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In for the Long Haul

Airbus and Boeing are heavily invested in widebody product lines and configurations that could remain the same for decades

Jens Flottau Le Bourget

The successful initial airborne maneuvers of Airbus A350 experimental test pilots Peter Chandler and Guy Magrin elicited immense relief and joy in Toulouse June 14. But the A350’s first flight just three days ahead of this year’s Paris air show also may well mark the end of an important chapter in aviation history.

The new Airbus long-haul aircraft, along with the Bombardier CSeries, are likely to be the last all-new, large commercial aircraft from Western manufacturers in a very long time. While Airbus and Boeing will be busy with development programs for many years to come, they are focusing on derivatives such as the Boeing 787-10 launched last week, either having just delivered an all-new aircraft (the 787) or flight-testing one (the A350). The next all-new Western jet could be as much as two decades away, as the twoairframers assemble their commercially successful A320NEO and Boeing 787 MAX offerings into the 2030s and work on further upgrades or stretches of the A350, 787 and 777.

The manufacturers argue that technology is not where it should be to warrant further all-new concepts and the market success of their current and planned aircraft seems to push the next moves further out, if anything. Just how receptive airlines are to the reengining and upgrading concept was demonstrated again by Emirair’s launch here of its next-generation E-Jets (see page 28) as well as the NEO and MAX orders Airbus and Boeing recorded during the show, mostly from low-fare carriers.

Eight years after the A380’s first flight, Airbus is hoping to complete A350 flight tests and certification in 12-18 months. After an almost flawless first flight, Fernando Alonso, head of the Airbus flight-test center, says one of his challenges is “not to be overconfident.” Alonso, part of the A350 crew of six, describes the first flight as “totally uneventful” and “a little bit boring.”

A350 flight-test aircraft MSN001 spent 4 hr. 5 min. in the air on its initial flight test. It climbed to 10,000 ft. in 8 min. and remained in the 10,000-15,000-ft. range for 2 hr. 48 min. while the crew tested the aircraft first in the most basic version of direct law and eventually in normal law.

“We went through seven ways to test the structure reacts before we went to normal law,” Alonso says. Similar tests were performed in normal law after around 90 min., with data being checked against calculated models through telemetry. “Two hours after takeoff, we were in normal law with all configurations cleared,” Alonso says.

The crew engaged the autopilot for the last 5 min. of the cruise flight. The double-looped afterburner, twin autopilot and autothrust mode, and buffeting effects were tested.

Back at 10,000 ft., an approach was simulated in full landing configuration, including a flare. Claudiu and Magrin also went through a go-around procedure and deaccelerated down to a stall warning. While the two had built in some margin on takeoff speed, they took out that margin on landing and used brakes, reversers and spoilers as in routine operations.

The A350 performed its second flight June 30 and cleared the full envelope on a mission that lasted more than 5 hr. The aircraft climbed to 42,000 ft. and reached Mach 0.88, its maximum cruise speed, as well as its maximum angle of attack in normal law. Airbus planned to fly the aircraft over the Paris air show on June 21.

The start of the A350 flight-test program was not the only morale-booster for Airbus. The manufacturer received 466 additional orders and commitments here, 241 of which were firm. That takes the total firm orders to 758 for the year, just short of its goal of exceeding 800 in 2013. Airbus says it has been leading Boeing in the passenger widebody market over the past five years with a combined 830 orders for the A380, A350 and A380, compared to 868 for the 747-8, 777, 777X and 787.

The A380 program received a boost at the air show as well, with a memorandum of understanding for 20 aircraft from Dori Lease Corp., which plans to take delivery of the first two in 2016. These are the first A380 orders this year, and, once firmed up, the Dori deal will be the largest for the program since Emirates ordered 32 units in 2010. Nevertheless, Airbus Chief Operating Officer for Customers John Leahy is not raising the target for 2013 (25 aircraft), although he conceives he might “sell a few more.”

Indeed, like Airbus itself, Doric is only betting on airlines to order the jet in significant quantities sooner or later, and it is now offering new leasing access to the aircraft. It remains to be seen if actual operators will pick up that opportunity in sufficient numbers. Leahy notes that leasing A380s through Dori will “take a lot of the risk out of the decision to order the A380. We see this is as a breakthrough in marketing the aircraft.”

Doric CEO Mark Laplaisius says that “the economics [of the A380] are unbeatable” and will be “very competitive” even after the new efficient twin such as the A350 or 777X become available. There will be 400 routes viable for aircraft seating 400 or more passengers by the year 2020, he argues, partly because of scheduling and airport constraints. “We are under-ordering if anything,” he says. “There is pent-up demand for this aircraft and we felt we needed to order now.”

As Airbus moves closer to introducing the A350, Boeing is further broadening its widebody offering in the medium-largeste twin segment. The long-anticipated 787-10 launch comes on the heels of 162 orders from five customers, Scott Parsley, Boeing Commercial Airplanes vice president and general manager for airplane development, says launch of the proposed 7779X is also “rapidly approaching,” perhaps by year-end. The 787-10, the largest of the three 787 versions, is to be delivered in 2018.

Among the customers launching the program are Air Lease Corp. (30 aircraft), Singapore Airlines (10), United Airlines (12), British Airways (12) and GE Capital Aviation Services (Gecas) (10). “There are all new commitments except 10 of the 20 United aircraft, rolled over from a previous 787 order and converted into the larger version,” the 787-10 is a 18-ft. stretch of the -9, allowing room for 40 more seats; Boeing says it will accommodate 200-263 passengers and have a range of 7,000 nm. Final assembly and flight tests are both to begin in 2020, with first delivery scheduled for 2018.

There have been concerns that, as a double-stretch of the original design, the -9X range might be insufficient for many carriers. And interestingly, none of the otherwise eagerly investing European airlines have ordered the 787-10, which will arrive in 2020.

