

Mid-Year Aerospace and Air Transport REPORT

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« Images of Farnborough International Airshow 2018 merged with a computer highlight the challenges facing show organizers during the Covid-19 pandemic while heralding the creativity that went into this year's FIA Connect event, conducted entirely online.

Aero industry assembles online

by Charles Alcock

This week should have seen more than 80,000 aviation industry professionals assemble for the Farnborough International Airshow, but instead they found themselves reflecting on where the Covid-19 pandemic, which triggered its cancellation, has left the aerospace business. The online FIA Connect event provided that opportunity, and on the foreheads of about 150 panelists in more than 70 webinars it was easy to visualize the burning questions on their minds: how bad will this crisis be, when will it start getting better, what will the dreaded “new normal” look like, and what steps do my colleagues and I need to take to get there?

The consensus was refreshingly candid, built on an expectation that the industry needs to dig in for a recovery more challenging than other crises in living memory, including the first Gulf War, 9/11, the financial crisis of 2008, and the SARS epidemic. Panelists used the term “perfect storm” more than once to describe the grim confluence of steep economic downturn, public health emergency, government travel

restrictions, and widespread fear of travel and human interaction itself.

Perhaps the clearest assessment came from the Roland Berger consultancy, which this week issued a report envisioning no prospect of airline capacity returning to 2019

levels until 2024. The company believes that the civil aerospace sector has just about gotten through the crisis-management phase, characterized by painful cost-cutting and job losses.

» continues on page 26

Tempest a game-changer

by David Donald

Speakers at a series of FIA Connect webinars this week have underlined the revolutionary way in which the Tempest program partners have undertaken development of a future combat air system (FCAS), as well as its significant effects on the national skills base, economy, defense industrial capabilities, and the ability of air forces to maintain an operational advantage.

The program is adopting new processes and new ways of approaching challenges

to not only make the Tempest FCAS a “system-of-systems,” capable of defeating the threat and successfully achieving desired effects in future operations, but one achieved with maximum development and manufacturing efficiency to reduce costs and development times to around half of what can be achieved traditionally.

“We need a game-changer, we need new approaches,” said Dave Holmes,

» continues on page 26

Pandemic

Airlines dealing with Covid cuts › page 6

Sustainability

SAF and hydrogen may power the future › page 8

Manufacturing

Smart factories forging a digital path › page 18

Mobility

EmbraerX flies eVTOL simulator › page 20

Diversity

Panel aims to welcome women › page 28

Emissions

Net-zero seeks carbon cuts by 2050 › page 46

Airbus and Leonardo bosses voice Brexit concerns

by Charles Alcock

Senior leaders from European aerospace groups Airbus and Leonardo on July 20 expressed concern about working arrangements with British companies in the event that the Brexit transition period ends with no trade deal agreed between the European Union and the UK. One difficulty would likely center on the absence of a Bilateral Aviation Safety Agreement (BASA), which is supposed to form part of the Brexit settlement to allow for a relatively smooth regulatory landscape when the UK leaves the European Union Aviation Safety Agency at the end of the transition period on Dec. 31, 2020.

Industry groups have continued to express fears that the Brexit negotiations could soon collapse, as the two sides apparently remain far apart in their expectations for a complex trade deal. UK Prime Minister Boris Johnson



Guillaume Faury, Airbus CEO

has indicated that he is willing to let the UK complete its departure from the EU without a deal, even if it means having to trade on standard World Trade Organization terms.

Speaking during the opening ceremony for the online FIA Connect event, Airbus CEO Guillaume Faury said that the France-based group very much wants to keep working with UK partners, but

warned that a failure to agree to acceptable terms for future trading relations could cause serious complications. “We know there is an additional challenge from a hard Brexit and we don’t like it,” said Faury.

Adding that the French and German governments have been quick to provide high levels of support for the aerospace industry during the Covid crisis, Faury expressed hope that the UK government would follow suit. “We have been able to count on a doubling in the money available for research and development, and this represents a sustained effort for the future of aviation,” he commented. “We hope that the UK [aviation] ecosystem will be more innovative and competitive and we see that this is high on the agenda of the UK government.”

Leonardo CEO Alessandro Profumo told the FIA Connect audience that a complete and balanced Brexit settlement is imperative to Europe’s aerospace sector, in which he sees the UK continuing to play a leading role. “I am strongly in favor of an agreement even if it means postponement [of the Brexit transition period],” he said.



Alessandro Profumo, Leonardo CEO

“We have 10,000 people in the UK, including a big base for our helicopter division, and my main worry is for the people,” Profumo added. He said he worries that tightening UK immigration rules will prevent a free flow of talent needed for companies across the continent to get the technical skills they need to support key programs.

However, Victoria Foy, CEO of Safran Seats GB, said that the Covid-19 pandemic has so far proved far more disruptive than Brexit. “For us, the situation is really no different than it was pre-Brexit,” she commented. “We are part of [France-based] Safran and they have invested in the UK by buying our business and have invested more in the company over the past two years.” ■

Consumer confidence key to relaunching airline travel

by Kerry Lynch

Facing the unprecedented drop-off in passengers during the Covid-19 pandemic, commercial aviation industry leaders must closely collaborate on technology, cleanliness, and other means to reduce health risks, increase passenger confidence, and facilitate the return of travel, government and industry officials agreed.

By June, airlines globally had cut back their capacity by 75 to 85 percent, “a huge proportion,” Oliver Wyman partner David Stewart said during an FIA Connect 2020 session on the relaunch of commercial aviation on July 20. “The impact of the Covid-19 pandemic on our aviation ecosystem has been unprecedented and dramatic. Now the industry has to prepare to facilitate the recovery.” The industry needs to understand what drives consumer confidence. “The airlines need passengers to be happy to travel,” Stewart said.

He noted surveys conducted by his consultancy revealed passengers pointed to government regulation and restrictions as the biggest factor in decisions to travel. However, airline cleanliness was a top-three factor in passenger decision-making. Passengers further rated the airport environment as equally important in their travel decisions. On a more positive front, Stewart added, 75 percent of business travelers expressed a willingness to return to travel in the future as much as or more than they had pre-Covid.

However, a key to drawing travelers back will be confidence and communications, said Jack Goodwin, deputy director, restart, recovery, and engagement unit for the UK Department for Transport. The industry must overcome issues such as insurance for Covid and unexpected cancellations, Goodwin said. Recognizing the importance of aviation to the UK GDP, he said the government should endeavor to lift quarantines from various countries to gradually open travel without mandatory self-quarantines. Consumers must be reassured that travel is safe again, he said.

To provide that reassurance, industry leaders have begun collaborating on a multi-layered approach that looks at the travel experience from beginning to end, the airplane and airport environments, and protection with the acknowledgment of the possibility of passengers who may be carrying the virus, said Mike Delaney, v-p and confident travel initiative leader for Boeing Commercial Airplanes.

In the short term, airlines and airports have concentrated on cleanliness and measures to enable passengers to fly again. But focus must also center on preparing for an increase of traffic as passengers return and “hardened systems” based on lessons learned to not only help airlines navigate through the pandemic but future possible pandemics.



Preventive measures in aircraft and airport environments are equally important to the reassurance of passengers, an Oliver Wyman survey revealed.

Such systems must provide an equivalent level of safety as measures taken on the ground, even if they take into account other approaches, Delaney said. While basic social distancing might be helpful on the ground, it is not a practical solution in the air, he added. But, stressing the belief that aviation remains the safest form of transportation, he said other measures are effective, from the air filtration system to the use of masks, antimicrobial coatings, aircraft geometry, and operational systems.

Technology can play a significant factor in the recovery, said LeAnn Ridgeway, v-p of avionics and general manager of information management services for Collins Aerospace. In the airport environment, biometrics present an “easy solution” to reduce touchpoints and congestion. The technology is already available and had been growing in acceptance. With Covid-19,

a number of key international aviation organizations have expressed more support for expansion, Ridgeway said.

Other areas to help in the airport include kiosks to minimize the use of cash, increased use of mobile applications to help ease congestion points, and the deployment of artificial intelligence to help in the gate areas to minimize exposure risks, she said.

Research further centers on ultraviolet technologies in the airplane to help kill harmful pathogens, but more needs to be explored on the effects on passengers and airport materials, Ridgeway said.

The participants in the FIA Connect panel agreed that communication of all such efforts is essential to facilitate the return of ridership, but they also agreed that the industry must apply the measures consistently to reassure the traveling public. ■

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Engineers at the Pratt & Whitney-SIA Engineering MRO joint venture Eagle Services Asia in Singapore inspect a newly overhauled PW1100G.

Pratt & Whitney finds silver lining in Covid-19 pandemic

by Gregory Polek

While virtually no one welcomed the near pause in airline operations this year caused by the Covid-19 pandemic, one of the industry's prominent engine companies has managed to find a silver lining. Pratt & Whitney, whose geared turbofan (GTF) family for years suffered from technical snags, has seized the opportunity to aggressively address some of the GTF's latest problems, perhaps most notably those involving the main low-pressure turbine (LPT) in the PW1100G—one of the engines that power the Airbus A320neo.

Speaking with *AIN* just before the start of the July 20 to 24 FIA Connect event, Pratt & Whitney chief commercial officer Rick Deurloo expressed satisfaction with the progress his company has made in replacing the parts in the PW1100Gs in the field during a time of low utilization due to the pandemic.

"I can't tell you how many airline executives have said to me, 'Don't ruin this opportunity,'" said Deurloo. "And we are actually laser-focused on taking our GTF fleet and taking a look at what that configuration looked like pre-Covid and making sure when we exit this calendar year, and as we go forward, we are able to upgrade that configuration."

Areas of focus include the PW1100G's accessory gearbox, an airworthiness directive for which the FAA issued late last year. Deurloo reported good progress on that replacement program, as well as on one that involved the LPT, the blades on which required a material change. "That's a known challenge—we have a new material going into that third-stage LPT; we're setting up quick turns," he explained. "One of the things we did as a company during this crisis is committing ourselves

to the MRO piece and upgrading the GTF fleet across all platforms—Neo, A220, E2—to take the opportunity to focus on the entire fleet."

Deurloo described the effort to solve the LPT problem as a "surgical strike" in which the company managed to access excess capacity at MRO partners caused by the Covid-19-associated lull in operations.

"Let me give you a great example—Delta Air Lines," he said. "They are a GTF customer; they have the A220 airplane they're flying today, and they have an order book with us on the GTF for their A321neos. They also have an MRO partnership with us, similar to how Lufthansa does. As Delta's MRO load came down, it freed up capacity for them to say, 'Hey, you know what? I'll accelerate these LPT quick turns.' They stepped up."

Deurloo reported that Pratt "feels comfortable" that it will have gained access to all the A320neos at Indian airlines Indigo and Go Air for LPT retrofits by the August 31 deadline set by India's Directorate General of Civil Aviation (DGCA). The agency extended the deadline for replacing the LPTs from the end of May to allow for disruptions caused by the nationwide Covid-19 lockdown.

"It's actually progressing well," he said. "We're taking advantage because as you know, India has been for a great part of this time on a lockdown. So it gave us the opportunity to get access to their fleet as well. They're now back in operations, but they're not 100 percent. They're slowly introducing the fleet in."

So far, Pratt has completed 75 percent of the LPT upgrades and 82 percent of the accessory gearbox replacements on the

1,282 PW1100Gs in the field. It expects to finish 90 percent of the needed LPT fixes and all of the roughly 200 remaining accessory gearboxes by the end of the year.

"We're on track to get this fleet into a much better place as we enter 2021," Deurloo stressed.

