



# AMERICAN ADVANTAGE



THE STRATEGIC VALUE OF AEROSPACE-GRADE  
CARBON FIBER COMPOSITES



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*Three companies make aerospace-grade carbon fiber.  
Just one is American.*

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U.S. defense programs are becoming more reliant than ever on lightweight carbon fiber composites. From helicopter blades to the wings and fuselage of the F-35 stealth fighter, most major military aerospace platforms that form America's advantage today depend on carbon fiber composites for their lightweight designs and advanced shaping and performance to increase range and reduce fuel consumption. For future systems, composites have been a design factor from the beginning. The Air Force's Collaborative Combat Aircraft drone family and the Boeing F-47 Next Generation Air Dominance fighter systems incorporate composites. So does the new carrier-based F/A-XX fighter plane. The Army's Future Long Range Attack Aircraft also relies on advanced composites. On the list are other drones, missiles, space and satellite systems covering a wide swathe of the most advanced U.S. military capability. Production of these

foundational U.S. defense programs simply cannot be allowed to depend on foreign-controlled sources.

Based in Stamford, Connecticut, Hexcel Corporation is the world's top manufacturer of aerospace-grade carbon fiber used to produce lightweight composite material used in aircraft. While that's good for America – Hexcel has several plants and production sites in the USA, and a 100% American internal manufacturing supply chain – both Japanese and Chinese companies also play large roles in the market for this valuable strategic material. Currently, other than Hexcel, most of the remaining critical aerospace carbon fiber market is served by Japanese firms. Without some prudent stewardship and Department of Defense attention, the production of vital U.S. defense capabilities may be increasingly at risk.

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## WHAT IS CARBON FIBER COMPOSITE?



Over the past 40 years, carbon fiber composites have significantly replaced metal in both military and commercial aerospace manufacturing, for wings, fuselages, helicopter rotors and blades, engines, nacelles, spacecraft, and various

secondary and interior structures. Carbon fiber is five times stronger and 30% lighter than aluminum and has better heat tolerance and shaping properties that reduce drag and increase the range and stealth characteristics of manned and unmanned combat aircraft, helicopters, missiles, and space applications. Nearly all military aviation programs use some elements of carbon fiber composites, and newer programs with advanced shaping for stealth operations use more.

Production of carbon fiber begins with a chemical process to create a precursor called polyacrylonitrile (PAN), which is then heated and stretched through a series of ovens and furnaces to create carbon fiber. Impregnating carbon fiber with epoxy resins and curing the material in a pressurized oven or heated tool creates the composite material used in aircraft.



## AVOIDING FOREIGN DEPENDENCY

While Hexcel is a leader in the aerospace-grade carbon fiber market, foreign controlled competitors play a significant role in U.S. military platforms; for example, Japan's Toray and Teijin supply carbon fiber for many current U.S. military programs. Another foreign company, Syensqo, headquartered in Belgium, uses different sources of carbon fibers, including some from foreign sources, with their resin systems that provide composites for military programs. Foreign companies are also involved in new development programs. Toray is a major supplier to the U.S. Army's future long-range assault aircraft (FLRAA).

Carbon fiber precursor, PAN, is highly proprietary, and not sold in the open market. In the 1980s, DoD considered PAN such an important national security asset that it instituted a domestic sourcing requirement for PAN and carbon fiber until it was phased out in 2006. Since then, certain DoD weapons programs rely on carbon fiber produced with foreign sources of PAN. One example is Teijin, a Japanese headquartered carbon fiber manufacturer, which provides PAN made in Japan for certain DoD weapons programs.