In other aviation news, Sukhoi’s Su-35 stole the spotlight at the show, demonstrating remarkable thrust-vectoring maneuvers in the air. Watch the Russian fighter in action as our senior international defense editor, Bill Sweetman, explains its capabilities.

The Airbus A400M also took center stage at Le Bourget, flying daily in the air display and proving its performance promises.

Boeing stole some of the commercial spotlight from the Airbus A350 when it officially launched the double-stretched 787-10 at the show.

Thales unveiled its new concept for the cockpit of the future, dubbed Avionics 2020. The OEM’s head of innovation gave Aviation Week a demonstration of the concept during the show.
Speeding Up
With demand for new narrowbodies unbroken, Boeing accelerates the 737 MAX schedule

Jens Flottau Le Bourget

The Airbus A320NEO used to have a head start of more than two years on the competing Boeing 737 MAX. But that advantage is now becoming smaller, as Boeing is bringing forward the introduction of all three versions of its new narrowbody by several months.

The initial 737-8 is now due for first delivery toward the beginning of the third quarter of 2017, rather than toward the end of the third quarter of 2015.

The MAX program has tallied more than 1,400 orders; the NEO had chalked up 2,245 as of June 19.

While Airbus secured orders for 135 NEOs from EasyJet here last week, Boeing can be confident it will be able to soon firm up what could be an even larger commitment from fellow European low-fare carrier Ryanair—CEO Michael O’Leary hopes to finalize a deal for more than 200 737 MAXs before year-end. “If it is not 200 plus, then it is not worth doing,” O’Leary said here. Ryanair expects talks on specifics of a potential deal to continue until the end of September before final negotiations are started.

Ryanair’s anticipated MAX deal is preceded by an order for 175 Boeing 787-800s, which the airline firmed up following approval by the board of directors last week. The aircraft, planned to be delivered in 2014-18, are strategically important to Boeing because the large order will help ease the transition from the 737NG to the MAX.

Ryanair plans to grow its fleet to 400 aircraft in 2018 from around 300 today. Of the 175 additional 737s, 100 will be used for expansion and 75 as replacements. O’Leary says one of the most important aspects of the -800 is that it can hold more seats than the A320. “Boeing doesn’t get enough credit for the phenomenal success of Ryanair,” he notes.

While Ryanair had expressed an interest in the Comac C919, O’Leary now says that aircraft is too small for the airline. However, he says Ryanair would look at it again if Comac introduces a stretched version, planned to enter service early in the next decade.

Boeing’s success with Ryanair is mirrored by Airbus’s with EasyJet, which signed a preliminary agreement to acquire up to 200 A320NEOs and 35 A320s. The deal is still subject to shareholder approval and has already hit some very public opposition by founder Stelios Haji-Ioannou, who has been against further expansion of the airline in favor of focusing more on shareholder value.

The EasyJet deal is an even bigger blow for Bombardier than for Boeing. The Canadian manufacturer had been pitching a 160-seat version of its CS300 against Boeing and Airbus narrowbodies and had high hopes that an EasyJet buy would become the breakthrough for its new jet. Bombardier says it is still in discussions with EasyJet about a possible order.

Once shareholders approve the agreement, EasyJet plans to place a firm order for 100 NEOs plus 100 options. The 25 A320s are options that are converted from a previous deal. The current-generation aircraft are to be delivered in 2015-17. The airline plans to take on the NEOs in 2017-22.

EasyJet says it is aiming for a fleet of 276 aircraft in 2022, but the availability of options and a flexible retirement schedule for its existing aircraft could put the fleet size at 165-298. The carrier plans to use 85 of the 135 A320s and NEOs to replace aging aircraft.

The massive commitments made here last week—along with Norwegian Air Shuttle orders for more than 200 MAXs and NEOs in January 2012—beg the question of whether overcapacity is building up in the European direct services market and will likely lead to more competition between low-cost carriers, which they have so far sought to avoid. The deals are also likely to move more low-fare traffic on trunk routes that have been the domain of legacy airlines.
Niche Plays
Embraer serves existing customer base, looks for new markets with its E-Jet E2s

Graham Warwick, Cathy Buyck and Joseph C. Anselmo Le Bourget

However tempting it is to compare Embraer’s launch orders for the new E-Jet E2 with Bombardier’s lack of orders here for the CSeries, the companies are aiming at different markets. But there is an overlap that could prove crucial in the longer term.

Embraer launched its three-aircraft E-Jet E2 family with 355 orders and other commitments anchored by its traditional regional-airline customer base. Bombardier, meanwhile, is trying to carve out a niche for its CSeries. Both are eyeing the potential market for their new aircraft at those airlines now ordering Airbus A320NEOs and Boeing 737 MAXs by the hundreds.

The E-Jet E2 “is not just a reengined—we are investing heavily to achieve the efficiency of a clean-sheet aircraft,” says Luis Carlos Affonso, chief operating officer for commercial aviation. The new family comprises the 88-seat E175-E2, one-seat-row longer than today’s Embraer 170; the 106-seat E190-E2, the same size as the Embraer 190; and the 132-seat E195-E2, three seat-rows longer than the Embraer 195.

Affonso says the E2’s lower fuel burn per trip versus the new narrowbody airliners “will be an important market driver” allowing airlines to “right-size” their fleets by operating the E190-E2 or E195-E2 on services that do not support an A319neo or A320neo. Bombardier is trying to make a similar case for the 135-160-seat CS300, arguing it has similar seat costs to a 180-seater but 20% lower trip costs.

The complementarity argument did not prevail at EasyJet, which announced plans here to buy 100 A320neoes after evaluating the CS300 as well as the 737 MAX. Bombardier says it continues to talk to the European low-cost carrier about its 150-passenger segment, and does not believe the door is closed to the CSeries.

