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Blurred Lines: Military-Civil Fusion and the "Going Out" of China's Defense Industry

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I. Abbreviations

AM	Additive Manufacturing
AVIC	Aviation Industry Corporation of China
BAMTRI	Beijing Aeronautical Manufacturing Technology Research Institute
BGBES	Beidou Ground Base Enhancement System
CALT	China Academy of Launch Vehicle Technology
CASC	China Aerospace Science and Technology Corporation
CASIC	China Aerospace Science and Industry Corporation
CCP	Communist Party of China
CFIUS	Committee on Foreign Investment in the United States
CMC	Central Military Commission
CMC/EDD	Equipment Development Department
CMI	Civil-Military Integration
CMIPD	Civil-Military Integration Promotion Department
CNOOC	China National Offshore Oil Corporation
COMAC	Commercial Aircraft Corporation of China
COSTIND	Commission for Science, Technology, and Industry for National Defense
DOD	Department of Defense
FACC	Future Advanced Composite Components
FADEC	Full-authority Digital Electronic Control
GAD	General Armaments Department
HTP	Horizontal Tail Plane
MCF	Military-Civil Fusion
MIIT	Ministry of Industry and Information Technology
MOST	Ministry of Science and Technology
NDRC	National Development & Reform Commission
NORINCO	China North Industries Group Corporation

ORNL	Oak Ridge National Laboratories
PBOC	People's Bank of China
PLA	People's Liberation Army
PRC	People's Republic of China
S&T	Science and Technology
SAC	Standardization Administration of China
SASAC	State-owned Assets Supervision and Administration Commission
SASTIND	State Administration for Science, Technology and Industry for Natonal Defense
SCFA	Strategic Cooperation Framework Agreement
SIPO	State Intellectual Property Office

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III. Executive Summary

Since taking the helm as the paramount leader of the Chinese Communist Party (CCP) and the People's Republic of China (PRC) in 2012, General Secretary Xi Jinping has embarked on a dramatic shakeup of the country's armed forces. Under the leadership of Xi Jinping and the Central Military Commission (CMC), the People's Liberation Army (PLA) seeks to build a modern military capable of waging and winning "informatized wars." A key pillar of Xi's defense reform campaign is an innovative military industrial complex capable of delivering cutting-edge technologies to meet future requirements of the PLA. A cornerstone of PRC national defense reform is a concept known as *military-civilian fusion* (MCF). Further blurring distinctions between the PLA and civilian activities, the MCF concept is shaping Beijing's economic and foreign policies, as well as the strategies of state owned defense industrial enterprises.

MCF builds on well-established principles of civil-military integration (CMI), a process combining defense and civilian industrial bases to support military and commercial demands. Aiming to lower longstanding institutional barriers separating China's civilian and defense science & technology (S&T) systems, MCF policies also seek greater integration of civilian and military resources for improving national defense mobilization, militia assets, reserves, and border and coastal defense operations.[1] However, MCF in the defense industrial context goes beyond traditional notions of CMI. MCF policies advance the construction of a national infrastructure that connects the PLA, state-owned defense research, development, and manufacturing enterprises, government agencies under the State Council, universities, and private sector firms.

Acquiring and absorbing foreign technologies has long been an important part of PRC military modernization. The MCF concept, which was introduced in 2009 by former CCP General Secretary Hu Jintao in 2009, was elevated to a national strategy during the Third Plenum of the 18th Party Congress in 2013. MCF policy is becoming increasingly intertwined with China's broader economic strategies and the corporate strategies of state-owned defense enterprises.[2] MCF directives appear to support the "going out" of state-owned defense enterprises. Supporting development of a self-reliant and internationally relevant defense industry, MCF policy, in part, appears to drive international acquisition of dual-use technologies and resources, and knowledge to fill domestic defense S&T gaps. A contemporary manifestation of People's War, MCF policies intentionally blur the lines between military and civilian communities. As such, motivations driving ostensibly commercial ventures and or research activities of defense industrial enterprises warrant greater scrutiny. They may also present compliance challenges for foreign companies partnering with Chinese firms.

The PRC has had challenges implementing MCF-like policies in the past. However, Xi Jinping's consolidation of power, along with a growing base of defense industrial stakeholders, appears to be leading to rapid adoption of MCF policy directives. This includes a growing number of former and current senior defense industrial cadre serving in prominent party and state posts. An interagency working group has also been established to coordinate MCF activities among stakeholders and oversee implementation of national MCF policies, priorities, and assessing successes.

While the list of MCF stakeholders is growing, the State Administration for Science, Technology and Industry for National Defense (SASTIND) is leading the charge implementing MCF directives and constructing an expanding infrastructure for fusing together military and civilian research, development, and acquisition communities. Just in the last two years, SASTIND has played a central role in: 1) supporting private sector participation in defense acquisition; 2) facilitating institutional alliances between defense industry and private enterprises, to include providing direct capital investment in MCF-related R&D programs and joint ventures; 3) concluding more than ten strategic cooperation framework agreements (SCFAs) between central authorities, local governments and industry associations for promoting MCF initiatives; 4) improving the system for drafting and implementing common military and civilian technical standards; and 5) establishing MCF industry demonstration bases around the country.

With high-level support, MCF policies and their effects on governance and economic activities are likely to expand over time. The national MCF strategy transcends technical defense industry considerations. Policies call for greater fusion of military and civilian administration, at all levels of government, in national defense mobilization, airspace management and civil air defense, reserves, militia, and border/coastal defense. Under defense industrial MCF policies, authorities in Beijing are leveraging state owned enterprises, such as the China National Offshore Oil Corporation and the Aviation Industry Corporation of China, to support territorial claims in the South China Sea. In addition to other actors, provincial maritime militia, comprised of civilian vessels operating under PLA authority, are also enforcing claims to alter the *status quo* in the South China Sea.

MCF policies that blur the distinction between China's defense and ostensibly commercial related activities create a new set of challenges for foreign companies and policymakers. The deployment of state owned enterprises to bolster Chinese territorial claims in the South China Sea exemplifies Beijing's use of state assets as an extension of CCP policies and the difficulty of foreign governments to respond meaningfully. MCF also obfuscates an accurate estimation of China's defense expenditures and degree of PLA influence within the civilian state sector. With the acceleration of MCF-initiatives and the "going out" of China's defense industry, such challenges are likely to increase over the near term.

1 . Introduction

Every Chinese leader since Mao Zedong has deliberately sought to leverage the residual benefits of integrating military and civilian research and development (R&D) and production systems, a concept known as civil-military integration (CMI), as a means of advancing defense modernization and supporting economic development.[3] Former CCP General Secretary Jiang Zemin directed China's defense S&T system to focus on developing modern strategic weapon systems capable of targeting U.S. vulnerabilities. Under Jiang, Beijing emphasized a more self-reliant Chinese defense industry while also stepping up efforts to actively identify, acquire, and digest foreign weapons and technology.[4] However, unlike his predecessors, Xi Jinping is marshaling a national effo t to remove the institutional hurdles hindering meaningful collaboration between China's military and civilian S&T systems and leverage dual-use technologies to support a more innovative and modern defense industrial base.

Jiang's successors, Hu Jintao and Xi Jinping, have expanded the CMI concept, adopting a modified policy encapsulated in the term *junmin ronghe* (军民融合), or *military-civil fusion* (MCF), to capture Beijing's vision of leveraging both military and civilian resources to construct a modern military capable of waging and winning "informatized" wars, while supporting economic growth.[5] First coined under Hu Jintao and elevated to a national strategy by Xi Jinping in March 2014, MCF promotes dual-use technologies and "joint building and utilization of military and civilian infrastructure, joint exploration of the sea, outer space and air, and shared use of resources such as surveying and mapping, navigation, meteorology, and frequency spectra."[6]

As CCP General Secretary, President, and Chairman of the CMC, Xi Jinping outlined his vision for MCF early in his administration. At the plenary meeting of the PLA delegation during the First Session of the 12th National People's Congress, Xi announced:

> *"We should coordinate the development of our economy and defense capabilities, and combine efforts to make the country prosperous and military strong. We should further the great integration of military and civilian development, and work to achieve in-depth integration of the use of infrastructure and other key facilities based on demands and led by the government."*

Building upon Xi's strategic vision, CMC Vice Chairman General Xu Qiliang outlined China's defense reform goals in November 2013:[8]

- Improve research and innovation capabilities around defense S&T and armaments;
- Strengthen China's defense industry system;
- Boost collaboration and improve the defense S&T innovation system;
- Reform China's defense R&D, production, and procurement systems; and
- "Guide" private industry and high-quality "social resources" into military R&D, production, and maintenance to promote military industrial upgrading.

Today, MCF is a common theme in major CMC and State Council economic, military, and national security strategies.[9] From the "China Dream" to "Made in China 2025," and "One Belt, One Road" to the "Yangtze River Economic Belt," MCF links Beijing's economic strategic initiatives with military force modernization and advancing China's international S&T competitiveness.[10] MCF policies are also reflected in the strategies of Chinese state owned enterprises, inform overseas mergers and acquisitions (M&A), international joint ventures, and collaborative projects with foreign universities.

Underpinning MCF as a guiding national strategy is Beijing's growing emphasis on state-controlled and directed technological and industrial development. This techno-nationalist approach emphasizes indigenous development, restriction of foreign direct investment (FDI) in key sectors, and importation and absorption of foreign technologies and know-how.[11] In addition, the rise of a "defense industry faction" comprised of former and current defense industry executives serving in high profile government or CCP posts may increase the influence of the defense industry in government policymaking and accelerate implementation of MCF directives.

2 . Modernizing China's Military

Since taking the helm as China's paramount leader in 2012, Xi Jinping has outlined his vision for modernizing the country's military and strengthening the CCP's absolute leadership over the PLA.[12] To date, this ambitious project has included the prosecution of influential etired officials, defens reform, such as MCF, and reorganization of the PLA and the CMC, which has overall administration of China's armed forces and its subordinate departments.

While these impressive developments reflect X 's consolidation of power over the party, state, and military, a growing number of former defense industry cadre promoted to senior party and state positions may be facilitating defense reform and MCF policies.[13]

Strengthening the Party's Absolute Leadership

CMC Chairman Xi Jinping has highlighted the need to strengthen the party's leadership over the PLA. The shuffling and purging of senior military officers arguably follows the pattern of his predecessors, including Mao Zedong and Deng Xiaoping, to suppress military factionalism and ensure allegiance to the Party. Ongoing defense reforms, combined with the expected retirements of senior PLA officers at the 19th Party Congress in Fall 2017, are expected to further consolidate Xi's authority over the PLA.

Eight PLA officers were appointed members of the 18th Central Committee, including CMC Vice Chairman General Fan Changlong (范长龙) and deputy secretary of the Central Commission for Discipline Inspection, General Du Jincai (杜金才). Although the total number of military officers appointed to the 18th CCP Central Committee is in line with historical figures, a majority of them (40 of the 66) will most likely be replaced due to mandatory retirement age restrictions, including five officers on the CMC, at the 19th CCP Central Committee slated for late 2017. To date, two members have already been removed for corruption, while another 27 have already retired.[14]

To date, Xi's anti-corruption campaign has led to the arrest of more than 52 senior military officers. In addition, 60 percent of the top 90 military officers ere appointed after the 18th Party Congress.[15] These purges and appointments are helping Xi consolidate power over the PLA, ensuring implementation of his administration's military reforms and strategies, including MCF.

Rise of China's Defense Industry Faction

The political profile of China's defense industry has risen rapidly over the last five years increasing its influence in national economic and defense policymaking.[16] At the 18th Party Congress in 2012, a number of senior defense industry cadre were admitted into the policymaking CCP Central Committee. This includes State Councilor Wang Yong (王勇), who previously directed the State-owned Assets Supervision and Administration Commission (SASAC) and has a manufacturing background within China's space and missile industry.[17]

Others include Lin Zuoming (林左鸣) from the Aviation Industry Corporation of China (AVIC); Xu Dazhe (许达哲) who directed the China Academy of Launch Technology (CALT) before his promotion as chairman of the China Aerospace Science and Industry Corporation (CASIC);[18] Ma Xingrui (马兴瑞), a satellite systems engineer who served as CASC chairman; and Zhang Guoqing (张国清) from the China North Industries Group Corporation (NORINCO). In addition, a number of former defense industry executives and regulators have been promoted to senior CCP and government postings in Liaoning, Heilongjiang, Guangdong, Chongqing, the Ministry of Science & Technology (MOST), and SASAC. **(See Table 1 The Rise of China's Defense Industry Faction)**

The SASTIND Effect

SASTIND, which is the leading defense industry policymaking body within the Ministry of Industry and Information Technology (MIIT), appears to be an entry point and launching pad for defense industry executives transitioning to high-profile government and CCP posts. Since its reorganization in 2008, four men have served as director of SASTIND: Zhang Qingwei (张庆伟; 2008-09), Chen Qiufa（陈求发; 2009-13) Ma Xingrui (2013-14), and Xu Dazhe (2014-16). Prior to leading SASTIND, all four spent much of their careers in the space missile industry, which now consists of two state owned defense groups (CASC and CASIC) and suggests a dominating position of these entities within the broader defense industry. SASTIND directors have served concurrently as heads of the China National Space Administration (CNSA) and China Atomic Energy Authority.[19] One example of a CNSA MCF initiative was establishment of the Space Debris Monitoring and Application Center in 2015.[20]

Former SASTIND directors and deputy directors are now serving in high profile government and CCP posts. For example, Zhang Qingwei now serves as governor of Hubei Province (2012-present) and executive chairman of the Beijing 2022 Winter Olympics Committee. Chen Qiufa serves as governor of Liaoning Province (2015-present). After directing SASTIND for less than a year, Ma Xingrui was assigned to serve as vice secretary of the Guangdong Provincial Party Committee in November 2013.[21] Xu Dazhe was appointed acting governor of Hunan Province in August 2016. All four were elevated as members of the 18th CCP Central Committee in 2012.

Many SASTIND deputy directors appear to follow a similar trajectory, joining the agency from senior defense industry posts to take on more senior government and CCP posts thereafter. Current SASTIND deputy directors Zhang Kejian (张克俭),Xu Zhanbin (徐占斌), and Wu Yanhua (吴艳华) were senior defense industry executives at the China Academy of Engineering Physics (CAEP), AVIC, and CASC, respectively, before assignment to SASTIND in 2014. Former SASTIND deputy directors Huang Qiang (黄强) and Hu Yafeng (湖亚枫) are now serving as vice governors of Gansu Province and Heilongjiang Province, respectively.[22]

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Table 1

The Rise of China's Defense Industry Clique

Name	Name (Chinese)	Current Position(s)	Member, 18th CPC Central Committee	Past Position(s)
Chen Qiufa	陈求发	Governor & Deputy Party Secretary, Liaoning Province (2015-present)	Yes	Director, SASTIND (2009-13)
Hu Yafeng	胡亚枫	Vice Governor, Heilongjiang Province (2014-present)	No	Deputy Director, SASTIND (2010-14); Director, Factory 121, NORINCO (1995-2000)
Huang Qiang	黄强	Vice Governor, Gansu Province (2014-present)	No	Deputy Director, SASTIND (2008-14); Secretary General, SASTIND (2006-08)
Jin Donghan	金东寒	Director, Chief Engineer, 711th Research Institute, China Shipbuilding Industry Corporation (CSIC)	Alternate	
Jin Zhuanglong	金壮龙	General Manager, COMAC (2008-present); Vice-Chairman, COMAC (2008-present)	Alternate	Deputy Director, SASTIND (2005-08); Deputy Director, China National Space Administration (2004-05); Deputy General Manager, CASC (2001-04)
Lin Zuoming	林左鸣	Chairman,Aviation Industry Corporation of China (AVIC)	Yes	
Liu Shiquan	刘石泉	Deputy General Manager, China Aerospace Science and Industry Corporation (CASIC)	Alternate	Director, 4th Research Institute, CASIC (2011-13);Vice President, 9th Academy, CASIC (2007-11)
Ma Xingrui	马兴瑞	Deputy Party Secretary, Guangdong Province (2014-present)	Yes	Director, SASTIND (2013-14); Director, China National Space Administration (2013-14); Director, China Atomic Energy Authority (2013-14); General Manager, CASC (2007-13)
Sun Laiyan	孙来燕	Chairman, Key Large State-owned Enterprise Supervisory Council, SASAC (2010-present)	No	Deputy Director, SASTIND (2004-10); Director, China National Space Administration (2004-10)

