

DATENNA INTELLIGENCE BRIEFING



China's Commercial Jet Engines Poised to Overcome a Long-standing Hurdle

**Advancements in heat resistance
for the CJ-1000A jet engine may
push China forward in the
aerospace field**

By Daniel Burke

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KEY FINDINGS

- China is close to completing certification and deployment of the CJ-1000A turbofan jet engine for civilian use. Reportedly, this engine was domestically produced and is not tied to international inputs.
- Reporting suggests the final barrier for China may be the required heat resistance levels that advanced engines are expected to maintain.
- If realized, this would represent a key step on China's road to self-sufficiency in advanced technological fields, and herald a new arrival in the international ecosystem.
- China has been working towards the goal of an advanced, domestically produced jet engine for decades. Russian technology was an early target for acquisition and duplication.
- Research projects and patents filings on ceramic matrix composite technology highlight the recent focus on heat resistance as a key limiting factor in the field.
- Procurements show that the Aero Engine Corporation of China is a large center of gravity for activity in the ecosystem, as well as the main organization developing the CJ-1000A.

WHAT HAPPENED

CJ-1000A Engine Nearing Certification for Civilian Field

China is [reportedly](#) closing in on completing its certification of the CJ-1000A [长江-1000A] turbofan jet engine. After more than a decade's pursuit of advanced aerospace technology, this step would represent a major improvement in the country's push for self-sufficiency in the field.

The [CJ-1000A](#) is a Chinese domestically-produced turbofan jet engine developed by the state-owned Aero Engine Corporation of China (AECC) (中国航空发动机集团). Its ultimate purpose is to serve as the power behind China's commercial jet ambitions, particularly the COMAC [C919](#) narrowbody airliner.

The CJ-1000A [features](#) thrust capabilities between 10,000–20,000 kgf and draws many comparisons to the CFM LEAP-1C engine currently powering the C919. Both engines feature similar overall body dimensions, with the CJ-1000A additionally supporting a two-spool design, a single-stage fan, three-stage booster, ten-stage high-pressure compressor, two-stage high-pressure turbine, a six-stage low-pressure turbine, and eighteen hollow titanium wide-chord fan blades.

However, despite the enthusiasm for the new engine, China is still to fully certify the CJ-1000A or its derivatives such as the CJ-2000. [Reportedly](#), one of the biggest hurdles encountered is managing the extreme heat present in modern advanced engines and the damage they can cause to systems. This is a barrier few countries have managed to overcome,



COMAC's [C919 Airliner](#).

and although the engine has had some successful test runs and use-cases, it has yet to be deployed anywhere near the numbers that were hoped.

WHY IT MATTERS

China Seeks to Reduce Foreign Dependency

If China can realize these reported breakthroughs and achieve a reliable and consistent commercial turbofan engine, it will enter the company of a small and select group of nations able to capitalize on the field. Currently, western countries like the United States, France, Russia, and the United Kingdom dominate the competition, but China is rapidly advancing and likely to break through into the field in the near future.

The Chinese government is motivated by a strong desire to reduce its foreign dependency as much as possible. Based on recent policy initiatives, China is acutely aware of the dangers of technology bottlenecks, overreliance on foreign inputs, and the leverage they provide to outside powers. For example, at least two major policy pushes, [Made in China 2025](#) and the [Dual Circulation](#) strategy were explicitly created to address foreign dependency. First released in 2015, Made in China 2025 [aimed](#) to nearly double the percentage of China's domestically produced key components from 40% to 70% by 2025. Likewise, the Dual Circulation strategy was [released](#) in 2020 with the goal of both reducing dependency on Western inputs to China's supply chains and improving China's domestic consumption numbers for more stable growth.

Taken together with the many other initiatives and punitive trade actions in recent years, it's clear China is focused on closing as many foreign supply bottlenecks as possible. If the CCP can effectively tackle these issues, Western nations will lose a key tool for shaping non-violent deterrence while allowing China to pursue its goals without the fear of effective retaliation from the international community.