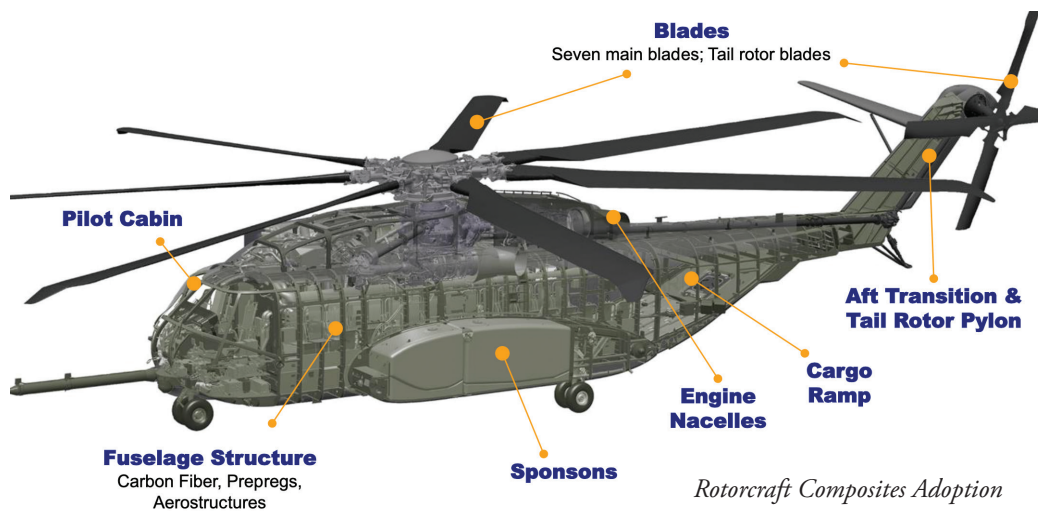
Given the evolving geopolitical environment and disrupted global supply chains, the reasons for the original domestic sourcing requirement for PAN and carbon fiber are more relevant today than ever. That is why DoD should reestablish a requirement for procurement of PAN and carbon fiber which is domestically owned with domestically controlled intellectual property to strengthen the supply chain for carbon fiber.

This type of foreign dependency has been cited as a critical defense industrial base risk. In the first Trump

Administration, President Trump's Executive Order 13806 led to a 2018 DoD study of the industrial base that highlighted the vulnerability of DoD's access to carbon fiber composites:

“Single foreign sources of unique and proprietary carbon fibers from Japan and Europe represent considerable DoD supply chain vulnerabilities. A sudden and catastrophic loss of supply would disrupt DoD missile, satellite, space launch, and other defense manufacturing programs. In many cases, there are no substitutes readily available. Replacing a carbon fiber factory is very expensive and time-consuming. Of similar concern is the uncertainty of qualifying replacement suppliers and significant resource requirements.”

Like computer semiconductor chips, carbon fiber is a vital strategic commodity. As DoD procures more sixth-generation aircraft, drones, advanced missiles and space systems, demand for carbon fiber is growing, and the U.S. risks becoming dependent on foreign companies to supply it. The Japanese government also closely monitors the export of carbon fiber through METI (Ministry of Economy, Trade, and Industry) for military programs. Japanese carbon fiber manufacturers must explain the planned end-use of their products to METI and must also complete application forms to purchase the fiber needed for DoD programs. The layers of risk and administrative burden of these regulatory approvals can add a significant amount of time to the procurement process and adds yet another layer of vulnerability to the supply chain. In a U.S. national emergency, delayed or denied access to foreign sources of PAN and carbon fiber could create significant and unacceptable vulnerabilities for critical DoD programs.



## INVESTMENT IN AMERICA

America needs to take steps now to ensure a secure supply of U.S.-sourced carbon fiber precursors and composites. Hexcel is the only aerospace-grade carbon fiber manufacturer that is headquartered in the U.S., and its critical intellectual property (IP) is 100% American originated and controlled. Hexcel has research and technology centers of excellence for precursor polyacrylonitrile (PAN), the basic raw material used to produce carbon fiber composite, in Decatur, Alabama, and carbon fiber manufacturing in Salt Lake City, Utah.

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## CALL TO ACTION

Officials and lawmakers need to be aware of strategic importance of carbon fiber composites, and take steps to protect a strong U.S. headquartered source for that lightweight material. Careful action now can safeguard this strategic resource. Congress should consider steps to:

- Amend the Defense Federal Acquisition Regulation Supplement (DFARS) to require domestic manufacturing of PAN and carbon fiber for major weapons programs over a five-year period.
- Apply laws such as the Buy American Act to support domestic procurement of composite materials for DoD programs.
- Implement a policy to define “Domestic Carbon Fiber Manufacturer” as a company with headquarters, manufacturing, materials, and intellectual property located in the United States.
- Prioritize government funding for research on advanced materials by domestic carbon fiber manufacturers.

Extending America’s lead in carbon fiber composites is critical to building sixth-generation aircraft, combat drones, missiles and space products.

The U.S. is in a battle to stay ahead of China and other great power rivals in key areas such as artificial intelligence and manufacturing. Unlike sectors where the U.S. advantage has slipped away due to market forces, carbon fiber composites represent a strategic resource. Keeping this edge during a period of accelerating military demand will be essential for national security.