Name	Name (Chinese)	Current Position(s)	Member, 18th CPC Central Committee	Past Position(s)
Tan Zuojun	谭作钧	Vice Governor, Liaoning Province (2012- present)	No	General Manager, China State Shipbuilding Corporation (2008-12)
Wang Zhigang	王志刚	Vice Minister, Ministry of Science and Technology (MOST) (2011-present); Deputy Secretary, MOST (2011-present)	Yes	Deputy Secretary, China Electronics Technology Group Corporation (CETC), Leading Party Group (2008-11); General Manager, CETC (2003-08)
Wu Yanhua	吴艳华	Deputy Director, SASTIND; Deputy Director, China National Space Administration (2014- present)	No	Deputy General Manager, CASC (2013-14); Chief Accountant, CASC (2005-14); General Manager, China Aerospace Investment Holdings (2007-14)
Wang Yong	王勇	State Councilor (2013-present); Director, National Committee for Disaster Reduction (2013-present)	Yes	Secretary, SASAC (2010-13); Secretary, State Administration of Quality Supervision, Inspection and Quarantine (2008-10); Deputy General Manager, China Aerospace Mechanic and Electronic Corporation (1999-2000); Head, China Aeronautics Corporation (1997-98)
Xu Dazhe	许达哲	Governor, Hunan Province (2016-present)	Yes	Vice Minister, MIIT; Director, SASTIND; Director, China National Space Administration; Director, China Atomic EnergyAuthority (2014-16);General Manager, CASIC (2007-14)
Xu Zhanbin	徐占斌	Deputy Director, SASTIND (2014-present)	No	Deputy General Manager, AVIC (2008-14)
Zhang Guoqing	张国清	Deputy Secretary, CPC Municipal Committee, Chongqing (2013-present); President, Chongqing Municipal Party School (2013- present);	Yes	General Manager, China North Industries Group (NORINCO) (2008-13)

Name	Name (Chinese)	Current Position(s)	Member, 18th CPC Central Committee	Past Position(s)
Zhang Qingwei	张庆伟	Executive Chairman, China Olympics Committee, 2022 Winter Olympics (2015- present); Governor, Hebei Province (2012- present); Deputy Party Secretary, Hebei Province (2011-present)	Yes	Chairman, COMAC (2008-11); Director, SASTIND (2008-09); Deputy Chief Commander, Manned Space Program (2007-12)
Zhang Yinchuan	张云川	Vice Chairman, Environmental and Resources Protection Committee, National People's Congress (2011-present)	No	Secretary, Provincial People's Congress, Provincial Military District, Hebei Province (2008-11); Minister, COSTIND (2003-07); Governor, Hunan Province (2002-03)

Sources: Information regarding positions were collected from a variety of sources including, Baidu's Baike, Chinavitae, as well as official government and corporate announcements.

3 . MCF Blueprints & Architects—Key Policies and Agencies Driving MCF Development

Defense industrial MCF's elevation to a national strategy has been reflected in a growing number of State Council and CMC-driven policy directives. MCF policies tend to focus on defense S&T priorities originally prescribed in a major joint State Council-CMC directive published in 2010 on integrating military and civilian weapon systems research, development, and production. Known as *Document 37*, the directive was promulgated at the end of the Hu Jintao administration and continues to serve as a blueprint guiding China's MCF development. Most notably, *Document 37* identifies six barriers hindering the fusion of military and civilian sectors, which the Xi administration is continuing to tackle:[23]

- Imperfect CMI coordination mechanisms between relevant institutions in government, business, and research communities;
- The prevalence of barriers preventing civilian enterprises from effectively participating in the defense market;
- Insufficient resource sharing between civilian and military sectors;
- Incomplete reforms in relevant [CMI] institutional mechanisms;
- Underdeveloped CMI industries; and
- Poorly designed or incomplete policies and guidelines directing CMI activities.

Though Chinese leaders have promoted MCF-like policies in the past, the rapid progress implementing *Document 37*'s prescriptions can only be credited to the Xi administration's high-level support. In the last five years, significant advancements have been made to revise MCF policies and standards, construct online information sharing platforms to facilitate "spin-on" and "spin-off" technology development, and coordinate MCF policies across government agencies, the PLA, and state research institutes. Notable achievements include:

- Fusing MCF within China's broader economic and industrial reform (i.e. upgrading) agenda, ensuring adequate incentives and resources for promoting MCF at the provincial and local levels;
- Improving MCF coordination mechanisms between government, industry, and military;
- Constructing national military-civil S&T resource and information sharing platforms and directories;
- Beginning to remove regulatory barriers to enable and attract private sector (Chinese firms) participation in the defense procurement market; and
- Constructing and designating MCF industry zones or bases.

Key Government & Military Agencies Directing MCF Work

The State Council - CMC's all-of-government approach to military modernization has expanded the number of MCF stakeholders at the national, provincial, and prefectural levels, as well as within the PLA, defense industry, research institutes, and universities. Despite the growing

number of stakeholders, subordinate agencies of MIIT, specifically SASTIND and the Civil-military Integration Promotion Department (CMIPD), and select departments within the CMC exercise MCF oversight and administration.

An interagency policy body, referred to as The Inter-Ministerial Coordination Small Group for Military-Civil Fusion Integrating Weapons Research and Production Systems ("Small Group") coordinates and tracks MCF implementation nationwide.[24] The mall Group's structure (i.e. leadership and members) reflects China's evolving and expanding MCF stakeholder infrastructure, decision-making process, and priorities. Although MIIT sits atop China's MCF defense industrial stakeholder pyramid, MCF's prioritization of defense requires close collaboration between the CMC and State Council, including review of defense industry enterprise licensing, developing and implementing MCF policies and standards, and other actions requiring collaboration between military and civilian bureaucracies.

Atop the Pyramid—MIIT, SASTIND, CMIPD,

MIIT is the principle State Council organ responsible for defense industrial policies. Within MIIT, key organizations include SASTIND and CMIPD. Both SASTIND and CMIPD were created in 2008 following the State Council's reorganization and establishment of five new "super ministries," which included MIIT. SASTIND's predecessor, the Commission of Science, Technology, and Industry for National Defense (COSTIND), was a ministry-level body and civilian counterpart to the former General Armaments Department (GAD). As part of broader defense reforms and reorganizations unveiled in early 2016, the newly established CMC Equipment Development Department (CMC/EDD) has assumed many of GAD's previous duties. Today, SASTIND's director is at least a vice-ministerial level position probably equal in grade to a deputy director of the CMC/EDD, as demonstrated by their respective positions as vice-chairs of the Small Group.

CMIPD ostensibly develops and integrates defense industrial S&T standards and policies for both military and civilian products.[25] However, it has limited purview over the defense industry, a core responsibility of SASTIND, and works largely behind the scenes. Its chief responsibilities include:[26]

- Promoting the sharing of resources, information and transfer of dual-use technologies between military and industrial partners;
- Streamlining military and civilian standards systems;
- Developing and implementing military-civil fusion promotion policies and reforms;
- Coordinating defense grant programs and foreign cooperation on nuclear and space activities with other Chinese agencies.

While CMIPD is assigned responsibilities for MCF defense industrial policy development, SASTIND is taking a more assertive role implementing directives and coordinating MCF work with provincial and municipal leaders, defense enterprises, and the PLA. According to the State Council, SASTIND's chief responsibility is to "strengthen military forces with additional personnel and more

advanced equipment"—whether developed domestically or acquired from abroad.

SASTIND has responsibilities for "nuclear weapons, aerospace technology, aviation, armament, shipping, and electronics industries." In the economic realm, SASTIND contributes to national prosperity by "stimulating the manufacturing industry and gaining competitive edges with superior production techniques." SASTIND's unique position, operating at the intersection of China's defense industry, government, and military, offers le erage when implementing MCF directives.[27]

The Central Military Commission

The former GAD managed PLA defense R&D and acquisition policy, along with defense industrial MCF-related activities. GAD and MIIT/SASTIND appeared to have some overlapping responsibilities for managing defense-related S&T funding programs (e.g. 863 program), licensing producers of weapons and equipment, and accrediting defense laboratories in collaboration with relevant state agencies. Since January 2016, the GAD's previous duties have been transferred to the newly created CMC/EDD, CMC S&T Commission, and the PLA Strategic Support Force.

The CMC S&T Commission's mission is to "strengthen the strategic management of national defense science and technology, promote independent innovation in that area, and push for the integrated development of military and civilian science and technology."[28] The newly established CMC National Defense Mobilization Department is responsible for non-defense industrial aspects of MCF, such as mobilization, civil defense, reserves, militia, and border/coastal defense. Finally, the newly established CMC Joint Staff Department has responsibilities for deconflicting military and civilian use of national airspace.[29]

Specifics on how these new CMC organizations will coordinate MCF activities remain obscure. For now, however, public appearances point to a prominent CMC/EDD role in leading PLA defense industrial MCF work. For example, recent press reports highlight CMC/EDD and senior PLA officers taking part in national-level MCF meetings, expos, and forums.[30] Having served in the position while assigned to GAD, the deputy director CMC/EDD Lieutenant General Liu Sheng (刘胜), continues to be the vice-chair and senior PLA representative on the interagency Small Group.[31] That said, other entities beyond CMC/EDD, including the theater commands, are increasingly engaged in MCF defense industry issues, making numerous public statements regarding MCF work and visiting local MCF demonstration bases.[32]

The Inter-Ministerial MCF Small Working Group

Guided by *Document 37*, the interagency defense R&D Small Group, established by the State Council and CMC in March 2012, oversees the implementation and coordination of China's defense industrial MCF strategy. Small Group meetings are held annually to review progress, issue work reports, and promulgate priorities. In most respects, Small Group priorities mirror the near-term policy proposals prescribed in *Document 37* — achieving breakthroughs in resource and information

sharing between civilian and military entities, increasing private sector participation in the defense sector, and improving policy guidance to construct a more favorable macro environment for MCF. Xi Jinping's MCF policies began showing up in Small Group announcements in 2014.

The Small Group's leadership, members, and participants further reflect its role as a coordinating body and the growing role of MCF policy in economic planning. As noted above, MIIT Minister Miao Wei chairs the Small Group. Members span China's military, government, defense industry, and financial institutions. Small Group vice-chairs include the director of SASTIND and a deputy director of CMC/EDD. One source cited a deputy director of the National Development and Reform Commission (NDRC) as a vice-chair.[33]

Over the last five years, the Small Group has refined priorities to reflect MCF-related pronouncements of Xi Jinping. Beginning in June 2014, Small Group pronouncements began to mirror MCF directives delivered at the 18th Party Congress and its Third and Fourth Plenums.[34] For example, the Small Group's most important work in 2014, according to Minister Miao Wei, is "studying and implementing" Xi's MCF development "spirit and evolving ideas" to "break through" MCF development challenges.[35]

Small Group announcements note hundreds of participants. However, special references are made to senior officials from the People's Bank of China (PBOC), SASAC, Chinese Academy of Science, Standardization Administration of China (SAC), the National Administration for the Protection of State Secrets, and senior officers from various CMC departments. Coordination of Small Group policy, planning, and reporting activities are managed through MIIT's CMIPD. The CMIPD director serves concurrently as director of the Small Group Office, a staff that manages its daily affiars.[36] **(See Table 2 Notable Small Group Members)**

Small Group meeting announcements demonstrate the PLA's prominence in setting the direction of MCF priorities and activities. Senior military officers from the CMC regularly attend and speak at Small Group meetings. At the Small Group's third meeting in June 2014, then-Deputy Chief of the General Staff, Wang Guanzhong, highlighted China's complex security environment, need for weapon systems R&D and production to "defer to, support, and serve military combat readiness requirements," and the importance of MCF in military planning.[37]

Table 2

Notable Small Group Members

Name (English)	Name (Chinese)	Position (listed in announcement)	Organization	Session(s) Attended (Reported)
Cao Jianlin	曹健林	Vice Minister	Ministry of Industry & Information Technology (MIIT)	4
Cui Gang	崔钢	Deputy Director	National Standards Administration	4
Du Zhanyuan	杜占元	Vice Minister	Ministry of Education	2
Guo Qingping	郭庆平	Deputy Governor	People's Bank of China	2
He Fuchu	贺福初	Deputy Director	Science & Technology Commission, Central Military Commission	5
Kong Changsheng	孔昌生	Vice Minister	Ministry of Human Resources and Social Security	4
Lt. General Li Shuzhang	李书章	Vice Chief	Logistics Support Department, Central Military Commission	5
Li Xiaoquan	李晓全	Director-General	State Commission Office for Public Sector Reform	4
Liang Jiansheng	梁建生	Deputy Director	National Administration for the Protection of State Secrets	4
Lian Weiliang	连维良	Deputy Director	National Development & Reform Commission	2
Lt. General Liu Sheng	刘胜	Deputy Director	Equipment Development Department, Central Military Commission	4,5
Ma Xingrui	马兴瑞	Director	State Administration of Science, Technology and Industry for National Defense, MIIT	1,2
Pan Gongsheng	潘功胜	Deputy Governor	People's Bank of China	4

Source: MIIT, SASTIND

Name (English)	Name (Chinese)	Position (listed in announcement)	Organization	Session(s) Attended (Reported)
Ren Shaolong	少龙等	Deputy Director	Office of Strategic Planning, Central Military Commission	5
Miao Wei	苗圩	Minister	Ministry of Industry & Information Technology	1,2,3,4,5
Lt. General Wang Guanzhong	王冠中	Deputy Chief	General Staff Department, Central Military Commission	3
Lt. General Wang Jianping	王建平	Chief of Staff	People's Armed Police Force	5
Wang Kang	汪康	Chief Accountant	State Administration of Taxation	2
Xiang Libin	相里斌	Vice President	Chinese Academy of Science	5
Xu Dazhe	许达哲	Director	State Administration of Science, Technology and Industry for National Defense, MIIT	3,4,5
Xu Zhanbin	徐占斌	Deputy Director	State Administration of Science, Technology and Industry for National Defense, MIIT	4
Yan Xiaofeng	阎晓峰	Secretary General, Party Committee	State-owned Assets Supervision and Administration Commission	5
Yang Ziqiang	杨子强	Deputy Governor	People's Bank of China	5
Yin Weijun	尹卫军	Director	Military-Civil Fusion Promotion Office, MI	5
Yu Xinli	于欣丽	Vice Administrator	Standardization Administration of China	5
Zhang Xiwu	张喜武	Deputy Director	State-owned Assets Supervision and Administration Commission	3
Zhang Yizhen	张义珍	Vice Minister	Ministry of Human Resources and Social Security	5

Source: MIIT, SASTIND

4 . Leading the Charge: SASTIND's MCF Work

More than any other agency, SASTIND is mobilizing and coordinating China's collective resources across the government, military, and defense industry to implement MCF policies prescribed in *Document 37*. SASTIND is working in partnership with central government agencies and local government, providing technical and financial support through strategic cooperation framework agreements (SCFAs) to implement MCF initiatives. SASTIND's most recent director, Xu Dazhe, describes his agency's accomplishments implementing MCF over the last two years, including:[38]

- Supporting private sector participation in the defense procurement market via the promulgation of policies that provide the means for investment of private capital into defense industry fixed asset projects;
- Publishing a new weaponry research and production license directory, and reducing the number of projects requiring state-level approval by 62 percent;
- Supporting innovative strategic alliances among defense industry and other civilian enterprises, including the establishment of joint research and production units to leverage technical achievements;
- Signing MCF strategic cooperation framework agreements with provincial governments; and
- Establishing MCF industry demonstration zones to promote MCF-related projects.

In June 2015, SASTIND established a National Defense Science, Technology, and Industry Committee to further support MCF. Former SASTIND director Xu Dazhe, who served concurrently as director of the committee, pointed out that its mission is "aimed to gather opinions and advice from leaders and experts in relevant military and civilian departments and units, and get external intellectual support for the strategic development and technological innovation of China's defense industry." The committee is comprised of senior expe ts from the CMC/EDD, Chinese Academy of Sciences, Chinese Academy of Engineering, NDRC, MOST, Ministry of Education, Ministry of Finance (MOF), and select universities.[39]

SASTIND's Special Action Plans

SASTIND exercises its authority through MCF Special Action Plans that function as "blueprints" defining agency priorities, operational goals, and guiding ideologies. SASTIND s *2016 Special Action Plan* is extensive and specific. Some priorities, such as promoting private sector participation in the defense market and the open sharing of military-civil resources and facilities, mirror directives from *Document 37*.[40] The document offers greater specificity and augments *Document 37*, emphasizing a more self-reliant and internationally relevant Chinese defense industry. Priorities include:

- Expanding defense industry collaborations outside of the defense sector;
- Developing and implementing an import substitution plan for key defense-related materials to hedge against supply chain risks;
- Establishing an MCF investment fund to promote defense S&T industries;

- Promoting regional integration of economic and military development through the signing of strategic cooperation framework agreements; and
- Supporting the "going out" of China's defense industry, to include enhancing cooperation with foreign governments and promoting China's nuclear equipment and technologies.