The E195-E2’s cash operating cost per seat is 5% lower than the 154-seat A319neo, but its fuel burn per trip is 20% lower, Affonso says. Embraer also believes it can compete against Bombardier’s smaller 110-seat CS100. “The CS100 is bigger than the 190, which has the right size and a lower trip cost. The 195 has more seats, and is the most optimized aircraft. The CS300 is a bigger aircraft and competes more directly with Airbus and Boeing,” he says.

Staying away from Airbus and Boeing territory is key to Embraer’s commercial-aircraft strategy as the company looks to grow. “The fact that defense can grow to be a solid business and business aviation to be another important pillar is embedded in our decision not to try to engage in larger commercial aircraft,” says President/CEO Frederico Fleury Curado. “Diversification is a need for us. I don’t see either being larger than commercial aircraft, at least on the visible horizon, but they can be important enough.”

The biggest change to the E2 family is the Pratt & Whitney geared turbofan (GTF) engines: PW1700G on the E175-E2 and larger PW1900G on the E190/195-E2. The engines are low-risk, says Pratt & Whitney President David Hess, because the PW1700G is almost identical to the PW1200G under development for the Mitsubishi MRJ and the PW1900G to the PW1500G already certified for the CSeries.

“We are comfortable with the engine. It is more than just the gear,” says Affonso. The GTF was selected over incumbent General Electric’s NG34 and a Rolls-Royce offering. “The GTF has reserves,” says Curado. “It runs a little bit cooler and has margins that history shows are often needed as engines run hotter over time. That was a plus.”

Other changes include new high aspect-ratio wings for the E175-E2 and the E190/195-E2, both with longer span and raked tips instead of winglets. The wings are metal. Affonso says composites are not as cost-effective on this size of aircraft. The landing gear is longer to accommodate the larger-diameter engines, and the Honeywell EGP-2 avionics feature large-screen displays.

The E2 family moves to full fly-by-wire, as used by Embraer on the Legacy 450/500 business jet and KC-390 tanker/transport. After problems developing the Legacy system, the company has switched its supplier to Moog, and will take a greater role in developing the control laws, writing the software and integrating the fly-by-wire system, says Curado.

While the E175-E2 and E195-E2 are stretched, they retain the same range as the Embraer 175 and 195. The E190-E2 stays at the same capacity, but has 450-nm longer range “to provide a bigger market catchment area,” says Affonso. List prices for the E2s will be about 15% higher than for the current E-Jet family.

Suppliers have been selected and the joint definition phase is underway in Brazil. The E190-E2 will be the first variant to fly, in the second half of 2016, and will enter service in the first half of 2018, followed by the E195-E2 in 2019 and E175-E2 in 2020. Embraer is aiming to gain 40-45% of a market it estimates at 6,400 deliveries over 20 years, the E175-E2 being marketed as a hub feeder with lower seat costs than a turboprop, the E190-E2 as a new-market opener and the E195-E2 as providing capacity growth for existing E-Jet operators as well as lower costs in mid-density markets.

Versus the equivalent members of the current E-Jet family, the E175-E2 and E190-E2 will have 16% lower fuel per seat while the E195-E2 will be 23% lower. Embraer is aiming for a 65% reduction in noise footprint, and 17% lower maintenance costs.

The E2 family has been launched with 100 firm orders and 100 purchase rights for the E175-E2 from U.S. regional SkyWest Inc.—in addition to up to 200 orders and options for Embraer 175s placed in May—and a letter of intent (LOI) from the International Lease Finance Corp. for 25 orders and 25 options each for the E190-E2 and E195-E2. LOIs for 65 aircraft from airlines in Europe, South America, Africa and Asia round out the total.

Because of the fuselage stretch, longer wing and bigger engines, the E175-E2 is heavier than the Embraer 175, and SkyWest CFO Michael Krupp says the maximum takeoff weight (MTOW) will be outside U.S. airline scope limits unless Embraer reduces the weight or pilots’ unions relax restrictions. This is true for the 200 MRJ90s that SkyWest has on order for delivery from 2017.

Most scope clauses limit MTOW to 86,000 lb.—the E175-E2 weighs in at 97,731 lb. and the MRJ90-LR ordered by SkyWest at 94,358 lb. Krupp says SkyWest has “sought the protections we believed were necessary to address the issue,” without specifying details. But certifying the MRJ to the lower limits of individual agreements will be a “paperwork exercise,” says Mitsubishi Aircraft head of marketing Yugo Fukuhara.

“This is an open item and we will have to see how things develop with scope clauses over the next few years,” Krupp adds. Embraer says higher weights are typical for newer-generation aircraft because of heavier new-technology engines, but “believes that major carriers in North America will be able to negotiate new contracts with their pilot unions to allow them to operate higher-weight, but much more economical, aircraft in their fleets.”

Bombardier, meanwhile, did not add to its 177-aircraft firm-order backlog at Paris, but it did reveal U.K.-based Odysseus Airlines as a previously undisclosed customer for 10 CS100s ordered in 2011. The airline plans to operate a premium service from airports such as London City, using the short-runway performance and long range of the CS100, says CEO Adam Scott. (With Andrew Compart in Washington.)
Growth Pains
As Superjet 100 enters international market, project partners are at odds

Jens Flottau and Cathy Buyck Le Bourget

Last week’s delivery of a Superjet 100 to its first Western customer—Interjet—was to be celebrated as the international breakthrough for the Russian-build regional aircraft. But now Finmeccanica, Sukhoi’s partner in the Superjet International joint venture, is threatening to pull out.

