Striving to Write a New Chapter in the Innovative Development of the Defense Science and Technology Industry in the New Era (Postprint)

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Abstract

Full Text

Introduction: The Spring of Science and Its Enduring Legacy

On March 18, 1978, the Communist Party of China Central Committee convened the National Science Conference in Beijing, ushering in a "spring of science" for China's scientific and technological development. Over the past four decades, China's scientific and technological landscape has evolved dramatically—from the principle that "science and technology are productive forces" to implementing the strategy of revitalizing the nation through science and education, from building an innovation-oriented country to pursuing innovation-driven development, and from recognizing "innovation as the primary driver of development" to the ambition of becoming a world leader in science and technology. Throughout this journey, the Party has formulated a series of major strategic concepts on scientific and technological development, pioneering a path of independent innovation with Chinese characteristics that reflects the demands of our era, the expectations of our people, and the weight of historical responsibility. Today, revisiting Comrade Deng Xiaoping's important speeches and summarizing the achievements and experiences of defense science and technology innovation hold profound significance for accelerating the construction of an advanced defense science and technology industrial system with Chinese characteristics, building China into a world leader in science and technology and the People's Liberation Army into a world-class military, and realizing the "Two Centenary Goals."

Forty Years of Striving: Glorious Achievements in Defense Science and Technology Innovation

Innovation serves as the inexhaustible driving force behind the development of the defense science and technology industry. Over the past 40 years, through the tireless efforts of countless scientific and technical workers, the defense science and technology sector has advanced through reform and innovation, gradually establishing an independent, comprehensive, and integrated research and production system that has yielded a host of landmark innovations. These achievements have made vital contributions to modernizing national defense and the armed forces while enhancing China's comprehensive national strength and international standing.

(1) Weapons and Equipment Technology Reaches New Heights

The weapons and equipment system has transitioned toward high-technology dominance, significantly strengthening China's national defense capabilities. Evolving from a system dominated by second-generation platforms with third-generation systems as the backbone, our weapons and equipment have advanced to higher levels, with breakthroughs in the development of new systems and substantially improved capabilities in independent research and supply assurance. A weapons and equipment system with distinctive Chinese characteristics has taken initial shape, providing a solid material and technological foundation for building a world-class military capable of "fighting and winning wars." The defense science and technology industry has essentially established the capacity for independent supply of third-generation weapons, research and development of fourth-generation systems, and exploratory development of next-generation platforms.

(2) Major Science and Technology Programs Yield Significant Progress

Strategic high-tech fields have witnessed the emergence of major innovations that have enhanced national competitiveness. Defense science and technology systems have led or participated in national major science and technology special projects, programs, and initiatives that have become hallmarks of the nation's scientific and technological innovation. The Chang'e-3 mission achieved humanity's first soft landing on an extraterrestrial body and autonomous lunar surface exploration. The Tiangong-2 and Shenzhou-11 manned spaceflight missions successfully enabled China's first medium-term on-orbit crew residence. The Gaofen-3 and Gaofen-4 satellites have been commissioned into service. New-generation large and medium-lift carrier rockets have completed successful maiden flights. Preliminary development of the first Mars exploration mission is progressing smoothly. The BeiDou Navigation Satellite System now provides meter-level coverage in the Asia-Pacific region and sub-meter-level service domestically. Large transport aircraft have achieved breakthroughs in independent development. The domestically developed C919 large passenger aircraft completed its successful maiden flight. China's first domestically built aircraft carrier was successfully launched. Mastery of third-generation nuclear power technology such as Hualong One and fourth-generation high-temperature gas-cooled reactor technology has been achieved. New-generation independent uranium enrichment equipment has reached internationally advanced levels, and CF3 domestic nuclear fuel assemblies have realized import substitution.

(3) Foundational Defense Science and Technology Innovation Achieves Breakthroughs

A number of internationally leading innovations in foundational research have provided crucial support for major national programs and projects. Over the past four decades, capabilities in defense science and technology basic research, frontier technologies, advanced industrial technology innovation, and technical infrastructure support have steadily improved. Particularly since the 12th Five-Year Plan period, following the approach of "laying foundations, building systems, and raising standards," verification and research platforms for critical defense basic products have been established. In frontier fields such as quantum information, terahertz technology, micro-electro-mechanical systems, and additive manufacturing, China has mastered new technologies, mechanisms, and methodologies. Advanced design technologies including three-dimensional digital design, virtual prototyping, and simulation verification have been widely applied. Advanced manufacturing modes such as agile manufacturing, lean production, and flexible machining have expanded in depth, while testing and verification technologies have developed toward comprehensive integration. The technical infrastructure system encompassing standards, metrology, quality, and environmental testing has been perfected, providing more robust support for defense science and technology innovation.