Separately, Pratt continues work on fixes to problems discovered with the PW1500G's first rotating low-pressure compressor stage following a series of in-flight shutdowns at Swiss International Airlines and Air Baltic. Last October Swiss temporarily grounded its 29-strong fleet of Airbus A220-300s and -100s after experiencing three engine shutdowns over four months. The most recent incident happened this past February, when the crew of an Air Baltic A220-300 had to shut down an engine and divert to Bordeaux while en route from the Latvian capital Riga to Malaga in Spain. Pratt has determined an appropriate fix and has finished the first round of associated testing, said Deurloo, who added that the company has managed to limit the number of resulting AOG days with effective spares management.

"We have corrective action identified, we've gone through initial testing, and

that's something we're trying to work closely on with Airbus and our airline customers to get behind us," reported Deurloo. "The A220 fleet has been doing incredibly well in service. We've noticed that as the airlines go back into operation, the A220 fleet is the first one they pull up."

Deurloo pointed to Delta Air Lines's A220 utilization rate as evidence of the model's operational effectiveness, noting that the airline has not parked one of the Airbus narrowbodies since the onset of the Covid crisis. "They kept flying the entire time," he said. "And today I think that fleet, from a utilization perspective, is only 18 percent lower than pre-Covid. It's pretty remarkable when you think the world utilization rate is still below 50 percent of what pre-Covid was."

In fact, Deurloo explained that the comparatively small A220 fleet allowed Pratt to more effectively support the customers with spare engines than it could when the A320neo suffered some of its early problems, resulting in far fewer AOG cases. "Even though they had some removals, they didn't have some of the longer AOG or multi-day AOGs the Neo fleet saw," he noted. "So the A220 has actually had a very, very good customer experience." ■



Leonardo AW139 gets Honeywell Primus Epic upgrade

EASA has granted certification approval for Honeywell's Primus Epic Phase 8 software and EGPWS with offshore modes, and Leonardo will offer the new software in the AW139 intermediate twin. Phase 8 features an advanced synthetic vision system (SVS) tailored to helicopter operations and improved 2D maps and wireless data loading.

The advanced SVS assists with navigation and landing approaches to challenging terrain and oil rigs via 3D presentation of the external environment, including surrounding terrain, obstacles, runways, and helipads within the background of the primary flight display (PFD). A 2D interactive navigation (INAV) feature displays the

helicopter's position and flight plan on the multifunction display, enabling navigation system alignment with the actual flight path, adjusted for environmental factors.

The custom approach function offers the capability to design, set, and fly an automated approach to any user-defined location, including oil rig helidecks. Embedded wireless connectivity provides high-speed data access for flight plan transfer and maintenance data capture from the aircraft. The new EGPWS version -036, also available for Phase 7, is a more sophisticated helicopter TAWS optimized for use in offshore environments and designed to provide more warning lead time of potential collisions.

Honeywell Epic Phase 8 is one of more than 1,000 kits available for the AW139. Leonardo has received nearly 1,200 orders for the helicopter and more than 1,050 operate in some 70 countries. **M.H.**

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DAVID MCINTOSH

Eurocontrol data show that 13,378 flights operated in the European network on July 13, equating to about 37 percent of the levels seen on the same day a year earlier.

Novel Coronavirus shakes global airline industry

by Cathy Buyck

In keeping with his motto “Stay strong. We will get through this crisis and keep the world connected,” International Air Transport Association (IATA) director-general Alexandre de Juniac did not want to sound too pessimistic when briefing media earlier this month on the recovery prospects for the industry. Yet, his message was gloomy. “This crisis could have a very long shadow. Passengers are telling us that it will take time before they return to their old travel habits. Many airlines are not planning for demand to return to 2019 levels until 2023 or 2024,” he warned, as he shared the results of a survey of leisure and business travelers in 11 countries, conducted in February, April, and June on behalf of IATA.

Eighty-four percent of passengers—or more than 8 out of 10—surveyed in June are afraid to travel until Covid-19 is contained, up from 74 percent in February, and just 45 percent said that they will travel again in the first months after the pandemic subsides. In early April, 61 percent said that they would. About two-thirds see less travel in their future—be it for vacation, visiting friends and relatives, or business.

Research from global consultancy ICF echoes IATA’s findings. Its surveys of aviation sector participants and travelers from across the world conducted in late March/early April and in late May/early June show that views on the recovery have become markedly more pessimistic. Industry stakeholders expect a much slower recovery to pre-crisis activity levels. Where in late March/early April most anticipated the recovery to take six to 12 months, in late May/early June the majority of respondents (56 percent) put the recovery timeframe at more than two

years. Within that category, 28 percent of respondents answered between two and three years, 24 percent answered between three and four years, and 4 percent expected the recovery to take longer than four years. As for consumers, regardless of location or reason for traveling, almost everyone (95 percent) expressed different attitudes about traveling in the wake of the Covid-19 pandemic. “It is clear that the road to recovery is not going to be smooth—or rapid,” ICF’s consultants concluded.

Worst Year in Aviation History

For sure 2020 is set to become a dismal year for airlines financially, as the pandemic and related travel restrictions or bans, border closures, and quarantines bring an abrupt end to a decade of steady profitability. Globally, airlines can expect to lose \$84.3 billion this year, for a negative net profit margin of 20.1 percent, according to IATA’s latest outlook, released in early June. IATA expects revenues to fall 50 percent, from \$838 billion in 2019 to \$419 billion this year. Passenger revenues will likely collapse to \$241 billion, about a third of last year’s level. Passenger numbers will roughly halve to 2.25 billion, roughly equal to 2006 levels, which would equate to an average net loss of \$37.54 per passenger. During the height of the financial crisis, in 2008, operators incurred an average loss of \$10.49 per passenger. “Financially, 2020 will go down as the worst year in the history of aviation,” commented De Juniac. “On average, every day of this year will add \$230 million to industry losses.”

IATA’s projections assume no second wave of Covid-19 cases and thus end-of-year figures could prove worse owing to

the continued rise of the number of infections—from 5.9 million reported cases on May 31 to 12.8 million reported cases on July 13, according to World Health Organization (WHO) data. “There is a lot to be concerned about,” stressed WHO director-general Tedros Adhanom Ghebreyesus during a July 13 media briefing. “The virus remains public enemy number one, but the actions of many governments and people do not reflect this,” he said, warning that if people don’t follow basics the pandemic will get “worse and worse and worse.”

Fractured Approach

Several countries, regions, or cities that overcame the first peak of the outbreak and eased lockdowns and now see an increase of new infections have begun to reinstate restrictions or quarantines. In Europe, the situation changes almost daily, as each government applies its own rules for travel to and from non-EU countries but also within the bloc, wreaking havoc on airlines’ schedules as they unground part of their fleets and restore networks. “This has effectively led to a patchwork system of travel restrictions and border controls throughout Europe, which may remain in place for weeks or months to come,” Airlines for Europe (A4E) and ACI Europe lamented in a joint statement. “As a result, there is very little clarity and significant uncertainty on which citizens can travel where,” the European airlines and airports trade groups said.

For Thomas Reynaert, managing director of A4E, the situation “is also creating an uneven playing field within Europe at a time when our sector is still struggling for survival.” IATA projects Europe’s airlines to lose \$21.5 billion in 2020 and account for among the top three worst-affected regions, globally. Passenger demand is set to decline by over half, according to IATA’s forecast.

Eurocontrol data show that 13,378 flights operated in the European network on July 13. That equates to about 37 percent of 2019 levels, though it represents

a welcome increase on the 4,679 flights that took place a month earlier. Ryanair, which grounded up to 98 percent of its fleet, reclaimed its pre-coronavirus leadership position and operated 1,006 flights. Three low-cost carriers rank in the top five in terms of movements, Ryanair, Wizz Air, and EasyJet. Only one EU legacy airline, Germany’s Lufthansa, features in the top five despite most of the bloc’s flag carriers—including Air France, Austrian Airlines, airBaltic, Finnair, KLM, SAS, and TAP Air Portugal—having received generous financial support packages from their governments.

Generous Government Aid But Not to All Airlines

State aid made available to airlines due to Covid-19 topped \$120 billion by early June, IATA analysis reveals. However, not all governments, mainly in Asia, Latin America, and Africa, have shown a willingness or an ability to afford supporting their airlines in the same fashion, leaving operators cashless. “Several airlines have already entered bankruptcy protection or administration since the start of the pandemic, including Aeromexico, Air Mauritius, Avianca, South Africa’s Comair, LATAM Airlines, Thai Airways, and Virgin Australia. With all of them, the failure to secure financial support from their governments was the main driver,” pointed out Brendan Sobie, founder of Singapore-based independent aviation consulting and analysis firm Sobie Aviation. He added he expects all seven to successfully emerge from bankruptcy or administration and survive following restructurings.

A handful of other airlines have ceased operations entirely and are in the process of being liquidated—Austria’s Level Europe and sister airline Level France, Germany’s SunExpress Deutschland, and Thailand-based NokScoot—“but they were small subsidiaries of much larger parents that continue to operate,” Sobie told AIN.

He warned that a few more Asian budget airlines could shut down, joining NokScoot, including some of the nine airlines that operate under the AirAsia brand. “Asia’s independent LCCs are currently at a disadvantage because thus far the bailout packages by Asian governments have only benefitted full-service airlines and their LCC subsidiaries,” Sobie asserted, adding that governments might still step in on behalf of LCCs. For example, AirAsia expects to secure government loan guarantees in Malaysia and the Philippines, helping to support an overall restructuring that also includes a planned equity sale and renegotiated aircraft lease agreements.

According to IATA predictions, airlines in the Asia-Pacific region will be the hardest hit by the coronavirus crisis of any global region, with losses expected to total \$29 billion for 2020. The association expects Asia-Pacific passenger demand to fall 53.8 percent year-over-year. ■

Special-mission roles are a Bombardier bizjet specialty

by Chris Pocock

Bombardier made a fresh pitch for special mission versions of its business jets at an online briefing held in conjunction with the Farnborough Airshow's FIA Connect effort. Steve Patrick, v-p of specialized aircraft, said that all of the company's portfolio, from the Learjet 75 to the Global 7500, are candidates for conversion.

In particular though, Patrick claimed that the Global jets offer "unrivaled size, weight, power, and cooling capacity." For instance, the Global 5000/5500 series provides up to eight operator workstations, up to 200 Kva of baseline electrical power, and a payload of 7,139 pounds. The largest of the breed, the Global 7500, can accommodate at least 10 operators, plus four seats at the rear for crew rest, VIP transport, or briefings. According to Patrick, the spacious cabins offer "a low-fatigue environment." That is significant, because the larger Bombardier jets offer an endurance of 18 hours.

To date, the 6000/6500 series has proved the most popular for Intelligence,

Surveillance and Reconnaissance (ISR) missions, with "hundreds of thousands of hours flown," according to Patrick. The lead customer appears to be the UK Royal Air Force, which has flown its five Sentinel R.1 aircraft on multiple operations since 2008. Saab recently delivered the first of three 6000s converted for Airborne Early Warning and Control (AEW&C) missions to the UAE Air Force.

Bombardier allows integrators like Saab considerable flexibility in customization. Patrick identified four available options. In the "all-inclusive" Option A, the company performs all the design, integration, test, and certification and modifies the aircraft. In Option B, the customer does the modification. In Option C, Bombardier does the design, but the customer does everything else. In Option D, Bombardier provides only licensed design data and engineering support.

Gulfstream, Bombardier's main competitor, has a much more restrictive



The Royal Air Force has been flying five Sentinel radar-imaging aircraft on operations in the Near and Middle East since 2008.

policy. For instance, it has previously told **AIN** that it would not allow third parties to alter the outer mold line of its aircraft. One third-party conversion of Bombardier Global 6000s, done secretly and possibly using Option D, appears to have encountered significant technical problems. It took five years for the UK's Marshall Aerospace to deliver the first of two aircraft equipped with imaging and SIGINT sensors to the UAE Air Force.