“We signed an agreement which has been implemented in a not very satisfactory way for quite a long time,” Finmeccanica CEO Allessandro Pansa said at the Paris air show last week. He points out that his company might opt to bail out of the project if the situation does not improve. He says the arrangement is in serious need of restructuring.

United Aircraft Corporation (UAC) President Mikhail Pogosyan seems to acknowledge the Superjet issues. He concedes that the partnership can be improved. Neither executive went into detail about the situation. Finmeccanica and its aerospace unit Alenia Aermacchi, the direct joint venture partner, are under severe pressure to restructure.

Production of the Superjet is to be ramped up from fewer than 30 in 2013 to up to 60 aircraft in about two years. Its success in Western markets will largely depend on the Interjet operation in Mexico. The airline has 20 Superjets on order and Sukhoi has invested heavily in product support facilities.

Interjet is also understood to have far-reaching guarantees, including residual values.

According to a 2007 agreement, Sukhoi is in charge of building the aircraft, while Italy-based Superjet International is dealing with marketing, sales and product support. The deal is a key project for UAC in its efforts to become more integrated in the international aerospace industry and gain more credibility in the market. Sukhoi is a UAC subsidiary. The Superjet is seen as a first step in a broader initiative to relaunch production of large civil aircraft, with the narrow-body MS-21 the next project in line.

The MS-21 is due to perform its first flight in 2015, followed by certification and entry into service in 2017. Pogosyan sees this as an ambitious but realistic goal. The aircraft is “creating the base for the future of Russian aviation,” he says. Preliminary facilities for assembly are nearing completion in Irkut, the design of the aircraft is frozen and initial components have been manufactured for testing.

Interjet takes delivery of the first of its 20 Superjet 100s on firm order.

These include stretching the aircraft by two seat rows to enable the CS300’s 160-seat “extra capacity option,” revealed in May and already specified by Air Baltic among others.

This change was made before Lufthansa placed its order in 2009, but brochures were never updated to avoid alerting the competition, says Chet Fuller, Bombardier’s senior vice president of sales and marketing.

“We analyzed the technology for the aircraft and engines and eventually became convinced it would actually happen,” says Buchholz. “Bombardier has actually managed to deliver on its promise. Every step was the right action for the program.”

Buchholz says airlines usually pay for performance, “but we get performance with the CS100 and do not have to pay for it in bad operating economics,” citing the aircraft’s ability to fly from small city airports.

Malmo Aviation owner Per Braathen says his airline plans to operate the CSeries from Stockholm Bromma City Airport, and use the aircraft’s long range on charter services for tour operators when not flying scheduled services at peak times. Malmo has five CS100s and five CS300s on firm order.

U.K. startup Odyssey Airlines plans to fly the 10 CS100s it has on order from London City Airport and other “difficult and restricted, primarily city airports” in Europe and elsewhere, says CEO Adam Scott.
Opening the Air Campaign
A350 testing gets off the ground
Rupa Haria Le Bourget

Airbus kicked off the flight-test campaign of its newest clean-sheet widebody, the A350, on June 14. Test aircraft MSN001 took off from Toulouse-Blagnac airport at 10 a.m. local time and remained in the air for 4 hr., 5 min. Chief test pilot Peter Chandler was at the controls along with Guy Magrin, an A350 project test pilot. They climbed to 10,000 ft., then 25,000 ft., reaching 340 kt. at both altitudes. The landing gear were retracted for the first time 33 min. into the flight. Fernando Alonso, head of Airbus's flight and integration test center, described the flight as “totally uneventful and a little bit boring.”
Booster or Bust
The search is on for Antares engine as ULA is probed for allegedly blocking RD-180 sales

Amy Butler Le Bourget

Orbital Sciences is scrambling to find a liquid-propulsion rocket engine that is in production and available for export to the U.S. to pave the way for its new Antares rocket, the centerpiece of a bid to compete for commercial and government work for decades to come. But just as NASA is finally turning to commercial launch providers, the Virginia-based company is running into roadblocks that jeopardize the rocket’s future after only one launch.

Orbital hopes to sell Antares well beyond the 16 missions it has already won through NASA’s first Commercial Resupply Services (CRS-1) contract. But, industry officials say the company must solidify a propulsion path by early next year in order to compete for the next batch of CRS missions for NASA. That contract is potentially worth billions and would help keep Antares in production as Orbital chases its ultimate goal of winning contracts to launch U.S. military and intelligence satellites. The NK-33 engine that powered Antares’ first flight was built decades ago by Russia’s Kuznetsov Design Bureau and is no longer in production. Further, Orbital is uncertain about the quality of Aerojet’s remaining stockpile of 23 NK-33s, beyond those set aside for NASA’s CRS-1. Aerojet Rocketdyne is Orbital’s primary subcontractor and overhauls the old NK-33 engines into a configuration for Antares, dubbed AJ-26.

Orbital officials say its only current alternative is the RD-180 engine made in Russia by NPO Energomash. But the United Launch Alliance (ULA), which operates the U.S. Air Force’s Atlas V and Delta IV fleets, holds exclusive rights in the U.S. to buy the RD-180.

Over the last four years, Orbital has inquired about purchasing the RD-180 from ULA, RD Amross and Energomash. “We could never get to first base on that,” says Michael Hamel, the company’s senior vice president of corporate strategy and development. Requests for support from the Air Force, Office of the Secretary of Defense and Congress were also met with silence, company officials say.

They suggest that these roadblocks amount to anticompetitive practices by ULA, which holds a monopoly for large government launches and uses the RD-180 to power the Atlas V Evolved Expendable Launch Vehicle (EELV).

Sparked by Orbital’s concerns, the U.S. Federal Trade Commission is investigating whether ULA’s exclusive arrangement with Russia’s RD Amross violates antitrust laws.