(4) Defense Science and Technology Innovation System Gradually Optimized

The innovation ecosystem has become increasingly sophisticated. Over 40 years, the innovation system's main entities, resource allocation, and policy frameworks have become more diversified, comprehensive, and open, initially forming a civil-military integration pattern led by overall design, final assembly, system integration, and test verification, supported by specialized development of critical systems and equipment, and relying on socialized collaborative support. By coordinating model development tasks with innovation needs and balancing weapons platforms with specialized collaboration, China has strengthened its scientific and technological innovation capacity, establishing world-class research and testing facilities that provide foundational support for tackling defense critical technologies. The defense science and technology innovation base system now encompasses defense science and technology key laboratories, defense key discipline laboratories, and defense science and technology industry innovation centers. The basic institutional framework for defense science and technology innovation has taken shape, with continuous improvement in policies and systems for science and technology rewards, evaluation and incentives, intellectual property, technology transfer, and open sharing of innovation resources. Through major talent programs and initiatives, a high-level innovation talent echelon has been cultivated with rational distribution across old, middle-aged, and young generations, and orderly combination of leading, high-end, and backbone talent layers.

(5) Civil-Military Science and Technology Synergy Significantly Enhanced

Civil-military science and technology coordination has effectively promoted bidirectional technology transfer and transformation. By leveraging defense industry technological advantages, breakthroughs have been achieved in industrialization of key technologies in new-generation information technology, high-end equipment manufacturing, energy conservation and environmental protection, new materials, fine chemicals, and non-traditional security domains, yielding numerous high-tech products with defense industry characteristics. Support and guidance have been provided for qualified civilian resources and advantageous social forces to undertake defense research tasks. Currently, nearly 70% of entities holding weapons and equipment research and production licenses are civilian-owned (including private enterprises), with their task responsibilities elevated from low-end supporting components to critical subsystems and complete system development. The *Defense Science and Technology Industry Intellectual Property Transfer Catalog*, *Military-to-Civilian Technology Promotion Catalog*, and *Civilian Participation in Military Technology and Product Recommendation Catalog* have been published consecutively, with information on numerous major defense testing facilities and large-scale instruments made publicly available. The output value of civilian products from defense enterprise groups has remained stable at approximately 70% of total output value, half of which constitutes defense high-tech industries that have achieved large-scale exports.

Four Decades of Experience: Foundational Principles for Defense Science and Technology Innovation

These hard-won achievements demonstrate that the tremendous success of defense science and technology innovation over the past 40 years stems from our unwavering commitment to the direction set by Comrade Deng Xiaoping and other proletarian revolutionaries of the older generation, and our resolute implementation of the Party Central Committee's major decisions and deployments in pioneering a path of independent innovation with Chinese characteristics.

Prioritizing Military Strengthening as the Fundamental Mission

For 40 years, we have consistently regarded strengthening the military as the fundamental starting point and ultimate objective of defense science and technology innovation. Without modernization of science and technology, there can be no modernization of national defense and the armed forces. We have strengthened strategic planning for defense science and technology development, main directions of attack, and key task allocation in alignment with evolving military strategic guidelines, military struggle preparation needs at different stages, and defense and military construction requirements across various periods. This has enhanced the scientific orientation, relevance, and foresight of defense science and technology innovation, providing robust support for improving defense capabilities and military combat effectiveness.

Upholding Independent Innovation as the Strategic Foundation

For 40 years, we have consistently regarded independent innovation as the strategic cornerstone of defense science and technology work. By combining demand-driven approaches with technology push, coordinating engineering management with technical management, linking preliminary research with breakthrough development, and balancing system integration with focused breakthroughs, we have concentrated on overcoming major critical technologies and bottleneck constraints. This has propelled defense science and technology development from imitation and tracking to independent research, effectively enhancing indigenous innovation and autonomous control capabilities.

Promoting Civil-Military Integration as a Critical Pathway

For 40 years, we have consistently regarded civil-military integration as an essential route for defense science and technology innovation. Evolving from "military-to-civilian conversion, supporting the military through civilian means" to "combining military and civilian, embedding military potential in civilian capabilities," and further to implementing the civil-military integration development strategy, defense science and technology innovation has adhered to the "grand science and technology, grand industry" concept. By leveraging both the principal role of defense enterprise groups and military research institutes in defense science and technology innovation, and the potential advantages of the Chinese Academy of Sciences, universities, and civilian enterprises, we have progressively promoted efficient utilization of all innovation elements—technology, talent, capital, facilities, and policy systems—enhancing the overall effectiveness of the defense science and technology innovation system.