HOW WE GOT HERE

Aerospace Development is a Long-standing Goal

Advanced aerospace jet engines have been a persistent area of weakness in China's above-mentioned push for self-sufficiency. Thus far, China's preferred method of catch-up has been to obtain, copy, and produce, but this may be changing as the PLA advances and faces diminishing returns from its ability to indigenize other militaries' breakthroughs.

When China first began modernizing its military away from massed infantry doctrines in the late 90's, it struggled with many of the advanced technical aspects required for cutting-edge systems. The PLA [pursued](#) a unique route for its national defense, buying what could from Russia and paying a premium for licenses to build the PLAAF J-11 multirole fighter as a copy of the Russian Su-27. However, shortly after receiving its first batch of fighters, China withdrew from the agreement and began producing its copies independently in violation of the licensing terms.

This pattern re-emerged when China first began to experience its difficulties with modern jet engines. By 2018, the PLAAF was [seeking](#) to upgrade the J-11D.



Chinese officer poses by the cockpit of an imported [Russian Su-27](#).

Despite Russia's loss of more than \$30 million from the failed deal with the PLAAF mentioned above, the Kremlin [agreed](#) to sell the advanced Su-35 and [include](#) a conspicuously high number of spare turbofan engines in the shipment. After receiving the agreed cargo, China appears to have then reverse-engineered the engines and implemented their design broadly to build out its aerospace sector without further input from Russia.

This history of theft, duplication, and implementation is still playing out today as one method for closing the aerospace gap. For example, in 2022 Chinese intelligence officer Xu Yanjun was [sentenced](#) to 20 years in U.S. federal prison for attempts to steal trade secrets from aircraft engine manufacturers GE Aviation and the Safran Group. Xu operated a group of 11 individuals who sought to develop relationships within the aviation companies that would eventually become assets within the field and deliver critical industrial techniques to China.

WHAT WE FOUND

Ceramic Matrix Composites Trace China's Development

However, importing critical knowledge from abroad isn't the only method China is pursuing to obtain this key technology. Alongside these external actions, China has also been pursuing domestic efforts to build up its capabilities through research, development, application, and deployment.

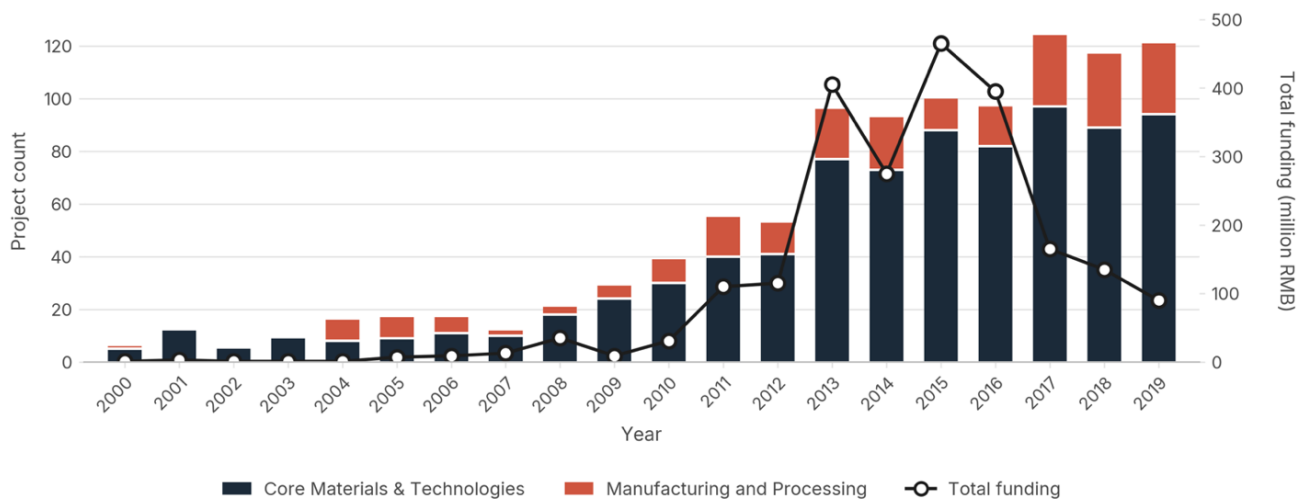
As mentioned above, a major roadblock to fully developing advanced jet engines is the large amount of heat resistance necessary in their components. [Ceramic matrix composite](#) (CMC) components are high-performance structural materials that combine ceramic matrices with continuous fiber reinforcement, enabling superior strength retention, oxidation resistance, and damage tolerance at temperatures far beyond the limits of advanced metallic alloys. These composites maintain structural integrity and mechanical properties in operating environments exceeding 1,400°C, while also offering significantly lower density and weight. These combined factors represent a critical advantage for aerospace applications requiring low weight and high thermal resistance such as turbine blades, vanes, combustor liners, and exhaust nozzles.