But, the company is not waiting for the outcome of this review to move forward. Officials are already reviewing alternatives, though the only viable option is currently the RD-180, not intended to compete against ULA in the large-payload market. Antares is designed to reopen a market once served by the workhorse Boeing Delta II, which was used to launch GPS and defense weather satellites in the 1990s.

If successful, Antares could impact more than just the business of other launch providers by opening the door for satellite manufacturers to take advantage of new technologies to build smaller, but equally or more capable spacecraft, Hamel says. Such a shift could also threaten traditional defense and satellite manufacturing by large primes, such as Lockheed Martin and Boeing, who sized their spacecraft to utilize as much of the available volume and thrust of these rockets to maximize their return on investment in launch costs. 

Hamel says Orbital has also looked at the RD-181, RD-191 and RD-193. These are either still in development, or not yet approved for export. The RD-191 is the propulsion system being developed for Russia’s Angara rocket.

Meanwhile, worried about losing its exclusive business with Antares, Aerojet Rocketdyne’s president, William Boley, is offering to restart NK-33 production with Kuznetsov. Boley says in order to start deliveries as soon as 2016, when NASA’s CRS-2 contract moves forward, he would need to have a deal with Orbital by this fall.

The total production rate depends on the demand for Antares, but Boley says it is likely to be at least 4-6 engines annually. The strategy is to use the new engines for Antares as quickly as possible, and draw from the remaining 23 NK-33 engines requiring overhaul as a “buffer” if problems arise in restarting the production process, says Boley.

Hamel says that unlike upstart Space Exploration Technologies (SpaceX), Orbital does not intend to compete against ULA in the large-payload market. Antares is designed to reopen a market once served by the workhorse Boeing Delta II, which was used to launch GPS and defense weather satellites in the 1990s.

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An overhauled, Russian NK-33 engine lofted Orbital’s new Antares rocket during its first launch April 21 from Wallops Island, Va.
Tight Corners
Su-35S maneuvers point to combat capability

Bill Sweetman Le Bourget

The high agility demonstrated by the Sukhoi Su-35S fighter at the Paris air show is rooted in a Russian concept in which close-range, low-speed air combat remains important, according to Sukhoi chief test pilot Sergey Bogdan.

The aircraft, equipped with three-axis thrust-vectoring and fully integrated flight and propulsion control, performed maneuvers here which no other operational fighter can match. These include a controlled vertical, flat-attitude descent with the aircraft rotating and a dynamic deceleration, or “cobra”, leading to a small-radius 180-deg turn and course reversal. It demonstrated a dynamic deceleration followed by extremely slow flight at a near-90-deg angle of attack.

“Most of the fighters we have available today with vectored thrust, the

Sukhoi chief test pilot Sergey Bogdan outlines the combat value of supermaneuverability to a Russian delegate at the show. A standard series production Su-35S was used for demonstration flights.

Su-30MKI and MKM, can perform these maneuvers,” Bogdan tells Aviation Week. “Where this aircraft is different is that it has more thrust, so when it performs the ‘bell’ maneuver, it can stand still, with afterburning on, and can sustain flight at 120-140 kph.”

The emphasis in “supermaneuverability” runs counter to much Western air combat doctrine, which stresses high speed, the avoidance of the slower “merge” and tactics that do not lose the aircraft’s energy. Bogdan, however, says supermaneuverability can be essential.

“The classical air combat starts at high speed, but if you miss on the first shot—and the probability is there because there are maneuvers to avoid missiles—the combat will be more prolonged,” he says. “After maneuvering, the aircraft will be at a lower speed, but both aircraft may be in a position where they cannot shoot. But supermaneuverability allows an aircraft to turn within three seconds and take another shot.”

However, Bogdan adds, “you have to be careful using that weapon. It’s like a sniper—you can’t shoot many times from the same spot because you disclose your position.”

As for the doctrine that energy should be conserved, Bogdan notes: “The theory of air combat has always evolved. In the 1940s and 1950s, the first priority was height, then speed, then maneuver and then firepower. Then with the third and fourth generation, it was speed, then height and then maneuver. Supermaneuverability adds to this. It’s the knife in the soldier’s pocket.”

Bogdan repeats a claim made when the Su-27 first performed the cobra maneuver: The rapid change in velocity can cause a Doppler fire-control radar to break lock. The maneuver is more useful on the Su-35S because the pilot can fly the aircraft out in any direction.

AviationWeek.com/awst
Answering the MALE
HammerHead UAV aims to swallow Reaper’s European market

Amy Svitak, Amy Butler and Bill Sweetman Le Bourget

As Europe dithers on joint development of a strategic unmanned aerial vehicle, Italy is touting a government-backed development with collaborative potential: the Piaggio-Selex HammerHead, a medium-altitude, long-endurance (MALE) drone that offers a capability similar to the General Atomics MQ-9 Reaper at what supporters say will be a lower price.

But after a decade of fits and starts in launching a pan-European MALE development, skeptics question whether Europe’s top defense spenders—U.K., France, Italy and Germany—are willing or able to fund a long-term industrial collaboration in a field where Europe already lags at least a decade behind the competition.

“All together, we’ve lost 10 years in Europe on UAV development,” says Tom Enders, CEO of EADS, about the moribund Talarion MALE drone unveiled by the aerospace giant’s Cassidian defense unit in 2009. “Our company has spent serious money to advance UAVs, but without orders we stopped.”

A parallel development between France and the U.K. was stalled last summer when French President Francois Hollande took a clean-sheet approach to key elements of the nation’s UAV roadmap, which included plans for bilateral cooperation between Dassault Aviation and Britain’s BAE Systems on a MALE drone to be fielded by 2020, as well as an unmanned combat air system (UCAS) targeted for 2030.