In 2018, the U.S. Air Force ended a competition to replace its aging Boeing 707 JSTARS radar imaging and battlefield

management aircraft with a business jet. Bombardier teamed with Lockheed Martin to offer the Global 6000. The Air Force expressed fears that such aircraft were now vulnerable to new air defense developments such as the Russian S-400 surface-to-air missile system. But Patrick appeared to suggest that all was not lost in that particular campaign. "I'm sure as [the U.S. Air Force] goes forward and identifies the solutions to their threats in the near-peer conflict, if there is a need for a business jet solution, we will offer one," he told **AIN**. ■

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Airbus hopes to bring a zero-emissions commercial airliner to market in the early 2030s and says it must make key technology decisions in the next five years.

Airbus eyes hydrogen-powered airliner in 10 years

by Kerry Lynch

Airbus sees hydrogen as the pathway toward its goal of bringing a zero-emissions commercial airliner to market in the next decade, a key executive said on July 21.

But that executive, Glenn Llewellyn, v-p of zero-emissions technology for Airbus, agreed with other panelists during an FIA Connect 2020 webinar titled “Clean Flight—Path to Zero Emissions Aircraft” that hydrogen ranks among multiple approaches that will be necessary to reach their ultimate sustainability goals.

“We’ve been very clear recently that we have the ambition to bring a zero-emissions commercial airliner to market in the early 2030s, and one of the most promising

technologies to allow us to do that is hydrogen,” Llewellyn said. “We believe we need to position the aviation industry to be powered by renewable energy, and hydrogen is a very good surrogate for allowing us to do that.”

Hydrogen can be produced by solar or wind, he said, adding that energy can be carried onboard through fuel cells to drive gas turbines or a hybrid-electric combination of the two. That would enable a significant reduction in aviation’s effect on climate change, Llewellyn said.

“We are talking about making some significant decisions in the 2024 to 2025 timeframes in terms of the technology

choices we need to make,” he said, adding that the technology development needs to progress fairly quickly over the next four to five years.

Such progress will entail reaching beyond “aircraft borders” to the automotive and space sectors, both of which have experience with hydrogen energy use, he said. In addition, Airbus believes the airport community must also prepare for hydrogen-powered aircraft in the 2030s. That means bringing hydrogen onto the airport to power ground vehicles, he said. “That’s going to require work already starting today,” not just for aircraft but preparing the roadmap. Airbus already has begun the initial work, as well as reaching out to energy companies to scale for hydrogen usage. “That infrastructure piece is as important as the aircraft development piece,” noted Llewellyn.

Hydrogen, however, is just one approach needed for the future mix of fuels. Aircraft already have received certification to carry up to 50 percent of sustainable aviation fuels (SAF), such as biofuel. “That’s a huge lever that today we are not adequately using,” Llewellyn said, primarily because of the need to lower the cost. But SAF stands as the most promising short-term option. “There is no technology limit. There is no technology boundary in us being able to do more there,” he said.

Longer-term, however, scientists know the current generation of biofuel will reach a scalability limit, he said, adding that aviation will need more investment into power-to-liquid synthetic fuels, such as those using Fischer-Tropsch synthesis involving hydrogen and carbon molecules. “We believe that it is a highly scalable sustainable aviation fuel,” he said, and that such synthetic fuels would not compete against hydrogen. Currently, hydrogen looks promising for aircraft up to 200 passengers, but SAF or power-to-liquid

fuels might prove to be better options for larger aircraft, he said.

Riona Armesmith, chief project engineer for hybrid-electric propulsion for Rolls-Royce, agreed that in the short term “we’ve absolutely demonstrated” that the industry can use SAF immediately. “Hydrogen needs a bit more work” for use in gas turbines, but it is something Rolls-Royce is examining, along with electric. “It would be an easy thing to say it is an either-or. It’s not. It’s both,” Armesmith said, adding the industry needs to support such efforts to push them forward “rather than just waiting to see what happens.”

“Nobody’s under the illusion that there’s one technology that’s going to solve [sustainability challenges],” agreed Eamonn Beirne, head of emerging aviation technologies for the UK Department for Transport. SAF stands as the most immediate approach, but other means, including hydrogen, look as if they can help deliver on sustainability.

“There are huge opportunities,” said Russ Dunn, chief technology officer and head of strategy for GKN Aerospace. Dunn noted most aircraft developed today employ older technologies, but that significant advances have occurred in recent years. SAF is possible but needs the right economic conditions, Dunn added. However, “there are huge advances that you can make beyond that,” he said. “SAF is an important ingredient...but one of the ingredients.”

Further opportunities exist in areas such as hydrogen and electric. “Not one of those individual ingredients will meet the requirements for zero-emissions aviation for net-zero 2050,” insisted Dunn, who added that the community must address new technologies, support SAF, and explore emerging technologies such as the use of hydrogen. “Yes, there are huge challenges to overcome but they are all within our grasp,” he concluded. ■

Report examines SAF viability in the UK

by Curt Epstein

Despite the UK’s status as a major air transport gateway and a leading proponent of carbon reduction, the country produces no sustainable aviation fuel (SAF) and has seen very limited consumption of the product. To address the shortcoming, especially in light of the UK’s declared goal of achieving net-zero emissions by 2050, PA Consulting in partnership with aerospace industry association ADS is preparing to publish a white paper to resolve what the country can do to boost adoption of SAF.

“The UK is already leading the world when it comes to enshrining sustainability targets in law and decarbonizing industry,” said Kim McCann, PA’s aviation sustainability expert. “We were the first G7 nation to set the Paris climate agreement into law and the first country where that law has been directly used to challenge the aviation

industry’s right to grow,” citing the recent veto of a third runway at London Heathrow Airport on sustainability objections.

In an FIA Connect webinar on July 20, she gave a preview of the forthcoming research paper, which was the result of dozens of interviews with industry stakeholders. McCann stated that the UK possesses the full supply chain required to foster an SAF industry, and the apparent will to do so, noting the establishment just last month of the Jet Zero Council by the country’s transport secretary Grant Shapps, a move government says substantiates its pledge to back decarbonization efforts in the aviation industry.

McCann explained that several key factors block the development and investment in an SAF industry in the UK, the most important being the price differential

between conventional Jet A and sustainable fuel, which currently stands at three and a half times more per gallon. “Right now we are asking a nascent industry, a new technology to compete on a like-for-like basis with one of the world’s most established and optimized hydrocarbon supply chains,” she said. “This is not a fair fight.”

She explained how fuel represents more than 20 percent of an airline’s cost and is its biggest variable cost. With tight margins, any additional surcharge for SAF won’t likely get passed down to the consumer. With some forecasts calling for the price per barrel of oil to stabilize at \$50 to \$55 for the foreseeable future in the post-Covid world, that could further hamper investment into the sustainable fuel sector.

Uncertainty regarding optimum feedstocks remains another factor. While many

different substances have been used to make SAF, from specific terrestrial crops such as Camelina and Salicornia, to algae, to household waste, to spent cooking oils and grease, McCann said none of them offer a “silver bullet” in terms of yield and all suffer some constraints.

Despite the growing viability of SAF, many investors tend to look past it, considering SAF as a “stop-gap” measure, solely intended to hold the line until future technologies such as electric and hydrogen-powered propulsion are ready, further diluting the investment funding needed to scale production. Indeed, much of the early-stage investment in the industry has come from the oil companies and airlines. Of that investment, much has gone to fuel technologies and less to actual production, according to McCann.

Even in the biofuel arena, SAF competes with road fuels such as biodiesel.

Furthermore, the existence of disparate voices within the SAF industry in themselves

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Sustainability requires a multi-faceted approach

by Curt Epstein

When it comes to the issues surrounding sustainable aviation, there is not just one solution. That was the consensus among the panelists participating in an FIA Connect webinar titled “Sustainability—a future of clean skies, financial and human stability.”

From the industry’s earliest commitments to the reduction of CO₂ emissions, there have been three pillars on which it has hung its decarbonization ambitions. “First of all [it will take] a relentless pursuit of efficiency in airplane/engine combinations,” explained Paul Stein, chief technology officer at engine maker Rolls-Royce. He said that to achieve its stated goals of reductions in carbon emissions, the industry will require an approximately 30 percent improvement in whole fleet efficiency between now and 2050. “Second [is] the necessity to scale up sustainable aviation fuels to the levels required to really make a difference, and the third [is] to start exploring novel technologies and new propulsion methods.”

Stein noted of the latter, most of those technologies are not suited, at least in the short to medium timeframe, to power longer-haul aircraft, but he expects as they mature in the e-VTOL, UAM, and short-haul sectors, such technology will

eventually spill over into regional and larger aircraft. He said that his company has been working with the world’s major oil companies to increase the volume of sustainable aviation fuel (SAF) production, but also pointed to the exploration of nuclear power as an energy source for producing e-fuels, which could someday power electric aircraft.

Stein added that other technologies that can offer improvements to operators include the company’s Ultrafan engine under development with Airbus, which incorporates an enormous fan. “So you have a very slow-moving fan that is very quiet as well as fuel-efficient,” he said. “So customers will get other benefits, namely the noise profile of the airplane will get even lower.”

As a representative of the commercial airline sector on the panel, Etihad Aviation Group has been active in the sustainability field, according to CEO Tony Douglas. “I don’t think there will be single giant leaps,” he told the audience. “It’s going to be about how we use every opportunity to get better.”

The airline operates one of the world’s largest fleets of Boeing’s fuel-efficient 787 Dreamliner, and Douglas pointed to the environmental learning value of its



Etihad Airways and Boeing plan to work together starting in August on the seventh iteration of the ecoDemonstrator program.

“Greenliner” 787, which entered service earlier this year. The twinjet was delivered with a fuel load of 30 percent SAF and is being used in partnership with the airframer to explore methods of optimization. In one flight earlier this year from its base in Abu Dhabi to Dublin, using optimized route planning and more efficient airspace management such as continuous ascents and descents, the aircraft shaved 40 minutes off the flight, which equated to a savings of three tons of CO₂. The two companies will continue that partnership starting in August with the delivery of Etihad’s latest 787-10, which they’ll use as an eco-demonstrator in a multi-week program to test innovative strategies.

Indeed, the modernization of airspace management is on the minds of many. “The roads so to speak in the skies, were

almost laid down by the Romans,” said Douglas. “Many of them haven’t been reorganized since. They are seldom the optimum route between A and B.” He added when you look at the world’s busier airspace and their legacy protocols, there’s little consideration for current aircraft performance from an ascent and descent standpoint. “There’s too much fuel being burned for all the wrong reasons,” he said.

UK transport secretary Grant Shapps recently introduced a measure calling for the creation of the Jet Zero Council, to ensure that the British government is fully behind the measures required to achieve zero carbon emissions. Among them are ATC modernization, which could help cut carbon emissions without even taking into account new fuels or new systems. “With the algorithms we have these days, the aircraft is coming over the Atlantic, the computer slows it down to whatever speed, it comes in and it gets to its slot to the minute and flies in,” he explained. “It literally isn’t rocket science and it’s quite literally possible today.”

The panelists acknowledged that the industry remains one of the industrial sectors hit hardest by the Covid pandemic. “Obviously Covid dominates the aviation agenda at the moment,” said Douglas. “But in no way does it overshadow the work that was going on and the commitments we previously made to sustainability.” Among those efforts is work with the Abu Dhabi National Fuel Company and its work in developing SAF derived from the salicornia plant, which can grow in extraordinarily hostile environments such as deserts and salt marshes. He acknowledged that while such work is promising, “the economics aren’t at breakthrough level,” and he said he believes that the industry needs to bring in government and broader industry players to find ways to support and further develop such work.