The development and production of CMCs presents a complex, multi-layered technological challenge spanning materials science, chemical precursor synthesis fiber manufacturing, densification processing, and component integration. Each stage requires specialized equipment, process control, and accumulated manufacturing know-how that can take decades to develop. Because of this, and the repeated [mentions](#) of heat resistance affecting China's ability to produce a reliable domestic turbofan jet engine, these key components may well form an approximation of China's advanced jet engine field as a whole.

Chinese research projects first began to focus heavily on the core materials and enabling technologies that go into developing advanced CMCs in the early 2010's, especially in 2013. Used as a benchmark for summarizing the ecosystem, data on China's National Natural Science Foundation (NSFC), Ministry of Science and Technology (MOST), and various provincial funding sources point towards continued interest in the field, and increased support for developing involved manufacturing and processes.

It appears that the largest contributors to these research projects are military-affiliated organizations. The top entity in Datenna's datasets is the Harbin Institute of Technology, one of the "[Seven Sons](#)" of national defense and a major contributor to China's rocketry and space programs. The second and third top contributors towards this research are Northwestern Polytechnical University and China's National University of Defense Technology. The former is also a member of the Seven Sons, while the latter is formally under the control of the People's Liberation Army. This military affiliation likely points towards the inherent dual-use nature of aerospace applications.

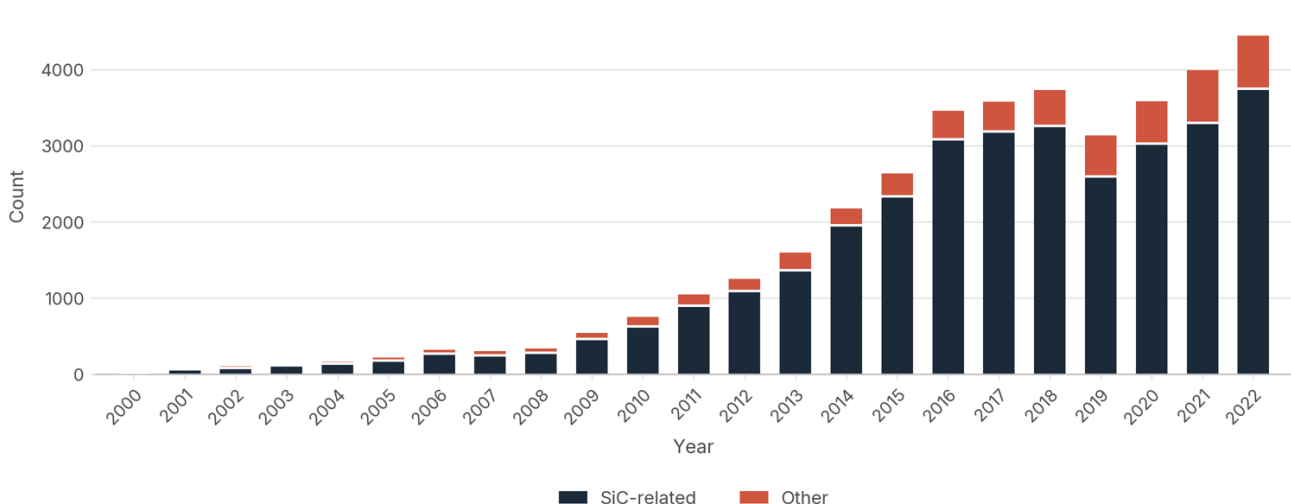
CMC Research Projects, 2000–2020



Project count by category (bars) against total funding in million RMB (line). Source: Datenna.