Ensuing visits by French Defense Minister Jean-Yves Le Drian to Italy, Germany and Poland hinted at broadening the Franco-U.K. collaboration. But while the minister recently signaled plans to forge ahead with joint UCAS development, Le Drian recently stated a preference for purchasing a dozen Reaper drones by 2020, potentially dimming prospects for French participation in a European MALE program.

The Italian air force’s own Reapers will need to be replaced by decade’s end, but Rome’s frustration with the U.S. government, which has been reluctant to approve requests to arm them, has prompted pursuit of HammerHead as an alternative.

The timing of the Piaggio-Selex announcement June 18 followed the unveiling of a pact between Cassidian, Dassault and Finmeccanica of Italy, in which the three rivals said they plan to embark on yet another unfunded European MALE development. But absent government monies, some industry analysts believe this is unlikely. They say HammerHead, with its commitment from Italy to buy up to 10 drones, brings a degree of credibility to the debate.

Designated P.1HH and based on the twin-turboprop, nine-passenger aircraft, the HammerHead has been supported in secret by Italy’s defense ministry through a mix of financing, personnel and access to facilities. Until now, government involvement was kept quiet, but in May, Aviation Week first reported the ministry’s investment in a classified UAV program, which Italian air force Lt. Gen. Claudio Debertolis, Italy’s secretary general of defense and national armaments, confirmed as HammerHead last week.

Debertolis says the ministry and its industrial partners at Piaggio and Selex ES—which is supplying the HammerHead’s mission management system—are ready to expand cooperation on the project.

Debertolis says the goal with HammerHead is to eventually carry up to 1,100 lb. of weapons, just enough to comply with the Missile Technology Control Regime. With a max speed of 395 kt. and endurance of 16 hr., Italian officials are calling the HammerHead the “Super MALE,” and say it is designed to operate as high as 45,000 ft. and loiter at 235 kt. Taxi tests have already begun and first flight is slated for the summer, Piaggio officials say.

HammerHead is expected to fly at the Italian government’s Sardinian test ranges in August or September, with the air force managing military certification.

The initial HammerHead demonstrator will be followed by a production-standard aircraft that will fly next year. It will be fitted with a complete sensor suite and definitive airframe modifications, including an extended wing, ventral sensor bay (used for the Selex Seaspray 7300E radar in the basic configuration) and fuselage fuel tank. Italy is looking for an initial operational capability in 2016-17.

“We won’t wait for France and the U.K.,” Guiseppe Giordo, CEO of Finmeccanica’s Alenia Aeronautica aircraft manufacturing unit, said in May. miracles.
Different Strokes
Companies take mixed approaches to booming maritime surveillance arena

Amy Butler Le Bourget

A

bundant opportunities in one of the few defense markets poised to grow despite the economic downturn are separating the prime contractors from the “subs.”

Aerospace companies are taking different approaches to securing work in the airborne maritime surveillance and patrol arena, which defense analysts estimate at $80 billion in the next 10 years.

As indigenous funding streams dry up, companies in the Americas, Europe and the Middle East are looking to secure a foothold abroad to meet the growing need for maritime surveillance. Numerous countries face increasing challenges in monitoring sea lanes, thwarting piracy and conducting anti-submarine operations and training.

This trend has platform and sensor providers taking discrete approaches to a market that runs the gamut—from sophisticated customers such as Singapore and Taiwan to smaller nations with limited resources, such as Brunei.

To capture this market, two different tactics are crystallizing. Platform providers are pushing to sell integration of intelligence-collection gear onto their aircraft as well as long-term sustainment or services. Traditional payload providers, by contrast, are offering more flexible alternatives, allowing for use of existing platforms owned by customers. This, they say, could prove financially beneficial for countries that lack the infrastructure or skill set to introduce new aircraft models into service.

In Europe, Thales and Dassault Aviation are poised to begin work on a long-planned midlife upgrade to France’s Atlantique 2 maritime patrol aircraft this year, which is currently supporting combat missions in Mali.

Thales is proposing its scalable Amascos maritime mission system, which company executives say has matured under a contract signed with Turkey in 2004 to modify CASA C295 transports for the Turkish coast guard and navy. Under a separate program, Meltem 3, Thales is providing the Amascos to Alenia Aermacchi for integration onto its ATR-72 platform.

“Amascos is fully operational, and we will present the full system with four consoles, integration of anti-submarine warfare, very smart radar algorithms, tactical situation and the use of electronic support measures,” says Pierre-Eric Fommellet, senior vice president of defense mission systems at Thales.

In the U.S., Raytheon, L-3 Communications and Sierra Nevada Corp. have embraced either modifying a customer’s existing platforms or offering integration of specialized gear on a low-end platform, including used aircraft.

The platform providers—Boeing, Lockheed Martin, Northrop Grumman, Embraer and Bombardier—are being pressured to offer a full-up, platform-based solution. “The market is oversaturated with individual platform providers trying to deliver a specific platform,” says an industry official. “We just are not married to any kind of platform [and] I am not trying to force a box down [their] throats.”

In some cases, countries end up purchasing equipment they are unable to properly maintain or operate. The Philippines, for example, has bought Russian helicopters and sensors that have been in storage for a lack of proper support. In this case, the executive says, the country might have been better off purchasing a less-sophisticated system or intelligence via a services contract whereby the company manages the sensor and aircraft and provides the finished intelligence to the customer. “We are not interested in having to go and be a prime,” the executive says, adding that in the case of the Philippines, some assets wind up “rusting on the end of the runway.”

Boeing’s 737-based P-8 maritime patrol aircraft, which will replace the U.S. Navy’s aging P-3s, is setting the global standard for a fully integrated—but expensive—option. By contrast, Boeing is proposing its small, catapult-launched ScanEagle as a fully integrated solution for nations that cannot afford or do not want a complicated fixed-wing system to maintain and operate. It is operating in eight countries and, last week, Boeing announced a sale to the U.K.