Mincanjun—Boosting Private Sector Participation

Over the last two years, SASTIND and the PLA have issued a number of policies aiming to boost private sector participation in the defense industry. Identified as a priority task in *Document 37*, "opening up" China's defense market to private sector firms—a concept referred to as *mincanjun* (民参军)—is designed to acquire rapidly advancing military technologies and innovation spin-on into the defense sector via dual-use technology transfers or developing new products exclusively for military purposes.[41] According to now retired LTG Li Andong (李安东), a leading architect of China's armament modernization efforts between the early 2000's and mid-2010, civilian entities should participate in R&D and production of military equipment, as well as after-market support services like repair and maintenance.[42] Doing so, he argues, would promote a more competitive procurement process.[43] Promoting *mincanjun* is identified as a top priority in Small Group meeting reports.

SASTIND is working in concert with key government agencies, the PLA, and defense enterprises to implement *mincanjun* directives. These activities focus on streamlining licensing processes, military and civil product standards, and constructing more transparent procurement platforms. SASTIND is also working with the All-China Federation of Industry & Commerce, a channel for the party and state to engage non-state owned enterprises, to attract private sector participation in the defense industry. The two signed a strategic cooperation framework agreement (SCFA) in May 2016.[44]

SASTIND's *mincanjun* efforts appear to be paying off. Private firms in China are boosting collaboration with state-owned defense industrial enterprises and research institutes to develop and deliver high-tech dual-use products. Results of this collaboration are showcased at MCF expos. In July 2015, the First China Military-Civil Integration Expo, co-sponsored by the China Association of Science and Technology and NORINCO, exhibited high-tech products from nearly 200 organizations, including "NORINCO, Sugon, Tsinghua University, Beijing Institute of Technology, Beijing Union University, and Military Transportation University."[45] Roughly 2,000 representatives from the PLA, Ministry of Public Security, defense industry research institutes, and other government organizations turned out to "discuss policies, business opportunities, and new defense technologies" with private sector firms. These firms were showcasing an array of dual-use technologies, including command information systems, digitized soldiers, cyber security systems, geo-location products and services, infrared night vision equipment, and border monitoring and control systems.[46]

A similar expo, held in Beijing in December 2015, had more than 200 private enterprise participants showcasing UAVs, military robots, and cutting-edge materials. MCF exhibitions are "designed to provide a driving force for the development of defense technology and the transformation and

upgrading of defense-related enterprises by setting up an open exchange platform for the hi-tech results of the military and civilian integration development."[47]

The PLA is also improving the competitiveness and transparency of its defense acquisition process. In March 2015, the PLA organized its first online acquisition portal for general-purpose equipment.[48] Chinese defense enterprises also have announced programs to enhance cooperation with private Chinese firms. For example, CASIC plans to increase engagement with private companies by outsourcing roughly RMB 43 billion (USD $6.6 billion) in "Tier 2/3" defense and commercial contracts via an in-house online platform called CASICloud.com.[49]

Despite institutional barriers, private sector participation in China's defense industry appears to be growing. In the last five years, more than 1,000 private sector firms (roughly 40 percent of all Chinese defense contractors) were certified to research, develop, and produce military equipment—a 127 percent increase compared to the end of the 11th Five-Year Plan (2006-2010) period.[50]

The quality and depth of private sector participation is open to debate. SASTIND's "core military industry" production certifications, which allow research and production of complete weapon systems, remain finite. Security requirements appear designed to ensure only state-owned enterprises qualify.[51] SASTIND's most recent director, Xu Dazhe, has committed to opening up more defense sector fields and educing entry thresholds for private firms, which primarily produce auxiliary defense products. True to its word, SASTIND's 2016 *Special Action Plan* announced the eventual release of two new catalogs for researching, developing, and producing military weapons and equipment.[52]

Until greater reform and opening up of the defense procurement market is achieved, SASTIND and the PLA are encouraging private sector firms to focus on building market share in "secondary" projects, which includes research and production of subsystems, auxiliary products, and special materials.[53]

Strategic Cooperation Framework Agreements (SCFAs)

A recurring MCF theme is the need to improve coordination mechanisms across defense S&T stakeholders. SCFAs are one mechanism SASTIND is deploying to improve coordination between provincial governments and government agencies. At least 13 SCFAs have been signed since late 2012. SCFAs seek to overcome selected regulatory and policy obstacles that hinder MCF development. The also offer resources, including investment and technical expertise, for establishing new military-civil fusion industry demonstration bases.

SCFAs between SASTIND and provincial governments highlight MCF as a new path of economic development and industrial modernization. These agreements regularly involve defense industry enterprises that seek to leverage local and central government defense S&T resources, such as universities, national labs, and grants supporting local industrial clusters. These industrial clusters are focused on transferring and producing dual-use technologies for both military and civilian consumers.

MCF: A New Path of Economic Development

To date, SASTIND has signed SCFAs with provincial governments in Yunnan, Guizhou, Hebei, Sichuan, Jiangsu, Jiangxi, Shanxi, and Hubei as a means to promote development of local MCF industries. These agreements cite MCF as "a new path of economic development." They promise joint promotion and construction of key MCF R&D projects and joint development of high-tech dual-use industries, which mirror "breakthrough" sectors of the "Made-in-China 2025" initiative.[54] Local government SCFAs involve one or more state-owned defense industrial enterprises, and highlight their role as vehicles delivering promised economic benefits. They also reflect SASTINDs ability to coordinate and direct defense industrial policy.[55] Two brief examples may illustrate the composition and type of MCF industry development activities, as well as their connection to local government SCFAs with SASTIND.

Hubei's Zigui County—August 2013

In August 2013, SASTIND led the signing of a multi-party SCFA involving Hubei's Zigui County Government, Beidou Science and Technology Company in Beijing,[56] Great Wall Computer Company, and Hubei KENTO Electronic Stock Corporation. The agreement's purpose was to jointly promote the development of dual-use electronic and satellite navigation products.[57] As a hub in China's Beidou satellite navigation system, Hubei is home to China's Beidou Ground Base Enhancement System (BGBES), a network of 30 ground-based stations, an operating system, and a precision positioning system developed to enhance the Beidou's effectiveness.[58]

Leveraging Hubei's government-supported satellite infrastructure and reflecting provincial development priorities, the SCFA covered the construction of a Beidou satellite navigation-manufacturing zone in Zigui County, a locality along the Yangtze River. The Beidou S&T Company and Great Wall Computer planned to invest more than RMB 10 billion (USD $1.5 billion) in the zone's development. The zone reportedly will be comprised of the Beidou Satellite Navigation Park, Beidou R&D and Manufacturing Center, an information security manufacturing center that will produce encrypted walkie-talkies and package semiconductors. MIIT projects the zone's industrial output to reach RMB 20 billion (USD $3 billion) within the first five years.[59]

Hebei—December 2015

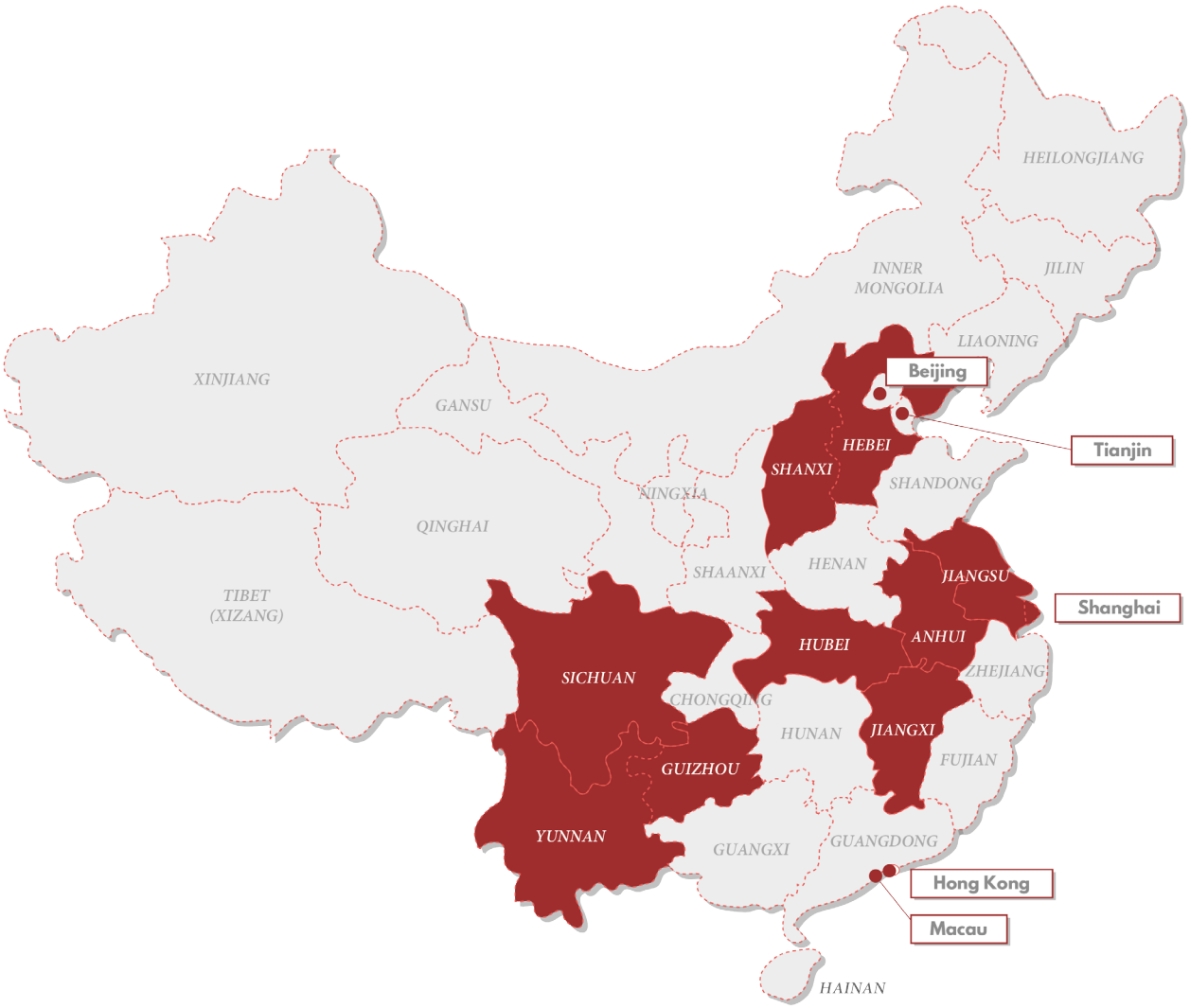
Beyond its role as defense industry regulator, SASTIND also invests alongside local governments to form new MCF industry enterprises. In December 2015, SASTIND and Hebei Province led the signing of an SCFA to promote MCF big data technologies and big data governance, a target sector of Hebei's high-tech industrial development strategy.[60] In addition to Hebei vice governor Zhang Jiehui (张杰辉) and SASTIND deputy director Zhang Kejian (张克俭), a number of military officers attended the signing ceremony, most notably the commander of the Hebei Military District, Major General Shao Heng (邵亨).

The Hebei SCFA announces plans to construct an MCF-related Big Data Industrial Base. SASTIND and the Hebei provincial government are jointly investing RMB 50 million (USD $7.6 million) to form a corporate entity for "supporting military-civil fusion and innovative national defense industry collaborations." Beyond this vague mission statement, details about the new entity's corporate structure or the source of investment funds (e.g. a central government administered industrial or S&T program such as "863" Program) are lacking. Hebei plans to attract big data and Internet start-ups to the new industrial base by leveraging build-operate-transfer project financing and public private partnerships, with the goal of forming a center for providing all-in-one big data and cloud services for government, industry, and consumers.[61]

Pointe Bello

Visual 1

SASTIND SCFA's - Provincial Level



Provincial SCFA's

Yunan - October 2012
Guizhou - July 2013
Hebei - October 2013
Sichuan - July 2015
Jiangsu - September 2015
Jiangxi - October 2015
Shanxi - Dec 2015
Hebei (2.0) - Dec 2015
Hubei - March 2016

SCFAs with Government Agencies

SASTIND's SCFAs with government agencies focus on revamping regulations and standards impeding MCF development. SCFAs with the Standardization Administration of China (SAC) and the State Intellectual Property Office (SIPO) have led to the development of new dual-use S&T standards and policies improving protections of defense-related IP.

National standards are critical to China's defense S&T development. They ensure detailed MCF coordination and provide a common language for domestic and international exchange and cooperation. SASTIND's September 2015 SCFA with SAC targets further development and implementation of the *State Council's Directive for Deepening Standardization Work Reform* and China's strategy to establish itself as a "powerful aerospace country."' It calls for:[62]

- Improving coordination and development of a new national defense dual-use S&T standards system;
- Improving the Chinese aerospace standards system; and
- Promoting the "going out" or internationalization of China's aerospace and nuclear standards.

One early reflection of SASTIND-SAC efforts to internationalize Chinese defense standards was publication of the English edition of the *China Aerospace Standards System and China Aerospace Standards*. Defining 20 standards covering aerospace management, product assurance, engineering and technology and space applications, the new English edition addresses Chinese standards associated with satellite exports, construction of remote sensing satellite ground stations, and international cooperation.[63]

SASTIND's March 2015 SCFA with SIPO addresses an improved intellectual property system in support of defense S&T development. The SCFA is a clear effort to encourage private sector investment and participation in the defense industry. During the signing ceremony, the two sides unveiled a new Defense Industry Intellectual Property Center. Shortly after signing the agreement, SASTIND and SIPO jointly released 600 patents for converting national defense technology to the civilian market and supporting "multiple businesses, including electronic information technology and advanced manufacturing."[64]

Visual 2

SASTIND SCFA's - Government Agencies/Associations

All-China Federation of Industry & Commerce - Focus: Promote private sector participation in the defense industry	**May 2016**
State Intellectual Property Office - Focus: Improve IP system to support defense S&T development, encourage private sector participation	**March 2015**
Standardization Administration of China - Focus: Improve coordination and development of new national defense dual-use S&T standards system; promote "going out" of aerospace and nuclear (excl. nuclear energy) standards	**September 2015**

5 . China's Expanding MCF Infrastructure: Demonstration Bases & Online Platforms

Arguably the most visible sign of China's MCF development drive is the designation and formation of MCF industry demonstration bases (or zones). Prescribed in *Document 37*, MCF industry clustering fosters development of China's high-tech industry and spurs technical innovation by creating sustainable linkages between defense and civilian enterprises. MCF industry demonstration bases are a recurring topic in reporting from Small Group meetings. Based on public comments by its former director, SASTIND has had a leading role coordinating, reviewing, and administering MCF industry demonstration bases over the last two years.[65]

MIIT designates MCF industry demonstration bases as part of a "National New Industrial Demonstration Base" initiative. The initiative aims to promote restructuring and development of China's high-tech industries in at least six areas:[66]

- Equipment Manufacturing;
- Raw Materials;
- Consumer Products;
- Electronic Information;
- Civil-Military Integration; and
- Software and Information Services.

Since 2009, MIIT has established 34 national MCF industry demonstration bases across the country. MCF industry demonstration bases prioritize dual-use technologies associated with satellite and satellite applications, other space technologies, aviation, advanced equipment manufacturing, special vehicles, shipping, new materials, and new energy. These priorities closely mirror China's broader high-tech industry development plans, particularly "Made in China 2025."[67] In June 2015, SASTIND director Xu Dazhe confirmed the close connection between the "Defense Science and Technology Industry 2025 Plan," MCF, and "Made in China 2025."[68]

Designation as a national MCF industry demonstration base does not appear to be an easy process. Provinces, autonomous regions, and municipalities must submit applications to MIIT declaring the "group" designation they seek and the local companies operating or expected to operate in the base. Applications are submitted annually, and capped at two per province (or autonomous region) and one per municipality. Local governments eager to get on the MCF development path are constructing their own industry clusters. These bases appear to be separate f om MIIT's nationally designated MCF bases, although local governments may eventually seek national-level designation.

