New Landing Gear Materials

The development of new materials for the aerospace industry is moving at a rapid pace. And what herculean tasks these new materials must accomplish: Durability, robustness, weight reduction, cost economies, and environmental responsibility. Even so, steel components in landing gear are being challenged on every level and it's important to recognize the changes and opportunities for the shot peening industry.

Polymer Matrix Composites

In 2010, Fokker Landing Gear, located in the Netherlands, signed a three-year agreement with Goodrich Corporation to introduce thick-walled polymer matrix composite (PMC) landing gear drag braces for the Lockheed Martin F-35 Lightning II joint strike fighter aircraft. PMC is a plastic matrix reinforced by high-performance carbon or organic fibers. The fiber reinforcement is stronger than the matrix and provide stiffness and strength. Reinforcement is laid in a particular direction within the matrix and the resulting PMC will have different properties in different directions (anisotropic properties).

Fokker Gear has brought the development of PMC technology to a position where it can be certified and qualified against FAA/EASA requirements with these benefits:

- Increased aircraft performance due to weight reductions of up to 30%
- Increased durability and robustness of landing gear
- Elimination of metal corrosion and cracking

Messier-Bugatti-Dowty is using fiber-reinforced composite braces, too. A U.S. company, Albany Engineered Composites, is preforming the carbon fiber braces for Messier-Bugatti-Dowty's 787 landing gear structure. The preforms will be infused with epoxy resin via resin transfer molding and will provide weight savings to the 787. Messier-Bugatti-Dowty has also used ultra high-strength steels (300M steel) and aluminium alloys in landing gears.

Titanium and Titanium Matrix Composites

A number of the Boeing 787 landing gear components, including the main gear inner cylinder, have been made from titanium by Messier-Bugatti-Dowty—a first in the industry. According to Messier-Bugatti-Dowty, titanium provides weight savings and the strength of existing steels.

In an article titled, "The Science of the Safe Landing Gear" from www.aerospace-technology.com, Messier-Bugatti-Dowty is evaluating components in titanium matrix composites, which are claimed to far exceed the performance of 300M steels and titanium. "The use of metal matrix composites is currently uneconomical, but they clearly offer great future potential," the article states.

High-Strength Stainless Steels

New high-strength stainless steels offer a high corrosion resistance, high fracture toughness and excellent corrosion resistance. Aubert & Duval, a member of the global company Eramet, claims that the strength of its MLX17 high strength stainless steel is such that "a 1mm diameter wire would be strong enough to lift a car." MLX17 (X1CrNiMoAlTi12-11-2) is capable of 1700 MPa; aluminum and titanium are used for hardening. Applications for MLX17 include landing gears, actuators, and flaps.

In addition to stainless steel's strength and anti-corrosion properties, it has environmentally-responsible attributes—it doesn't require toxic cadmium surface treatments like other steels and stainless steel is recyclable.

Economy and Weight Will Be the Final Arbitrators

If these new materials are equally robust and reliable compared to their predecessors, their success in the marketplace will depend upon their ability to reduce weight and lower fabrication costs since these are two crucial factors in aerospace manufacturing today.

Fokker Landing Gear's Polymer Matrix Composite drag brace