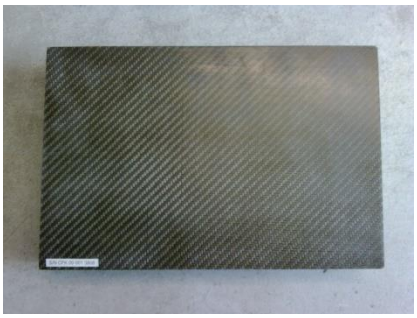
What's Going on in the Interior Composites World?

Every year, the aerospace and materials industries create new and impressive innovations. Driven by a desire to reduce weight, increase performance, and improve bottom-lines, aircraft designers are relying on more advanced materials and composites to build airframes and interiors. So far 2015 has been no exception to this trend, seeing new composites and coatings, sustainable sourcing of materials, and progressive lightweight designs.



Carbon fiber composite

Advanced Aircraft Materials and Composites

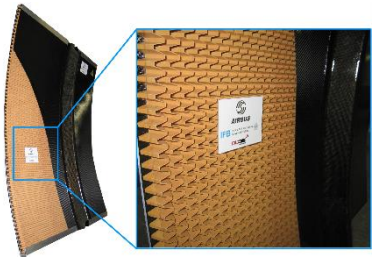
Modern material science has enabled form to meet function in aircraft interior design. A number of new materials have been developed, announced, and released in 2015 that allow designers to create a contemporary aesthetic in cabins while achieving impressive safety features.

For example, SABIC's CLEAR LEXAN XHR Sheet Series provides the transparent material that designers need to create light-filled interiors[i]. This thermoplastic material, which won the Crystal Cabin Award in the Material and Components category[ii], offers a lightweight option with high levels of light transmission while still meeting OSU 65/65 heat release and other industry requirements for stability in extreme conditions.

Solvay introduced a family of lightweight materials, particularly based around thermoplastics, called Tegralite[iii]. Most notably they devfeloped a sandwich panel combining their recyclable thermoplastic skins and their Tegracore structural foam[iv]. This panel exceeded FAR 25.853 requirements and also maintains mechanical functionality up to 180 degrees Celsius. All of this is packaged into a lightweight solution that can be used in the cabin interior as well as a variety of other applications in the aircraft.

Using composite materials, in particular, in aircraft has enabled designers to reduce weight while also increasing the strength of many components. This has allowed for some impressive forward leaps in creating more efficient and safe aircraft. It has also unlocked the potential for creating components with extremely high thermal stability and resistance.

Foldcore is one example. By folding a variety of materials in regular and irregular patterns, not only are they hoping to reduce aircraft fuselage materials weight by 30% and costs by 40%, they also have a system that can be manipulated to deliver fire protection. Passive spaces can be filled with materials that discourage flame while active materials can be made of fluid-flow elements. For instance, one option is to sandwich thick fiberglass phenol with aramid-collapsible core.[v]



Foldcore sandwich panel

Huntsman revealed several epoxies for aircraft composite materials that provide excellent weight reduction, with increased safety, and reduced toxicity[vi]. For example, it's Epibond 8000 FR complies with FAR 25.853 and provides a cost-effective replacement for phenolic resins without gas release during curing.

The military has been helping to push forward composites with the U.S. Naval Research Laboratory developing a polyetheretherketone (PEEK)-like resin[vii]. This resin can be used in a variety of composite materials on aircraft. Being able to remain strong at temperatures up to 500 degrees Celsius, this resin is an ideal choice for use in fire resistant materials, particularly fabrics. Beyond these interior applications, this resin is also expected to be used in structural components.

These new composites are a testament to the forward strides the aerospace industry has been able to make in advanced, precisely engineered materials.

Coatings and Fire Retardant Barriers for Airplanes

One of the more versatile approaches to creating fireproof interiors is to use coatings that protect and enhance other materials. Sicomin recently presented a new clear coating, laminating, and foaming epoxy system[viii]. SR1526 is a two component epoxy system that has already been awarded a number of accreditations for aircraft interiors. They also revealed SR1124, a low viscosity fire retardant. It is halogen free and boasts both low smoke opacity and low toxicity[ix].