Tom Parsons, Air bp’s low carbon commercial development manager, suggested that economic bailout programs offered currently or in the future to airlines attach green conditions, locking them into a low-carbon agenda for any subsequent growth. Because the industry is currently experiencing so much pain due to the Covid crisis, he cautioned that any such conditions be applied thoughtfully. ■

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could persuade investors that it is not yet ready for serious growth. Unfounded concerns due to a lack of subject education that SAF would require costly infrastructure replacement is another factor.

McCann explained that SAF is the only technology currently available to make a carbon emissions impact, and if and when new propulsion technologies are ready, the industry likely will still need conventional fuels for long-haul aircraft

through 2050 and beyond. SAF will need to be a large part of that for the industry’s carbon emissions goals to be met. Based on her research, she indicated that there is a definite appetite for sustainable fuels from operators (if available at commercially viable prices) as well as companies seeking to push their sustainability goals out into the supply chain.

PA recommends a stepped strategy on the way to developing what could eventually amount to a £2 billion industry in the

UK, employing more than 11,000 people.

If the newly-developing SAF industry cannot compete on today’s uneven playing field, the report calls upon the government to change the rules through various policies such as an amendment of the UK’s 2008 Renewable Transport Fuel Obligation, which mandates that a proportion of the fuel producers supply come from renewable sources. Other strategies such as the introduction of a price floor or cost differential contracts can help address the imbalance and make the business more attractive to investors who desire differing timelines for return on investment.

McCann stressed that the industry has to coalesce and speak with one voice and one opinion and establish an integrated action plan to act as a catalyst for investment in the UK industry. Next, there needs to be formalized engagement and governance to develop proposals for the Jet Zero Council on the way to developing an integrated cross-industry roadmap. The final step, implemented as early as 2021, would see the establishment of a cross-industry support network to shepherd the nascent industry through commercialization and scale-up.

The full report, exploring and describing those concepts in greater detail, will be available in August. ■



While sustainable aviation fuel becomes more common at some U.S. airports, the UK consumes little sustainable fuel and produces none.

UK launches digital skills resource

by David Donald

Nadhim Zahawi, the UK's minister for business and industry, formally launched the Defence Digital Skills Framework (DDSF) on July 20 during the FIA Connect online event. An initiative of the Skills Group of the government/industry Defence Growth Partnership, DDSF is a portal that provides access to digital skills resources to enhance the capabilities and productivity of defense industry personnel and to permit the wider dissemination of new advances in digital technology.

Currently DDSF has 13 companies enrolled and hopes to attract many more to enhance and expand a common digital skills base within the UK defense industry. The portal is now in the proof-of-concept



Digital technology stands at the heart of new defense programs such as the Tempest future fighter, in turn requiring workplaces and workforces to transform their working practices and to embrace cloud-based, collaborative development efforts and artificial intelligence.

stage and will develop over the coming months, drawing on feedback from users.

Digital technology is at the heart of the so-called Fourth Industrial Revolution, and the UK stands as an acknowledged leader in harnessing the potential that technologies such as

artificial intelligence and data analytics can bring to industry, not only in terms of design and development, but also in manufacturing processes as well as in through-life support and sustainment. However, as Zahawi pointed out, "We can't stand still. To develop the products

for tomorrow we need the right digital tools today."

Digital technology can significantly reduce development times and costs and serves as a key enabler in assisting the UK to achieve its goal of net-zero carbon emissions by 2050. It also allows UK industry to maintain intellectual property rights and operational sovereignty, Zahawi noted.

Julia Sutcliffe, BAE Systems' director for air labs and chief technologist, spelled out some of the areas where digital technology can increase productivity, reduce development times, and slash costs by around a half. The use of cloud-based data-sharing infrastructure allows "collaboration with a much wider ecosystem of partners," while facilitating the passage of innovative technologies and solutions through the design process, she explained.

An example of reduced development time is wind tunnel testing. Using traditional processes, wind tunnel testing is time-consuming and costly, requiring designers to make numerous models and iteratively test them until they find the optimum configuration. Using advanced digital technology, engineers can perform much of that work using artificial intelligence and predictive analytics. Large datasets can be generated rapidly, after which algorithms can be "trained" to analyze the data to extract the optimal solutions for real-world testing.

Moreover, many more innovation-based subject-matter experts and academic institutions can get involved in the design process thanks to the cloud, so their innovations can be evaluated and incorporated at a much earlier stage of the design process than would normally be possible.

The requirement for digital expertise is growing: Microsoft's Hugh Milward reported that research conducted by the company had shown that the military would need around 8,000 digital technology posts over the next few years, while in industry that figure stands at around 40,000. With an aging workforce in the UK defense industry, that would require significant additional training of current personnel as well as an increased flow of young people entering the sector.

"Re-skilling" and "up-skilling" the workforce is essential to gaining maximum benefit from digital technologies, but there will inevitably be some inertia. During the panel session that followed the opening addresses, QinetiQ's Vicky Weise pointed out many of the younger generations are already "digital natives" and embrace the kind of advantages that technology can bring in terms of sharing data and communicating. Implementing digital processes could benefit in many areas from a form of role-reversal, in which the more junior members of the workforce could serve prominently in educating the older members. ■

■ UK defense industry demonstrates resilience during Covid crisis

The UK defense industry has applied its capacity to bring together all of its various elements to tackle Covid challenges, all the while continuing to deliver on programs vital to national security, stressed Simon Bollom, CEO of UK forces procurement and support agency Defence Equipment and Support (DE&S), during FIA Connect's July 21 panel session on defense resilience during the Covid pandemic.

"Defense is set up to deal with crisis and contingency, so if you look back at the conflicts we've been involved in, mobilizing as a whole force—the military, civil service, and industry colleagues—has always been something we've done well," said Bollom. "Covid was for us another crisis. It was a different crisis, but it brought out the best in the defense enterprise."

In the early days of the crisis, the UK Cabinet Office called on DE&S to support the National Health Service in whatever

way it could, albeit with the caveat that the nation's defense remained the first priority. As a result, DE&S rapidly reassigned 300 people to Covid-related activities, putting their procurement and logistics skills to good use to meet the principal challenges.

The two most urgent issues were the provision of personal protective equipment (PPE) and ventilators. DE&S procurement experts rapidly placed orders worth more than £6 billion, resulting in around 11 billion individual items of PPE acquired.

At the same time, the agency approached the ventilator challenge in much the same way it would an urgent military capability requirement, reaching out to the defense industry in particular for rapid engineering solutions and supply chain establishment. DE&S's warehouse also tackled the task of managing spare parts and distribution. "I'm very proud of the contribution they made," said Simon.

The Defense Suppliers Forum (DSF), a monthly meeting of government agencies and the defense industry, has served as a key enabler in the rapid engagement of industry. The DSF became the main platform through which industry increased its collaboration and shared relevant technologies by rapidly pooling best practices and the results of experimentation. The rapid implementation of a command and control network that leveraged the advantages of digital communications proved crucial to meeting those challenges. With the aid of the ADS aerospace industry organization, the DSF expanded to bring in the ideas of a greater number of small and medium-sized enterprises.

At the same time, meeting the crisis was undertaken during a period where the delivery of major defense programs continued unabated. The designation of defense workforces as key workers considerably aided the effort.

As a result, the UK's defense industry demonstrated admirable levels of collaboration and agility, attributes that most in industry would like to see being retained in a post-Covid environment. "We'd like to hang on to that sense of purpose and sense of collaboration," said Kevin Craven, CEO of Serco UK and Europe. "The collaboration was outstanding and the agility was pretty good as well."

There is also a similar desire on the government side. "We need to be lighter on our feet, more agile," said Bollom. "Institutionalizing what is good in terms of new working practices is what we must do." He added that the defense enterprise needs to remain vigilant and prepared for rapid reaction should a second Covid spike surface. **D.D.**



While industry has been tackling problems such as ventilators, the RAF itself has provided Covid support through helicopters and fixed-wing transports undertaking emergency medical evacuation missions. This Puma performed such operations in Scotland.



Joby Aviation is one of eight partners developing eVTOL aircraft for air taxi operations Uber plans to start as soon as 2023.

Urban air mobility holds promise of future efficiency

by Matt Thurber

Everyone is talking about urban air mobility (UAM) vehicles and how they are going to bring aviation to the masses, but what is it really going to take to make this new style of transportation happen for a large segment of the population? To address those questions, FIA Connect pulled

together a panel of experts on July 20 in a session titled “Elevated Mobility: getting from demo to do!”

Eric Allison, head of Uber Elevate, emphasized his company’s commitment to UAM, starting on this challenge three years ago. Technology is moving so quickly,

it may not be long until “everyday flight” becomes feasible “through the power of the platform that Uber brings through its huge network of demand,” he said.

Real estate developer Ross Perot Jr.’s experience creating the infrastructure that underlies the massive 27,000-acre AllianceTexas development will help Alliance partner with Uber to build its infrastructure, he explained. Perot’s company is also working with Deloitte University on the Deloitte Innovation Zone, he said, “on how to bring these companies together to work on the next generation of transportation.”

Michael Romanowski, director of the FAA’s Policy and Innovation Division, represented the U.S. agency on the panel. “I am the regulator,” he said. “It is my job to look out for the safety of the system” and the vehicles that will operate in the UAM environment. The FAA is now working with 30 companies in its Innovation Center to help them on the path toward certification of their UAM vehicles. But certification is only one step. Helping the public understand the safety of such vehicles will be another important factor, he explained.

The U.S. Air Force is also pursuing UAM technologies and is eager to help develop such platforms. “There is so much more innovation happening outside the government,” said Will Roper, U.S. Air Force assistant secretary for acquisition, technology, and logistics. “We have to get outside our walls and where innovation is happening. UAM is on the cusp of flying us around as the Jetsons promised in 1962. When we look at UAM and what a big impact that could be for the economy, the Air Force cannot stand by idly and hope the market evolves. We think we can be some of the first adopters of this technology.”

The panelists addressed questions that are likely on a lot of peoples’ minds as more money pours into UAM developments. How to make UAM operation routine is a big question and formed the backdrop for much of the session.

Uber’s Allison said efforts need to center on regulation, capital, and timing, and if any of those things does not happen in proper sequence, the market will not develop properly. “So when the vehicles are ready, the infrastructure is coming on line, and the regulations are in place, then they can operate in a commercially relevant way.”

Romanowski pointed out that when he speaks with local community groups, their big concern is whether UAMs will be flying over their houses. It is important to communicate, he explained, and “make sure the community understands. We can make the vehicles quiet, but where will they fly?” The most likely routes will be over freeways, mimicking how helicopters operate, but eventually as people realize how quietly UAM vehicles operate, random programming could be used to create routes that only occasionally fly over a particular home.

The Air Force’s Roper is working with government agencies like the FAA and NASA and commercial entities like Uber Elevate on UAM development. For too long, the Air Force has relied on military-unique assets, but now it wants the same systems that companies design for commercial markets. “We’re changing from being a procurer to being a partner,” he said. “We’re an ecosystem of like-minded users. It’s part and parcel of our American history. We were almost born as an aerospace nation. It’s fun to have this opportunity right at our doorstep.”

Stratasys to ship fourth 3D printer for BAE’s Samlesbury plant

BAE Systems has ordered another F900 3D printer from Stratasys to add to the three it already operates. The aerospace giant has been a Stratasys customer since 2006, and it bought its latest printer via local partner Laser Lines.

