Hexcel Composite Solutions for Aerospace

- HexTow® carbon fiber
- HexForce® reinforcements
- HiTape® reinforcements
- HexFlow® infusion resins
- HexPly® prepregs
- HexMC® molding composite
- HexAM® additive manufacturing
- HexWeb® honeycomb
- HexWeb® engineered core
- Redux® & HexBond® adhesives
- HexTool® tooling material

HEXCEL®

Commercial Aerospace

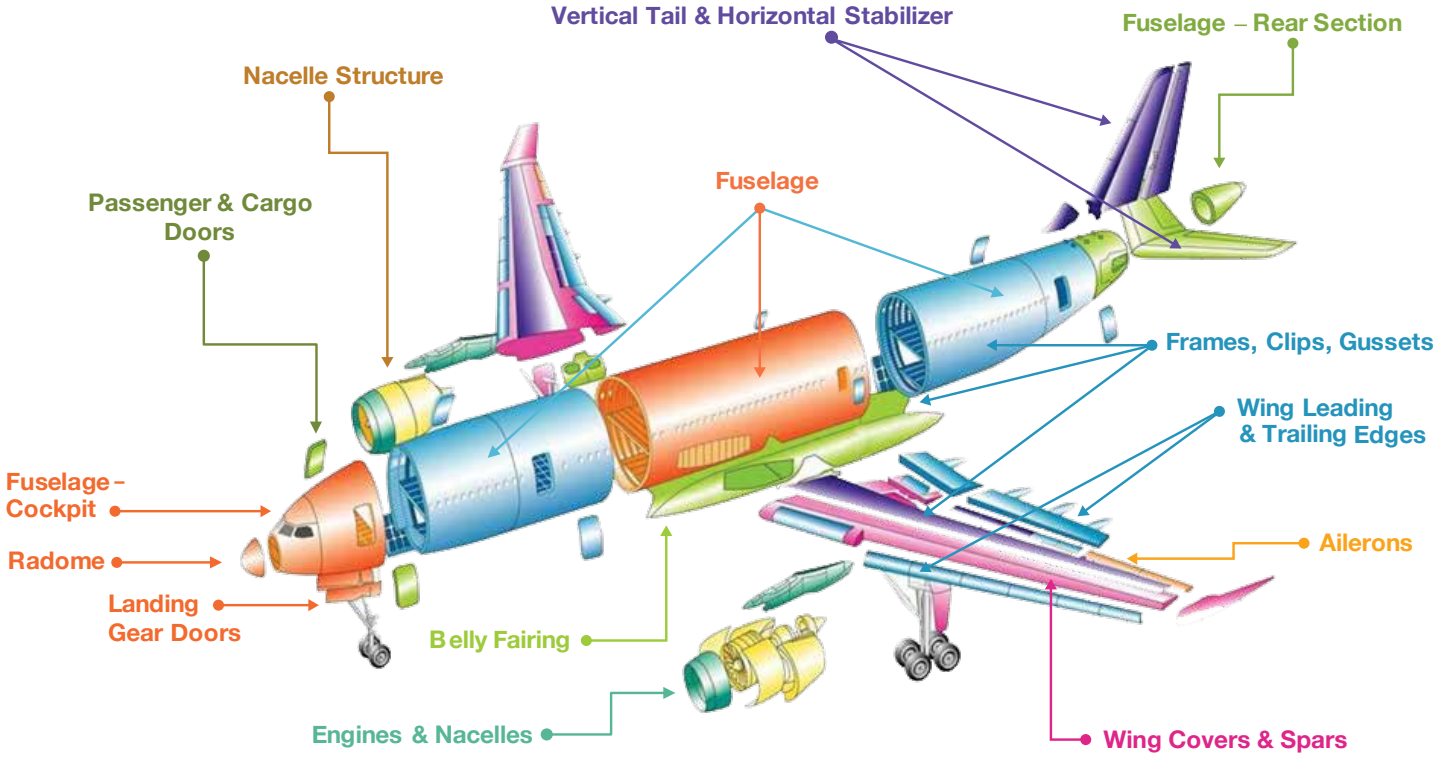
Hexcel has the greatest number of aerospace qualified products of any composite materials manufacturer worldwide.