Brook One's fire barrier cover film proven to be up to the mark with outstanding flammability and burn through results (a test that measures the heat flux of a material). The FAA requires that all materials remain less than 2 BTU/sec/ft2 for at least four minutes. The Brook One material exceeded 10 minutes[x]. Additionally, it experienced no flame penetration for 25 minutes. This was followed up by a recent smoke and toxic gas test which showed a smoke index of 2.8, Carbon Monoxide at 204.3 ppm, no Hydrogen Fluoride, no Hydrogen Chloride, Hydrogen Cyanide at 3 ppm, and no Sulphur Dioxide[xi]. Clearly this is an impressively engineered material

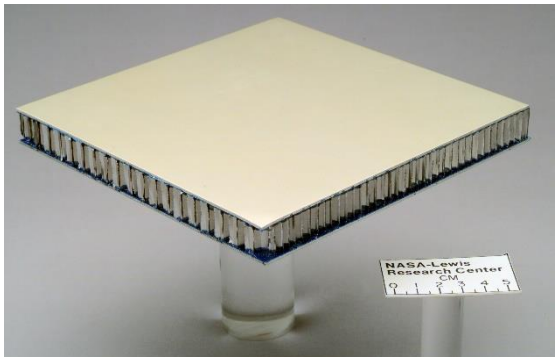
that represents how advanced aircraft interior materials are becoming in terms of minimizing toxicity.

Using these coatings and barriers, key components of the aircraft interior can be afforded additional protection, helping to the safety of those on board.

Sustainability For Aircraft Materials

There has been increasing effort in the industry to achieve greener aircraft. Recently a number of parties have been working to develop sustainable materials for the interior of aircraft that can offer all advantages of conventional materials without the negative environmental impact. For example, the Thermoplastic Composites Research Center along with the University of Twente, Saxion University, and the Delft University of Technology have been working on researching thermoplastics for aircraft. They have a number of goals for their investigation including how to create more recyclable options[xii].

EcoTechnilin and TransFurans Chemicals have developed a bio-sourced composite named FibriRock that, in addition to its largely organic composition, cures faster than conventional alternatives[xiii]. This sandwich composite combines the existing FribriPreg FR skins, basalt, and a nomex-type core[xiv]. Its use of natural fiber combined with bio resin performs excellently even in extreme situations. The heat release figures for their 5.5mm composite are 15kWmin/m2 (2 minutes total) and 18 Kw/m2 (peak), well within the target of 65[xv]. Clearly a highly sustainable composite material can stand up to and even exceed more conventional alternatives in strength, safety, and even cost.



Sandwich panel

Another firm, Composites Evolution has also unveiled a new composite material, called Ecoprep, which promises a greener alternative to conventional phenolic prepregs[xvi]. The key innovation with this material is that is uses a 100% bio-based polyfurfuryl alcohol resin system. This is offers in a 300g/m2 2281 style woven glass fabric with 40% resin content, primarily targeted at aircraft interiors including sandwich panels. Additionally, they provide an 840g/m2 8 harness satin woven fabric.

These sustainable, green alternatives to conventional materials enable aircraft designers to design environmentally friendly interiors that meet and exceed strength and safety standards. With organically sourced materials reaching a point where they can compete in terms of strength, weight, and safety while also minimizing environmental impact and event reducing cost, it is likely that we will continue to see increasing innovation in this space.

New Applications of Lightweight Materials in Specialized Interior Segments

When thinking of weight reduction in aircraft, it is easy to immediately consider the airframe. However, the interior can also greatly benefit from novel applications of lightweight materials. Increasingly, designers are coming up with highly specialized and innovative ways to reduce weight in the interior of aircraft.

A new French startup, Expliseat, has developed an extremely lightweight passenger seat using only composites which is rapidly being rolled out to airlines around the world[xvii]. At only 4kg, this advanced seating option can save airlines in the range of half a million dollars per aircraft per year in fuel consumption[xviii]. This seat was included a vision of the future of air travel created by Airbus' engineering team[xix].

Airbus' Composite Technology Center has been exploring the use of carbon fiber reinforced polymers (CFRP) in aircraft interiors. In particular they have been developing a prepeg recycled carbon fiber that they expect to be used largely in cabin linings[xx]. Although early stage, this application of lightweight composites could herald a major increase in the usage of recyclable, lightweight materials in aircraft.

Even outside of the commercial airlines, aircraft designers are using composites to make attractive and functionally superior interiors. Spirit Aeronautics recently completed work on a Cessna Citation 650 refurbishing the interior with a clean aesthetic which relies heavily on composites[xxi]. Notably, they used lightweight materials in unusual applications such as the carbon fiber inlays and the seats.

Wrapping Airplanes in Fire-Resistant Materials

As aircraft design advances, so too must the materials available to the people and organizations allowing us to take to the sky. This has given rise to a number of impressive innovations in materials that meet and often exceed fire, smoke, toxicity requirements within recent years. Thanks to the inventiveness of the aerospace industry, the aircraft of today are being built with materials that would have been unfathomable not long ago.

Maryruth Belsey Priebe

Maryruth can't help but seek out the keys to environmental sustainability - it's the fire that gets her leaping out of bed every day. With green writing interests that range from sustainable business practices to net-zero building designs, environmental health to cleantech, and green lifestyle choices to social entrepreneurism, Maryruth has been exploring and writing about earth-matters and ethics for over a decade. You can learn more about Maryruth's work on JadeCreative.com.

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