imitation to incremental innovation in less than two decades.

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THE ORDNANCE INDUSTRY

Piecing together a coherent picture of the state of the RDA process in the ordnance sector first requires a basic grasp of the current organizational structure of that industry.

China's ordnance industry comprises two of the ten major state-owned defense industrial conglomerates, China North Industries Group Corporation (CNGC) and China South Industries Group Corporation (CSGC). CNGC is the senior partner, and since its formation in 1999 it is the primary provider of weapons systems to People's Liberation Army (PLA) ground forces.

Both CNGC and CSGC are heavily involved in civilian industrial production, and derive the preponderance of revenues from civilian projects. CNGC is responsible for the majority of heavy equipment production for the PLA, with CSGC focusing primarily on small arms design and manufacture.

Sources indicate that MLRS design and production for the PLA falls under CNGC purview; but space industry organizations have been involved in large caliber MLRS RDA from program inception, and continue to provide systems for the export market. Innovative characteristics associated with current MLRS systems, and those likely to be fielded to the PLA in coming years, are in some part due to vehicle, launcher, and rocket design research and development in the space sector.

STRATEGY, DOCTRINE, AND MLRS RDA

Understanding ordnance industry RDA processes through the lens of the MLRS life cycle requires a multi-pronged analytic approach taking into account the evolution of Chinese national defense strategy, PLA ground force doctrinal developments and modernization strategy, foreign technology acquisition strategy, and export market considerations.

In the early 1990s, with the collapse of the Soviet Union as backdrop, Jiang Zemin developed and then promulgated a "Local War Under High-Tech Conditions" doctrine for the PLA. His "Strategic Guidelines for the New Era" directed the PLA to evolve from a manpower intensive force to one that leveraged an information age revolution in military affairs to win local, limited-objective wars—particularly a conflict in the Taiwan Strait. For the ground forces, this meant transforming a number of key units—essentially those focused on a Taiwan contingency— into a force capable of coordinating modern armor, infantry, and artillery operations.

Over the decade prior to this transformational period, the Chinese observed the most powerful militaries in the world, the United States and Soviet Union, developing longer-range, course-correcting MLRS systems with a variety of warhead configurations to provide fire support to large formation ground operations. As modern arms became available to Beijing from Russia in the 1980s and 1990s, the Chinese realized an opportunity to vastly improve the mobility, lethality, accuracy, and logistical efficiency of PLA artillery forces.

China's space and ordnance industries likely were both involved in the initial decision to acquire and exploit Russian MLRS systems and technologies for reverse engineering. Specific motivations behind the program are unclear, but indications point to a desire first to incrementally field a 300 millimeter MLRS capability to the PLA ground force to shore up shortfalls in Taiwan landing and border counter-attack campaigns, and then to build the industrial capability to strengthen China's hand in the advanced artillery export market.

Large-caliber MLRS fit very well into the doctrinal requirement for adding combat power to mobile, task-organized ground forces. Given systemic inadequacies in close air support for ground operations, the PLA stresses missile and rocket systems to meet this need. Short-range artillery systems and short-range ballistic missiles provide coverage out to 40 kilometers and beyond 300 km respectively, leaving a gap of coverage that poses a critical challenge for key mission requirements under China's current campaign doctrine. For operations to seize control of or suppress Taiwan-held islands in the Taiwan Strait, such as Jinmen, Matsu, Penghu and Dongyin, and to support amphibious operations on Taiwan itself, long-range MLRS systems can effectively address the coverage gap.

At the tactical level, these systems can be employed to rapidly deliver a large number and wide variety of sub-munitions against key targets that pose a threat to ground forces in landing or cross-border operations, particularly enemy airfields, tank formations, and radar sites. The self-propelled platforms that transport the MLRS can also support troop transport and logistical functions, which facilitates training and maintenance activities.

MLRS RESEARCH AND DEVELOPMENT

Two primary systems provide the basis for analysis of China's long-range MLRS program, and for assessments regarding the degree of innovation that might arise to meet future PLA and arms sale needs. Both systems are based on the Russian Smerch long-range MLRS. The first of these, the A100, was probably developed under license or agreement with Russian assistance by space industry conglomerate China Aerospace Science and Technology Corporation (CASC), with limited deployment to the ground forces (probably under the designation PHL96). The second, the PHL03, was reverse engineered by the ordnance industry and deployed as the PLA's primary long-range MLRS. Several indigenous variants and follow-ons to each of these systems have

been developed by each industry, and appear designed to compete both for PLA and export markets.