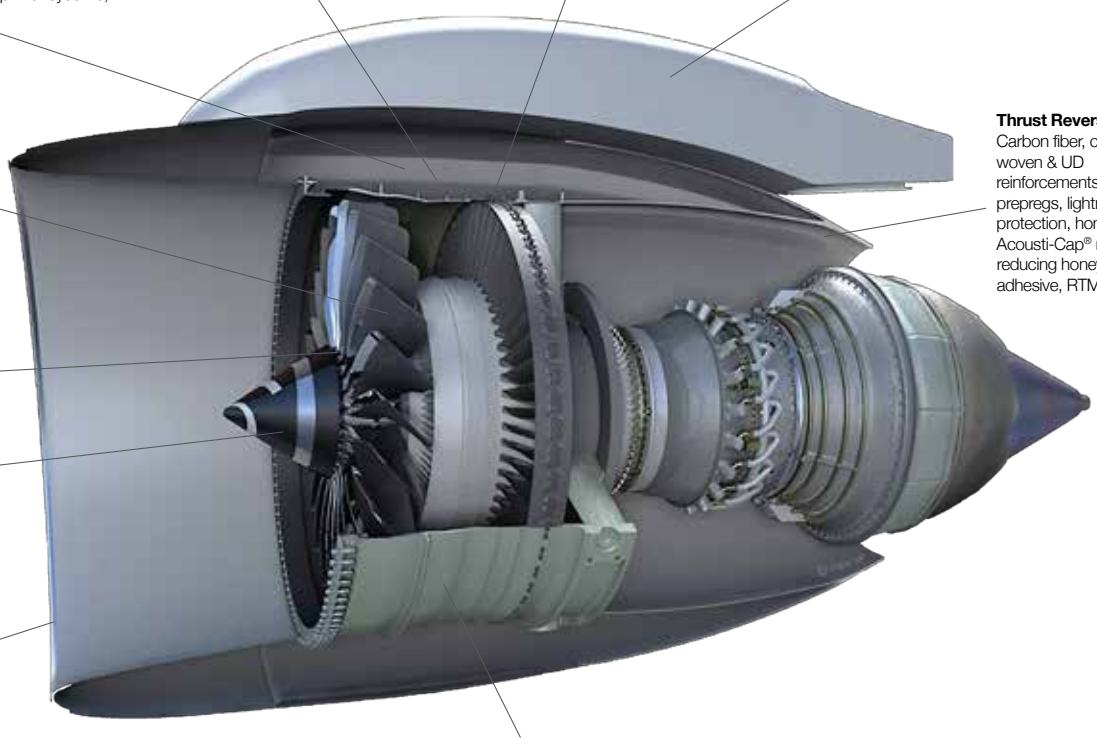
More than 50% of the Boeing 787 and the Airbus A350 XWB airframes are carbon fiber composite. Hexcel is a major supplier of materials to both programs and was awarded the contract by Airbus to supply the primary structure prepreg, with Hexcel carbon fiber, for the A350 XWB program.

Hexcel is a major supplier of composites for primary and secondary structures, aircraft interiors – and a leader in composites for new generation engines.

With a spirit of innovation that has gone from strength to strength for more than 70 years, Hexcel continues to push the performance boundaries for aircraft designers with IM carbon fiber, toughened epoxy resins, out-of-autoclave curing prepregs, noise-reducing honeycombs and value-added composite parts.

Hexcel's composite materials bring great benefits to aircraft design. They save weight and reduce fuel consumption, increase payload, extend flight range, enhance toughness and durability, optimize design, reduce part count, decrease maintenance cost and maximize passenger comfort and safety. The improvement in fatigue performance with carbon fiber reinforced prepregs (CFRP) compared to aluminum is also a major benefit.





Fan Cowl
Carbon fiber, carbon/glass woven & UD reinforcements, epoxy prepregs, lightning strike ptoection solutions, honeycomb, adhesives, Acousti-Cap® honeycomb, RTM, HiTape® reinforcements

Acoustic Lining Panels
Carbon/glass prepregs, high temperature adhesives, honeycomb, Acousti-Cap® noise reducing honeycomb

Outlet Guide Vane
Epoxy carbon RFI/RTM construction, engineered core

Nacelle Cowling
Carbon/glass prepregs, engineered core, honeycomb

Thrust Reverser
Carbon fiber, carbon/glass woven & UD reinforcements, epoxy prepregs, lightning strike protection, honeycomb, Acousti-Cap® noise reducing honeycomb, adhesive, RTM resin

Fan Blades
Carbon fiber, epoxy carbon prepregs or Resin Transfer Molding (RTM) construction