Cultivating Talent and Spirit as the Strategic Foundation

For 40 years, we have consistently regarded talent cultivation and spirit building as the strategic underpinning of defense science and technology innovation. Through people-oriented policy design and the inheritance of a pioneering spirit, we have emphasized both research achievements and talent development, integrating scientific research with personnel training. By vigorously promoting the "Two Bombs, One Satellite," manned spaceflight, and People's Military Industry spirits, we have enriched national cultural connotations and fostered an environment that respects knowledge, talent, and innovation. The defense science and technology industry has produced numerous world-class strategic scientists, with many professionals in their thirties and forties becoming core leaders in chief designer and chief engineer systems.

Strengthening the Sense of Mission and Responsibility in Defense Science and Technology Innovation

Global Perspective: Defense Technology as the Focus of Strategic Competition

From the perspective of global scientific and technological revolutions and military transformations, defense science and technology innovation has become the focal point of strategic competition among military powers. President Xi Jinping has emphasized that developing science and technology requires a global vision, demanding strategic foresight and proactive initiative. Scientific and technological revolutions often serve as the prelude to military revolutions. Each technological revolution has triggered major transformations in warfare forms, operational patterns, and weapons production models, driving the rise and fall of great powers and reshaping the global strategic landscape. The current round of scientific and technological revolution and military transformation is accelerating, with defense science and technology development exhibiting trends of interdisciplinary integration, cross-boundary fusion, and group breakthroughs. Emerging technologies such as artificial intelligence, big data, and cloud computing are rapidly penetrating military applications. Military powers like the United States and Russia are increasing strategic investment in frontier and disruptive technologies, striving to seize the initiative in intense international strategic and military competition.

The Call of the Times: Unprecedented Mission for Defense Innovation

From the perspective of realizing the Chinese Dream and the Strong Military Dream, defense science and technology innovation shoulders an unprecedented historical mission. President Xi Jinping has stressed that only by mastering core technologies in our own hands can we truly control the initiative in competition and development, fundamentally safeguarding national defense and other security interests. In today's world, high-tech characteristics are increasingly prominent in the security domain. China faces threats from both traditional and emerging security fields. Accelerating aerospace power construction leads the development of a science and technology powerhouse and manufacturing powerhouse, supports quality and talent powerhouse construction, and underpins cyber and maritime power building. Constructing a weapons and equipment system adapted to informationized warfare and the requirements of the new era demands that the defense science and technology industry grasp the main directions and breakthrough points of scientific and technological innovation, strengthen forward-looking planning, and rapidly develop unique advantages in strategically vital areas to play its proper role in safeguarding national strategic security.

Domestic Demands: Higher Requirements for Defense Innovation

From the perspective of China's defense science and technology industry and weapons and equipment development needs, defense science and technology innovation faces higher requirements. President Xi Jinping has emphasized the need to "seize the bull by the horns" and target weak links in defense science and technology and weapons and equipment development as the main direction for independent innovation. In modern warfare, the frontline contest involves weapons and equipment, the backstage competition involves defense industrial strength, and at a deeper level, it is a contest of defense science and technology strength and independent innovation capabilities. Currently, the demands for systematization, informatization, autonomy, and combat-realistic performance in weapons and equipment development are increasingly urgent, with accelerated replacement cycles imposing higher requirements on technological advancement, quality and reliability, autonomous control, and economic affordability. The defense science and technology industry urgently needs to transform its research and production models, vigorously developing emerging manufacturing technologies such as flexible manufacturing, network manufacturing, green manufacturing, and intelligent manufacturing to build an agile and responsive industrial capability.

Forging Ahead: A New Chapter in Defense Science and Technology Industry Innovation

A strong nation requires strong national defense, and a strong military requires a strong defense industry. Building a world-class military is inseparable from a world-class defense science and technology industry, which in turn must be supported by world-class defense science and technology capabilities. In the new era, defense science and technology industry innovation will be guided by Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, thoroughly implementing the holistic national security concept, vigorously pursuing innovation-driven development and civil-military integration strategies. We will focus on enhancing independent innovation capabilities, improving innovation system effectiveness, optimizing collaborative innovation environments, and continuously strengthening the foundation for autonomous control and long-term development. Our goal is to transform the defense science and technology industry into a national highland for scientific and technological innovation and a highland for top-tier innovative talent, providing robust scientific and technological support for weapons and equipment construction and major program implementation. This will contribute to building an advanced defense science and technology industrial system with Chinese characteristics, leading China's overall advancement into the ranks of innovative nations, and realizing the Chinese Dream and the Strong Military Dream.

