Boeing’s 787 program continues to make steady progress toward certification and delivery. Four of the new aircraft are undergoing final assembly in Everett, Wash.
Aircraft builders walked away from the recent Paris air show buoyed by more than $100 billion worth of new orders. But meeting all of those delivery obligations may prove to be a trickier proposition than landing them.

The convergence of major production increases in existing jets just as the new Boeing 787 and Lockheed Martin Joint Strike Fighter (JSF) lines are ramping up will put enormous pressure on the aerospace supply chain during the next few years. Airbus is forecast to churn out 495 A320 narrowbody jets in 2014, up from 388 last year and 323 in 2006. And that figure could keep rising if the European airframer’s A320NEO (new engine option) remains a runaway hit. Rival Boeing also plans to significantly boost output (see graphic, p. 23).

The two leading airframers and many of their first-tier suppliers exude confidence that the industry is ready for the onslaught. The planned rate increases are being phased in incrementally, over a period of several years, to give the supply base time to get ready. Production of Boeing’s 737 narrowbody jets, for example, is forecast to rise from 385 in 2010 to 402 in 2012 and 470 in 2014. “It’s very manageable for us to take on these added quantities in our factories,” says Parker Aerospace President Robert P. Barker. “We can go from 35 actuators a month to 42 pretty easily over a period of time.”

Deeper concerns, however, lurk further down the value chain. Two years ago, in the midst of the global economic downturn, top-tier suppliers reduced inventories in anticipation of production rate cuts at Airbus and Boeing that never came. This in turn squeezed the smaller vendors of components such as brackets, clips and pipes, which were forced to cut staff and reduce capacity. Some went out of business.

“In recent years you’ve seen a consolidation in the supply base,” says Donald Majcher, vice president for technology and innovation partnerships at the Ohio Aerospace Institute in Cleveland. “The question is, how much of an increase can it now support?”

Others ask whether original equipment manufacturers (OEMs) are doing a good enough job of looking at the supply chain in the aggregate to identify potential choke points. It is not just a matter of moving more production through existing plants. The 787, JSF and Airbus A350XWB widebody jet are underpinning demand for new products, such as advanced electronics, specialized composites and machined titanium components. Equipment to machine titanium can cost $250,000-$1 million, a hefty sum for an independent shop. And supply chain specialists say some small companies are still figuring out how to produce the new components in higher volumes.

Some composite parts are “nowhere near ready to be mass produced,” says Trent Wall, managing partner at Stream, a new firm in Cincinnati that works with aerospace OEMs and their suppliers on process improvement. “I don’t believe the majority of suppliers have figured out how to move from the
art of making low-volume, prototype parts to a high-volume, cost-efficient, full-fledged production system.”

Wull says aircraft manufacturers and their Tier 1 suppliers still don’t have enough visibility into what is going on at second-, third- and fourth-tier vendors. “They get metrics, but these are based on past performance,” he says. In a recent survey of aerospace CEOs, program directors, managers and engineers by CSC and Aviation Week, half of the 183 respondents said their organization did not have an enterprise data management system to collaborate across their supply chain. CSC also discovered that some smaller suppliers still use paper spreadsheets.

Such practices are one reason why delays in high-profile development programs have become embarrassingly routine, be they weapons platforms or commercial jets such as the Airbus A380 and 787. “The kind of delays we’ve been experiencing have been significantly greater than in the past,” confirms Eaton Aerospace President Brad Morton. “It’s a bit unprecedented.” Meanwhile, Airbus announced last month that it is postponing developments of two versions of the twin-aisle A350—the -800 and -9000—by 18-24 months. Analysts believe the company also will be hard-pressed to meet its schedule of starting deliveries of the initial version of the jet, the -900, in the second half of 2013.

Supply chain specialists say such setbacks have led to a cycle of mistrust between OEMs and suppliers. On the 787 program, for example, key suppliers failed to alert Boeing that they were falling behind schedule. This led to disruptions that have pushed back the innovative jet’s entry into service by more than three years, causing financial pain across the supply base. “We all invested a lot of money in these programs in the development cycle,” notes Parker Aerospace’s Barker. “Most of our business models anticipated revenue streams that would have started a couple of years ago. It’s going to take a lot longer to get the paybacks than we originally anticipated.”

