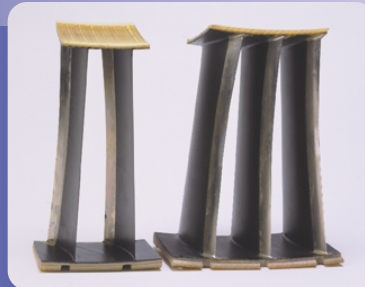




We take Composites to Market



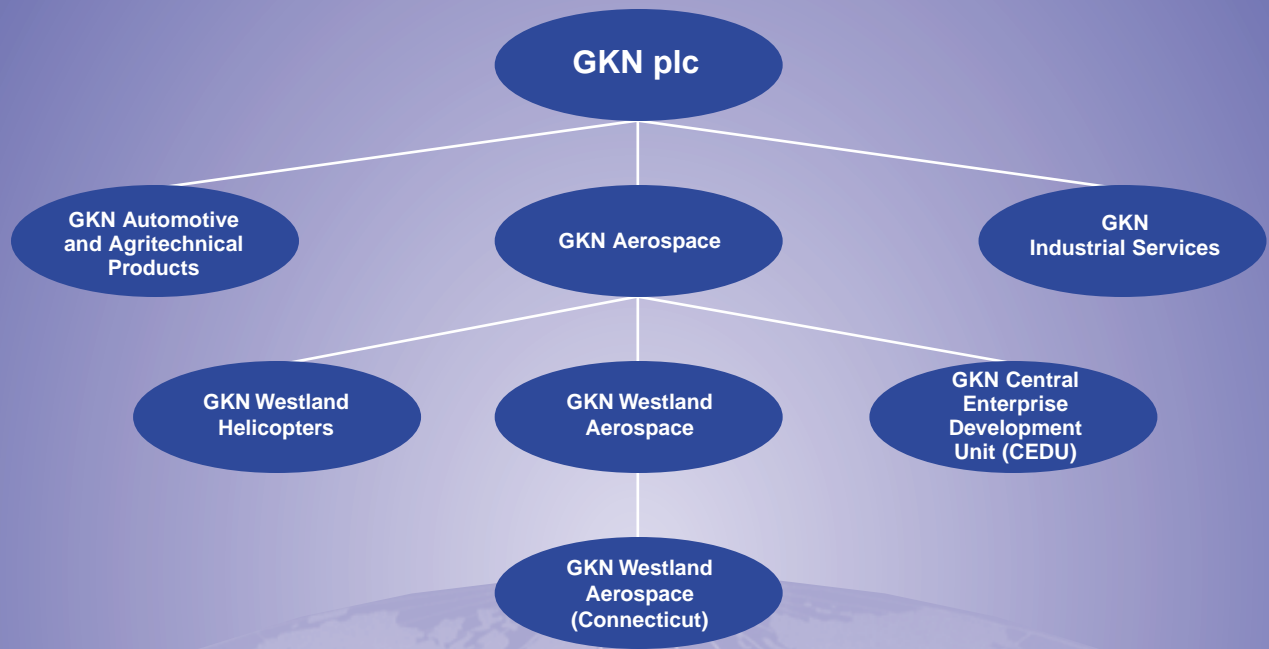
GKN Westland Aerospace, Inc.





GKN Westland Aerospace, Inc., a division of GKN plc, is an engineering LED first tier supplier to the global aerospace industry.

GKN has manufacturing facilities in East Cowes on the Isle of Wight, Avonmouth, Luton, Portsmouth and Yeovil all in the United Kingdom; Munich, Germany; Wallingford, Connecticut; Tallassee, Alabama; and San Diego and Los Angeles, California, in the USA.



COMPLETE COMPOSITES SOLUTIONS

If the question relates to high-performance composites, GKN Westland Aerospace, Inc., has the solution.

GKN Westland Aerospace, Inc. (GKNWA), today is recognized as one of the world leaders in reinforced carbon composites. Our engineers and manufacturing experts have the experience in both commercial and military applications for aerospace and industrial components.

We help customers create cost-effective alternatives to titanium and aluminum, offering the performance, complexity, laminate quality and dimensional accuracy required.

By working directly with customers, we jointly identify components best made with composites. Together, we select the best manufacturing method — pre-impregnated molding (prepreg), compression molding, resin transfer molding, or, perhaps, our proprietary Advanced Resin Transfer Molding (AdvRTM™).

