Tradition & INNOVATION

Orders for aircraft will remain high, driven by replacement demand and increased global travel

BY LAUREN DUENSING

In 1977, there were approximately 6,500 airplanes in the world jet fleet, according to data from Boeing's Long-Term Market Outlook. The company notes there were about 290 airlines—all large network carriers. Today, there are more than 900 airlines operating globally, and demand for air travel continues to increase.

In both the commercial and defense segments, "the bulk of new demand will come from emerging markets, including Asia, South America and Africa," according to Constellium, Paris, an aluminum products manufacturer. However, the company notes the more mature markets also will grow.

Eighty-five percent of the commercial jetliner market is an export market, says Richard Aboulafia, vice president, analysis at Teal Group Corp., Fairfax, Va. "In terms of the military side, about a third are exports, of which the overwhelming majority go to emerging markets or the Middle East."

"Eight out of 10 new commercial airplanes are sold outside the U.S.," adds Bob Mraz, vice president of sales and marketing at TW Metals, Exton, Pa. "So there's a tremendous demand for U.S. product in Asia and across the globe."

Next generation aircraft

Because of a long life cycle, commercial aircraft "will be a pretty steady-state industry technologically," Aboulafia says, but worldwide demand for modern planes will keep the order books full.

"There's an increase in global traffic," Mraz says. "We have some fleets that are being modernized and optimized for better fuel efficiency as the cost of fuel goes up, and we're seeing an expansion of more hub-to-hub and hub-to-spoke connections than ever before."

"The biggest driver behind the commercial jetliner surge is third-party finance looking for a home," Aboulafia says. "Jetliner financing is a relatively safe investment; money right now is free; and airlines, even if they're not making a lot of cash, need new planes because of high fuel prices."

The rise in fuel prices has encouraged manufacturers to engineer the next generation of fuel-efficient aircraft, innovations that largely are being driven by new fuel-efficient engines. Mraz notes American Airlines' fleet probably is the oldest in the United States. "They're replacing their planes with more fuel-efficient planes and certainly more modern planes," he says.

"Aircraft efficiency is getting so much better that the economics support investment in new aircraft," says Scott Thompson, U.S. aerospace and defense leader at PwC. "The next-generation aircraft are promising 15 to 20 percent fuel efficiency improvement. In 50-plus years of the jet age, the industry has averaged just over 50 percent in fuel efficiency—so about 1 percent per year. In one generation, a 15 to 20 percent improvement in fuel efficiency is huge."

About 15 percent of the efficiency improvements are the result of improved engine designs, he says, "but the aircraft itself is adding about 5 percent because of lighter-weight materials and new designs."

The outlook for metallics

"When you look at the 787, half of the aerostructures are composites," Mraz says. "They've been using composites in planes since the 1980s; it's nothing new, but just like metals have evolved, so have the other materials."

Although the 787 and the A350 are the first two jets to use composite primary structures, "there are plenty of other new jets in the pipeline that are traditional metals," says Aboulafia. "These things get introduced over very long periods of time. You've got another decade of current-generation 777s, which are 85 percent metal and relatively traditional. The single-aisle products from Airbus and Boeing, the A320 series and the 737 series, are 53 percent of output by value right now. And their replacements, the 737 Max and A320neo, are basically the same aircraft. They're all metal."

Photos: Airbus S.A.S.

The A350 XWB on the final assembly line's fuselage join-up station in Toulouse, France.

However, "there is no question that carbon fiber is taking some content away from metals," Thompson adds. "The good news for the metals industry is that airplanes are still predominantly metal, and the volumes are increasing. So net/net, I think it's a positive story for the metals industry."

Although composites are displacing metals in certain applications, "in order to make composites work, you need more exotic metals to connect them. In terms of the value of the metal, you'll see more titanium and other connector metals. You'll seen an increase in value if not volume," Aboulafia says.

Mraz also notes there's been a "tremendous demand" for aluminum plate production, "which has almost doubled in the past 10 years and is now on allocation. Aluminum sheet is holding its own and titanium products, primarily some of the long products, like tubing, are out a year or year and a half on delivery."

The industry also is developing new, lighter alloys, such as aluminum lithium, to compete with composites. According to Constellium, OEMs select material based on its lightness, performance and cost effectiveness through the life cycle. The company has an aluminum-lithium alloy, trade-named Airware, which can provide up to 25 percent weight savings compared to current aircraft.