An operation like Parker Aerospace, a unit of industrial giant Parker Hannifin, has the resources to absorb such a blow.

### Commercial Aircraft Production

<table>
<thead>
<tr>
<th>Model</th>
<th>2006</th>
<th>2010</th>
<th>2014</th>
</tr>
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<tbody>
<tr>
<td>737</td>
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<td>366</td>
<td>470</td>
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<tr>
<td>777</td>
<td>63</td>
<td>74</td>
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<td>27</td>
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</tr>
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</tr>
<tr>
<td>A380</td>
<td>3</td>
<td>18</td>
<td>26</td>
</tr>
</tbody>
</table>

**Source:** Forecast International.

Figures show actual aircraft production for 2006-10 and forecasts for 2014.

### Fit Check

**All Nippon, Boeing look for bugs in 787’s infrastructure interface**

**BRADLEY PERRETT/TOKYO and GUY NORRIS/LOS ANGELES**

After waiting seven years for what you hoped would be an airliner that would take the world by storm, it would be a shame to find that it did not fit your aerobridges.

With that sort of thing in mind, All Nippon Airways and Boeing have been putting the 787 through its paces in Japan, flying the second test aircraft between four airports to check its compatibility with established infrastructure and procedures. Delivery is just weeks away, says Boeing, standing by its promise, stated in May, to hand over the first 787 to launch customer All Nippon in August or September.

Separately, Boeing’s initial delivery-standard 787, ZA002, began the first block of function and reliability tests on July 3, an evaluation that marks the final phase of testing before certification and first delivery.

The tests in Japan, called service-ready operational validation, are far-ranging when it comes to other carriers. “No other airlines are directly involved in this activity, though we expect what we learn here will benefit all of our operators,” says Scott Fancher, vice president/general manager of the 787 program.

Areas needing attention may very well come to light; that is the objective. Fancher notes that when the 777 underwent similar tests, “we found processes and tools that could be improved to make operation easier for our customer. We expect to have similar findings here and will make the necessary improvements in time to support entry into revenue service.”

The tests include such activities as fueling and towing, line maintenance and ensuring the data link between the aircraft and airline is working properly. The airports are Osaka Itami, Osaka Kansai, Okayama, Hiroshima and Tokyo Haneda, so the aircraft, ZA002, is emulating the operations of All Nippon’s domestically flown 787s. But it is a test aircraft, so the activities have not included passengers.

Moreover, ZA002 has not been flown at an airline tempo in the exercise. Fancher says the aircraft is being kept on the ground for extended periods to test capabilities on site. The test is more about infrastructure than the aircraft, he stresses.

At first All Nippon will fly Boeing 787s only in Japan; it plans to offer just one 787 long-haul flight by March 31, the end of its financial year. The first service will be between Tokyo Haneda and either Okayama or Hiroshima, says Chief Executive Shin-ichiro Ito. The financial year 2011-12 long-haul service will go to Europe or the U.S., he adds.

The airline is still assuming it will have 14 787s by the end of
But Majcher notes that many privately owned small suppliers can have difficulty securing loans to bridge their operations through delays now that credit conditions have become more stringent.

To their credit, OEMs are not ignoring the potential problems. Airbus CEO Thomas Enders recently stressed that major investments will have to be made in the supply base to accommodate higher production rates. “The huge challenge for us over the next four years will not be to sell new aircraft, but to be able to deliver them in high quantity,” he told the International Herald Tribune.

Airbus, Boeing and their top-tier vendors say they are being exhaustive in their efforts to make sure the supply base is ready. Parker Hannifin has created a website where suppliers have access to its backlog and production forecasts for the next 18-24 months. Honeywell Aerospace President Tim Mahoney and his team presciently created a “V recovery buffer stock” of components during the downturn to ensure they were prepared for a sharp recovery in demand. And Goodrich CEO Marshall Larsen says his company is vigilant monitoring its own supply chain.