A Military Affair—MCF Demonstration Bases

PLA Military Districts appear to be involved in the administration of local MCF industry demonstration bases. For example, while meeting with Mianyang city officials in May 2016 to review the city's MCF "situation," Jiang Yongshen (姜永申), commander of the Sichuan Military District,

stressed the important role Mianyang plays in China's broader defense S&T development and significance of its MCF demonstration base. The base has m e than 100 MCF enterprises engaged in aerodynamics research, aircraft engine development, special and new materials, and radar.[69]

He You, former director of the PLA Navy Aeronautical Engineering Institute, is a leading figure in Shandong's efforts to construct a MCF demonstration base. The base reportedly is seeking to provide operational and logistics support to Chinese aircraft carriers.[70] After approaching the State Council and CMC in late 2013, He You and Shandong officials received support for the initiative from NDRC, MIIT, the Ministry of Environmental Protection, the PLA General Staff Department, and the PLA Navy in April 2014.[71]

Inner Mongolia's Baotou Equipment Manufacturing Industrial Park

Chinese defense industrial enterprises form the bedrock of MCF demonstration bases. They regularly partner with local governments, central government agencies (e.g. SASTIND), universities, state research institutions, and foreign enterprises to drive China's defense S&T development. With the rapid roll out of MCF development, however, many Western companies are now operating in MCF industry demonstration bases or partnering with centrally directed Chinese defense industry groups to support the diffusion of dual-use technologies, resources, and knowledge. While many examples exist, Inner Mongolia's Baotou Equipment Manufacturing Industrial Park illuminates this shifting dynamic.

Inner Mongolia's Baotou Equipment Manufacturing Industrial Park officially serves as "a national northwest base for heavy industry and national defense research and production." It was designated by MIIT as a MCF industry demonstration base in 2013.[72] Baotou Park's MCF program targets eight areas of equipment manufacturing: heavy vehicles and equipment, wind power equipment, railway equipment, mechanical and electrical equipment, oil equipment, engineering equipment, general equipment, and specialized equipment.[73] According to MIIT, Baotou Park is currently carrying out more than 240 MCF projects and aims for ten "cutting-edge" breakthroughs.[74] The technical focus and timeline for achieving these breakthroughs is not clear.

Baotou Park's emphasis on heavy industry and engineering makes it a natural operating base for a number of heavy industrial Chinese SOEs and defense enterprises, including Baotou Aluminum Group, PLA tank manufacturer Inner Mongolia First Machinery Group (also known as Factory 617), and Inner Mongolia North Heavy Industries Group.[75] Inner Mongolia's emphasis on promoting heavy industry has led officials to promote international cooperation with German industrial firms [76]

Dual-use technologies and technical know-how resulting from legitimate Sino-German commercial ventures may have military applications for the PLA. Baotou Park is home to a number of Sino-German joint ventures involving firms such as Siemens, CLOOS Schweißtechnik, Fritz Werner, and HESS Machinery. The Sino-German Equipment Industrial Park, which offers preferential investment opportunities for German firms, facilitates this interaction. [77] The park hosts the annual Germany-

China (Baotou) Urbanization Symposium, which serves as a forum for boosting "cooperation opportunities between enterprises" to support transformation and upgrading of industries in the region, as well as enhancing "the mutual cooperation between China and Germany."[78]

Resource Sharing: Online Platforms and National Directories

China is making significant p ogress developing an online MCF infrastructure that connects defense S&T stakeholders through public and private platforms. These platforms, which aim to facilitate S&T resource sharing, list the locations and technical capabilities of state laboratories, as well as new products or technologies developed or being developed by state-owned defense enterprises. These platforms also allow state-owned defense enterprises to post technical and resource requirements for ongoing R&D projects within their industry focus (e.g. aviation).

MCF platforms are also being used to streamline procurement processes and reporting standards across state-owned defense enterprises, the PLA, and a growing private defense industry. Early successes, especially in military-civil R&D programs, has lead MIIT and SASTIND to announce an expansion and "deepening" of these platforms across China's MCF stakeholders.

Approved by MIIT, SASTIND, and the MOF in December 2014, the Military-Civil Integration Public Service Platform is an online hub coordinating defense S&T priorities, monitoring relevant military-civil economic operations, and promoting commercial spin-offs of military technologies.[79] The platform is accessible online, allowing SASTIND to post defense enterprise products, technologies and funding needs across eight categories: nuclear, aerospace, aviation, shipping, weaponry, electronics, information technology, and other.[80] At the time of publication, nearly 600 military technologies and products were listed, including specifications and applications, investment requirements, supplier information, and points of contact.

While the Military-Civil Integration Public Service Platform is new, content appears to be drawn from MIIT and SASTIND's annual Military Technology Conversion Promotion Directory. This directory seeks to "broaden the channels for MCF resource sharing, promote MCF depth, and upgrade and transform industry."[81] It highlights military to civilian "spin off" cases of in the fields of intelligent manufacturing, emergency response, energy saving and environmental protection, power and transmission, nuclear technology, space technology, general aviation, and marine engineering equipment.[82] Although its target audience is domestic, the directory offers insight into China's defense S&T priorities and R&D activities, as well as the technological purviews of defense industry groups and research institutes. In some cases, it may also be a valuable resource for examining the drivers of some defense enterprises' international M&A activities.

Directories in Action

S&T resource and information platforms and directories have facilitated cooperation and coordination among entities supporting defense R&D programs. In 2006, a consortium of China's

largest electronics firms—CETC, ZTE, and Huawei—teamed up with Xidian University to create a vehicle for cooperation on electronic information systems. The platform is funded through Project 985. The platform, which became fully operational in 2011, pools resources and information of participants as a means of developing advanced military electronic technologies.[83]

Similarly, in response to *Document 37*, MIIT published a public and classified directory of more than 450 dual-use items, military equipment, and R&D facilities to support aviation-related MCF. The directories, which included cost estimates, encouraged local government authorities to support S&T programs of enterprises as a means to spur economic development.[84]

Expanding MCF Platforms

Building on successes to date, MIIT is creating a larger and more integrated "platform operation management system" connecting China's MCF stakeholders. The system includes a secure means of sharing classified MCF information. MIIT promulgated a notice in December 2015 that provides guidance for constructing this system. The notice also announces the creation of a new office within SASTIND's Information Center to oversee the system's daily operations, and coordinate information collection. In addition, the notice:

- Appoints SASTIND's Propaganda Center, China Shipbuilding Industry Corporation's 714th Research Institute, NORINCO's New Technology Promotion Office, and AVIC's 301st Institute as operations management support entities.[85]
- Directs all MCF government administrators and defense enterprises (including the Chinese Academy of Engineering Physics) to appoint a department responsible for supporting the platform and collecting, organizing, reviewing, and submitting local MCF information.
- Announces construction of a private portal facilitating dissemination of classified military information across MCF stakeholders.[86]

Pointe Bello

Visual 3

National MCF Demonstration Zones

Designation Key

- First Edition (Jan. 2010)
- Second Edition (Dec. 2010)
- Third Edition (Feb. 2012)
- Fourth Edition (Feb. 2013)
- Fifth Edition (Feb. 2014)
- Sixth Edition (Mar. 2015)
- Seventh Edition (Jan. 2016)

6 . MCF and the "Going-out" of China's Defense Industry - AVIC

MCF strategy affects the international commercial activities of state-owned defense enterprises. At a national meting on building the role of the CCP in state-owned enterprises (SOEs) in October 2016, President Xi stressed with CCP's unswerving leadership over SOEs, defining their role as extensions of the Party-state. Xi pronounced that SOEs should "become important forces to implement decisions" of the CCP and "major strategies," such as the "going out" strategies to "enhance overall national power, economic and social development, and people's wellbeing."[87]

The most poignant example of SOEs extending the each of the Party-state is the South China Sea where Beijing is leveraging SOE assets (e.g. vessels, drilling rigs, aircraft) to assert territorial claims in disputed waters. On the commercial front, defense industry groups are acquiring firms with valuable dual-use technologies and products with the financial backing of Chinese state banks. SASTIND has announced strategic cooperation agreements between Chinese state banks and defense industrial enterprises to support their "going out" strategies. Recent examples include:

- China ExIm Bank's RMB 35 billion (USD $5.26 billion) credit line for the China Electronics Technology Group in February 2015 supporting CETC's international sales activities and its "going out" strategy.[88]
- Industrial and Commercial Bank of China's RMB 50 billion (USD $7.5 billion) credit line for CSIC in September 2016 over a five year period supporting CSIC's M&A, export, and "going out" strategy.[89]

According to the US Department of Defense (DOD), Beijing's acceleration of MCF initiatives is providing a conduit for the transfer of foreign advanced technologies for defense and dual-use purposes. Aviation and space industries are Chinese priorities and concern for DOD.[90] Foreign acquisitions executed by state-owned defense industrial enterprises appear consistent with Chinese industrial policies for introducing, digesting, and assimilating technologies that lead to re-innovated products. As noted by Tai Ming Cheung, a foremost authority on Chinese technical innovation, this "IDAR" process can be described as "homegrown."[91] IDAR process priorities include aviation, space, advanced materials, and manufacturing technology.[92] IDAR-related policies highlight the need to:[93]

- Actively seek bilateral and multilateral technical cooperation;
- Improve and expand open-source international information services that can be disseminated to local actors;
- Encourage and help Chinese firms to go global" in order to gain access to foreign R&D knowledge; and
- Attract multinationals to establish R&D institutes and facilities in China.

Extending Beijing's Reach: Chinese Defense SOEs

Under an MCF umbrella, Beijing leverages state owned enterprises to bolster territorial claims. In

July 2015, *The Global Times* (a subsidiary of *People's Daily*) reported that CSIC was planning to deploy an upgraded dual-use drilling platform (the HY 982) in the South China Sea sometime in 2016.[94] In 2014, Beijing deployed CSIC's HY 981 drilling rig in the South China Sea sparking anti-Chinese protests across Vietnam.[95] In September, China National Offshore Oil Corporation (CNOOC) announced it was beginning production on the Weizhou oil field in the outh China Sea.[96] A week after the Permanent Court of Arbitration in The Hague ruled that China had no basis for its territorial claims in the South China Sea, state-owned AVIC unveiled the *Jiaolong* (Water Dragon) AG600, reportedly the world's largest amphibious aircraft, which AVIC and Beijing plan to use to conduct operations in the disputed territory.[97]

Participation of commercial vessels, including ferries or roll on/roll off vessels, in several PLA amphibious exercises point to Beijing's continuing use of non-military assets to increase the PLA's mobility and projection in disputed waters.[98] According to the PLA's recently promulgated *National Defense Transportation Law*, commercial vessels (e.g. tankers, container ships) owned by large and medium sized shipping companies, including those classified as state owned enterprises, are required to serve as "strategic delivery support forces." The law is intended to enhance Chin 's "military maritime projection."[99]

AVIC: A Pillar of China's Defense Industry and National Economy

AVIC exemplifies defense industrial incorporation of MCF policy into corporate strategy. According to AVIC president Tan Ruisong (谭瑞松), the group's "coordinated development" of its non-aviation civilian business and military business reflects national MCF and aviation industry development policy directives.[100]

As a key pillar of China's defense industry and national economy, AVIC is the sole supplier of military aircraft to the PLA. Its business operations and military programs support a number of China's military and industrial strategies. As a premier state owned defense enterprise, AVIC is deeply involved in implementing and administering MCF initiatives. Public comments by AVIC's chairman, Lin Zuoming, highlight AVIC's importance to military modernization and economic development:[101]

> *As one of the important industries and key fields of the national security and the national economy…Our mission is to serve the security of national defense and economic development…AVIC always regards "serve our country with aviation" as its core responsibility; adheres to military-oriented strategy, while supplying munitions with high quality and efficiency, and guaranteeing military aircraft... AVIC has always regarded civil-military integration as its historical mission.*[102]

AVIC's Western Appetite

In line with China's MCF strategy, AVIC has acquired Western companies with valuable dual-use technologies. Acquisitions, in part, are means to augment and fill gaps in domestic commercial and military development programs. AVIC acquisitions, primarily in the US and Europe, cut across industry sectors, including automotive and general aviation. Investments appear to target financially distressed small and medium sized companies with advanced dual-use technologies, R&D capabilities, and technical manufacturing expertise.

AVIC receives financial support to execute its M&A and industrial development activities from the Chinese government. For example, in 2010, AVIC and China Construction Bank established a USD $3 billion private equity fund for the purpose of acquiring dual-use technology companies and investing in defense R&D projects to support the restructuring and development of China's aviation industry.[103] As a strategic partner, the Tianjin Municipal Government pledged an initial USD $75 million to support the fund.[104]

Europe

In Europe, AVIC-controlled enterprises have spent more than USD $1.25 billion acquiring aviation, engineering, and automotive businesses in Austria, Germany, the United Kingdom, and Spain. All of these firms provide AVIC advanced dual-use technologies and technical design and manufacturing expertise. For example, at the time of their acquisition, at least three European firms were suppliers to both U.S. and European military and civil aviation programs.

In December 2009, AVIC's Xi'an Aircraft Industry Company acquired Austrian-based Future Advanced Composite Components (FACC). According to its website, FACC is "*a leading force in the development and production of components and systems made of composite materials*" and a supplier to large aircraft manufacturers, including Airbus, Boeing, and Bombardier.[105] Since the acquisition, FACC has become increasingly integrated into AVIC's domestic civil aircraft programs. It is supplying a number of components to COMAC's C919 passenger aircraft, including wing spoilers, winglets, and cockpit linings manufactured at a new FACC-AVIC joint venture facility in Zhenjiang, roughly 100 miles northwest of Shanghai.[106] According to FACC, it plans to "relocate additional projects from Austria to China both to secure the company's attractive earnings profile…and also to free up capacities at the site in Austria to support future growth."[107]

In 2013, AVIC subsidiary Technify Motors GmbH acquired German-based general aircraft engine manufacturer Thielert Aircraft.[108] Thielert's engines powered the MQ-10C Gray Eagle unmanned aerial vehicle, a derivative of General Atomics Predator drone used by the U.S. Air Force. It also has been used in the military versions of the Diamond Aircraft DA42, a largely composite twin engine aircraft used for both manned and unmanned surveillance.[109] Thielert was originally slated to provide engines to Turkey's indigenous UAV program, Tanka. After acquiring Thielert, AVIC announced a cessation to Thielert's military business line, consolidating the company, along with its other U.S.

aviation engine acquisitions (see below), into a Hong Kong-based holding company.

United Kingdom

In the UK, AVIC has launched multiple research initiatives with world-class UK universities and acquired aircraft interior designer and manufacturer AIM Altitude in March 2016. AVIC's research activities are largely conducted through its Beijing Aeronautical Manufacturing Technology Research Institute (BAMTRI). BAMTRI reportedly has signed joint research agreements covering aerospace technologies and materials with Imperial College London and Birmingham University.[111]

Imperial College is working with BAMTRI through the joint establishment of the AVIC Centre for Materials Characterization, Processing, and Modeling. The center's mission is to undertake applied and fundamental research; explore mutual areas of interest; disseminate scientific information and conduct post-doctorate and PhD project research."[112] Housed within the Department of Mechanical Engineering and Department of Materials, the center's projects appear focused on superalloys, notably the development of a direct powder forging process for nickel-based superalloys and aircraft windshield materials.[113]

Following U.S. Department of Commerce inclusion of BAMTRI on its watch list for alleged ties with a PRC national wanted for selling missile technology to Iran, the *Financial Times* revealed in June 2015 that AVIC's high-tech collaboration with UK universities was under scrutiny by the UK government.[114] It's unclear if the UK government took any actions related to these research partnerships.

As a final note AVIC Trust reportedly is part of a Chinese consortium seeking to acquire a 50 percent stake in UK-based Global Switch, a large-scale global data center, for upwards of £2 billion.[115]

Spain

AVIC's most recent European acquisition involves the purchase of a 95 percent stake in Aritex, an innovative Spanish industrial firm developing, manufacturing, and installing production and assembly lines for manufacturers in the aeronautics and automotive sectors.[116] In addition, Aritex is active in wind turbine blade manufacturing, railway, and renewable energy.

