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Artificial Intelligence/Machine Learning Transition Timetable

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MAIN OFFICE

4695 Millennium Drive
Belcamp, MD 21017-1505

Office: 443-360-4600

REPORT PREPARED BY:

Ma Xiu

Office: BluePath Labs

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The Cybersecurity and Information Systems Information Analysis Center (CSIAC) was asked how fast the People's Republic of China (PRC) can transition artificial intelligence (AI)/machine-learning (ML) technologies from the lab to the field. CSIAC subject matter experts from BluePath Labs researched online, open-source, Chinese and English documents on the topic. They found that the speed of transition depended on sector and technology. Per one case study into high-temperature materials used in hypersonic flight vehicles, the transition from research lab to product prototyping was ~11 years. Overall, the PRC has had a low rate of success transitioning new technologies from lab to marketplace, with fewer than 10% of government-funded research outcomes successfully commercialized, despite high levels of investment from their government. The PRC's military has traditionally relied on state-owned defense conglomerates for its equipment and technology. However, in recent years, they developed several vehicles to leverage the private sector for defense technology and innovation.					
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ABOUT DTIC AND CSIAC

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A chief service of the DoD IACs is free technical inquiry (TI) research, limited to 4 research hours per inquiry. This TI response report summarizes the research findings of one such inquiry jointly conducted by CSIAC.

ABSTRACT

The Cybersecurity and Information Systems Information Analysis Center (CSIAC) was asked how fast the People's Republic of China (PRC) can transition artificial intelligence (AI)/machine-learning (ML) technologies from the lab to the field. CSIAC subject matter experts from BluePath Labs researched online, open-source, Chinese and English documents on the topic. They found that the speed of transition depended on sector and technology. Per one case study into high-temperature materials used in hypersonic flight vehicles, the transition from research lab to product prototyping was ~11 years. Overall, the PRC has had a low rate of success transitioning new technologies from lab to marketplace, with fewer than 10% of government-funded research outcomes successfully commercialized, despite high levels of investment from their government. The PRC's military has traditionally relied on state-owned defense conglomerates for its technology. However, in recent years, they developed several vehicles to leverage the private sector for defense technology and innovation.

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1.0 TI Request

1.1 INQUIRY

How fast do artificial intelligence (AI)/machine-learning (ML) technologies transition from paper to fielded capability for the People's Republic of China (PRC)?

1.2 DESCRIPTION

Cybersecurity and Information Systems Information Analysis Center (CSIA) subject matter experts from BluePath Labs (BPL) attempted to answer how fast the PRC can transition AI/ML technologies from the lab to the field. Although information was difficult to obtain using open sources, they found that the speed of transition depended on sector and technology.

2.0 TI Response

According to a news article from June 2021 [1], the general message coming out of the 2020 China AI Industry Annual Conference (hosted by the Chinese Association of Artificial Intelligence) is that mature application of AI technology has so far been limited to speech recognition only. Other AI technologies, such as ML, computer vision, natural language processing, knowledge graphs, and intelligence will take “several years” to reach maturity, and autonomous vehicles are unlikely to appear in the next 10 years.

In an April 2020 report discussing AI weapons in China's military innovation [2], Elsa B. Kania wrote the following:

“Based on publicly available information, the PLA's trajectory in the development and potential employment of AI/ML-enabled and autonomous weapons systems remains uncertain. The maturity of these capabilities — as well as if, when, and to what extent weapons systems with greater levels of autonomy have been fielded — cannot be assessed with high confidence at this point.”

An October 2021 report by the Center for Security and Emerging Technology (CSET) noted that the People's Liberation Army (PLA) is purchasing AI systems for “all manner of applications, including autonomous vehicles, intelligence analysis, decision support, electronic warfare and cyber operations” [3].

Deloitte released a report examining AI's commercial applications in China [4]. The report included a comparison of key AI industry indicators between the United States and China (see Figure 1).

Key fields	Indicators	China	U.S.
Hardware	Global market share of semiconductor products (2015)	4%	50%
	Financing of FPGA chip manufacturers (2017)	USD34.4 million (7.6% of the global total)	USD192.5 million (42.2% of the global total)
Data	Number of mobile subscribers (2016)	1.4 billion (20% of the global total)	420 million (5.5% of the global total)
Research capability and paradigm	Number of AI experts	39,200 (13% of the global total)	78,200 (26% of the global total)
	Proportion of speeches delivered at AAAI (2015)	20.5% of the global total	48.4% of the global total
Commercialization	Proportion of AI companies (2017)	23% of the global total	42% of the global total
	Investments gained by AI companies (2012-2016)	USD2.6 billion (6.6% of the global total)	USD17.2 billion (43.4% of the global total)
	Investments from PEs for startups (2017)	48% of the global total	38% of the global total

Source: Public information, Deloitte Research

Figure 1: Comparison From Deloitte White Paper (Source: Deloitte [4]).

The *speed* of tech transition is sector and technology dependent. According to a speech by Chinese Science and Technology then-Deputy Minister Wang Zhigang in 2016, China has yet to develop a set of standardized indicators to track and quantify technology transfer activities [5].

A case study conducted by BPL into the research and development (R&D) process of high-temperature materials used on Chinese hypersonic flight vehicles and missiles suggested that the process of transitioning technologies from the research lab to product prototyping took about 11 years [6].

In general, Chinese analysts have noted that the rate of successful transitions of technologies from the research lab to the marketplace remains low across the board. According to Deputy Director of the Development Research Center of the PRC State Council Wang Yiming, less than 10% of government-funded scientific research outcomes have been successfully commercialized, suggesting a failure in policies designed to enhance the synergy between the research performers and the innovation system at large [7]. The low conversion rates indicated a low rate of return on investment for the Chinese central and local governments, which together spent 1.1 trillion RMB (Chinese currency which is approx. 159.9 billion dollars) supporting broad scientific and technical information development in 2019 and 454 billion RMB (approx. 66 billion dollars) on research and development [8, 9].

The Chinese military has traditionally relied on state-owned defense corporations for equipment and technology needs. In recent years, however, the PLA has created multiple programs and channels to leverage private sector technologies more rapidly in response to defense technology innovation needs. Most of the programs are run by the Central Military Commission's Science and Technology Committee and the Equipment Development Department. Some examples include the following:

- A “defense science and technology innovation rapid response task force” (sometimes characterized as China’s DIUx), which operates out of offices in Shenzhen, Dalian, and Chongqing [10]. In the first quarter of 2020 alone, the Shenzhen office released six sets of requests for proposals, seeking technologies ranging from unmanned aerial vehicle fast obstacle avoidance technology and software-defined multifunction sonar to preparation technology of ceramic coatings [11, 12].
- “Operation Acumen,” the Central Military Commission's first attempt to leverage private sector innovation capabilities to rapidly produce a new application in support of PLA equipment development needs [13].
- “National Defense Science and Technology 173 Program,” which seeks commercial, off-the-shelf solutions [14].

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BIOGRAPHY

Ma Xiu is a senior analyst at BluePath Labs (BPL), where he conducts Chinese-language open-source research into the People's Liberation Army. His most recent reports include a comprehensive order of battle for the PLA Rocket Force and an analysis of the PRC's defense lab system, both written for the China Aerospace Studies Institute.