A number of key trends emerge as research from these projects matured and developed into patented technology, processes, and techniques. Foremost, in the patent corpus “silicon carbide” (SiC) is present as a key term in nearly 85% of filed patents, remaining consistently high as a percentage of output compared with all “other” categorizations. This concentration reflects SiC’s position as the most mature and widely adopted material system for both CMC fibers and matrices.

CMC Patent Publications by Filing Year, 2000–2022

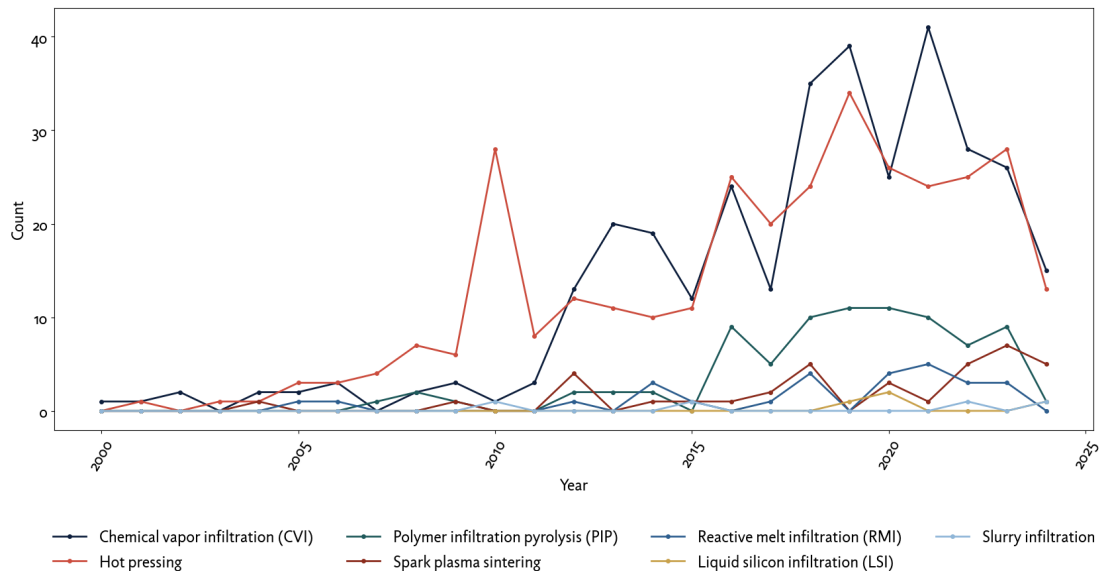


Patent publication count by filing year. Source: Datenna.

Regarding manufacturing technologies, the graph below indicates how frequently various methods of matrix infiltration and densification are mentioned in patent titles or abstracts over time. “Chemical vapor infiltration” and “hot pressing” are the most frequently mentioned, suggesting they are mainstream methods. “Polymer

infiltration pyrolysis” began picking up in frequency starting in 2007. The remaining methods are mentioned significantly less frequently. “Slurry infiltration” and “liquid silicon infiltration” are relatively new approaches, emerging first in 2010 and 2019 respectively. Although overall patents appear to have declined in 2024, these downwards trends are more likely an indication of publication lag rather than an actual decrease in manufacturing technology patents.