Our greatest strength is the background and depth of experience of our team, offering customers the opportunity to leverage on proven success, eliminating risks previously associated with composites. Our experienced advanced engineering department specializes in composite design and analysis, using CATIA and Unigraphics systems as well as more typical tools for composites analysis.

In the past, manufacture of high-performance composites was esoteric, sensitive and complex. Today, at GKNWA, it is understood, routine, accomplished.

We are proud to have taken composites technology to the next level. And, we are enthusiastic about the opportunity to demonstrate how GKNWA can help your company advance its production and assembly needs for the future.



Coordinate Measuring Machine is used to assure conformance of parts to the electronic master.



Turbo Fan Exit Case.
One piece AdvRTM molding.
Ten of these complex units combine to replace a traditional titanium assembly.

Turbo Fan Exit Case.



COMPOSITES FOR A NEW CLASS OF PARTS

With AdvRTM, for the first time, complex geometric components can be manufactured with composites, effectively competing with traditional metal designs and manufacturing approaches.

We have manufactured and delivered more than 10,000 critical, rotating jet engine components.

In the AdvRTM process, advanced polymer resins are injected into a matched mold encapsulating a continuous fiber, preformed reinforcement. The results are high performance precision molded parts controlling both contour and laminate thickness.

The quality of the laminate is the inherent advantage of AdvRTM. Porosity, fiber distortion and fiber wrinkling are no longer a problem. Repeatability and delivery of the first piece molded from a new tool, are routine.

Cost effectiveness also has taken on an added dimension with AdvRTM because multiple part numbers can be combined into a single composite component. In addition, AdvRTM offers cost avoidance for our customers in their subsequent assembly operations.

The key to these savings is the unique ability to closely control tolerances, eliminating fit-up and shimming during our customers' final assembly operations.

The Boeing Company said it saves approximately \$250,000 on each F-22 Advanced Tactical Fighter — because of GKNWA's AdvRTM. We manufacture

more than 140 separate components for the wings and fuselage of this aircraft.

What is AdvRTM?

The AdvRTM process builds the preforms to specific engineering requirements, with continuous in-process verification, allowing the finished preforms to be managed without disorientation of the fibers during loading, mold closure and resin injection.

AdvRTM's ability to manufacture net-shape preforms is based on the use of special fiber binders created to maintain the integrity of the preform throughout the

process. The process also uses different binders, each specific and chemically identical with the resin being processed,

critical to assuring the uniformity and quality of the matrix.

AdvRTM is not a replacement for prepreg molding. Rather, it allows introduction of composites into new applications — engine components, including platforms, frames, cases, and blades, and complex airframe structures such as beams, fittings, bulkheads and spars.

If your application can be described as "5-axis, NC machined titanium," then AdvRTM probably can reduce your costs and provide significant weight savings.

Now, composites are a low risk and viable option, where only metals could be considered in the past.

GKNWA is continuing to invest in development of more advanced tooling methodologies, new resins and fabrics, and related composites manufacturing processes.

Why Composites?

Compared with equivalent metal structure, composites have:

- less weight;
- improved fatigue strength; and,
- greater corrosion resistance.

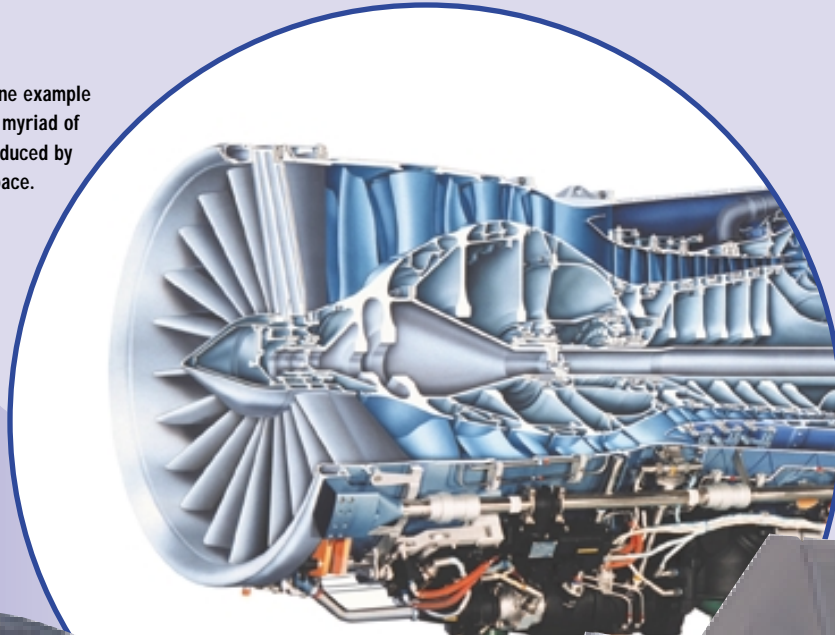
With the appropriate process, composites also can reduce manufacturing costs.