Chris Raymond, vice president of business development and strategy for Boeing Defense, Space and Security, acknowledges that the intelligence/surveillance aircraft market—including maritime patrol/surveillance—is “a little crowded.”

Meanwhile, business jet manufacturers such as Embraer and Bombardier are mirroring the approach of the large U.S. primes, emphasizing the platform as an integrated solution for customers.

Modernization of the Atlantique 2 maritime patroller is one of France’s top defense-spending priorities.
Taxi Electric
Minimizing engine use on the ground promises significant fuel and emissions savings

Guy Norris, Los Angeles, and Graham Warwick, Le Bourget

A
n Airbus A320 accelerating, reversing, and prevising its engines silent, may be an unusual sight, but the public demonstration of electric taxiing at Le Bourget may become a common occurrence as airlines strive to acquire to airline demands and install the fuel-saving technology.

The concept involves fitting electrically driven motors to the aircraft’s wheels, which will be used in place of the main engines to taxi. The system, which will take power from the aircraft’s auxiliary power unit (APU), are designed to reduce fuel-burn and emissions, lower direct operating costs, reduce maintenance time, extend engine life and provide environment-friendly eco-flight.

Unlike the taxing system in development by Wielton Tug, which uses electric motors to provide emergency power, the Honeywell-Safran system demonstrated on an A320 at last week’s Paris air show has motors in the wheels of the main landing gear. In development by EGTS (Electric Green Taxiing System), a 50/50 joint venture formed by the two companies in 2012, the system could save up to 820,000 per aircraft per year in fuel costs, says Em Furiaro, Honeywell product marketing vice president and EGTS business manager.

“We’ve looked at the mid- to short-haul market, and we think that is the market where the greatest value,” he says. Based on the standard taxing procedures of a typical A320 making a 500-nm flight, the company predicts the system will save up to 4% in block fuel costs. Assumptions include an average taxi time of 20 min, with a single engine on the taxing operation. “We are looking at the total system savings, fuel consumption of the APU versus the main engines, the energy efficiency of the system, and any ancillary benefits such as savings associated with tug operations, a 2-min. shave off the push-back time, reduced brake wear, and less foreign object damage to the engines,” he adds. The system will also reduce carbon emissions by 75% and nitrogen-oxide emissions by up to 50%, reducing carbon taxes on various European airports.

The decision to power the main rather than nosewheels was “predictable on the safety of the aircraft’s weight being transmitted through the main gear,” says Furiaro. Less than 10% of an aircraft’s weight is on the nose gear, so EGTS believes its system is therefore better equipped to handle adverse surface conditions on the ground, snowy, icy and breakaway torque considerations when aircraft “sink” into soft surfaces on hot days.

Honeywell and Safran, which first announced their intent to explore an electric taxi system in 2011, have combined their expertise in avionics, power and landing-gear equipment into an integrated taxiing system designed to accelerate an aircraft to around 20 kt. 90 sec., or 18 kt. at maximum takeoff weight (MTOW). The system is capable of accelerating to 10 kt. in 20 sec. to cross active runways, and will also have the capability of generating torque on a 15% slope at MTOW.

A 50-kW electric motor will be built into the entire wheel, on each main landing-gear unit, says Olivier Savin, Safran vice president for EGTS. “This has been tested with three pilots and they have been very positively surprised at how easy it is to maneuver and has no kickback movements, including reverse,” Savin says. “There is no reverse today on an aircraft, so we are creating a revolution.”

To enable an aircraft to turn around its center, the wheel on one side is driven in reverse while the other side is driven forward, allowing for a “tank-style” turn which could be useful when maneuvering out of an airport gate.

Initial tests to evaluate runway conditions and calculate the necessary loads to move an A320 took place in Montpellier, France, and electrical landing-gear sub-systems are currently underway at Honeywell and Safran sites in Canada, Europe and the U.S. Needed $100,000 of laboratory testing has been achieved so far on electric landing-gear subsystems. SAfran is now working on ground systems that distance has been amassed on qualification tests of wheels and brakes under normal and load conditions.

Testing on the A320 covered 160 km and 300 hr. Many hurdles have been crossed in this first phase of testing, says Furiaro. “The fully integrated system is designed for both forward and reverse,” and the A320 and 737 from Boeing and Fokker are expected to be available for test flights with both airlines have been engaged with various manufacturers and operators, he says.

JetRanger Reborn?
Bell informs new design with experience to get a jump in light-single market

Tony Osborne, Le Bourget

Bell Helicopter is aiming to reinvent the JetRanger and reenter a market it left behind five years ago. According to Bell’s president for helicopter business, John Garrison, Bell Helicopter president, says customers had been calling for a JetRanger successor with new technology and materials.

While virtually every Bell helicopter since the Model 900 has followed the JetRanger’s design, according to the latest 429, the SLS and E2 Turbomeca engine are a wholesale departure from Bell tradition. The new design fuselage is a mix of metal and carbon-fiber composite construction. Large cockpit and cabin windows bring high visibility from the pilot seat and passenger cabin. The SLS will also feature a flat bench seat with floor-forward facing seats as well as cabin doors underneath the tail boom giving access to a baggage compartment.

According to Bell, cruise speed will be 125 kt., with a range of 360-420 nm (667-775 km) while lifting a useful load of 1,600 lb. (706 kg). The SLS will use the dynamic components of the company’s Model 206L4 LongRanger, including the tetering rotor hub, single-blade main rotor and two-blade tail rotor. It is not clear whether the helicopter will have a second engine option. Bell’s new design will be the most significant change in 35 years since the Bell 206.

Newly released are Bell’s new SLS departure from the company’s traditional JetRanger-like design lines.