The printers operate at the BAE Systems site at Samlesbury in Lancashire, where the company is creating a “Factory of the Future” that embraces a range of “disruptive” technologies and processes to improve productivity and drive down the

costs of manufacturing.

Fused deposition modeling (FDM) 3D printers from Stratasys already have come into use for the production of a variety of aerospace-related items, ranging from design verification prototypes through manufacturing tools to end-use parts. Employing additive manufacturing has allowed BAE Systems to achieve “significant cost and lead time reductions.”

While the new 3D printer will increase additive manufacturing capacity, it will also help in the exploitation of new materials, including the carbon-fiber-filled FDM Nylon 12CF material, which BAE uses to create robust and lightweight repair and development tools.

“We can rapidly 3D print one-off parts for new products, replace tools more easily and cost-effectively, and maintain production operations when hardware is delayed,” said Greg Flanagan, additive manufacturing lead at BAE Systems-Air. “If supply chains become disrupted, having this production power in-house also enables us to be more agile as a business and continue to best serve the needs of our customers.”

D.D.



BAE Systems already runs three Stratasys F900 3D printers at its Samlesbury factory.

Roland Berger calls for incremental green steps

by Charles Alcock

Even allowing for the hopefully short-term reduction of airline traffic volumes due to the Covid-19 pandemic, carbon dioxide (CO₂) emissions will triple by 2050, according to aviation consultancy Roland Berger. In fact, current annual levels of 1 billion tonnes of CO₂ emissions had appeared likely to quadruple by 2050, but now emission levels are set to fall during 2020, followed by some “muted growth” anticipated for the next few years, according to a new study released by the company on July 21 during the FIA Connect event.

However, according to project manager Nikhil Sachdeva, CO₂ emissions are not the only challenging aspect of aviation’s environmental footprint. Factoring in other contaminants such as oxides from nitrogen, water vapor, sulfites, soot, contrails, and aviation-induced cloudiness, the sector’s impact could end up three times higher than that of CO₂ alone by 2050.

In Roland Berger’s view, the industry needs to take an urgent and multi-pronged approach if it will have any chance of achieving a widely shared stated objective of so-called net zero emissions in the next 30 years. The company has

published a road map for the key steps that it advocates the industry follow.

First, explained Sachdeva, airlines must continue replacing older, less efficient aircraft in their fleets with new models like the Boeing 737 Max and Airbus A320neo, which deliver around a 15 percent reduction in fuel burn. He acknowledged that the immediate fallout from Covid has dampened fleet replacement plans but said that the industry cannot abandon the effort for long. The company estimates that the measure could deliver an overall 25 percent cut in emissions.

As a second step, Roland Berger said that authorities must reform air traffic management to make more efficient use of available airspace, both in terms of route and altitude optimization. While that could marginally increase fuel burn, the moves would contribute to a 10 percent overall reduction in emissions, said the consultancy.

The Roland Berger report spells out how the industry could achieve a 15 percent improvement from each of the following measures: optimizing flight trajectories; introducing battery-based electric aircraft for flights of up to 1,500 km (as long as they are recharged



Hydrogen propulsion system pioneer ZeroAvia has been flight-testing a converted Piper M600 piston single and has laid plans to power larger aircraft in the future.

with renewable energy); and introducing hybrid-electric (with sustainable aviation fuel) and/or hydrogen-powered aircraft.

The company estimates that switching to sustainable aviation fuel for longer-haul flights could yield another 10 percent savings in emissions. That would leave another 10 percent portion of current emissions that would need to be nullified by paying for carbon offsets.

According to Roland Berger partner Uwe Wechenhain, hydrogen carries significant potential to improve aviation’s environmental performance if industry can overcome various challenges, such as cost and lack of infrastructure. In his

view, hydrogen fuel cell-based propulsion systems are the most practical for aircraft seating fewer than 100 passengers, while hydrogen combustion systems will work best for larger aircraft.

Last week, the European Commission committed €300 billion to support a comprehensive, multi-industry program to boost the availability of so-called green hydrogen (i.e. produced in sustainable ways). As things stand, Wechenhain said there is insufficient capacity to produce enough green hydrogen for widespread aviation use, but he sees that situation changing after 2030, with prices coming down in the process. ■

UK aims to decarbonize aviation during Covid fight

Efforts to achieve carbon-free flights must form a key part of plans to rebuild the aviation industry, according to UK business, energy, and industrial strategy minister Nadhim Zahawi. Speaking in a webinar as part of the FIA Connect event on July 21, he reported that the newly announced Jet Zero Council will meet

soon, bringing together senior leadership from government and industry to set a strategy for achieving the goal of net-zero emissions for long- and short-haul air transport by 2050.

“While we are combating Covid we need to still work on longer-term priorities for the industry, and decarbonization of

transport is critical,” said Zahawi. He confirmed that UK transport secretary Grant Shapps is planning to launch a consultation on aviation and climate change later this year and said that the government is committed to helping the UK industry take a leading role in the field.

According to Giles Wilkes, a senior research fellow with the Institute of Government, it might prove complicated to introduce a workable mix of incentives and disincentives to drive progress in making aviation greener. However, he pointed to the fact that wind energy growth has surpassed expectations as evidence of the possible progress.

“There is not the equivalent demanded trend that we have seen in the electricity sector,” he suggested. “In current circumstances, it will be hard to make flying more expensive with taxes [that would discourage growth in aircraft emissions], but there might be progress [on wider adoption of new technology] if electricity prices keep falling.”

Mandy Ridyard, finance director with UK-based flight controls and components manufacturer ProDumax, called on the government to provide incentives for companies throughout the supply chain to retrain employees in green technology and take steps to reduce

their own carbon footprints. “We need to move on this and be ready to work with Boeing and Airbus so that we can take advantage of breakthroughs in technology,” she commented.

Former Airbus chief operating officer Tom Williams, who is now leading the UK Aerospace Supply Chain Taskforce established by industry group ADS, said that it is no longer optional for aviation to decarbonize. “Although air transport is still only 3 percent of carbon dioxide emissions, the rate is doubling every 15 years and if we don’t address this we will come under [social] pressure, especially from younger people who are more conscious [of environmental concerns],” he said.

Williams proposed that governments introduce financial incentives for airlines to replace old, inefficient aircraft with new equipment in a move that he compared to the so-called “cash for clunkers” campaign to get old automobiles off the road. He said that aerospace companies wanting to introduce new technology will have to engage urgently with Boeing and Airbus with workable proposals needed by around 2027 or 2028, “or you won’t be on the next-generation aircraft due in 2035.” In his view, hydrogen propulsion systems will emerge as the dominant platform for decarbonization. C.A.



Faraday plans to build its proposed Bio Electric Hybrid Aircraft at Duxford in the UK as part of efforts to lower carbon emissions from air transport.

Deloitte sees headwinds for commercial aviation

by Curt Epstein

Commercial aviation is “facing an uphill battle” as it attempts to adjust to new worldwide crises wrought by the Covid-19 pandemic, according to global financial audit and consulting firm Deloitte. In its recently issued 2020 Aerospace and Defense Outlook midyear update, the firm noted that it sees a prolonged recovery for the sector, which has seen a significant reduction in both international and domestic passenger traffic, particularly on the heels of a production decline in 2019.

The International Air Transport Association expects this year’s passenger traffic to decline by as much as 55 percent from the previous year, and Deloitte stated that levels could possibly take as long as three years to recover to the pre-Covid state. In a recent survey conducted by the company, 73 percent of respondents indicated they did not feel safe flying right now. Among U.S. respondents, 77 percent said they would likely not take a domestic flight for leisure purposes in the next three months, and 86 percent stated they were unlikely to fly internationally during that same span.

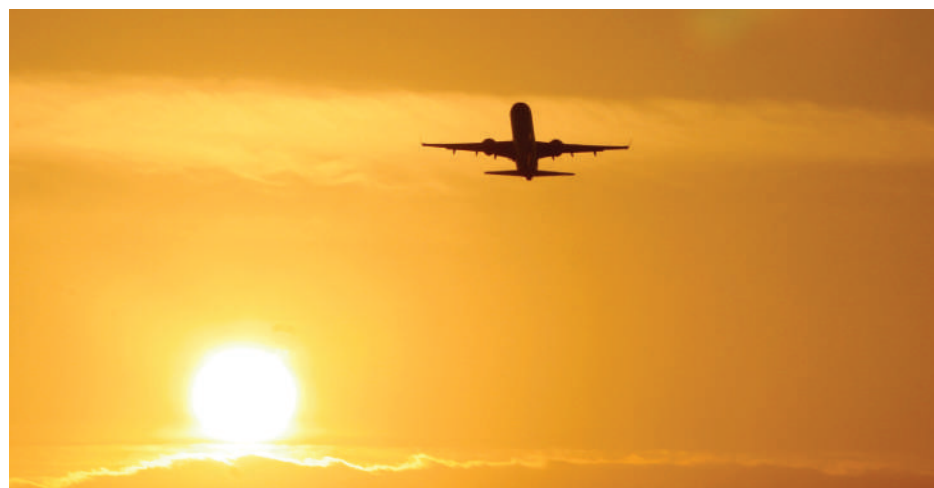
Against that backdrop, with several air carriers already announcing order

cancellations and deferrals, the company suggests global commercial aircraft deliveries this year could range from 650 to 690 aircraft, a slip of as much as 50 percent compared with 2018’s peak and a drastic downgrade from the company’s initial 2020 production estimate of 1,900. That number also takes into account delays in the return to service and resumption of deliveries for Boeing’s troubled 737 Max.

Deloitte suggests that airlines will initially see heightened demand for short-haul and domestic travel as the effects of the pandemic ease. Estimates call for the shortening of the average trip length by approximately 8.5 percent globally, which could eventually lead to higher demand for narrowbody aircraft, but Deloitte expects a bleak outlook for new orders in the second half of the year.

The global commercial aircraft backlog as of the end of May totaled some 14,100 aircraft, only slightly below the previous year’s level of 14,300. In the long term, the company sees a rebound in demand with a production of nearly 40,000 units anticipated over the next two decades.

The military sector has seen sustained



DAVID MCINTOSH

Global financial audit and consulting firm Deloitte believes commercial aviation traffic could take as much as three years to rebound to pre-Covid levels.

growth as security threats have increased, requiring governments to continue boosting their defense budgets, which Deloitte expects to reach an estimated \$1.9 trillion worldwide in 2020. According to Deloitte, most of that growth will come from increased spending in the U.S. and other areas such as China, Japan, and India as well as by members of NATO, which continue to feel pressure to reach a defense spending target of 2 percent of GDP.

The U.S. defense industry will likely not feel significant effects from the pandemic due to the increased spending by the current administration. “Though the rate of growth may decrease or flatten in 2020, the United States’ emphasis on firming up its military capabilities is expected to

result in relative stability in the defense sector,” the report noted. It said that despite efforts by the U.S. Department of Defense to ensure that the defense industrial base remains strong during the Covid crisis, supply chains could see temporary disruptions due to their complexity and geographic exposure.

Deloitte stated that the result of the upcoming U.S. presidential election in November will likely not affect defense budgets before 2022.

U.S. foreign military sales will also remain steady in the face of global threats and will likely add to the performance of the defense sector, reckons Deloitte. While such opportunities could spur an increase for U.S. contractors, Deloitte cautioned a strengthening U.S. dollar could have a dampening effect, as it could allow European defense exporters to become more price-competitive.