(1) Fulfilling the Primary Responsibility of Strengthening the Military to Support Leapfrog Development of Weapons and Equipment

We will comprehensively advance the construction of a performance-oriented defense core capability system, strengthening the development of major scientific research and testing facilities and infrastructure in new domains and specialties. By enhancing scientific research support capabilities, we will address areas where we are constrained by foreign dependencies. Focusing on nuclear, space, maritime, and cyberspace security, we will vigorously develop new-generation weapons and equipment technologies while exploring new-concept weapons technologies. Upholding the principle that "quality is life, quality is victory," we will implement a defense science and technology industry quality enhancement program, accelerating the application of advanced quality technologies such as zero-defect systems engineering management, data envelope analysis, quality intersection analysis, and product quality fluctuation control to improve weapons and equipment supply quality.

(2) Exercising Leading Roles to Accelerate Implementation of Major National Science and Technology Programs

We will organize and implement major national science and technology special projects oriented toward 2020, including manned spaceflight and lunar exploration, high-resolution earth observation systems, the BeiDou satellite navigation system, and large aircraft programs, ensuring timely goal achievement. We will accelerate implementation and deepen demonstration of major "Science and Technology Innovation-2030" projects, including aero-engines and gas turbines, deep-sea space stations, deep-space exploration and on-orbit servicing and maintenance of spacecraft, integrated space-ground information networks, key new materials research and development and application, and national cyberspace security. We will also organize and implement major defense science and technology industry programs such as national civil space infrastructure, Mars exploration, and heavy-lift carrier rockets.

(3) Focusing on Bottlenecks and Weak Links to Implement the Defense Science and Technology Industry Foundation Strengthening Program

Targeting common and critical foundational issues in defense science and technology industry—such as weak foundations, blank frontiers, and foreign dependencies—we will continuously implement the foundation strengthening program. This will comprehensively advance various special action plans to rapidly produce major innovations that substitute imports, fill gaps, and lead frontiers, enhancing autonomous control levels. We will strengthen forward deployment and infrastructure development for frontier and disruptive technologies, striving for major breakthroughs in artificial intelligence, network information, cognitive computing, bio-crossover, and new materials. We will accelerate development of advanced industrial technologies, strengthening research and development in additive manufacturing, intelligent robotics, and industrial internet to elevate the digitalization, networking, and intelligence levels of defense manufacturing. We will continuously strengthen technical foundations such as defense industry standards and metrology.

(4) Improving Collaborative Mechanisms to Enhance Overall Innovation System Effectiveness

We will strengthen coordination between military and civilian science and technology management departments, enhancing communication and demand alignment on major defense science and technology development issues, planning formulation, major project implementation, and resource allocation. We will fully leverage the advantages of the "six forces"—defense enterprise groups, military research institutes, national research institutes, universities, and civilian and private enterprises—to tap the full potential of society's scientific and technological innovation, creating a vibrant landscape of innovation. We will continuously optimize the layout of defense science and technology innovation bases, establishing national laboratories in defense fields and strengthening defense science and technology key laboratories, defense key discipline laboratories, and defense science and technology industry innovation centers. Through talent programs and initiatives, we will cultivate large numbers of world-class strategic scientists, leading scientific talents, young scientific talents, and high-level innovation teams. We will promote the spirit of "craftsmanship," inheriting master artisan skills and cultivating a contingent of master craftsmen, while fostering an innovation environment that values innovation and tolerates failure.

(5) Deepening Management Reform to Stimulate Scientific and Technological Innovation Vitality

We will actively yet prudently advance reform of defense research institutes to stimulate internal momentum and development vitality, cultivating a group of internationally competitive innovative enterprises. We will accelerate adjustment of military product capability structures, building a "small core, large collaboration, specialized, open" weapons and equipment research and production system. We will establish and improve defense science and technology innovation mechanisms and measures, improving research project investment models and comprehensively implementing post-compensation systems for defense research projects to guide research institutions in forward-looking planning and independent innovation. We will strengthen stable support for basic research, implementing long-term stable support mechanisms for defense science and technology key laboratories to mobilize researchers' enthusiasm and initiative for independent research. We will implement a public release system for defense research project guidelines to guide advantageous forces across society to participate in defense science and technology innovation activities. Focusing on rights and interests in defense science and technology transfer, we will advance reforms in the usage rights, income rights, and disposal rights of defense science and technology achievements.

With surging spring tides over four decades inspiring nationwide innovation, the defense science and technology industry system will continue to unite closely around the Party Central Committee with Comrade Xi Jinping at its core. Fully implementing Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, we will remain true to our original aspiration, keep our mission firmly in mind, forge ahead with determination, and steadfastly fulfill the dual mission of enriching the nation and strengthening the military. We will better shoulder the "three glorious responsibilities" and make new and greater contributions to realizing the Chinese Dream and the Strong Military Dream.

Note: Figure translations are in progress. See original paper for figures.