Fan Spacers
Carbon fiber, carbon molding material, epoxy prepreg, or RTM resin

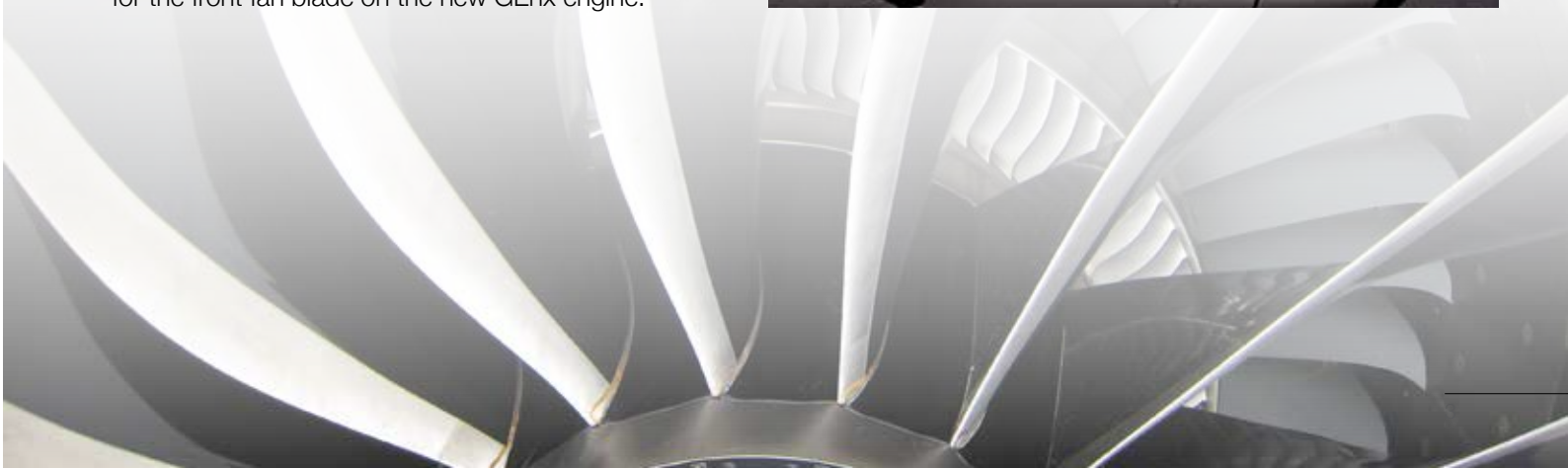
Nose Cone
Carbon fiber, carbon/glass/aramid reinforcements, epoxy prepreg or RTM resin

Inlet Cowl
Carbon fiber, carbon/glass woven & UD reinforcements, epoxy prepregs, honeycomb, Acousti-Cap® sound reducing honeycomb, lightning strike protection

Fan Containment Case
Carbon fiber, epoxy prepregs, carbon woven & UD reinforcements, RTM resin, adhesives

Engines & Nacelles

Aircraft engines have evolved to include so many major composite components that carbon fiber epoxy prepregs account for typically half the volume of the entire nacelle structure. The next step for aero engine designers has been to apply composites technology to more complex structures within the engine itself. A new treatment for our honeycomb core called Acousti-Cap® has been proven to quiet jet engine noise more effectively than any competing system and has been specified on the Boeing 787 nacelles. A unique capability to weave carbon on a 45-degree bias helps our customer reduce scrap and our toughest carbon fiber prepreg system won a position for the front fan blade on the new GEnx engine.



Defense Aircraft

The defense market has historically been an innovator in the use of, and source of significant demand for, adhesives and composites and Hexcel is currently qualified to supply materials to a broad range of more than 100 military aircraft and rotorcraft programs. These programs include the C-17, F/A-18E/F Hornet, F-22 Raptor and the Eurofighter Typhoon. The military transporter aircraft Airbus A400M is also supplied by Hexcel – and Hexcel supplies the carbon fiber for the F-35 Joint Strike Fighter.

All composite structures on the Eurofighter Typhoon, including wings, front fuselage and tail section, are built with Hexcel's HexPly® 8552 epoxy prepreg. Together with Hexcel's advanced Bismaleimide (BMI) system that is used for high temperature components and HexWeb® honeycomb used in the sandwich structures, Hexcel's total contribution per aircraft is over a ton of composite material.

Hexcel's prepregs, out-of-autoclave products, reinforcements and honeycombs are also suitable for the manufacture of Unmanned Aircraft Vehicles (UAVs).

HexTow® IM7 is the leading carbon fiber in the defense market. HexTow® HM63 high modulus carbon fiber (in UD or woven format) offers superior stiffness for UAV applications.