Aritex is a top-tier supplier to civilian and military aircraft programs. Customers include Airbus, EADS, Embraer, Volkswagen, Audi, and Mercedes-Benz, among others. Aritex is reportedly responsible for designing and constructing the flexible wing assembly lines for the Eurofighter described as the world's most powerful and reliable swing-role combat aircraft with max speed at Mach 2.0—and the Neuron—Europe's unmanned stealth aircraft similar in size to a combat aircraft. It also supports the assembly line and carbon fiber components for the Airbus A400M Horizontal Tail Plane (HTP) boxes.[117] Aritex is working with state-owned Commercial Aircraft Corporation of

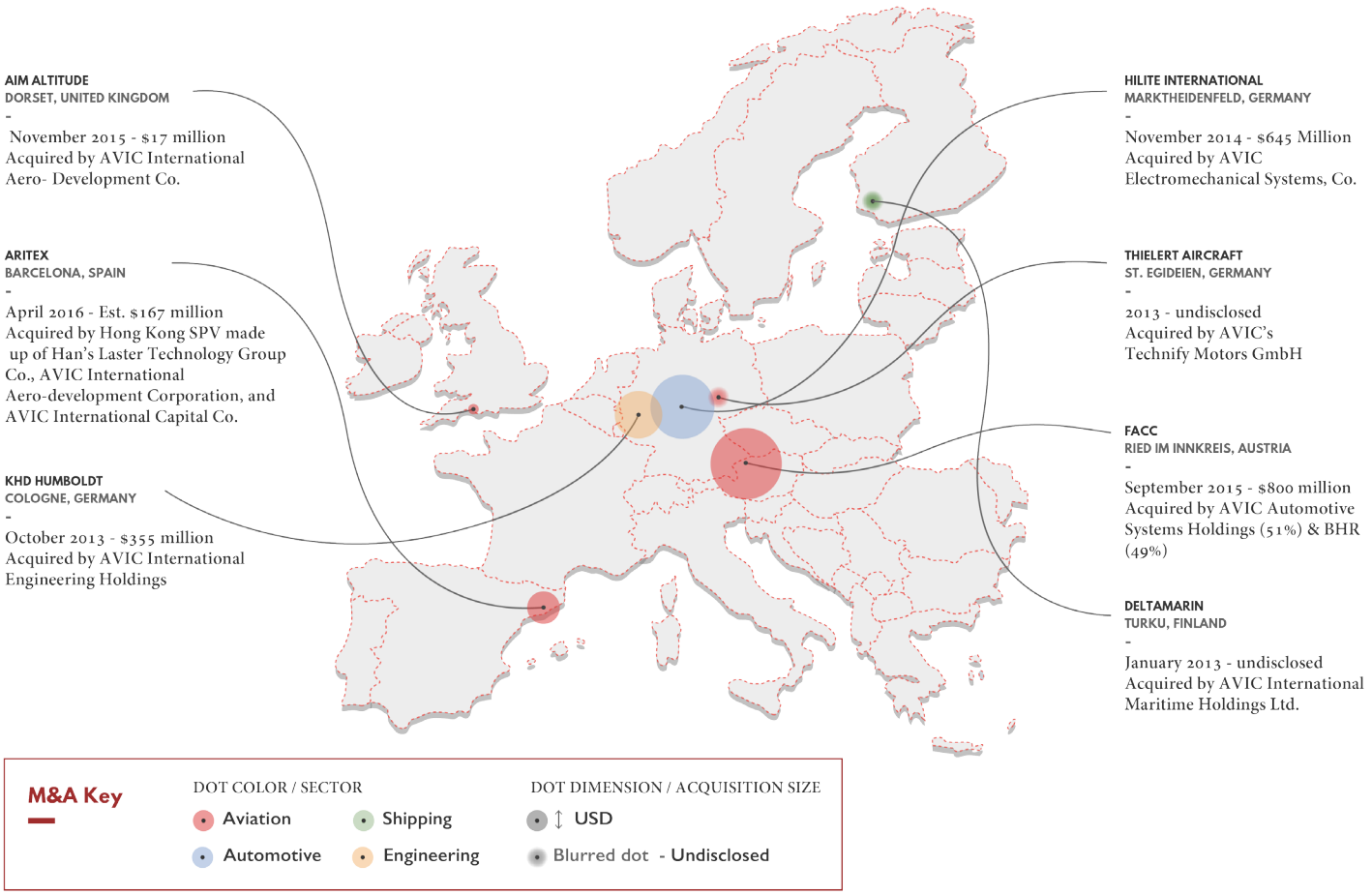
China (COMAC) in designing, manufacturing, and assembling two production lines—the HTP and Central Wing Box—for the C919 aircraft program.[118]

As a side note, COMAC's founding chairman and vice chairman, Zhang Qingwei and Jin Zhuanglong, previously served as director and deputy director of SASTIND's predecessor COSTIND. Jin now serves as COMAC's chairman. As noted previously, Zhang Qingwei is currently governor of Hebei Province.

Pointe Bello

Visual 4

AVIC Europe Acquisitions



United States

With U.S. operations administered out of its Pomona, CA headquarters, AVIC has spent more than $2 billion to acquire at least 12 American aviation and automotive firms over the last six years. These acquisitions include Alabama-based Continental Motors, Minnesota-based Cirrus Aircraft, and Michigan-based Nexteer Automotive. Despite Congressional national security concerns about AVIC's military ties, and the potential for technology diversion, the Obama administration has approved all of AVIC's U.S. acquisitions to date.

Aircraft Engines

AVIC's U.S. acquisitions target critical nodes in the general aviation production chain—design, R&D, avionics, engines, and maintenance, repair, and overhaul (MRO). Engine design and manufacturing is a known shortcoming of China's aviation industry. Since 2010, AVIC has been acquiring U.S. aircraft engine companies, including Continental Motors, a pioneer in the area of full-authority digital engine control (FADEC) technology. It also acquired its sister company, Mattituck Services, as well as Danbury Aerospace, United Turbine, and UT Aeroparts. According to its website, AVIC's acquisitions were driven by its "special place and obligation to bring general aviation products to China."[119]

In April 2014, AVIC announced it was "consolidating its aircraft engine businesses under a single corporate structure." AVIC's newly acquired assets were transferred to a Hong Kong-based holding company called Continental Motors Group. Its subordinate unit, Continental Motors Group Beijing, was formed "to ensure the Chinese market receives the exceptional products offered by Continental Motors Group."[120]

Advanced Materials and Manufacturing

After acquiring the intellectual property of Oregon-based Epic LT in 2010 and Cirrus Aircraft in 2011, AVIC's China Aviation Industry General Aircraft unveiled China's first domestically produced all composite business aircraft, the AG300, which is based on Epic's Primus 150 design.[121] The State of Tennessee offered Cirrus, a wholly owned unit of AVIC, funding and access to work with Oak Ridge National Laboratories (ORNL) as part of an incentive package to attract the firm to establish a new facility in the state. ORNL is one of the world's foremost advanced materials, supercomputing, and additive manufacturing R&D centers. Additive manufacturing (AM) is a top priority of SASTIND's Medium and Long-Term Defense Science and Technology Development Plan (2006-2020). More commonly known as 3D printing, AM components are stronger and lighter, reduce aircraft weight, boosting aircraft performance.[122] AM also has the advantage of reducing costs and cycle times of prototypes, tooling, and production systems.[123]

It does not appear that Cirrus is currently engaged with ORNL on any research initiatives and any proposed work would have to first be approved by the U.S Department of Energy. However, the fact

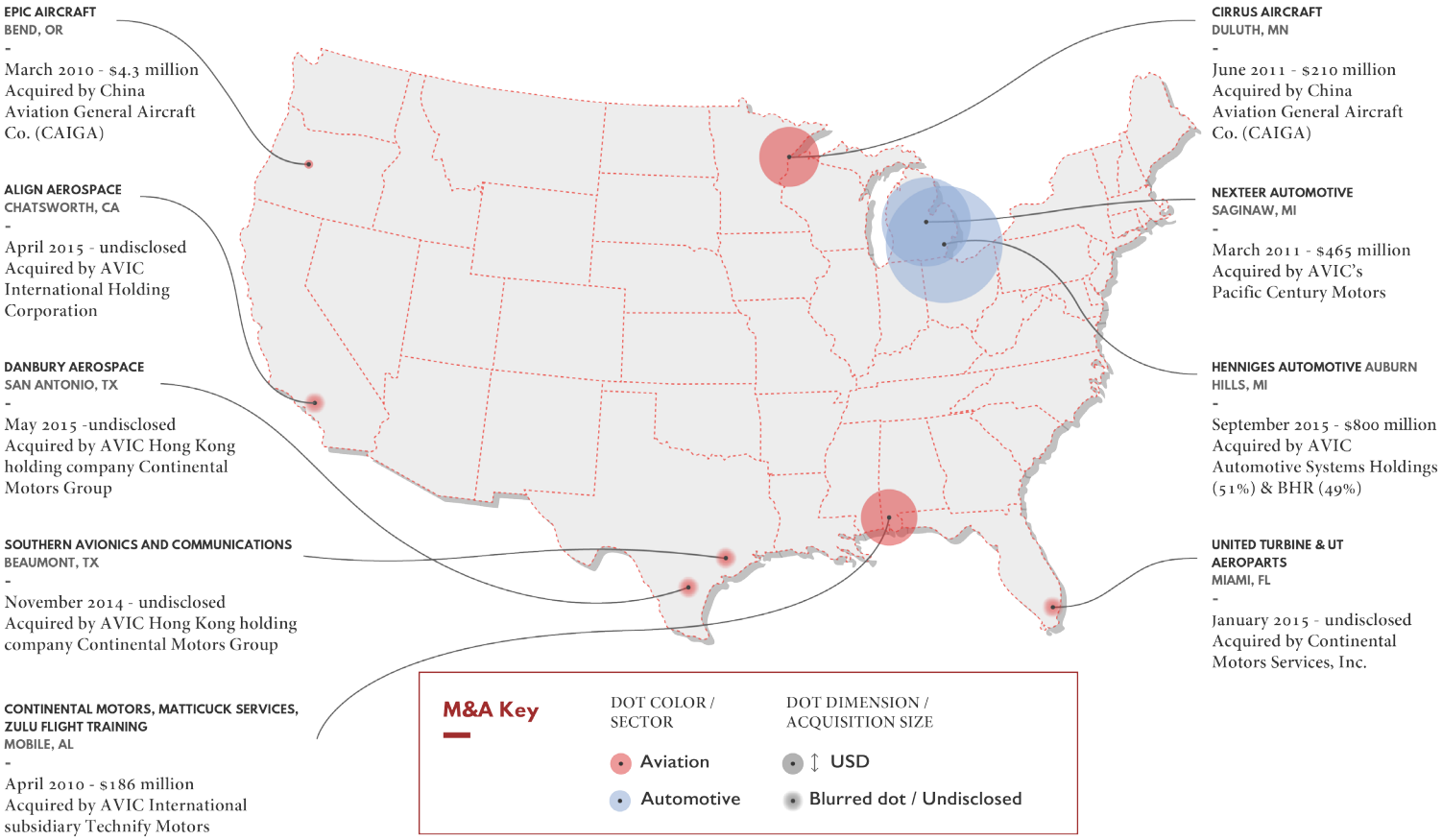
that a subsidiary of AVIC was offered access to ORNL facilities to "tackle some of the challenges they may face" as part of a commercial incentive package highlights the increasing sophistication of Chinese SOEs operating in the U.S., as well as the potential national security risks associated with their expanding activities.[124]

AM is an important technology for advancing China's space and aviation programs. AVIC reportedly is leveraging 3D printing for a stealth fighter jet project, the J-20, and other military programs.[125] SASTIND's 2015 "spin-off" directory identifies eleven dual-use technologies developed by AVIC, many of which correlate with the groups foreign acquisitions over the last decade. These include intelligent manufacturing, aero-engines, and composite materials. The directory also lists AVIC as the "lead unit" for AM technology.[126]

During the Committee on Foreign Investment in the United States (CFIUS) review of AVIC's acquisition of Cirrus Aircraft, then U.S. Representative Chip Cravaack (R-MN-8th)—who's congressional district included Cirrus—urged "extreme caution" in examining the deal out of concern that its technologies could be used by China's military.[127]

Visual 5

AVIC USA Acquisitions



7 . Conclusion

Despite challenges, the PRC is gradually overcoming structural barriers that have impeded integration of its defense and civilian S&T systems. MCF's elevation to a national strategy and linkages with China's economic development plans suggest MCF will continue to be a prominent theme through the 19th Party Congress slated for late 2017.

Beijing's emphasis on acquiring dual-use technologies, and its deployment of state owned enterprise assets in Chinese territorial disputes, present new challenges for U.S. policymakers and companies. Defense industrial enterprises enjoy financial support and guidance from state banks and government agencies, particularly SASTIND. As a result, motivations driving ostensibly commercial ventures and or research activities of defense industrial enterprises warrant greater scrutiny.

To date, the Obama administration has generally welcomed Chinese investments in the U.S., even in many strategic sectors. CFIUS reviews the national security implications of Chinese investments, like those by AVIC, which "could result in control of a U.S. business by a foreign person."[128] Factors informing CFIUS decisions are unclear. However, reviews do not appear to consider the acquiring entities' previous M&A or investment activities, which is necessary to evaluate the broader implications of a single transaction. Most importantly, no mechanism appears to be in place that could enable CFIUS to re-evaluate the national security implications of an acquisition after it has been approved. At a minimum, U.S. national security and economic policymakers must adapt and respond to PRC strategies that further blur the distinction between military and civilian commercial activities.

Notes

[1] See, for example, "Xu Qiliang: Resolutely Advancing National Defense and Military Reform" (许其亮：坚定不移推进国防和军队改革), People's Daily, November 2013, at http://CCP.people.com.cn/n/2013/1121/c64094-23610085-2.html and "On Implementation of Strategy for Military Civilian Fusion" (关于实施军民融合发展战略), PLA Daily, May 31, 2016, at http://www.81.cn/xuexi/2016-05/31/content_7079231_3.htm.

[2] For an excellent overview of defense industrial MCF (in Chinese, junmin ronghe; or 军民融合) , see Daniel Alderman, Lisa Crawford, Brian Laffe ty, and Aaron Shraberg, "The Rise of Chinese Civil-Military Integration," in Tai Ming Cheung (ed.), Forging China's Military Might: A New Framework for Assessing Innovation (Baltimore: Johns Hopkins University Press, 2014), pp. 109-135. Also see "Hu Jintao: Military-Civil Fusion Development Path with Chinese Characteristics" (胡锦涛:走出中国特色式发展路子), Xinhua News Agency (新华网), July 24, 2009, at http://news.xinhuanet.com/politics/2009-07/24/content_11768163.htm.

[3] A July 2010 report introducing military-civil fusion as a "major innovation" in guiding military theory quotes cites both Mao Zedong and Deng Xiaoping's support for integrating military and civilian industries. See "The Value of Military-Civil Fusion in this Age" (军民融合式发展战略的时代价值), PLA Daily (解放军报), July 4, 2010, at http://news.163.com/10/0704/07/6ANU120R00014AED.html.

[4] Tai Ming Cheung, Thomas Mahnken, Deborah Seligsohn, Kevin Pollpeter, Eric Anderson, and Fan Yang, "Planning for Innovation – Understanding China's Plans for Technological, Energy, Industrial, and Defense Development," report prepared for the U.S.-China Economic and Security Review Commission, July 28, 2016, at http://www.uscc.gov/Research/planning-innovation-understanding-china%E2%80%99s-plans-technological-energy-industrial-and-defense.

[5] Brian Lafferty, Aaron Shraberg, and Morgan Clemens, "China's Civil-Military Integration," *Study of Innovation and Technology in China (SITC) Research Brief*, January 2013, at http://escholarship.org/uc/item/1712q1h0.

[6] Song Miou, "*Full Text: China's 2015 Military Strategy*," *Xinhua News Agency*, May 25, 2015, at http://news.xinhuanet.com/english/china/2015-05/26/c_134271001_5.htm.

[7] Xi Jinping, "Build People's Armed Forces That Follow the Party's Commands, Are Able to Win and Exemplary in Conduct," *Xi Jinping: The Governance of China*, (Beijing: Foreign Language Press, 2014), March 11, 2013, p. 243.

[8] Xu Qiliang (许其亮), "Expounding National Defense Reform Goals," (撰文阐述国防军队改革目标), *Xinhua News Agency* (新华网), November 21, 2013 at http://news.xinhuanet.com/2013-11/21/c_125736965.htm.

[9] See "Xi Jinping Presiding Over Politburo Meeting" (习近平主持中共中央政治局会议), Xinhua News (新华网), March 25, 2016, at http://news.xinhuanet.com/politics/2016-03/25/c_1118448613.htm.

[10] See "Transcript of 3rd Plenary Session of 18th CCP Central Committee," The Central People's Government of the People's Republic of China, November 9-12, 2013, at http://www.gov.cn/jrzg/2013-11/12/content_2525960.htm.

[11] See Tai Ming Cheung, Thomas Mahnken, Deborah Seligsohn, Kevin Pollpeter, Eric Anderson, and Fan Yang, "Planning for Innovation – Understanding China's Plans for Technological, Energy, Industrial, and Defense Development," report prepared for the U.S.-China Economic and Security Review Commission, July 28, 2016, p. 155.