Fuselage Frames

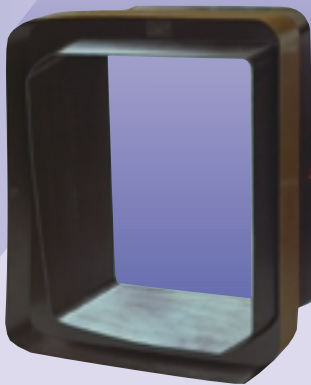
Stabilizer Kick Rib



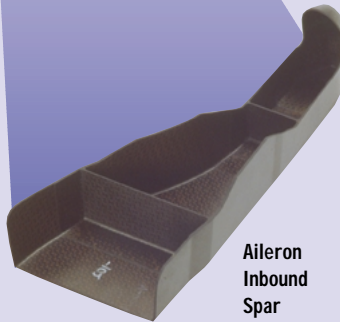
The F119 Engine — one example which incorporates a myriad of composite details produced by GKN Westland Aerospace.



Spar



Engine Air Inlet Lip



Aileron Inboard Spar

Why AdvRTM™?

With development of Advanced Resin Transfer Molding (AdvRTM), composites now are for primary load bearing structure in airframes and propulsion systems. The inherent attributes are:

- incorporate significantly greater complexity into a single part;
- replace aluminum or titanium in high performance jet engine or structural applications;
- consolidation of parts;
- quality and repeatability (97% yield on production programs); and,
- control of both sides of a laminate.

These characteristics define the best applications for the process. If requirements of an application do not materially benefit from these attributes, another process may be more cost effective.





GKN's specialized Instrument Analysis Laboratory helps us to optimize cure parameters and process controls and assure product quality.



Finish Trimming—one example of the size, complexity and quality now achievable.



Flexible Molding Cell. Computer management of cell scheduling, tool handling, thermal cycle and resin injection.



Certified ISO9001 and AS9000

QUALITY STARTS WITH THE PROCESS

In today's aerospace world, only those processes capable of manufacturing parts free of rejections the first time, and every time, are considered as suitable for production. Our internal quality requirements conform to those of our customers, meeting cost and schedule targets, to assure GKNWA's products answer all needs and specifications.

Statistical process control is the key to assuring reliability and quality.

Advanced process control equipment, integrated into the company's computer network, manages and monitors every stage of production, providing documented assurance that all standards are constantly being met.

GKNWA's manufacturing systems have enabled the company to become a qualified supplier to major aerospace manufacturers. We are under contract and are delivering parts to such major companies as The Boeing Company, Lockheed Martin, Pratt & Whitney, General Electric and others. We are delivering primary and damage critical structure for aerospace applications.

Our manufacturing employees are certified for key quality inspections, emphasizing quality at every level of the AdvRTM™ process. When an individual worker is certified, the Quality Assurance Team will audit the work, making random inspections to guarantee each step remains in constant compliance with specifications.

At GKNWA, quality is everyone's responsibility.

AdvRTM provides the confidence of a superior technology and experienced engineering and manufacturing resources. Now you can accelerate introduction of composites in your product and realize the benefits of composites today.



Quality evaluation may involve advanced ultrasonic inspection.

AN INVITATION

We invite you to meet with us so, together, we can identify components best made with composites. Our engineers can help maximize the benefits of composites, working to meet your objectives of improved cost, higher quality, and reliable scheduling.

GKN Process Capabilities

Feature	Design Guide	Actual Cpk Data	Yield
Molded Profile	.020	1.3	99.99%
Molded Profile Point Repeatability	.010	1.0	99.73%
Molded Thickness	±.005	1.0	99.73%
Molded to Molded Position	.010	0.8	98.4%
Weight	±0.8%	1.3	99.99%
Machined to Molded Position	±.010	1.4	99.997%
Machined to Machined Features	±.005	1.3	99.99%



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**GKN Westland
Aerospace**