Space & Launchers

Satellites
The unique environment of outer space places rigorous demands on the materials used for construction of military and commercial satellites. Severe temperature changes can cause ordinary materials to warp, expand or contract depending on temperature. By contrast, satellites are subject to relatively little risk from collision damage.

HexPly® M18 is used widely in Europe and is a 180°C (350°F) curing epoxy system operating at temperatures up to 170°C (340°F) and with 30 days outlife at room temperature. The system provides outstanding low moisture absorption and high strain to failure. Combinations of M18 resins with ultra-high modulus PAN-based HexTow® HM63 (UD or very light-weight PrimeTex® fabrics) provide improved dimensional stability and structural performance for demanding applications.

The HexPly® 954 family of 350° F-curing toughened cyanate resin prepregs is selected by designers and fabricators of space hardware for the low moisture absorption that improves dimensional stability and outgassing performance when compared to epoxies. Inherent toughness and micro-cracking resistance, high temperature dry and wet service, lower dielectric constants, and better radiation resistance are other performance advantages for space, radium and structural applications. Combinations of 954 resins with ultra-high modulus pitch-and PAN-based graphite fibers provide improved dimensional stability and structural performance for demanding NASA applications.

Launchers
Launching satellites and vessels into space creates the ultimate performance challenge for composite materials. In addition to the crucial weight savings, the materials also have to withstand extreme temperature fluctuations. The performance requirements can be accommodated by Hexcel's wide range of matrix systems.

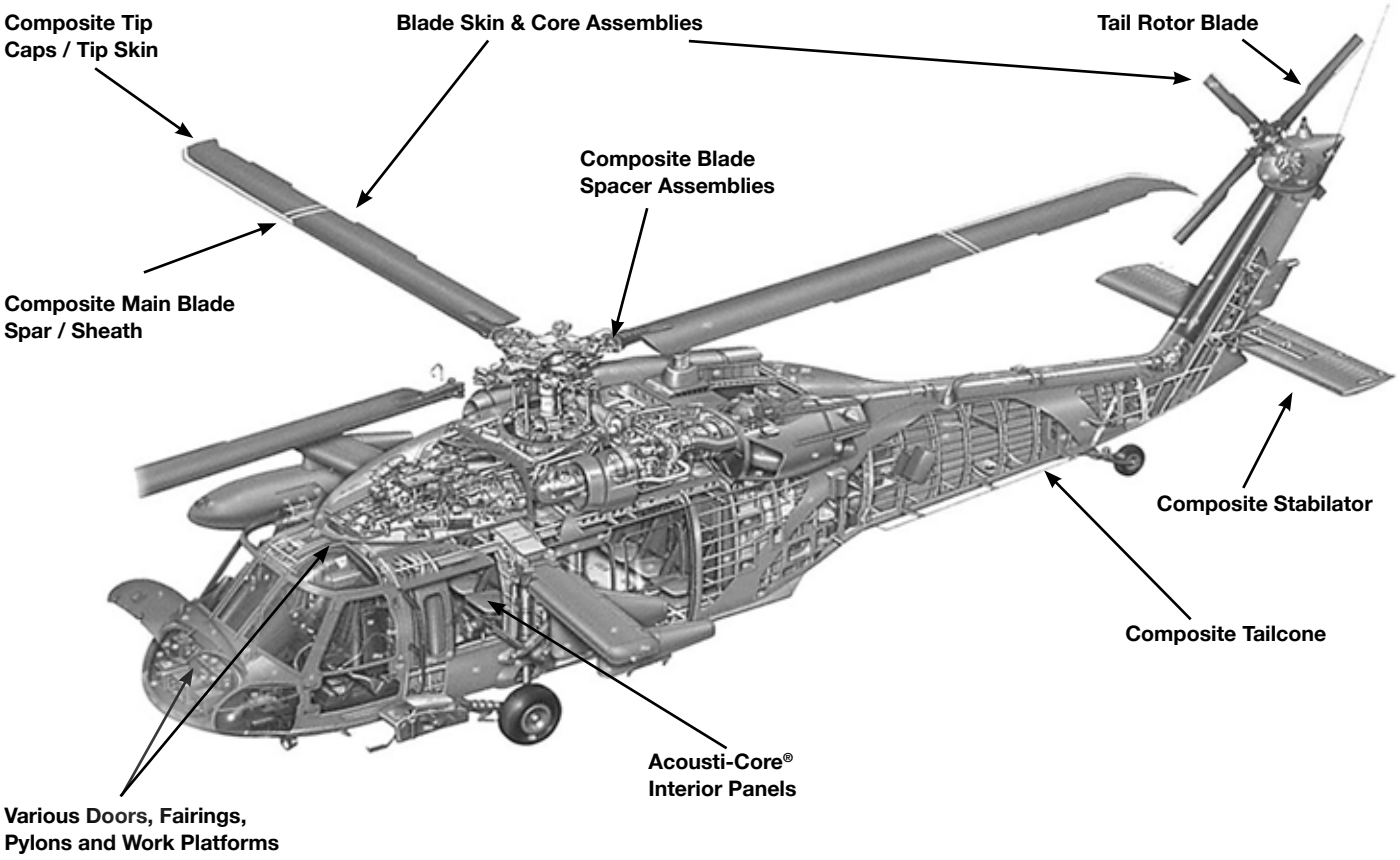
- Fairings: Carbon prepregs. Aluminum honeycomb and adhesives.
- External Payload Carrier Assembly: Carbon prepregs, aluminum honeycombs and adhesives.
- EPS Ring: Epoxy/carbon prepreg or RTM.
- Front Skirt: Carbon prepreg.
- Booster Capotage: Epoxy glass/non-metallic honeycomb.
- Yoke: Epoxy carbon filament winding.
- Heat Shield: Carbon prepreg/high temperature resistant glass fabric.