Overall, Deloitte’s analysts said, the aerospace and defense industry “needs to prepare for a hard landing” in the wake of the pandemic. It believes those companies that embraced digital transformation in terms of the adoption of robotics and automation in their manufacturing processes will more effectively weather the crisis, along with those that have followed “a more focused capital discipline strategy” in the past. Companies could also leverage digital technologies to manage a remote workforce, as well as ensure health and safety on the factory floor. Some will no doubt view the crisis as an opportunity to accelerate their adoption and integration of digital technologies to help them not just better survive business disruptions but to recover and thrive.

Regarding merger and acquisition activity, the company expects a sluggish second half of the year as the pandemic continues to affect demand, particularly in the commercial aerospace sector. Liquidity could also become a consideration as the year progresses. Such concerns have even led to the dissolution of deals announced pre-Covid, such as Boeing’s agreement to acquire a controlling stake in Embraer’s commercial aircraft division. It noted that the U.S. has recently taken measures aimed at restricting opportunistic purchases by foreign entities during the pandemic, especially those from China. ■

■ EAG Launches 70-Seat Hybrid-electric Regional Aircraft

Electric Aviation Group (EAG) has announced plans for a 70-seat hybrid-electric regional airliner, which the UK group says will be ready to enter service in 2028. The Bristol, UK-based start-up unveiled its design on July 20 to coincide with the opening of the FIA Connect event.

According to EAG, the short takeoff and landing Hybrid Electric Regional Aircraft (HERA) will deliver range of up to 800 nm. The company says it expects to be able to offer an all-electric version of the narrow-body airliner by around 2030.

The current design shows four sets of propellers across the leading edge of its fixed wing. EAG has not specified what type of engine it will use to generate electricity for HERA’s motors. It said that the aircraft will feature what it calls Gear Assisted Takeoff Run (GATOR) technology to support its short takeoff capability while reducing energy requirements.

According to EAG founder and CEO Kamran Iqbal, he has held talks with multiple leading aerospace suppliers that have expressed a willingness to partner in what EAG calls its JetZero Consortium. The group is unrelated to the UK government’s recently formed Jet Zero Council, established to advance plans for the development of zero-carbon-emission airliners.



Electric Aviation Group says its HERA airliner will carry 70 passengers up to around 800 nm.

Iqbal told **AIN** the company intends to assemble a flight demonstrator aircraft based on an existing Bombardier Dash 7 or Dash 8 twin-turboprop, in order to evaluate its planned propulsion system. It expects to start flight tests with the aircraft within the next four years before building the airframe for the HERA.

EAG estimates that it will need \$5 billion to get the HERA into series production. The company is looking to raise capital through a mix of government funding and private sector investors.

Plans call for the aircraft to have a maximum takeoff weight of 55,000 pounds,

speed of around 275 knots, and a takeoff field length of less than 4,000 feet.

“We expect this to be a great example of British design, engineering, and build,” said Iqbal. “Not only will the development of HERA help the [UK] Department for Transport accelerate its ‘Jet Zero’ carbon reduction goals, it will also help create job opportunities in the aerospace manufacturing, engineering, and services industries post-Brexit. This represents the future of both passenger and cargo flights internationally, and as an opportunity for investment it could not be better timed.” **C.A.**

Covid dents F-35 production as development continues

by David Donald

Considering that the Lockheed Martin F-35 is the largest global defense program currently under way, with a vast number of suppliers—both domestic and international—in the supply chain tiers, it comes as no surprise that the Covid-19 pandemic has affected its production rate.

“We expect to see F-35 delays of two to three months,” said Darren Sekiguchi, Lockheed Martin v-p of F-35 production during an FIA Connect event. “At this time, we expect to see impacts of 18 to 24 aircraft in 2020. However, we will accelerate production when we return to pre-Covid-19 conditions to recover as many delayed aircraft as possible. This year’s delivery target is 141 aircraft, and we continue to work towards that goal.”

Lockheed Martin designed the F-35 production system to be as flexible and resilient as possible so that alternative sources can cover single-point supply problems, but the worldwide effects of Covid-19 have inevitably affected the supply chain. Sekiguchi hopes that production rates can return to pre-Covid rates by “the late summer or early fall this year.”

Lockheed Martin is keen to maintain the financial health of its suppliers, especially the smaller Tier 2 and 3 companies. To maintain its major defense contractors and their key programs during the crisis, the U.S. government introduced an accelerated program payment scheme that released more than \$1 billion in F-35 payments to Lockheed Martin, all of which has cascaded into the supply chain to ensure that it remains intact.

The F-35 production line has delivered 540 aircraft, and more than 1,000 pilots and 10,000 maintainers are now trained to fly and work on the aircraft. Eight countries have F-35s operating from their territories, and six services have declared initial operational capability (IOC).

The aircraft continues to expand its capability and is currently undergoing a program known as Tech Refresh 3, which provides additional computer capacity. “That computational capability allows us to have additional new software modes, to be able to use new information and fuse it in different ways from the sensors,” said Santi Bulnes, v-p of F-35 engineering



F-35As from the 388th and 419th Fighter Wings perform an “elephant walk” during a Combat Power exercise at Hill AFB, Utah in January. The Lockheed Martin program has now delivered 540 aircraft to U.S. and allied air arms.

and technology. “It will enable interoperability, new datalinks, [and] the connectivity that is so important in the modern warfare world.”

New weapons are coming too, said Bulnes. “We’re going to be easily adding upwards of 20 new weapons over the next few years,” he noted. “That gives the warfighter the flexibility needed when they go into theater.”

The automatic ground collision avoidance system, which has been operational in the F-16 for some time, has proved an important addition from a safety standpoint.

Arguably the most important upgrade

underway is to the aircraft’s data information system, which lies at the heart of logistics, maintenance, training, operations, and technical support planning. The original Autonomic Logistics Information System (ALIS) design emerged in the mid-2000s and has not benefitted from any technological refreshes.

To replace it, Lockheed Martin has developed the Operational Data Integrated Network (ODIN), which leverages huge advances in digital technology to create a system that can handle far more data. The company expects ODIN to achieve IOC next year and reach full operational capability in 2022. ■

Europe on course for two future combat programs

Since the UK announced in July 2018 its Tempest future combat air system (FCAS), which followed the launch of the Franco-German Système de Combat Aérien Futur (SCAF or FCAS) weeks before, speculation about whether Europe can afford two programs of such magnitude has led, in turn, to repeated calls for the two projects to merge.

For now, though, such a harmonization of efforts appears unlikely, at least in the

near term. Moreover, as each program progresses further, the stakes involved for both sides increase to the point where conceding defeat carries with it huge penalties that strike hard at the very reasons the projects were launched in the first place, particularly in terms of technological standing in the global defense market and the beneficial effects on national economies and technological capabilities.

“The problem at the European level

is that half the sector loses out,” said Douglas Barrie, senior fellow for military aerospace at the International Institute of Strategic Studies during an FIA Connect panel session. For countries that lose out it would be “very damaging” he said, adding that “there’s a very strong national element in all of this.”

That “national element” sees the UK, which leads Tempest, pitted against France, which is the lead nation for SCAF, and neither would likely give up their leadership roles. Robin Southwell, former CEO of Airbus UK, noted that “France and Germany are clear in their direction” and warned that while they might welcome the UK’s involvement, it might be limited. “Involved is a word of many meanings,” he commented.

While in general scope the two competing concepts have great similarities of operational employment—both feature “combat cloud” connectivity and the use of multiple uninhabited “loyal wingmen” or “remote carriers”—there are some differences. For instance, the Tempest might, as some suggest, carry an optionally-crewed capability, whereas SCAF is envisioned for only piloted operations.

If, as appears likely, there are two FCAS programs in Europe, the problem remains that, at present, the huge development costs must be amortized across fewer customers. Achieving the “critical mass” necessary to reduce the individual costs to partner nations would involve taking

on more partners. For Tempest, the UK has signed up Italy and Sweden to join in the development, bringing in companies such as Saab, GKN Aerospace Sweden, Leonardo Italy, Elettronica, Avia Aero, and MBDA Italy. Spain has joined France and Germany in their efforts.

Claude Alber, a senior Collins Aerospace executive, offered some middle-ground possibilities, in which partners could co-develop individual technologies while still taking into account differences in operational concepts. In that way, costs could drop for both programs without denting national leadership ambitions at a major program level.

This already is taking place in a fashion with the missile work undertaken by MBDA, which is a major partner in both projects. The new range of weapons under development by the company on both sides of the English Channel is applicable to both Tempest and SCAF systems. The company’s recent success in arming all three European combat aircraft types—Gripen, Rafale, and Typhoon—with the Meteor long-range air-to-air missile is proof that such arrangements can work.

Alber also dismissed any difficulties in divisions of multinational companies working on opposite sides of the Tempest/SCAF divide as they are local product lines developed entirely within the framework of national sovereign intellectual property that exists in their own countries. **D.D.**



Development of two future combat air systems in Europe—the Tempest (illustrated) and SCAF/FCAS—now seems assured in the short term, but long-term success appears more achievable with further investment from additional international partners.

FAA review of 737 Max reaches its final stages

by Gregory Polek

As members of the FAA's Aircraft Evaluation Group (AEG) and Boeing flight test pilots prepared to perform the 737 Max's July 10 operational suitability flights between Boeing Field in Seattle and Moses Lake, Washington, industry observers and airline customers alike eagerly awaited the results of three days of certification flying that ended a week and a half earlier. Described by an FAA spokesman as a routine part of any certification effort, the operational suitability flights marked one of the last procedural hurdles the program must clear before the agency issues its final approval for the airplane to return to service.

Before that happens, authorities must determine whether or not the software changes engineers made to the flight control systems met design criteria. During the series of certification flights, test pilots would typically fly so-called hardovers, during which control surfaces deflect to their maximum automated limit, according to retired Boeing designated engineering representative (DER) and FAA organization designation authorization (ODA) administrator Mike Borfitz.

"I would also imagine there would be a lot of analysis of the two angle-of-attack vanes," Borfitz added. "I would imagine there would be a lot of work into the reliability of those things. What happens if there's a disconnect between the two? Because that's where things went south on them."

Perhaps most vitally, testing will center on the airplane's maneuvering characteristics augmentation system (MCAS), a malfunction of which led to the twin crashes in October 2018 and March 2019 that killed 346 people and the Max's now 16-month grounding by global aviation authorities.

"The software is going to be a huge, huge deal...I would imagine they'd be looking at MCAS failures in all phases of flight, that being takeoff, departure, cruise, approach, and landing, that sort of thing," explained Borfitz. "It would just be a matter of wringing out every possibility for this system to fail in."

According to a Department of Transportation Inspector General's report issued on July 1, Boeing failed to submit certification documents to the FAA on modifications to the MCAS, including significantly increasing the system's ability to lower the aircraft's nose automatically under certain conditions. According to the report, FAA flight test personnel knew



Boeing 737 Max jets sit in storage at Moses Lake, Washington.

of the change, but "key" agency certification engineers and personnel responsible for approving the level of airline pilot training told the IG's office they did not.

The report also revealed that because Boeing's safety analysis did not assess system-level safety risks as catastrophic, the company's engineers designed MCAS to rely on data from just one of the two flight control computers associated with the angle-of-attack sensors.

Although Boeing did not communicate to the FAA the formal safety risk assessments related to MCAS until November 2016 and January 2017, more than four years into the five-year certification process, FAA managers told the IG's office that "it isn't unusual" for manufacturers to complete and submit safety assessments toward the end of the certification process.

Meanwhile, because Boeing presented the software as a modification to the 737's existing speed trim system that would activate only in limited conditions, the FAA did not emphasize MCAS in its certification efforts and, therefore, a more detailed review of the system did not occur between agency engineers and Boeing. Rather, the FAA concentrated its efforts on what it considered high-risk areas such as the airplane's larger engines, fly-by-wire spoilers, and landing gear changes.