[12] Zhang Tao, "China Well On Track to Building Modern and Strong Army," China Military Online, March 2. 2015 at http://english.chinamil.com.cn/news-channels/china-military-news/2016-03/02/content_6938126.htm.

[13] China's defense industry groups include: China National Nuclear Corporation; China Nuclear Engineering and Construction Corporation; China Aerospace Science and Technology Corporation (中国航天科技集团公司); China Aerospace Science and Industry Corporation (中国航天科工集团公司); Aviation Industry Corporation of China; China State Shipbuilding Corporation; China Shipbuilding Industry Corporation; China North Industries Group Corporation; China South Industries Group Corporation; China Electronics Technology Group Corporation; and the China Electronic Information Industry Group Corporation

[14] 65 military officers were members of the 17th CCP Central Committee compared to 66 members of the 18th CCP Central Committee. See Cheng Li, "Promoting 'Young Guards: The recent High Turnover in the PLA Leadership (Part II), China Leadership Monitor, No.49, 1 March 2016, at http://www.hoover.org/sites/default/files/ esearch/docs/clm49cl.pdf. For more in-depth analysis on the appointment of PLA officers to the CMC at the 18th arty Congress see James Mulvenon, "The New Central Military Commission," China Leadership Monitor, No. 40, January 14, 2013 at http://www.hoover.org/sites/default/files/uploads/documents CLM40JM.pdf.

[15] Cheng Li, "Promoting "Young Guards": The Recent High Turnover in the PLA Leadership (Part I)," China Leadership Monitor, No.48, August 13, 2015, at https://www.brookings.edu/wp-content/uploads/2016/06/Promoting-Young-Guards-The-Recent-High-Turnover-in-the-PLA-Leadership-Part-1-Purges-and-Reshuffles.p .

[16] Among various sources, see Eric Anderson, "The Political and Bureaucratic Influence of the Defense Industrial Lobby in the Chinese Policy Process," SITC Research Brief, January 2015, at http://escholarship.org/uc/item/8130b5h6; and Willy Lam, "The Rise of the Military-Space Faction," Jamestown Foundation China Brief, Vol. 14, Issue 8, September 25, 2014 at http://www.jamestown.org/programs/chinabrief/single/?tx_ttnews%5Bpointer%5D=1&tx_ttnews%5Btt_news%5D=42875&tx_ttnews%5BbackPid%5D=25&cHash=16eec90b1c201f57ae3f77c5e6ad6d95#.V2K_DpMrJsN.

[17] Wang Yong rose through the ranks of the space industry's 230 Factory, which is also known as the Beijing Xinghua Machinery Factory (北京兴华机械厂). Until its resubordination to the newly established CASC Ninth Academy and integration with the CASC 13th Research Institute, the 230 Factory was subordinate to the CASC's China Academy of Launch Technology (CALT; or First Academy). He also served as vice general manager of CASIC's predecessor, China Aerospace Machinery and Electronics Corporation (CAMEC). For reference to Wang Yong's association with the 230 Factory see "History of State Councilor Wang Yong" (国务委员王勇简历), Xinhua, March 16, 2013, at http://news.xinhuanet.com/2013lh/2013-03/16/c_115051080.htm.
For the 230 Factory's association with the First Academy, see "Modeling and Simulation of Virtual Machining Process (虚拟加工过程的建模与仿真), Journal of National University of Defense Technology, Vol. 20 No. 4, 1998, at http://journal.nudt.edu.cn/publish_article/1998/4/199804008.pdf.

[18] Xu Dazhe rose through the ranks of the CASC First Academy's 15th Research Institute, which is responsible for ground launch systems. He subsequently served concurrently as director of the First Academy's general assembly plant (211 Factory) and deputy director of the First Academy. Between 2007 and 2013, he served as CASIC general manager (总经理), then briefly as CASC chairman (董事长) before his assignment to SASTIND. See "History of Xu Dazhe" (许达哲同志简历), Hunan Daily, September 6, 2016, at http://hnrb.voc.com.cn/hnrb_epaper/html/2016-09/06/content_1137131.htm?div=-1.

[19] In addition to official SASTIND director biographies, see "SASTIND (CNSA, CAEA) Publishes 'Sangong Expenditures'" (国防科工局 [国家航天局、国家原子能机构] 发布"三公经费"), Renminwang, July 21, 2011, at http://scitech.people.com.cn/GB/15214451.html.

[20] The center was established within the China Academy of Sciences' astronomical observatory. See "CNSA Space Debris Monitoring and Application Center" (国家航天局空间碎片监测与应用中心挂牌成立), SASTIND website, June 9, 2015, at http://www.miit.gov.cn/n1146285/n1146347/n1147676/n1147679/c3481003/content.html.

[21] In 2015, Ma Xingrui was concurrently appointed as party secretary of the Shenzhen Special Economic Zone. See Ma Xingrui (马兴瑞), Communist Party of China Cadre Information Base, undated, at http://cpc.people.com.cn/gbzl/html/121000169.html.

[22] Xu Zhanbin oversaw general aviation issues within AVIC. He directed AVIC Heavy Machinery and AVIC General Aircraft Co. Ltd., the parent company of US-based Cirrus Aircraft. Among various sources, see "Xu Zhanbin, Executive Profile and Biography," *Bloomberg*, at http://www.bloomberg.com/research/stocks/private/person.asp?personId=49686241&privcapId=106884519&previousCapId=106884519&previousTitle=AVIC%20General%20Aircraft%20Co.,%20Ltd; Wu Yanhua was promoted to vice president of CASC by SASAC in March 2013 after serving as CFO. See "Wu Yanhua appointed vice president of CASC, China Aerospace Science and Technology Corporation," *China Space News*, March 29, 2013, at http://english.spacechina.com/n16421/n17212/c408444/content.html.

[23] See Brian Lafferty, Aaron Shraberg, and Morgan Clemens, "China's Civil-Military Integration," *Study of Innovation and Technology in China (SITC) Research Brief*, January 2013; and Daniel Alderman, Lisa Crawford, Brian Laffe ty, and Aaron Shraberg, "The Rise of Chinese Civil-Military Integration," in Tai-Ming Cheung (ed.), *Forging China's Military Might: A New Framework for Assessing Innovation* (Baltimore: Johns Hopkins University Press, 2014), pp. 109-135. Also see "Opinions on Building and Improving 'Combining the Military and Civilian Sectors' and 'Locating Military Potential in Civilian Capabilities' Research and Production Systems for Weapons and Equipment" (关于建立和完善军民结合寓军于民武器装备 科研生产体系的若干意见 [37号]), China Law Star Network, October 24, 2010, at http://law1.law-star.com/law?fn=chl380s024.txt.

[24] The Inter-Ministerial Coordination Small Group for Military-Civil Fusion Integrating Weapons Research and Production Systems ("Small Group"; 军民结合寓军于民武器装备科研生产体系建设部际协调小组)was set up by the State Council and Central Military Commission in accordance with the State Council/CMC notice "Establishing the Inter-Ministerial Coordination Small Group for Military-Civil Fusion Integrating Weapons Research and Production Systems" (国务院办公厅 中央军委办公厅关于成立军民结合、寓军于民武器装备科研生产体系建设部际协调小组的通知), Document No. 37 (37号), 2010.

[25] Ed Francis and Susan M. Puska, "Contemporary Chinese Defense Industry Reforms and Civil-Military Integration in Th ee Key Organizations," *SITC Policy Brief*, September 2010, at http://escholarship.org/uc/item/3dq7x6d2.

[26] See "Civil-Military Integration Promotion Deparment," (军民结合推进司), Ministry of Industry and Information Technology website, at http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057613/index.html.

[27] See "State Administration of Science, Technology and Industry for National Defense," The tate Council of the People's Republic of China, October 6, 2014, at http://english.gov.cn/state_council/2014/10/06/content_281474992893468.htm

[28] Yao Jianing, "MND Holds Press Conference on CMC Organ Reshuffle" *China Military Online*, 12 January 2016. http://english.chinamil.com.cn/news-channels/china-military-news/2016-01/12/content_6854444.htm.

[29] See Cheng Li, "Promoting "Young Guards": The Recent High Turnover in the PLA Leadership (Part II: Expansion and Escalation)," *China Leadership Monitor*, No.49, March 1, 2016, at http://www.hoover.org/research/promoting-young-guards-recent-high-turnover-pla-leadership-part-ii-expansion-and-escalation.

[30] See Brian Lafferty, Aaron Shraberg, and Morgan Clemens, "China's Civil-Military Integration," *Study of Innovation and Technology in China (SITC) Research Brief*, January 2013.

[31] In addition to being deputy director of the newly formed CMC Equipment Development Department, LTG Liu Sheng (b. 1956) previously directed the GAD Services Department and Comprehensive Planning Department before his promotion as deputy director of GAD in 2009. He is a graduate of Northwestern Polytechnical University. and was promoted to LTG in 2011.

[32] As an example, Jiang Yongshen (姜永神), commander of the Sichuan Military District, met with Mianyang City party officials in May 2016 to review the city's military-civil fusion situation, discuss the city's important role in China's defense S&T development and encourage the construction of a military-civil fusion development zone. See Deng Xuelin (邓雪琳), "Actively Creating Military-Civil Fusion Areas of Innovation , Forms of Multi-Faceted, Highly Effective, and Deepened Fusion Between Military and Civilians" (积极打造一批军民融合创新示范区形成全要素多领域高效益军民深度融合发展格局), Mianyang Daily (绵阳日报), May 26, 2016, at http://tech.gmw.cn/newspaper/2016-05/26/content_112729439.htm.

[33] The April 23, 2013 Small Group meeting announcement lists NDRC Deputy Director Lian Weiliang (连维良) as a vice chair (部际协调小组副组长). This is the only preference to an NDRC official attending the mall Group in post-meeting announcements.

[34] The Communiqué of the 3rd Plenary Session of the 18th CCP places military-civil fusion within China's broader strategy to build a modern military force with Chinese characteristics. According to the Communiqué, "the plenum pointed out: Aiming at the goal of building up the people's armed forces that are loyal to the CCP, be able to win and uphold fine traditions under n w conditions, we will endeavor to resolve the prominent problems that constrain the development of national defense and the armed forces, be innovative in developing military theories, enhance military strategic guidance, implement correct military strategy for the new period, and build a system of modern military forces with Chinese characteristics. For endeavor in this regard, the tasks listed include deepening the adjustment and reform of the military administrative setup and staffing, omoting adjustment and reform of military policies and systems, and deepening integration between the military and civilian sectors." See "Communiqué of the Thi d Plenary Session of the 18th Central Committee of the Communist Party of China," The Chinese Communist arty, November 12, 2013, at http://www.china.org.cn/china/third_plenary_session/2014-01/15/content_31203056.htm

[35] "Convening of the Thi d Meeting of the Inter-Ministerial Coordination Small Group for Military-Civil Fusion Integrating Weapons Research and Production Systems" (军民结合、寓军于民武器装备科研生产体系建设部际协调小组第三次会议召开), State Administration of Science, Technology and Industry for National Defense, June 27, 2014, at http://www.sastind.gov.cn/n112/n52194/c353791/content.html.

[36] In all fi e Small Group press announcements, incumbent CMIPD directors are dual hatted as directors of the Small Working Group. CMPID directors include Tu Senlin (屠森林; 2008-2013), who now serves as director of MIIT's International Cooperation Department, and Yin Weijun (尹卫军; 2013-present).

[37] See "Convening of the Thi d Meeting of the Inter-Ministerial Coordination Small Group for Military-Civil Fusion Integrating Weapons Research and Production Systems" (军民结合、寓军于民武器装备科研生产体系建设部际协调小组第三次会议召开), State Administration of Science, Technology and Industry for National Defense, June 27, 2014.

[38] "SASTIND Deepening Military-Civil Fusion Development Opinions" (国防科工军民融合深度发展意见正制定), March 7, 2016, *Finance Sina* (新浪财经), at http://finance.sina.com.cn/stock/hyyj/2016-03-07/doc-if qaffy3692868.shtm .

[39] Zhang Tao, "China Eyes Strategic Development of Defense Industry," *China Military Online*, June 5 2015, at http://english.chinamil.com.cn/news-channels/china-military-news/2015-06/05/content_6526899.htm; and "National Defense Science, Technology, and Industry Development Strategy Committee Convenes Second General Meeting" (国防科技工业发展战略委员会召开第二次全体会议), State Administration of Science, Technology, and Industry for National Defense, July 7, 2016, at http://www.gov.cn/xinwen/2016-07/10/content_5090029.htm.

[40] "2016 SASTIND Military-Civilian Fusion Special Action Plan" (2016年国防科工局军民融合专项行动计划), State Administration of Science, Industry, and Industry for National Defense, March 2017, at http://www.sastind.gov.cn/n157/c6357580/content.html.

[41] See Brian Laffe ty, Aaron Shraberg, and Morgan Clemens, "China's Civil-Military Integration," *Study of Innovation and Technology in China (SITC) Research Brief*, January 2013.

[42] Li Andong, "Implement the Scientific evelopment Concept, Strengthen the Strategic Direction of Armament Building," *China*

[43] See Tai Ming Cheung, Thomas Mahnken, Deborah Seligsohn, Kevin Pollpeter, Eric Anderson, and Fan Yang, "Planning for Innovation – Understanding China's Plans for Technological, Energy, Industrial, and Defense Development," report prepared for the U.S.-China Economic and Security Review Commission, July 28, 2016, p. 23

[44] See "SASTIND & All-China Federation of Industry & Commerce Strategic Cooperation Framework Agreement" (国防科工局与全国工商联开展战略合作), National Military-Civil Fusion Public Service Platform (国家军民融合公共服务平台), May 31, 2016, at http://jmjh.miit.gov.cn/newsInfoWebMessage.action?newsId=15264&moduleId=1062.

[45] See Yao Jianing, "Civil-Military Integrated Technology and Equipment Expo Opens," *China Military Online*, July 8, 2015, at http://eng.mod.gov.cn/TopNews/2015-07/08/content_4593651.htm.

[46] Zhao Lei, "Beijing Wants Private Financing for Weapons and Military Equipment," *Xinhua News*, December 27, 2015, at http://news.xinhuanet.com/english/china/2015-12/27/c_134955230.htm

[47] See Yao Jianing, "Civil-Military Integrated Technology and Equipment Expo Opens," *China Military Online*, July 8, 2015.

[48] In addition to general-purpose equipment, private firms also delivered high-speed patrol boats used by the PLA Navy in the Gulf of Aden. See Yao Jianing, "Private Sector Speeds Up Participation in Military Industries," *China Military Online*, May 21, 2016, at http://english.chinamil.com.cn/news-channels/china-military-news/2015-05/21/content_6501865.htm.

[49] Jon Grevatt, "China's CASIC Seeks Greater Engagement With Private Sector," *IHS Jane's Defence Weekly*, May 5, 2016, at http://www.janes.com/article/60008/china-s-casic-seeks-greater-engagement-with-private-sector.

[50] Yao Jianing, "1,000 Private Sector Enterprises Obtain Weapon Production Permits," *China Military Online*, March 15, 2016, at http://english.chinamil.com.cn/news-channels/china-military-news/2016-03/15/content_6961187.htm.

[51] See Yao Jianing, "Private Sector Speeds Up Participation in Military Industries," *China Military Online*, May 21, 2016.

[52] These include the " ilitary Technology Conversion Directory" (军用技术转民用推广目录) and the "Mincanjun Technology and Product Promotion Directory"(民参军技术与产品推荐目录).

[53] See Yao Jianing, "Private Sector Speeds Up Participation in Military Industries," *China Military Online*, May 21, 2016.

[54] One example of this point in action is the 2013 SASTIND SCFA with Guizhou Province in which Guizhou officials pledge thei commitment to the "military-civil fusion economic development path." See Zhang Yang (张扬), "Guizhou Party Secretary Chen Miner Meets MIIT Vice Minister and SASTIND Director Xu Dazhe" (陈敏尔省长会见工业和信息化部副部长兼国家国防科技工业局局长马兴瑞一行), *Guizhou Daily* (贵州日报), July 31, 2013, at http://www.ddCCP.cn/2013/07/31/95641.html.