The PHL03 reportedly has a 20 to 40 kilometer range increase over the Smerch, indicating a degree of creative adaption in rocket design following the initial reverse-engineering effort. While an approximate range of 120 km provides increased capability for small island landing and cross-border operations, it does not facilitate fire support from mainland China to operations in depth on Taiwan. As such, follow-on RDA efforts have focused on increasing range, as well as on increased accuracy, wider warhead variety, and improved logistical efficiency. While no follow-on systems to the PHL03 appear to have entered service with the PLA yet, there are clearly Chinese systems with longer-range capability, improved guidance features, and advanced fire support and targeting connectivity with current command, control, communications, computer, intelligence, surveillance, and reconnaissance (C4ISR) systems.

With two industrial sectors contributing to the continuing RDA cycle, MLRS systems clearly remain a focus both for PLA ground force modernization and for cultivating market share for the long-range artillery export market. As such, defense conglomerates are making program decisions for the creation of new systems concurrent with production of existing, state-of-the-art systems. Generally speaking, systems produced by CASC appear designed for export, although as noted earlier a few A100 systems may have been fielded to the PLA. With course-correcting rockets and a range of around 100 kilometers, this system offers the capability to deliver anti-tank, scatterable mine, and fuel-air explosive warheads at a range and accuracy hitherto unavailable to ground forces in many countries. In 2007 or 2008, the system reportedly was exported to Pakistan, and in 2009 was sold to Tanzania.

CNGC primarily provides systems to the PLA, but has entered the export market in competition with CASC. The AR2 is the export designator for the PHL03. CNGC began offering the AR2 to the international market around 2007. In 2010, the AR2 was delivered to Morocco. This is the first identified export of the system, marking the ordnance industry's entry into this particular market. CNGC developed another export variant to provide the advantages of a modular reload capability that allows five-rocket pods to be switched out by the reloader, instead of single rocket reloads for each tube as featured in the PHL03/AR2.

The development of an AR3 variant, which reportedly has a 370 mm rocket, is indicative of CNGC's efforts to continue to increase the range, lethality, and accuracy of systems offered for export. These same capabilities have not yet been fielded to PLA, but are certainly available when ground force leaders assess an operational need.

Despite large knowledge gaps in our understanding of PHL03 development, three key factories appear to manufacture its core components. First, Hubei Jiangshan Heavy Industries Co. Ltd. (湖北江山重工有限责任公司 or 5137 Factory) is listed in multiple reports as the weapon's primary manufacturer. Second, online reports indicate that the Shanxi Shenyang Huagong Ltd. Co. (山西江阳化工有限公司 or 763 Factory) is also a key contributor to the PHL03, probably responsible for the production of rockets for the platform. Both of these companies are ordnance industry subordinates.

Finally, the PHL03's truck chassis (WS2400) is widely reported to be manufactured outside the ordnance industry by the Hubei Sanjiang Space Wanshan Special Vehicle Co. Ltd. (湖北三江航天万山特种车辆有限公司). This organization is a member of China's space sector, being a subordinate of the China Aerospace Science and Industry Corporation (CASIC). Interestingly, the WS2400 chassis appears to also be used on current variants of the A100, contributing to an additional area of overlap between these two strands of development.

Little documentation is available on the relationship between the PHL03's manufacturers and the PLA General Armament Department (GAD), which as a representative for PLA end-users is responsible for overseeing the entire RDA process. Even so, circumstantial evidence suggests that the PHL03's primary manufacturer, Hubei Jiangshan Heavy Industries, maintains extensive ties with a large number of GAD organizations.

DEPLOYMENT, OPERATION, AND MAINTENANCE

PHL03 production rates for the PLA have been relatively limited, with approximately 96 currently in the inventory. With the first of these systems deployed in the 2004–2005 time frame and no additional deliveries reported, it is possible that production of this variant is being curtailed for longer-range options under development and already available for the export market.