"From everything I've seen, it appears to me that the MCAS fault was overlooked," said Borfitz. "And it appears to me that it was undervalued...understated by the Boeing Company. You can only regulate what you know. That's the kind of thing that I really hang my hat on, that the FAA can only regulate what they're told."

Following the start of flight testing in 2016, the FAA's Flight Standards Service approved a training plan proposed by

Boeing—known as Level B training—for 737 Max pilots already qualified to fly the Boeing 737-800. According to the IG report, the outcome met with Boeing's "overarching" goal of gaining a common type rating for pilots moving to the Max from the NG largely because it limited costs by avoiding simulator training. Furthermore, required training did not include pilot response to automated MCAS activation, added the report.

System Safety

According to Borfitz, Boeing's failure to rank as catastrophic the level of system safety risks in the MCAS also might have allowed it to avoid the need for simulator training.

The FAA's Flight Standardization Board (FSB) and the Joint Operations Evaluation Board (JOEB)—which includes international partners from Canada, Europe, and Brazil—will evaluate minimum pilot training requirements, including the need for simulator time. The FSB will issue a draft report for public comment addressing the groups' findings before the FAA publishes a final FSB report.

Other tasks include an FAA review of Boeing's final design documentation to evaluate compliance with all agency regulations. The multi-agency Technical Advisory Board (TAB) will also review the final Boeing submission and issue a final report before the FAA determines compliance. The FAA then must issue a Continued Airworthiness Notification to the International Community (CANIC) of pending safety actions and publish an airworthiness directive (AD) that addresses the known problems that led to the grounding. The AD will advise operators of needed corrective actions before aircraft may re-enter commercial service.

Once it rescinds the grounding order, the FAA will retain its authority to issue airworthiness certificates and export certificates for all new 737 Max airplanes manufactured since the grounding and perform in-person, individual reviews of each aircraft. Those reviews, said Borfitz, will require the FAA to commit far more resources to delivery authorizations than usual, given that regulations allow for ODA personnel to release the airplanes for delivery in normal circumstances. Inspectors will have to conduct a review of manufacturing records, including approved corrective actions for typical deviations such as mis-drilled holes, deviations in materials or processes, as well as a thorough review of the more critical design changes such as software revision levels. Returning airplanes from storage is another process the FAA likely needs to review.

"Those inspectors are going to go out and they're going to take a look at the airplanes, they're going to first and foremost ensure that the software load on each airplane is correct and appropriate and the paperwork is all correct," explained Borfitz.

Inspectors might also review what Borfitz also described as a "stack of information" known as material review board (MRB) documentation that follows each airplane during the production process.

"The MRB is a pretty rigorous process and it's part of the production approval," he explained. "An inspector might want to look into the MRBs just to do a spot check through that paperwork, but first and foremost is to be sure the software load is correct and the process is appropriate. Typically they don't do that; everything is just delegated and the MIDO [FAA manufacturing inspection district office] folks just review the process."

UK aero, defense industry ask government for help

by Charles Alcock

Aerospace and defense industry leaders on July 20 called on the UK government to urgently increase support for companies to survive the Covid-19 crisis. Speaking during the opening ceremony for the online FIA Connect event being held in place of the Farnborough International Airshow, senior executives from Airbus, Rolls-Royce, Leonardo, BAE Systems, Meggitt, and Safran made the case for an alliance between industry and government to keep up levels of investment in key areas of research and development and to ensure that the supply chain remains viable to support a recovery many now expect to take until around the middle of this decade.

Meggitt CEO Tony Wood, who is also president of UK industry association ADS, spelled out four ways he would like to see government working more closely with companies to pull through what he called “the gravest crisis we have ever felt in the commercial aviation industry.” He spoke after several speakers pointed out that the French and German governments have already committed much larger amounts of financial support for their national aerospace sectors, while the UK response has so far centered on short-term relief to protect jobs.



Tony Wood,
ADS president

“The gravest crisis we have ever felt in the commercial aviation industry.”

Wood called for a doubling of government support for the UK’s Aerospace Technology Institute (ATI) to support the advancement of technology to make aviation environmentally sustainable. ATI, which brings together 100 experts from across industry and academia, is leading the FlyZero program to develop zero-carbon air travel.

Earlier on July 20, Alok Sharma, the UK minister for business, energy, and industrial strategy, committed £15 million (\$19 million) for the program as part of a wider £400 million package previously

announced. He said that his department and the Department for Transport will jointly oversee the so-called JetZero project, which is aimed at bringing a zero-carbon long-range airliner into commercial service by 2050.

By way of comparison, Wood pointed out the French government recently committed around €1.5 billion (\$1.7 billion) specifically to support the development of emissions-free aircraft. The German government also has pledged significantly higher levels of support than its UK counterparts.

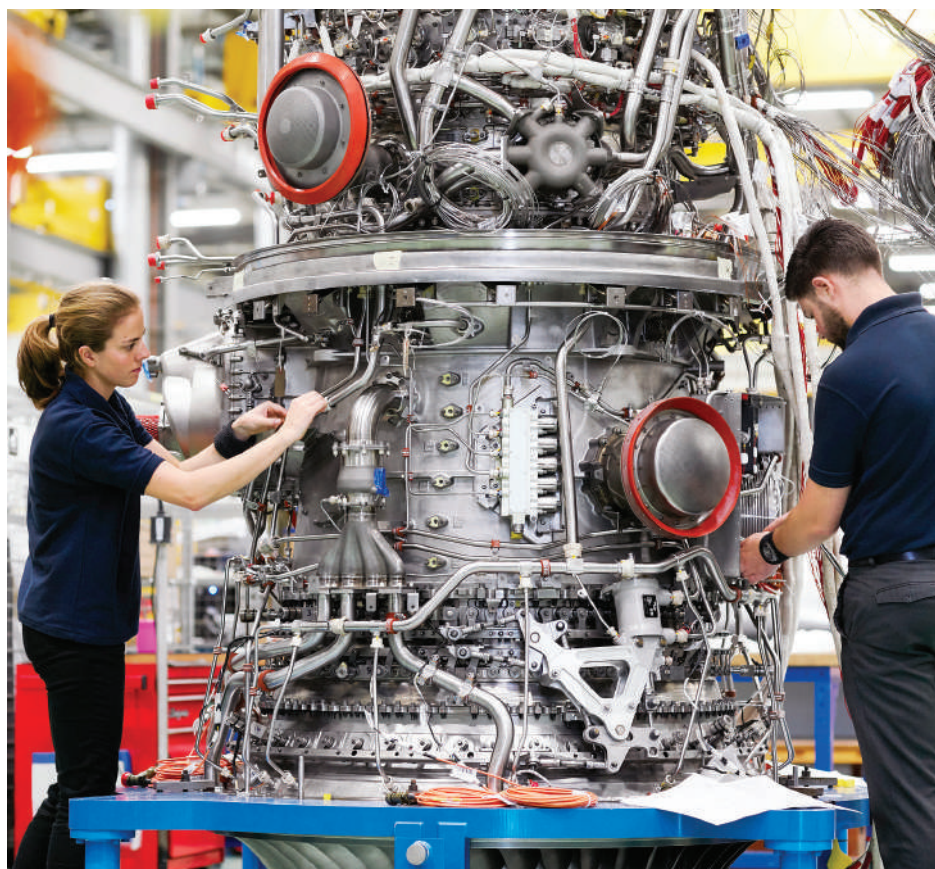
Asked whether the UK government is doing enough to support a key industry that currently supports around 375,000 jobs, Woods responded: “This is a key question for the UK and there is no doubt that the UK industry is under severe strain. This is a big opportunity for government and industry to come together and accelerate funding for a sustainable future.”

This week, ADS is set to hold talks with the government and it hopes to conclude further agreements on the sort of partnership it seeks. “This is one sector that can deliver strongly for the country in terms of intellectual property from research and development and high-value jobs for the future,” he argued. “And we want to be able to get the UK back to its number-two position on the global [aerospace] stage.”

Wood also urged the government to accelerate public spending on defense, space, and security programs to provide financial support to key suppliers who are suffering from a steep decline in the commercial side of their businesses. To further alleviate financial pressures as short-term relief for furloughed workers comes to an end in the coming weeks, he urged the government to work with the British Business Bank to offer additional funding means.

Acknowledging recent government support to incentivize companies to continue apprenticeship schemes, Wood said that apprentices on current training programs will need support to complete them and secure continued employment. “It is the younger and less experienced end of the workforce that is hard for companies to support in the current situation, and so we would like the government to further enhance its support for this effort,” he stated.

Airbus CEO Guillaume Faury said that “the gravest crisis in our history” is not one that even the company’s worst-case risk scenario planning had considered. “It went quickly from something that we treated as a short-term situation to something that we think will last for between three and five years, if not longer,” he



Engine maker Rolls-Royce has experienced a significant decline in demand for its civil aircraft engines, forcing it to reduce its workforce.

commented. Airbus’s initial response has been to stabilize the European aerospace group for the possible start of a ramp-up in operations from 2022, but Faury warned that he can’t rule out having to deal with another crisis at that point in terms of longer-term effects from the pandemic or some other global problem.

According to Faury, Airbus accepts that it might emerge from Covid-19 with the company at around the same size as it was 10 or 15 years ago. “What matters is that we can get back in the race and be able to invest again,” he said. “Decarbonized flight is vital and it is probably even more important now to make the right investment in this so, paradoxically, we have fewer means but more need to invest now. But I think we are on the right path, facing up to reality and not in denial about what Covid has done.”

BAE Systems CEO Charles Woodburn told the FIA Connect audience that even though as much as 90 percent of the group’s business is defense-related, it has not been immune to the steep decline in commercial aerospace. He pointed out that many of BAE’s key suppliers are heavily exposed to a loss of civil market revenues.

In his view, the defense industry could potentially play a role in bolstering struggling companies to preserve the long-term capability of the supply chain. He said that the UK government’s current review of the defense and security requirements should also consider how the industry can support economic prosperity by maintaining jobs and the industrial base.

Woodburn said that the Tempest future combat aircraft program could provide a part of the foundation for economic recovery. “It could benefit companies facing exposure to civil aerospace [losses] so we must make a case for this [to the

government], but since the budget is stretched we must demonstrate value for money,” he concluded. He confirmed that BAE has recommitted to hiring a record number of 800 young apprentices.

Safran Seats GB, the UK division of the cabin interiors business of French group Safran, is a prime example of a company that has felt the fallout from Covid-19. CEO Victoria Foy said that it first felt the effects as early as late February, when airline customers started reducing orders and that there had then been a second dip in demand from around April as OEM customers Airbus and Boeing cut back production. The company is in the process of cutting around 300 of its 1,200 jobs in the UK.

However, Foy added that OEMs have shown a willingness to work closely with their suppliers to provide help in the wake of the rescheduling of orders for airliner seats. “We have worked very closely with them throughout the crisis and we will come out of this together,” she concluded.

Leonardo CEO Alessandro Profumo said that the Italian group has stepped up its Leap 2020 long-term planning project with key suppliers. Explaining that 80 percent of Leonardo’s procurement resides with 20 percent of its suppliers, he said that the group aims for further rationalization of its supply chain over the next 10 years.

“We want to reduce the capital needed to support the supply chain and we have created a training system for SMEs,” he said. “We need more large suppliers and we are measuring key performance indicators to achieve this target, involving more than 1,300 site visits.” To address short term concerns, Leonardo has created what it calls “a control tower” to assess on a daily basis the effects of Covid and what help specific suppliers might need. ■



The Eurofighter Typhoon trials aircraft—IPA5—with the Captor-E radar undergoes tests in an anechoic chamber.