"The aerospace industry has to deliver on many requirements, from weight reduction to new fabrication processes or optimized aircraft life cycle, in order to reduce its environmental footprint," the company says.

As new alloys are developed, manufacturers of aerospace parts need to stay on top of emerging technology.

"If you're going to get contracts from the major producers, you have to convince them that you can produce these components with high quality, reliability and precision but also in a cost-effective manner," says Don Graham, manager, educational and technical services at Seco Tools, Troy, Mich., a manufacturer of cutting tools for industries such as automotive, aerospace and energy.

Graham sees challenges that arise during machining of the composite material associated with the Boeing 787 or the Airbus 350. "The fiber-reinforced materials are very abrasive, and controlling the heat is a big problem when people are using end mills or doing drilling," he says. "Secondly, there is a trend toward gamma titanium alloys that take two forms: A class of materials called titanium aluminide, which have incredibly low machinability, and a related material commonly called burn-resistant titanium alloys. Both of those materials are very difficult to machine."

Ken Baeszler, product manager at GF AgieCharmilles, Lincolnshire, Ill., a provider of EDM systems, milling ma-

The vertical tail plane of the first A350 XWB comes out of the paint hall in Toulouse. The tail plane is joined to the fuselage using a lighter connection that is more aerodynamic.

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> **SCOTT THOMPSON, PWC**

chines and laser texturing solutions, says on the EDM side of the business, he's noticing a lot of challenges when manufacturing blades and vanes from superalloys.

"We've seen new single-crystal alloys, and we have to make sure our technology works on all the alloys—not just a few of them," he says. "We also have to contend with the various thermal barrier coatings as they become more popular on blades and vanes."

He says it's imperative to be involved with the testing process long before advanced materials reach production. "This type of work requires close collaboration with the jet engine OEMs," he notes. "In addition, EDM is coming more into play with other engine components, not just blades and vanes, because as materials get tougher and more difficult to machine conventionally, EDM starts to become an option."

Big backlog, supply challenges

According to company statistics, Boeing and Airbus are sold out on the A320 and 737 lines until 2016. The A350 and 787 lines are sold out until 2018, and the A320neo and 737 Max are sold out to 2020.

"For the foreseeable future, we see large aircraft production increasing by about 10 percent compounded growth for at least the next five or six years," Thompson says. "In 2011, the industry delivered more than 1,000 large aircraft for the first time ever. 2011 was a record year for volume, and now we're going to grow 10 percent per year on top of that—we're talking about five, six, seven years of consecutive record output."

Thompson says these record numbers are "putting a fair amount of risk in the supply chain." Although the industry hasn't experienced shortages yet, there is uncertainty about its ability to continue producing at this breakneck pace.

"Barring something dramatic that's unforeseen, we should get to the point where we're approaching 20 years of consecutive growth," he says. "Before the financial crisis, the industry was growing considerably and it was putting a lot of strain on the availability of certain raw materials, particularly exotic materials that are somewhat unique to the aerospace industry."

Aerospace heat-treated plate demand is impacted by five key factors, according to Constellium: one-off events, buy-to-fly ratio, contractual commitments, evolution of inventory levels and build-rate forecasts.

"The real challenge is within the management of the supply chain, which is a complex group of players," the company notes, pointing out lead times from demand forecast to final assembly line can be up to 2.5 years. "The issue is about better anticipating possible changes in initial orders and requirements in order to ensure on-time supply delivery."

"At Constellium, we keep on innovating," says Christophe Villemin, president of Constellium's Global Aerospace, Transportation and Industry division. "Our highly performing Airware technology showcases our ability to meet customer challenges in a fast-moving environment. ... We believe in aligning technology roadmaps across the value chain, hence an early involvement of all players is what we need today."

Intimacy between customers and suppliers is increasing, Thompson says, "but it really needs to increase a lot more. We're talking not only about transparency of sharing information but also transparency of production, potential production issues, whether that's capacity constraints or quality problems or availability of materials."

He says it's necessary for suppliers and customers to rethink their relationship and establish greater trust. "If you want transparency, you have to have trust. Establishing trust and transparency in the supply chain allows OEMs to plan for what's really happening.

"Are they working closer together? Absolutely," he says. "Is it optimized, yet? No. We are in the process of continuing evolution, and companies are making good progress." ■