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Appendix 1

China's Defense Industry Groups

Source: SASTIND

Appendix 2

Table National MCF Demonstration Bases

Name (English)	Name (Chinese)	City/ District	Province/ Municipality	Industry/ Technology Focus	Description
Xi'an Weaponry Science & Technology Industrial Base	(航天)陕西西安市	Xi'an	Shaanxi	Aerospace, New Energy, New Materials, Advanced Equipment Manufacturing	Comprises 5 MCF demonstration zones: 1) Xi'an National Civil Industrial Base (space launch vehicles, satellite communications, navigation, satellite remote sensing, aerospace IT, new aerospace materials); 2) Xi'an Weapon Industry Technology Industrial Base (advanced equipment manufacturing, optoelectronics, new materials, new energy); 3) Xi'an Shipping Science & Technology Industrial Park (more than 20 MCF projects completed); 4) Hanzhong Aviation Industrial Park (aviation); and 5) Weinan Pucheng General Aviation Industrial Park (host of the China International General Aviation Convention).
Inner Mongolia Baotou Qing-shan District	内蒙古包头青山区	Baotou	Inner Mongolia	Heavy Industry, Equipment Manufacturing	Officially designated as a ational Northwest Heavy Industry and National Defense Research and Production Base. Baotou Equipment Manufacturing Industrial Park is engaged in manufacturing heavy vehicles, new energy, railway, electromechanical, and engineering equipment. It has seven sub- parks: 1) Baotou High End Equipment Park; 2) Emerging Industrial Park; 3) Beida (Beijing University) Science & Technology Industrial Park; 4) Lide Motor Center; 5) Small and Medium-sized Private Industry Park; 6) Supporting Park for Production and Living; and the 7) Sino-German Equipment Industrial Park.
Hubei Xiangyang Fangcheng District	湖北襄阳樊城区	Xiangyang	Hubei	Aviation, Aerospace, Biopharmaceuti cals, Electronic Product Manufacturing, Equipment Manufacturing	Xiangyang has received more than $33 billion in investment and has more than 42 MCF projects involving state owned defense groups completed or underway. Notables include: 1) AVIC's commercial aircraft seat assembly plant and carbon fiber p oject led by Factory 5713 (engine maintenance and production); 2) a polymer film p oduction project; 3) the China Railway 11th Bureau's equipment manufacturing base; 4) Xinxing Heavy Industry's light alloy R&D and production base (automotive components). The e are also ongoing projects by China South Industries Group and China North Industries Corporation.

Name (English)	Name (Chinese)	City/ District	Province/ Municipality	Industry/ Technology Focus	Description
Hubei Xiaogan Economic Development Zone (Xiaogan High-Tech Zone)	孝感经济开发区(孝感高新区)	Xiaogan	Hubei	Automotive, Optoelectronics, Advanced Equipment Manufacturing (Electrical and Mechanical Equipment), Biomedical	Initially formed as a provincial development zone in 1997, the Xiaogan municipal government has pushed to "speed up" the development of the zone as a high-tech hub "boosting military enterprise innovation." The one is a national research and production base for high-tech aerospace products and home to at least 18 military enterprises: China Electronics Technology Group Factory 4404; NORINCO Factory 238; CASIC Base 066; CNNC's 309th Brigade Central-South Geological Bureau; Hubei Hongyang Machinery Factory; Hubei Huazhong Photoelectric Science and Technology Ltd.; and China Sanjiang Space Group.The one is currently comprised of three parks: 1) Xiaogan Sanjiang Inudstiral Park, 2) Hanguang Technology Park (optoelectronics), and 3) Huazhong Photoelectronic Industrial Park.
Zhuzhou Civil- Military Integration Industry Base	株洲军民结合产业基地	Zhuzhou	Hunan	Aviation, Electronics, Mechanical Transmission	Designated as China's only "Small and Medium-sized Aeroengine Industrial Base," aviation is Zhuzhou's "pillar industry." The base aims to develop a complete general aviation industry chain. It is comprised of at least 61 companies, 18 of which are aviation firms. irms includes a number of AVIC subsidiaries and joint ventures researching and manufacturing helicopter transmission systems and engines, gas turbine and piston engines, and UAVs.The base includes the: 1) "General Aviation Engine Industry Technology Innovation Strategic Alliance" comprised of 18 companies, universities, and research institutes, including Tsinghua University and the Beijing Institute of Aeronautical Materials; 2) AVIC non- Aviation Industrial Park (Precision Transmission Project), formed in 2011 with roughly $4.5 billion in total investment to develop and produce electric power steering (EPS) systems and wind turbines; 3) Hunan AVIC General Aviation Engine Company—a joint venture between Southern Airlines Hunan Zhuzhou Power Machinery Company (Factory 331), China Aviation Power Machinery Research Institute (Unit 608), Hunan Xiangjiang Industrial Management Co., and Zhuzhou State-owned Assets Investment Holding Group Co. to design, produce, market, and provides after-sales services for civil turboshaft, turboprop, and piston aeroengines. CAIGA also signed a formal agreement with Zhuzhou Base in 2011.

Name (English)	Name (Chinese)	City/ District	Province/ Municipality	Industry/ Technology Focus	Description
Sichuan Mianyang High-Technology City	四川绵阳科技城	Mianyang	Sichuan	Aviation, Nuclear Physics, Advanced Manufacturing	Referred to as an “important” defense industry research, production, and human capital base, Mianyang High-tech Industrial Development Zone is home to more than 100 enterprises operating in a diverse set of sectors including, new materials, remote telemetry, nuclear physics and radiology, radar, and aircraft engines.This includes military research institutes, universities, and defense industry groups (e.g. China Academy of Engineering Physics and Southwest University of Science and Technology). Industrial projects are focused on accelerating the construction of MCF to promote technological, product, and industrial innovations.The pa k hosts Asia’s largest aerodynamics R&D center and is constructing China’s largest experimental aero-engineering test site.According to MIIT, Mianyang prioritizes international cooperation and “active industrial conversion” with notable investments from Foxconn, Emerson, Lafarge, and many other Fortune 500 companies.
Sichuan Guangyuan Military-Civil Fusion Industrial Park	四川广元军民结合产 业园	Guangyuan	Sichuan	Electronics, Nonferrous Metals, Food & Beverage, New Energy, New Materials, Biopharmaceu-ticals	Guangyuan MCF Industry Base is a large-scale scientific esearch and production base for electronic equipment and components. It is the headquarters of Factory 081, a state owned telecommunications firm. ccording to MIIT, the base comprises three core parks: 1) Tashan Bay MCF Industry Park; 2) Factory 081 Industrial Park; and 3) Changhong Industrial Park. Guangyuan officials h e identified building an active financing platform th ough bank loans and foreign investment to develop the base.Top priorities include forming a complete electronics industrial chain to promote the industrial transformation, upgrading, and expansion of military radar, fi e control systems, civilian radar systems, electronic equipment, microwave components, speciality electronic materials, new energy, and raw electronic materials.

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Guiyang Economic & Technology Development Zone	贵阳经济技术开发区	Guiyang	Guizhou	Aviation, Aerospace, Heavy Equipment, Automotive, Home Appliances	A key part of Guizhou Provinces' economic development and industrial transformation strategy.The one is home primarily to aerospace and aviation defense enterprises, but also attracts equipment manufacturing enterprises. According to MIIT, the zone encompasses a number of industrial clusters: 1) Guizhou Aerospace Electronics cluster; 2) AVIC MCF High-Tech Industrial Park; 3) Guiyang Haisense Electronics Industry Park; and 4) the Guiyang Meng Equipment Manufacturing Eco-industrial Park. The one has more than 51 equipment manufacturers; ten aviation enterprises producing aeroengines, hydraulic components, and aircraft control systems; four aerospace enterprises producing aerospace equipment, couplings, and oil equipment; eight automotive enterprises producing anti-theft systems and motors; two electronics manufacturers producing LED TVs and surface mount technology; and 22 equipment manufacturers producing hydraulic excavators, bearings, high strength bolts, etc. By 2015, the zone aims to have an annual production value of RMB 50 billion ($7.5 billion).
Beijing Daxing District Military-Civil Fusion Industrial Base	北京大兴区军民结合产业基地	Daxing	Beijing	Aerospace, Advanced Manufacturing, New Materials, New Energy, Emergency Response Equipment	A key part of the Beijing governments effo ts to promote MCF projects and the "two-way transfer of civilian technologies." The one focuses on strategic emerging industries and is home to more than 52 MCF enterprises operating in the aerospace, aircraft, steel, and electronics industries.The one serves as the headquarters for some Chinese defense enterprises—Long March Rocket Technology Co. and the China Aerospace Architecture Design & Research Institute. AviChina Industry & Technology Co., NORINCO, and the China Nuclear (Beijing) Instrument Factory also operate in the zone. According to MIIT, the zone will comprise: 1) a MCF park built by the Beijing Municipal government and the PLA Navy; 2) the China Aerospace Science & Technology Group High-tech Manufacturing Industry Base; 3) a Beihang "Conversion" Industrial Park; and 4) a AVIC International Science & Technology Park. By 2015, the Base aims to reach total revenues of RMB 100 billion ($15 billion), total production value of RMB 500 billion ($75 billion), fi e MCF enterprises with annual revenues of at least RMB 10 billion ($1.5 billion) and ten with at least RMB 1 billion ($150 million).

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Hebei Handan Economic Development Zone	河北邯郸经济开发区	Handan	Hebei	High-tech Equipment, New Energy, New Materials, Information Technology	Hebei's Handan Economic Development Zone spans more than 260 acres and plans to accommodate more than 100 MCF enterprises. It is one of fi e MCF zones identified in the ebei Military-Civil Fusion Industry Development Platform (2014-2020). In addition to a range of preferential investment policies supporting the zone's development, the Handan municipal government is deploying a RMB 50 million ($7.5 million) investment fund to support MCF conversion projects. More than RMB 1.5 billion ($226.3 million) in financing for the zone is coming from a the Hebei Economic Development Zone and the Provincial Science & Technology Department. According to MIIT, the zone's objectives are: 1) improve and develop a spin-off technology con ersion system; 2) strengthen support for key MCF projects; and 3) cultivate a "first batc " of key MCF enterprises. Significant in estment has been made to build the China Shipbuilding Corporation Handan High-tech Industrial Base, the Emerging New Energy and Energy Storage and Equipment Industrial Base, and the Hanguang Photoelectric Industry Park. One of the zone's policies identifies "implementing" Institute 718's "78 science and technology conversion projects," referencing China Shipbuilding Industry Corporation's Research Institute 718, which is based in Handan and is a national scientific esearch institute conducting scientific esearch on high- energy chemistry, hydrogen generation and development, special gases, and environmental engineering.

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Harbin Economic & Technology Development Zone	哈尔滨经济技术开发 区	Harbin	Heilongjiang	Aerospace, Advanced Equipment manufacturing, Automotive	Harbin Economic & Technology Development Zone prioritizes equipment manufacturing. Projects include: 1) AVIC's Hafei Airbus Composite Manufacturing Ltd's Y12F aircraft development and Z15 helicopter development projects; 2) Hafei Motor's electric car project; 3) Harbin First Machinery Group's (NORINCO subsidiary) all terrain vehicle assembly project; 4) CSIC Institute 703 and Harbin Steam Turbine Plant Co.'s joint natural gas compression and turbine R&D and manufacturing base; 5) Harbin Dongan Auto Engine Co.'s variable valve timing (VVT) engine development and manufacturing project; 6) Harbin Fenghua Aerospace Science & Industry Co.'s LNG vaporizer development and manufacturing project. Harbin plans to construct an Aerospace Industrial Park leveraging China Aerospace 3rd Institute and Harbin Fenghua Aerospace Science & Industry Co. resources, and a Nuclear Technology Applications Industry Base with the China Institute of Atomic Energy.The base will include applied research and radiation labs, as well as a training and technical analysis and testing center.
Shanghai National Civil Aviation Industry Base (Minhang District)	上海国家民用航天产 业基地 (闵行区)	Minhang	Shanghai	Aerospace, Aviation, New Energy	Shanghai's Minhang District MCF Base combines R&D centers and industrial zones supporting the development of leading enterprises "leapfrogging" development in key technologies in aerospace, aviation, and new energy industries. The bases th ee zones are: 1) Space Science and Technology R&D Center—made up of more than 6,000 personnel working at the Shanghai Academy of Spaceflight Technology, Shanghai Electrical and Mechanical Research Institute, the Shanghai Institute of Satellite Engineering and 17 other research institutes to develop and test rocket, satellite, manned spacecraft, and anti-aircraft applications; 2) Aerospace Science and Technology Industrial Base—comprised of two sub-bases which include the a) satellite navigation applications industry base, which is jointly overseen by the Shanghai Municipal Government, Minhang District Government, PLA General Staff epartment, and GAD, and b) the new energy industry base, which is focusing on achieving complete lithium-ion battery and solar photovoltaic cell production chains. According to MIIT, the Shanghai Municipal Government formed a RMB 300 million ($44.97 million) satellite navigation industry development fund to invest in early growth companies operating within the base. By 2020, the base aims to reach an annual output value of 70 billion RMB ($10.56 billion).

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Nigbo Yinzhou District Military-Civil Fusion Industry Base	宁波鄞州区军民结合产业基地	Yinzhou	Ningbo, Zhejiang	Advanced Equipment, Electronic and Information Technology, New Materials, New Energy	According to MIIT, the Ningbo MCF base aims to be a key vector promoting regional industry upgrading and economic development.The bas has four main parks focusing on equipment manufacturing, electronic and information technology, textiles and apparel, and new energy and new materials.
Anhui Wuhu High- tech Industry Development Zone	安徽芜湖高新技术产业开发区	Wuhu	Anhui	Electronic and Information Technology, Aviation, Shipbuilding, Large Equipment	The Wuhu High-tech Industry Development Zone has four main MCF industry clusters: 1) electronic and information technology with Anhui's East China Optoelectronics and Technology Institute as the "leading enterprise"; 2) aviation equipment manufacturing and services led by the PLA's 5720 Factory, which is focused on aircraft equipment repair; 3) shipbuilding, which includes the Wushu Xinlian Shipbuilding Co. and China Changjiang National Shipping Group focused on ship manufacturing technologies; and 4) heavy equipment (e.g. iron pipes and large castings) manufactured by Wuhu Xinxing Ductile Iron Pipes Co. According to MIIT, the Wuhu government plans to invest RMB 50 million ($7.5 million) annually to help fund MCF projects.The bases key goal is to implement 4 MCF projects with total investment over RMB 15 billion ($2.24 billion).
Anhui Hefei High-tech Industry Development Zone	合肥高新技术产业开 发区	Hefei	Anhui	Electronic and Information Technology	Hafei's High-tech Industrial Development Zone is home enterprises producing "advanced technology products." The ones MCF development goals aim to support "national scientific and technologica innovation," "brand building," and "independent innovation." The one is home to a number of Chinese IT enterprises, including: 1) China Electronic Technology Group's Research Institute 308, which is considered to be the "backbone" enterprise in the base's military electronics sector (it's also the main supplier of radar equipment for the PLA); 2) Hefei Meiya Optoelectronic Technology Inc.; and 3) Anhui USTC iFlytek Co., which produces voice recognition software.The ones MCF development and promotion strategy outlines constructing fi e high-tech enterprise incubators, forging joint-ventures and cooperation agreements with large technology companies, attracting human capital from within China and abroad, and issuing favorable investment and financing policies, includin opening up investment in some MCF projects to foreign investors.The one aims to reach total output value of RMB 100 billion ($15 billion) by 2020.

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Jiangxi Jingdezhen Military-Civil Fusion Industry Demonstration Base (Helicopters)	景德镇军民结合产业 示范基地 (直升机)	Jingdezhen	Jiangxi	Aviation (helicopters), Automotive, Appliances	Designated as an integrated helicopter R&D and production base with the aim of strengthening China's "aviation brand." While aviation is the top industry priority, the base is home to more than 200 enterprises across sectors (e.g automotive, household appliances).The base is comprised of four parks: 1) Aviation components and parts; 2) Helicopter assembly, approved by the Jiangxi NDRC bureau; 3) Helicopter R&D park; and 4) "International cooperation." A number of large state owned defense enterprises operate in the base, notably: a) AVIC Changhe Aircraft Industries Corporation; b) Jiangxi Changhe Automobile Co.; c) AVIC's China Helicopter Research & Development Institute (leading China's high altitude U8 unmanned helicopter program); d) Jiangxi Jinhang Aviation Forging & Casting Co.; and e) Huayi Compressor Co. In addition to preferential tax incentives, the Jiangxi Provincial Government is offering aviation firms operating in the base financial subsidies low interest loans, and direct financing for R&D projects.
Hunan Pingjiang Industrial Park Zone	湖南平江工业园区	Pingjiang	Hunan	High-tech Equipment Manufacturing, New Materials, Electronics and Information Technology	Home to more than 115 state owned and private enterprises, Hunan Pingjiang Industrial Park is comprised of four sub-parks: 1) Explosive Materials Industrial Park—China's largest industrial explosives park, produces dual-use explosives and explosive materials. Leading enterprises include, Australian-based Orica, Hunan Nanling Industry Explosive Material Co., Hunan Shenfu Group Co., a leader in the development and production of military products used by PLA (e.g. Second Artillery Corps, aka Army Rocket Force); 2) Advanced Equipment Manufacturing Park—12 enterprises and fi e active MCF projects. Leading enterprises include,AVIC Liyuan Hydraulic Co., Hunan Kunyu Heavy Industries Group, Sany Group, Zoomlion; 3) New Materials Industrial Zone—producing fledspar and synthetic mica p oducts for use in household and military appliances. Lead enterprise is Hunan Zhongnan Gold Smelting Co.; 4) Electronics and Information Technology Industry Park—producing advanced integrated circuit boards, IT platforms for military and civilian use. Industry leader is PLA Factory 6906, which conducts R&D and manufactures military radar, radio, communications, and satellite navigation equipment. It is also involved in China's Beidou satellite navigation program.