According to Bell, the SLS has been in quiet development for the last two years in conjunction with customer advisory panels. John Garrison, Bell Helicopter president, says customers had been calling for a JetRanger successor with new technology and materials.

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With the worldwide downturn in helicopter sales during the economic crisis, the lucrative light-twin market was saturated with new models from all the major manufacturers. While the Bell 206 has been well-received, its sales have been relatively slow.

In its initial three years of production, sales of the JetRanger were not as high as expected, even though the baseline rotorcraft, the Model 206, was last updated in 1982 and virtually unchanged until production ended. Indeed, there has been enough speculation that Bell would restart JetRanger production. The emergence of the turbine-powered Robinson R22 has certainly startled the major manufacturers. Ertmen says it is exploring a growth model of its 4800cft light turbine with a more powerful engine and increased payload capacity, while MD Helicopters is considering re-engineering its MD900C model but with a down-rated power plant to bring the helicopter closer to the R22’s price point.

AgustaWestland is working with Russian Helicopters on a new 2.5-ton machine, but details on its configuration have not been released.

Meanwhile, the Bell 205 is moving toward its 2014 first flight and the assembly line is being equipped to begin production in 2015. The tablet-enabled, touch-screen technology on the Bell 205 will have higher performance than originally planned, with a cruise speed of 155 kt. and an increase in maximum gross weight to 10,000 lb.

Newly released are Bell’s new SLS departure from the company’s traditional JetRanger-like design lines.
A Delicate Balance That Aids Us All

The aircraft that made the news at last week's 50th Paris air show are largely enabled by advances in propulsion technology that allow their manufacturers to offer big reductions in fuel burn over the previous generation of airliners. The savings of 15% or more are driving the orders. Whether it is the Airbus A320NEO with the CFM International Leap-1A or Pratt & Whitney PW1100G, Boeing 737MAX with the Leap-1B, Bombardier CSeries with the PW1500G, Embraer E-Jet E2 with the PW1700/1900G or Mitsubishi MRJ90 with the PW12000G, the engines are critical.

A highlight of this year's show was CFM Internationals “show and tell” on technology in the Leap-1 engine for the A320NEO and 737MAX, including 3D-woven composite fan blades, powder-metallurgy alloys, additive-manufactured fuel nozzles, ceramic-matrix composite (CMC) turbine shrouds and titanium-aluminide turbine blades. The notion that engine technology is driving the advances in commercial aviation was amplified at a press conference when General Electric passed around a CMC turbine blade planned for the GE9X that will power Boeing's 777X.

Just a few years ago, such a thing was unthinkable. CMCs are one-third the weight of metal alloys, twice as strong and can withstand 20% higher temperatures, eliminating the need for cooling, but it has taken years of research to overcome their inherent brittleness and make them usable in an engine. At Paris, they became emblematic of the huge investment that manufacturers are making in new aircraft engines, the different technology choices they are making, and their potential consequences.

CFM's claim that its technology will give the Leap-1 a fuel-burn and maintenance-cost advantage over the PW1100G geared turbofan (GTF) on the A320NEO goaded Pratt & Whitney into declaring that “it's not all about the gear,” and that too, makes use of carbon-fiber composites, powder-metallurgy alloys, additive-manufactured parts and titanium-aluminide blades in the GTF. All except CMCs, which Pratt says it tried in military engines, but removed because of cost and technical risk.

All this technology has taken years and billions of dollars to develop, and the crux of the debate at Paris was: Is it ready? Is it necessary? CFM says introducing a gearbox to reduce fuel burn by allowing a bigger, slower fan can only increase airline maintenance costs. Without the 5-6% fuel-burn reduction that a geared fan brings, Pratt counters, CFM has no choice but to use higher temperatures and “exotic technologies” to match the GTF’s 15% fuel saving, and that will increase component and maintenance costs.

Lower burn comes at a price, and the war of words between CFM and Pratt, in the short term, is about the maintenance-cost implications of their respective technology choices. In the long term, it is about their ability to continue to drive down fuel burn, because airlines will not want manufacturers to stop at the 15% step change of the A320NEO and 737 MAX, or CSeries and E-Jet E2.

Over time, industry has managed to improve fuel burn by 1-1.5% a year, helping airlines stay ahead of rising fuel costs. But fuel prices are still trending up, and by the mid-2020s, engine makers believe they will have to deliver a 25-30% fuel-burn reduction from today if airlines are to stay ahead. Pratt says it has a plan with the GTF, as does CFM with Leap—although GE and Snecma, partners in CFM, both independently continue research into open-rotor engines as one way to get there.

Billions are being spent on commercial engine R&D. Manufacturers count on recouping their investment not so much from engine sales, but from aftermarket support. So one worrisome development at Paris was Rolls-Royce’s decision finally to give in to Air France-KLM’s demands to maintain its own engines, and potentially those of others, for the Airbus A350.

"Billions are being spent on engine R&D. Manufacturers count on recouping their investment not so much from sales but from aftermarket support."

While it might seem a small concession to win a large order, per-hour maintenance cost agreements not only help manufacturers recover their investments, they help insulate airlines from the downside of new technologies, as the costs and risks are carried by the manufacturer. Pratt, for example, says its per-hour deals will inculcate airlines against any teething issues with the GTF’s fan gearbox. Similarly, if the Leap's CMCs prove hard to repair, CFM will carry the cost.

If engine manufacturers cannot manage the costs and risks of new technology—and recoup their R&D investments—through such maintenance agreements, it could make them think twice about the technology they put in their engines. That could slow the rate at which fuel burn, emissions and noise are reduced. And that could put at risk the continuous improvements on which airlines have come to rely. But this is not just good for business. It is something the industry has promised the world it will deliver so aviation may keep growing while being environmentally responsible.