“I’m not saying there couldn’t be a hiccup here or there with some of our suppliers, but we pay a lot of attention to them, because the last thing we want to do is hold up the production line,” he says. “Someone will be delivering at poor quality or at a 50% on-time rate, and we will go in and teach them how to [improve] that process. They usually get back up into the 90% area. That’s really important as we increase production rates.”

Some industry veterans believe fears of a supply chain meltdown are overblown. “I think you can manage this,” says Michael Goldberg, the head of Bain & Co.’s global A&D practice. And Frank Bamford, senior vice president for Business Development and Strategy at GKN Aerospace, says he sees OEMs being more farsighted in their selection of suppliers that can work together to bring a quality product to market faster.

Still, some suppliers question whether the industry is pushing too hard to bring cutting-edge technologies to market before they are ready for large-scale production. Airbus officials acknowledge that one reason behind their decision to delay the two A350 variants is that the company’s technical staff, such as composite specialists and design engineers, has been stretched thin, a challenge exacerbated by the launch of the A320neo development last December.

“There are tremendous competitive pressures on aircraft manufacturers by the airlines to deliver a product that offers new technology at a lower price,” says Eaton’s Morton. “We as an industry have to be careful about bowing to that pressure beyond our own capabilities.” Though Eaton has not been responsible for any of the major program delays, the company has redoubled efforts to make sure its technologies are mature before they are included in a product offering.

And Goodrich’s Larsen acknowledges that there were signs of relief last month when Airbus delayed the two variants of the A350. “Frankly, it gives the whole supply chain a little respite,” he says. “If you’ve got too many airplanes [entering production] on top of each other, that’s when the supply chain becomes an issue. It’s not the number, it’s all of them at once” that causes problems.

And then there are companies such as avionics producer Rockwell Collins, which is still recovering from a steep decline in business jet production and eagerly awaiting the production ramp ups at Airbus and Boeing—and the attendant additional revenues and profits. “All we are saying is, ‘Send me in coach,’” says CEO Clay Jones. “Raise that rate as fast as you want to. What’s taking you so long?”

With Robert Walke in London.

March 2012, implying a delivery average of about two a month. Boeing says that for all customers this year it will deliver 787s at the rate of two or two-and-a-half a month. The manufacturer has more than 80 structurally complete 787s at Seattle.

In the following financial year, All Nippon expects to receive a further 10 out of its 55 787s on order.

It says that, after a recent conversation with Jim Albaugh, president of Boeing Commercial Airplanes, he is confident the manufacturer will fulfill its first-delivery commitment.

ZA002, painted in All Nippon colors for the occasion but not intended for delivery to the airline, arrived at Haneda from Seattle on July 3, marking the type’s first flight to Asia.

All Nippon’s 787s, like ZA002, will be powered by Rolls-Royce Trent 1000 engines. The airline’s first four 787s will be powered by Package A engines and used on domestic flights. The first 787 for All Nippon will be the eighth built, ZA101, which is undergoing modifications and cabin outfitting.

International flights will be flown by later batches of 787s powered by the improved Package B engines, the first of which will be delivered before the end of the year, says Rolls-Royce. Boeing has been using the fourth test aircraft, ZA004, for fuel burn tests on the Package B engine.

Asked if the 787 will meet performance targets on delivery, Albaugh tells Aviation Week that Boeing has a plan to improve its efficiency that involves working with the engine companies. The 787 is also available with General Electric GEnx engines.

In Seattle, ZA102 was due last week to make the first of several long overwater flights, from Seattle to Alaska, as part of function and reliability testing.

This testing, set to cover nearly 300 flight hours, also simulates various normal and non-normal operations in a realistic airline-like flight environment. It includes vetting the aircraft’s capability for extended twin-engine operations (ETOPS). That part of the work is designed to validate the ability of the 787 to safely divert to an airfield for a variety of reasons, and includes long flights with one engine shut down.

Boeing is also continuing certification testing with GEnx-1Bs that will include a separate trial program for function and reliability and ETOPS. ©