Manufacturing Technology Types in Patents by Filing Year, 2000–2024



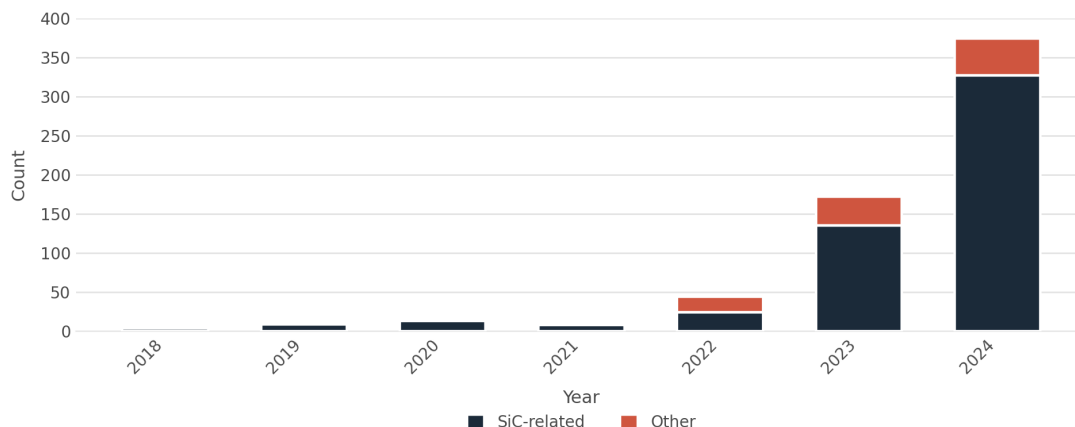
Mentions of matrix infiltration and densification methods in patent titles and abstracts. Source: Datenna.

Regarding advanced jet engine technology, most patents were filed more recently, representing the culmination of earlier R&D efforts. More than 80% of publications related to jet engine technology occurring after 2016 with a clear rise in the early 2020's. Of these, most inventions focus on CMC or silicon-carbide-based turbine airfoils, particularly blades and guide vanes, and address practical challenges such as cooling channel design, precision forming and molding, sintering, coatings, and high-temperature testing and evaluation.

Lastly, procurement analysis reveals a dramatic upswing in implementation of CMC technology starting in the early 2020's. As with patents, most of the procurement documents reference silicon-carbide, indicating that these materials and components dominate not only upstream research and IP activity, but also downstream acquisition and implementation, reinforcing its position as the most established CMC material system.

When examining the actors involved in these procurements, AECC stands out as a major locus for the ecosystem. As mentioned above, the Aero Engine Corporation of China is a massive Chinese state-owned enterprise and umbrella organization that focuses on the design and production of aeroengines and related technology. AECC and its subsidiaries form the largest cluster of procurements directly related to aerospace propulsion and materials, and the second largest cluster of procurements for CMC-related contracts in general at nearly 20% (semiconductor-related uses represent the largest topic by count). Additionally, AECC also tendered the largest contract on record by amount rewarded for the construction of a CMC technology research facility for \$23 million in 2022. AECC's strong presence in the field highlights the interest that the Chinese government places in developing this technology, and the resources they are willing to devote to obtain it.

CMC Procurement Records by Publication Year, 2011–2024



Procurement record count by publication year. Source: Datenna.

These procurement profiles suggest that although CMCs are very much still a technology in development, they are not confined to experimental testing. Rather, the technology is being integrated into applied research, validation, and at least pre-production systems for high-temperature resistant engine components such as those in the expectant CJ-1000A.

WHAT THIS MEANS GOING FORWARD

China May Be Poised to Break Into a Field It Has Long Coveted

China has been pursuing the development of its aerospace ecosystem for decades. Though it's not clear if China's recent advances on jet engines have been the result of indigenous development efforts or through acquiring and integrating foreign technology, its progress is undeniable.

If reports are to be believed, China may soon achieve these ends. Although the CJ-1000A has yet to be certified for routine civilian use, it is complete as a working prototype, and has [reportedly](#) been tested numerous times on the PLA's Y-20 transport aircraft.



PLA Air Force [Y-20](#).

Reliable, advanced turbofan engines for both military and civilian aerospace systems have been a long-standing prize for the CCP. Their pursuit has led to China pouring resources into the technology's acquisition, either through research and development or through acquisition and facsimile. If the remaining problem of heat-resistance can be overcome through developing key materials like ceramic matrix composites, China may be poised to break into a field it has long coveted.

ABOUT DATENNA

Datenna maps over 52 million Chinese organizations, tracking procurement contracts, patent filings, funding streams, and ownership structures. Our platform provides allied governments, defense institutions, and industry with provable, auditable intelligence on China's technology and defense ecosystem. This report was powered by Datenna's research team. To find out more about our research-based client services please visit our website or contact us at info@datenna.com

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