Rotorcraft

In recent years, both the Airbus Helicopters H175 and the Sikorsky S-76D medium twin-engine helicopters have made their maiden flights – each designed with all-composite main rotor blades. The UH-60M Blackhawk, which has been upgraded with a new composite wide-chord rotor blade and more powerful engine, demonstrates an impressive extra 500 pounds of lift. The composite intensive V-22 Osprey tilt-rotor is now successfully deployed and ramping up to full production. Hexcel is a proud supplier to these and other programs, with a wide range of materials including: carbon fiber, reinforcements, epoxy prepregs, and honeycomb engineered core.

Typical Composite Applications in Helicopters

- Rotor blades: carbon and glass prepreg (including carbon woven bias), honeycomb, engineered core, Redux® adhesive
- Rotor hub: carbon/epoxy prepreg
- Glazing bars: carbon and glass epoxy prepreg
- Seats and interiors: glass prepreg, honeycomb
- Engine/Body fairings/Access panels: glass, carbon and aramid prepregs with epoxy and BMI resins
- Fuselage: carbon and glass prepregs, honeycomb
- Main and cargo doors: carbon and glass epoxy prepreg, honeycomb and Redux® adhesive
- Horizontal Stabilizers: glass, carbon and aramid prepregs
- Fuselage panels: carbon and glass epoxy prepreg, honeycomb and Redux® adhesive



Beyond Materials

Innovative blade production concepts from Hexcel's Engineered Products group have resulted in contract wins to produce sub-assemblies and even a complete main rotor blade for the Sikorsky S-76D™.

Hexcel's Engineered Products for Rotorcraft:

- Tip caps
- Blade skins
- Skin to core assemblies
- Tail rotor skins and skin to cores
- Flight safety critical parts: MRB spars, TRB Flexbeams.

Hexcel Product Family

HexTow® Carbon Fiber

HexFlow® Resins

HexMC® Molding Composite

HexForce® Reinforcements

Polyspeed® Laminates & Pultruded Profiles

HexWeb® Honeycomb Core

HiTape® Advanced Reinforcements

Modipur® Polyurethane

HexWeb® Engineered Core

HexPly® Prepregs

Redux® & HexBond™ Adhesives

HexTool® Tooling Material

HiMax™ Multiaxial Reinforcements

For more information

Hexcel is a leading worldwide supplier of composite materials to aerospace and industrial markets. Our comprehensive range includes:

- HexTow® carbon fibers
- HexForce® reinforcements
- HiMax™ multiaxial reinforcements
- HexPly® prepregs
- HexMC® molding compounds
- HexFlow® RTM resins
- Redux® & HexBond™ adhesives
- HexTool® tooling materials
- HexWeb® honeycombs
- Acousti-Cap® sound attenuating honeycomb
- Engineered core
- Engineered products
- Polyspeed® laminates & pultruded profiles
- HexAM™ additive manufacturing

For US quotes, orders and product information call toll-free 1-866-601-5430. For other worldwide sales office telephone numbers and a full address list, please go to:

http://www.hexcel.com/contact/salesoffice

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