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Lanzhou Economic and Technology Development Zone	兰州经济技术开发区	Lanzhou	Gansu	High-end Aviation and Aerospace Equipment, New Materials, Nuclear,	According to MIIT, the Lanzhou Economic and Technology Development Zone comprises four zones supporting high-end aviation and aerospace equipment, new materials, and nuclear industry MCF projects. Lanzhou officials e actively seeking central government, provincial government, and military funds earmarked for MCF projects to support zone development. Funds or grants for MCF projects are also being provided by the "Lanzhou Industry Development Fund." Leading enterprises operating in the zones include, Gansu Lanke Petrochemical Equipment Co., CNNC Lanzhou Nuclear Controls Co., and Lanzhou Dachang Technology Co.
Kunming Economic and Technology Development Zone	昆明经济技术开发区	Kunming	Yunnan	Optoelectronics, High-end Equipment Manufacturing, Industrial Explosives	Yunnan's premier industry development zone is comprised of three core parks: 1) the Optoelectronics Industry Base, 2) the Kunming Shipbuilding Industry Park, and 3) the Aerospace Industry Park. Other bases or parks include the Kunming Haikou Industrial Park, and the Yunnan Civil Explosives Group Industry Park. The one's high-end equipment manufacturers are primarily engaged in water testing and logistics automation systems. Optoelectronics enterprises are developing and producing infrared night vision, solar cells, optoelectronic information materials, OLED flat panel displays, electromechanical equipment, and solar cells. Led by the Yunnan Civil Explosives Group, industrial blasting and equipment enterprises produce blasting equipment, advanced explosives, and detonators. Leading enterprises across the zones include: Kunming Shipbuilding Equipment Co.,; NORINCO subsidiary North Night Vision Technology Co.;CASIC subsidiaryYunnanAerospace Industry Co.; Kunming Yunnei Power Co.; Yunnan Yunkai Electric Co.; and Yunnan Tianda Photovoltaic Co.The one aims to develop an infrared thermal imaging system industry chain, logistics automation industry chain, PV industry chain, and become an "important" MCF demonstration base in western China.

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Liaoning Tieling Economic and Technology Development Zone Special Vehicle Production Base	辽宁铁岭经济开发区专用车生产基地	Tieling	Liaoning	Automotive, manufacturing, new materials, electronics, aviation	The base has mo e than 70 enterprises engaged in dual-use special vehicle R&D, new materials research, communications and electronics product R&D, and aircraft engine testing. In 2009, AVIC's Shenyang Aeroengine Research Institute (Institute 606), which designs military aircraft engines, and the Liaoning Jihua Group relocated to the Liaoning Special Vehicle Manufacturing Base. Other key enterprises operating in the base include: AVIC subsidiary Liaoning Luping Machinery Co., which provides special vehicle refitting se vices for civilian and military use;Tieling Changtian Mechanical and Electrical Co.; and Tieling Rubber Research Institute. The Liaoning rovincial Government provided RMB 1 billion ($150.7 million) to construct the zone with an additional RMB 1.5 billion ($226 million) raised by the city of Tieling through bonds.The one aims to upgrade Tieling's military industry and reach RMB 100 billion ($15 billion).
Hunan Luoyang Jianxi District	河南洛阳涧西区	Jianxi, Luoyang	Henan	Advanced Equipment Manufacturing, New Materials, Trade & Logistics Services	Jianxi District is designated as Luoyang's industrial, science and technology, military, and defense technology industry zone. It is home to more than 500 enterprises, research institutes, and universities. According to MIIT, the zone seeks to strengthen the transfer of high-tech products between military and civilian enterprises and aims to cultivate a large number of MCF enterprises. The ones new materials industry is focused on researching high-strength, anti-corrosive and protective materials, as well as ferrous and non-ferrous materials used in aviation, aerospace, ships, electronics, and light industry. Leading enterprises include: 1) CSIC Research Institute 725 (conducts R&D on ship materials); 2) Zhonggang Group Fire Resistant Material Co.; 3) Chinalco Luoyang Copper Co.; and 4) Luoyang Xinhuaxia Automotive Chainstore Co. Jianxi District is providing RMB 10 million($1.5 million) annually to support MCF projects carried out in the zone.According to MIIT, Luoyang City is also funding high-tech research projects from the National 863, 973, and 520 Programs.

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Hunan Xiangtan Yuhu District Military-Civil Fusion Industry Demonstration Base	湘潭雨湖区军民结合产业示范基地	Yuhu, Xiangtan	Hunan	Advanced Equipment Manufacturing, Automotive, Electronics,	Yuhu District MCF Industry Demonstration Base is a located within the Xiantan Economic and Technology Development Park.The base is focused on developing a number of MCF industries including, automotive parts, solar PV, electronic and information industry equipment, and advanced manufacturing. Leading enterprises include: 1) Jianglu Mechanical and Electrical Technology Co.; 2) Hunan Xiangdian Group; 3) Jiangnan Industry Group Co.;and 4) Hunan Jiangbin Machinery Co.Xiangtan City andYuhu District have established an MCF industry development fund providing a combined RMB 35 million ($5.3 million) annually to companies engaged in MCF projects.
Chongqing Bishan Industrial Park Zone	重庆璧山工业园区	Bishan	Chongqing	Automotive	Bishan Industrial Park's MCF activities focus on developing and supporting automotive enterprises.The base has mo e than 700 enterprises, including some 370 automotive enterprises with a total annual output value of RMB 38 billion ($5.7 billion). Bishan's Auto Parts Industry Base produces motorcycles, automobile engines, and special vehicles. It's also engaged in automobile transmission and automotive brake assembly. Leading enterprises include the Chongqing Jinguan Automobile Manufacture Co. and Chongqing Huxi Electric Motor Co.The Chongqing Municipal Government has already invested more than RMB 500 million ($75.3 million) in enterprise and technology upgrading projects to support base development. More than RMB 200 million ($30 million) of investment has been deployed through a series of municipal funds such as the "Industry Strengthening County Fund," "Informatization Special Fund," and "IPR Special Funds."

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Shaanxi Hanzhong Aviation Industrial Park (Aviation)	陕西汉中航空产业园(航空)	Hanzhong	Shaanxi	Aviation	Hanzhong Aviation Industrial Park is an aviation manufacturing industry cluster with more than 130 enterprises.The pa k consists of a medium transport aircraft and special professional development base, landing gear development and production center, and a flight data management system de elopment and production center. Enterprises are engaged in researching, developing, and manufacturing medium-sized military and civilian transport aircraft, avionics, precision machinery, and tools.Th base supports the integration of AVIC subsidiary Shaanxi Aircraft Corporation's "special transport aircraft." Leading enterprises include: 1) Shaanxi Huayan Aviation Instrument Co.; 2) AVIC Shaanxi Qianshan Avionics Co.; 3) Hanzhong 101 Aviation Electronics Equipment Co.; and 4) AVIC subsidiary Zemic Instruments Co. According to MIIT, the base plans to attract investment for a "large aircraft project" carried out by AVIC, COMAC, and Xi'an Aircraft Corporation and is targeting cooperation with "Boeing, Airbus, and other foreign aviation companies." The base is also exploring n w avenues for attracting investment from small and medium-sized US and European aviation firms.Three RMB 10 million ($1.5 million) investment funds have been set up by the park to "encourage and promote high-tech development and industrialization." Th zone aims to construct a world renowned turboprop aviation industry and become China's "core" high-tech aviation industrial park by 2021-2030.
Jiangsu Danyang	江苏丹阳	Danyang	Jiangsu	Aviation, Aerospace, New Materials	Danyang has more than 200 enterprises producing "military products," with a number of enterprises receiving Program 973 funding. According to MIIT, Danyang aims to become China's largest carbon fiber and composite materials production base, and the country's largest superalloy industry cluster. Danyang is working to attract more than 30 provincial level R&D institutes to provide technical support for its MCF industry. By 2020, Danyang aims to have two MCF zones.The first focusing o high performance composite materials, airborne equipment, satellite communications, satellite navigation, and remote sensing with a target annual output value of RMB 120 billion ($18 billion).The other one will focus on developing superalloy materials, aircraft parts, airport logistics, and advanced equipment manufacturing with a target annual output value of RMB 80 billion ($12 billion).The ones leading enterprise is Jiangsu Hengshen Fiber Materials Co.

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Guizhou Zunyi Economic and Technology Development Zone	贵州遵义经济技术开发区	Zunyi	Guizhou	Aviation, Advanced Equipment	The unyi Economic and Technology Development Zone has more than 70 MCF enterprises and is implementing mechanisms promoting resource and talent sharing to develop its MCF industry. Leading enterprises include Guizhou China Aerospace Science & Industry Group and Guizhou Aircraft Industry Group.
Xi'an Ordnance Industrial Technology Industry Base	西安兵器工业科技产业基地	Xi'an	Shaanxi	New Materials, New Energy, Optoelectronics	The X'an Ordnance Industrial Technology Industry Base was established jointly by NORINCO and the Xi'an Muncipal Government to accelerate the integration of Shaanxi's military and civilian high-tech industries. Its formation led to the founding of the Xi'an Weapon Industry Technology Development Co.To date, the Base has completed more than 20 MCF projects with total investment of more than RMB 50 billion ($7.5 billion). The base is comprised of five parks: 1) Modern Defense Park—national special equipment research and production base. Northwest Industry Group Co. is the park's leading enterprise. It is also home to a joint venture project researching and producing airbag gas generators involving US-based TRW Automotive; 2) Equipment Manufacturing Park— automobile, new energy, and advanced equipment manufacturing industry cluster. Includes Northwest Industry Group Co.'s military supply and logistic projects, as well as a dual-use technology transfer center; 3) Optoelectronics Park—Beidou satellite, lasers, infrared and optical communications.Also includes an optical control systems development and production base; 4) New Materials Park—battery materials, optoelectronic display materials, high-performance fibers and composites, laser and fine chemical materials. ncludes Xi'an Modern Chemistry Research Institute's TFT color liquid crystal materials project and AVIC Shaanxi's navigation testing center. During the 13th fi e year plan (2016-2020) the zone aims to attract one or two RMB 5 billion projects ($750 million); two-three RMB 2 billion ($300 million) projects; complete 50 MCF projects; attract total investment of RMB 30 billion ($4.5 billion); and reach total output value of RMB 50 billion ($7.5 billion).

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Hebei Guan New Industry Demonstration Zone	河北固安新兴产业示 范区	Guan	Hebei	Aerospace, Nuclear, Advanced Manufacturing, Biomedical	Hebei's Guan New Industry Demonstration Zone consists of "one core, three parks, and a base." This saying eferences the zones core focus on developing emerging and innovative industries; its Aerospace Science and Technology Industry Park, Biomedicine Science Park, IT Industrial Park; and its Advanced Equipment Manufacturing Base.The zone has more than 35 aerospace defense projects with total investment of RMB 31.7 billion ($4.75 billion) and 167 MCF projects with total investment of RMB 20 billion ($3 billion). In 2012, the Langfang City Government and CAST signed an SCFA to invest RMB 30 billion ($7.5 billion) to construct the Aerospace Science &Technology Industry Park.A partnership agreement between the Guan zone and CAST has led to at least 35 projects being completed by CAST's 1st Academy (China Academy of Launch Vehicle Technology), 4th Academy (Academy of Aerospace Solid Propulsion Technology), 5th Academy (China Academy of Space Technology), 6th Academy (Academy of Aerospace Propulsion Technology), 9th (China Aerospace Times Electronics Corporation). During the 13th FYP, Guan zone plans to invest RMB 9 billion ($1.35 billion) to attract major projects, top research institutes, roughly 200 high-end MCF enterprises and achieve total external investment of RMB 100 billion ($15 billion).
Shanxi Changzhi Chengnan Industry Park	山西长治城南工业园 区	Changzhi	Shanxi	Equipment Manufacturing, New Materials, Optoelectronics	Changzhi's Chengnan park is one of Shanxi Province's "four integrations" or zones promoting MCF. The pa k has at least 30 MCF enterprises and aims to attract equipment manufacturers producing military products.The one is home to 14 provincial-level enterprise R&D centers, nine provincial-level high tech enterprises, and two major defense enterprise research centers. Leading enterprises operating in the zone include NORINCO subsidiary Huahai Industrial Group Co. and CASC subsidiary Changzhi Tsinghua Machinery Factory.

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Fujian Ningde Military-Civil Fusion Development Industry Park	宁德市军民融合深度发展产业园	Ningde	Fujian	Marine Industry, Shipbuilding, New Materials, Electrical Appliances, New Energy Vehicles	Construction of the Ningde MCF base is under development and is expected to be 200 sq. miles. The one's provincial level assessments have been completed and submitted to MIIT for final approval. Ningde City officials h e announced that the base will be comprised of: 1) an R&D and production and strategic reserve sub-base developing small and medium- sized military engines; 2) a new medicine industry base; and 3) a southeast coast guard agricultural product protection sub-base.The city has selected mo e than 30 firms making up its "first bat " of MCF enterprises. According to Ningde City officials letters of intent have been signed with Wuchang Shipbuilding Industry Group Co.,Tangshan Marine Heavy Industry Co., and the National University of Defense Technology.
Guangdong Zhanjiang High-tech Industry Development Zone	广东湛江高新技术产业开发区	Zhanjiang	Guangdong	Bio-medicine, Advanced Equipment Manufacturing, Electronics	Zhanjiang's military-civil fusion base will comprise 20 sq. miles consisting of three zones: 1) Zhanjiang Economic and Technology Development Zone; 2) "New East Island Zone"; and 3) Fenyong High-tech Zone.The base is positioning itself to become a "21st Century maritime silk road MCF demonstration zone." By 2020 the base aims to reach annual production value of RMB 50 billion ($7.5 billion).
Chongqing Liangjiang New Area Military-Civil Fusion Industry Demonstration Base	重庆两江新区军民结合产业示范基地	Liangjiang	Chongqing	Automotive, Electronics, Equipment Manufacturing	Liangjiang New Area is China's only inland sub-provincial level new area and the third nationwide—the other two being Shanghai's Pudong New Area and Tianjin's Binhai New Area. The Liangjiang MCF indust y demonstration base covers 38 sq. miles comprising the Yufu Industry Park, Longxing Industry Park, and the Shuitu Industry Park.The base is home to at least seven defense industry group enterprises engaged in military weapon and equipment R&D and production programs. Leading enterprises include: Changan Automobile Group, China South Industries Group Corporation, and the China Shipbuilding Industry Corporation.

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Dalian Dengshahe Industry Zone	大连登沙河产业区	Dalian	Liaoning	Aviation, Advanced Equipment Manufacturing, New Materials	A key part of Liaoning's broader coastal economic zone serving as the provinces' leading general aviation industry base, high-tech industry base, and steel manufacturing industry base.The MCF demonstration base has at least 14 enterprises primarily engaged in the aviation and steel sectors. According to MIIT, Dongbei Special Steel Group Co. and the Dalian Huicheng Aluminum Co. are working on special alloy steel and advanced aluminum import substitution projects in the MCF zone.Additionally,AVIC International has an aviation parts "alliance" with the base.The base will ha e access to a number of provincial-level programs supporting industrial development.This includes special funds" for overseas M&A.The base also plans to introduce an MCF industry platform and and sign "alliances" with MCF enterprises to support resource and information sharing. By 2020, the zone aims to have more than 40 MCF enterprises.
Zhangxing Zhengchuang National Military-Civil Fusion Demonstration Zone	长兴争创全国军民融 合发展示范区	Zhangxing/ Huzhou	Zhejiang	New Energy, Textiles	Designated as a national military-civil fusion base in February 2016.

Source: MIIT