While there is no direct reporting regarding how the ordinance industry supported these weapons after they were delivered to the PLA, there are several examples from recent reforms and initiatives that suggest an increasingly active and structured support mechanism. Based on the nature of these reports, however, it is also likely that the process is in a relatively early stage and that the support is not uniform among elements of China's defense industries or across military regions. In addition, recent international press reports covering China's attempts to improve its overseas support capabilities following foreign sales suggests improvements that will likely make Chinese systems more attractive in foreign markets while possibly simultaneously im-

proving support to PLA units.

One of the most important indicators of how China's defense industry provides post-delivery support is offered by the discussion in recent press reporting regarding the Shenyang Military Region's program for "Independent Medium-Maintenance for Major Combat Equipment." In this broad initiative, the PLA has signed agreements with various defense industry entities to establish a new maintenance support structure and process. This joint effort combines military and civilian resources and makes mid-level maintenance support available for many of the PLA's most modern ground systems, including self-propelled artillery and tanks assigned to combat units in the military region. This relatively recent effort has established multiple cooperative support agreements with approximately 20 civilian organizations, and appears to be part of the broader PLA effort to improve civil-military ties in ways that allow the PLA to gain access to high-tech equipment and technically skilled workers and specialists.

Another indicator of post-delivery support is delineated in press reports concerning a technical service agreement between the Lanzhou Military Region Armaments Department and fifteen ordnance industry subsidiaries and affiliates. Forty-two experts from companies associated with the CNGC helped units assigned to the Lanzhou Military Region inspect and repair weapons and equipment. The assigned personnel were organized into five technical support groups that visited frontline units and provided technical support and diagnostic maintenance to a variety of systems including artillery, radar, optical instruments, missiles, and armor. Simultaneously, these groups performed technical training for the personnel assigned to those frontline units.

INCREMENTAL INNOVATION AND THE WAY AHEAD

While the research and development that created the PHL03 platform appears to have largely been an effort at indigenizing the previously licensed or acquired Russian system, the ordnance industry appears to be actively undertaking incremental innovation on two fronts. First, researchers appear to be working to better integrate the system with China's C4ISR platforms, particularly satellites and UAVs. Second, researchers appear to be striving to increase the accuracy, distance, and lethality of the system. Both of these developments present the opportunity for incremental innovation that could transform this derivative system into a much more useful weapon for modern, informatized warfare, particularly in a Taiwan situation or border dispute.

One sign of continued innovation is Chinese financial analyst's prediction of market returns stemming from the aforementioned improvement activities. These investors are particularly interested in the likelihood that publicly traded assets related to Jinxi Industries Group Co., Ltd., and North Navigation Control Technology Co., Ltd. (北方导航控制技术股份有限公司/218 Factory), will see increased profits based on the PHL03's incremental innovation. North Navigation Control Technology is a subordinate of the newly formed North Navigation Technology Group Co., Ltd. (北方导航科技集团有限公司). North Navigation is said to specialize in research of unmanned systems, as well as rocket guidance and command technology.

Furthermore, North Navigation has now merged with the China North Navigation and Control Technology Research Institute (中国兵器工业导航与控制技术研究所), a key ordnance industry research institute that is undertaking some of the Chinese ordnance industry's cutting-edge research on rocket guidance and C4ISR. This includes reported research on loitering munitions, Beidou 2 satellite guidance integration, and various smart munitions.

The integration of digital technologies, UAV targeting and battle damage inputs, and advanced radar in the rockets themselves will determine the future combat potential of the platform. The U.S. Department of Defense has already said that the PHL03 has the capability to hit parts of Taiwan from the mainland, projecting road mobile conventional strikes over the Taiwan Strait and onto the main island of Taiwan, and to reinforce a strong deterrent in the near seas. On land borders, this weapon and any follow-on systems may serve to deter India, which is reported to have a domestically produced Smerch variant of its own.

Over time, China's MLRS have successfully incorporated technologies for delivering longer-range, course-correcting, guided rockets with various payloads, networked for advanced targeting solutions, with modular reloading capabilities. Perhaps sensing a secure position as a leader in MLRS technologies, and seeking to capitalize on a rapid move from imitator to incremental innovator in the field, the PLA offers top-of-the-line MLRS for export, at competitive prices, to a wide range of customers.

Cortez COOPER is a senior international policy analyst at the RAND Corporation.

Daniel ALDERMAN is a research associate with Defense Group, Inc.

Mark COZAD is a senior defense research analyst at the RAND Corporation.