Intro of Typhoon E-scan radar just months away

by Jon Lake

The Eurofighter Typhoon has lagged behind some of its competitors in fielding an Active Electronically Scanned Array (AESA, or E-scan) radar, but the service introduction of the Captor-E AESA radar on the aircraft is now just months away. Captor-E is currently in production for Kuwait, which will receive its first aircraft this year, and under contract for Qatar. Airbus Defence and Space and sensor system supplier Hensoldt have also signed a contract for an AESA radar for retrofit to the German Tranche 2 and 3 and Spanish Tranche 3 Eurofighter fleets.

The effort to produce an AESA radar for Typhoon began in 1993, with the Anglo/French/German AMSAR (Airborne Multi-Mode Solid-State Active-Array Radar) research and development program. Captor-E, as it is known today, owes its origins to the 2002 British and German industry CECAR (Captor E-sCAN Risk reduction) project, which began as a strand of AMSAR. The project team aimed to develop an AESA derivative of the existing Captor, while adding a new AESA antenna to the existing Captor-D “back end,” retaining all features and capabilities of the original system.

A CAESAR (Captor AESA Radar) demonstrator flew aboard a UK MoD-operated BAC One-Eleven on Feb. 24, 2006, and later on Eurofighter Development Aircraft

DA5 starting May 8, 2007. The Euroradar consortium offered to provide a CAESAR-based AESA solution for the Eurofighter, but it became clear that a fixed antenna would be handicapped by a more limited scan in azimuth, and by reduced range at the edges of azimuth coverage. To overcome the deficiency, Euroradar explored a number of “moving AESA” designs, using a single or double swashplate repositioner to provide much wider scan limits, and developed CAPTOR-E using just such a system.

Plans originally called for the incorporation of an AESA radar on all Tranche 3 Eurofighters, and they were built with structural provision for a heavier AESA antenna, together with improved cooling and increased electrical power. The Eurofighter E-scan program was not accorded a high priority, however, not least because the mechanically scanned (M-scan) Captor demonstrated such impressive operational capabilities.

Competing visions of a Typhoon AESA led to further delay, but in 2012 Eurofighter established an AESA radar roadmap, with several versions of the basic Captor-E to meet different customer requirements. Work on Captor-E began using industry funding, and an initial radar was fitted to the UK Typhoon test aircraft, IPA5 (ZJ700), in time to be shown on static display at the 2014 Farnborough air show.

Eurofighter and the NATO Eurofighter and Tornado Management Agency (NETMA) signed a €1 billion contract to develop the electronically scanned Captor-E radar on Nov. 19, 2014, and work accelerated after Eurofighter and Finmeccanica (now Leonardo) signed an \$8.7 billion contract with Kuwait for the delivery of 28 AESA-equipped aircraft in April 2016, with Qatar then signing a contract with the UK for 24 aircraft in December 2017.

Captor-E Consortium

Leonardo led the development of Captor-E within the four-nation Euroradar consortium (Leonardo in the UK and Italy, Hensoldt in Germany, and Indra in Spain) and acted as the design authority for the radar, while BAE Systems took equipment design responsibility, integrating the radar onto the Typhoon aircraft. The AESA radar, in Radar 1+ (now known as Mko) form, is being introduced to the Typhoon as part of the Phase 3B Enhancements (P3Eb) program.

Flight trials began on July 8, 2016, using IPA5 and, from September 2016, IPA8—a German Tranche 3 Eurofighter. From Dec. 23, 2019, the two aircraft were joined by the first Typhoon in Kuwait Air Force configuration—Instrumented Series Production Aircraft 6. Between March 3 and 27, ISPA6 conducted the so-called “E-scan XCR#1” flight test campaign using other Typhoons as radar targets. That completed E-scan entry-into-service flight tests and the overall P3Eb flight test campaign, readying the way for deliveries to Kuwait.

Flight testing confirmed the tactical advantage conferred by the radar’s

repositioner, which gives a field of regard 50 percent wider than that provided by conventional fixed E-scan antenna systems. ISPA6 has continued flight testing to refine the radar’s ECCM (electronic counter-countermeasures) capabilities and to conduct final E-scan software release certification flights.

Plans originally called for the “four-nation” version of Captor-E for the original partners to use the same hardware as the export standard Radar 1+, but with additional documentation and performance data to satisfy the four-nation requirements set down by NETMA. However, when Hensoldt recently announced that it had won a contract to develop and produce a new AESA radar for retrofit to the in-service German and Spanish Eurofighter fleets, it revealed that plans had changed.

The aircraft will initially be fitted with the same Mko radar as that supplied to Kuwait and Qatar, but the radars will subsequently be upgraded to Mk1 standards with a new digital multi-channel receiver and new transmitter/receiver modules, which will be developed under the new €1.5 billion contract. Hensoldt will be the design authority for the new German Mk1 E-scan radar, while Airbus will carry equipment design responsibility. Leonardo will provide the necessary support to enable Hensoldt to assume its role and will continue to provide the processor for the new German radar, which will be assembled at Ulm in Germany, rather than at Leonardo’s Crewe Toll factory in Edinburgh.

No decision has come on which radar will be fitted to the 38 new-build Eurofighters sought under Germany’s Quadriga program, nor for any additional aircraft acquired to replace German Tornados. Germany has previously indicated an interest in the so-called Radar 2 version of Captor-E under development for the UK Royal Air Force and whose features include an expanded and enhanced electronic attack capability, and which Leonardo is developing for service from around the mid-2020s.

Radar Two is expected to be an incrementally improved version of Captor-E, almost certainly with a different antenna. The new antenna will still incorporate a repositioner, but might not have embedded IFF, which could make it harder to use the array as a means of communicating with other aircraft. Radar 2 would have maximum commonality with Radar 1+ in its other hardware and operating interfaces.

Euroradar has said very little about Radar 2, or the EAP and Bright Adder demonstrator programs that preceded it, partly due to secrecy surrounding the British-led program and Hensoldt’s sensitivities (Ulm is developing the Mk1 radar) as well as to avoid denting sales of the current Radar 1+. Although Radar 2 remains some years away from service, it is, according to one program insider, “a real thing, happening very soon, and it’s going to be transformational for Typhoon.” ■



DAVID MCINTOSH

New regional aircraft designs might come to fruition before larger commercial aircraft as OEMs and manufacturers focus on recovering from the pandemic downturn, according to Embraer Commercial Aviation president and CEO Arjan Meijer.

Smarter factories bring growth opportunity

by Matt Thurber

While many people work from home or face extended furloughs during the Covid pandemic, essential manufacturing operations must continue, and the so-called “smart factory” presents a way to help manufacturers keep their doors open to support customers.

“The crisis has accelerated the need for smart factory initiatives,” said Steve Shepley, U.S. aerospace and defense consulting leader at consultancy Deloitte, during an FIA Connect session. Deloitte smart factory leader Lindsey Berckman joined Shepley for the session, titled Implementing the Smart Factory—Accelerate the Journey to Digital.

Pandemic likely to delay development of new aircraft by several years

by Kerry Lynch

The Covid-19 pandemic downturn will delay any major developments for new aircraft by at least three to four years while the commercial aircraft manufacturing and airline sectors focus on recovery, leading commercial aviation executives believe. Even then, derivatives of existing aircraft appear more likely unless “disruptive” technologies come to fruition.

Speaking during an FIA Connect 2020 webinar titled “Commercial Aircraft: the Next Generation,” Embraer Commercial Aviation president and CEO Arjan Meijer characterized both the OEMs and airlines as “patients” that need to recover over the next several years and that he doesn’t see investments in significant capital-intensive programs during that span. Embraer has managed through the current timeframe with delays in aircraft orders rather than cancellations, Meijer said, adding that the regional airline sector likely would recover first, raising the likelihood that aircraft designed for those operators also come first.

Emirates Airline president Tim Clark agreed with the three- to four-year timeframe but added that manufacturers should wait to see how developments in new technologies play out, particularly as airlines come under increasing pressure to practice sustainability.

Given the increasing regulatory and political requirements, manufacturers need to be careful to ensure what they design now can become sustainable programs over several decades, said Steven Udvar-Házy, executive chairman of the board for Air Lease Corporation. The effect of environmental politics is huge, Udvar-Házy added. “We have to be very mindful of this trend,” he said, adding

that politicians cannot dictate design and operational parameters. “Otherwise, we’d have catastrophic results on the airline industry,” he warned.

The technology produced will dictate future designs, the executives agreed. They also believe such advances can come from non-traditional sources. Clark suggested that the industry reach out to other groups, such as automotive experts, to look at innovations.

“The disruption in design concept is not going to come from Boeing and Airbus,” Udvar-Házy said. “It’s going to come from smaller, innovative players.” Such players might not ultimately enjoy financial success but will drive innovation, he added.

New Technologies

The global pandemic will prove to become another factor in future designs. “With the pandemic, we have a whole new landscape in terms of passenger health concerns. That is going to be a gray area,” noted Udvar-Házy. “For a little while, I don’t see any manufacturers willing to make a bet on a specific configuration.” New technologies will more likely come on the propulsion side, he added.

Without such technologies, manufacturers might continue to prefer the derivative approach, because clean sheet designs run in the tens of billions of dollars for large airliners and carry much more risk, they agreed. “I’m not optimistic about airframers getting their teeth in new aircraft,” Clark said. “There’s no appetite for that at the moment.”

But in the aftermath of the Boeing 737 Max accidents, certification processes even for derivatives will prove much

more rigorous, they added. “There has been a certain amount of relaxation,” Clark said. With lessons learned from the Max, though, “that has come back with a vengeance.”

As for new entrants from China, the panel participants agreed that several obstacles remain. While the desire, commitment, and resources might exist, China’s ability to continue to benefit from technology and knowledge transfer from the West has tightened, according to Udvar-Házy. “The willingness of the Western world to partner with China has diminished significantly in the last 12 months,” he noted.

“The Chinese are hugely aspiring to be a major player in aerospace,” Clark said. But the Emirates boss added that their decision to take a route of importing Western technologies could prove to be a disadvantage in the long run. “I’m not convinced what they have actually produced is more than a reverse-engineered DC-9 or A320,” he said. “They’ve got a long way to go before they can satisfy certain Western markets that the aircraft design, construction, regulation, certification, operations, and after-sales support are up to the likes of what the Western [companies] are producing today.”

The Chinese might realize their aspirations, but they compromised their ability to do so by “fast-tracking” with existing technology. “They really need to start building their own airframes,” Clark said.

Another “major failure” on the part of the Chinese centers on aftermarket sales support, Udvar-Házy said. “They have just not built the global infrastructure... to support their customers outside of China,” he said. ■

“People can be safer, and technology can drive safety in the factory. You’re connected to supply chains so you can deal with issues before they hit the [factory] floor.”

—Steve Shepley, U.S. aerospace and defense consulting leader at consultancy Deloitte

It turns out that the benefits of a smart factory have become even more apparent during the pandemic. By connecting factory assets such as machinery, IT infrastructure, inventory, people, and processes, smart factories help manufacturers make products more efficiently and provide the ability to predict bottlenecks and shortcomings, all the while freeing people to do more important work. During the pandemic, Shepley explained, the concept can make it easier to let people work remotely while keeping the factory humming. “People can be safer, and technology can drive safety in the factory,” he said. “You’re connected to supply chains so you can deal with issues before they hit the [factory] floor.”

“The key is how they come together,” said Berckman. “To have a valuable predictive smart factory, those attributes come together so workers act on signals and make worthwhile decisions.”

Implementing a smart factory involves more than just deciding to do it and hiring consultants. It is important to consider the use case and whether the organization

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Covid to speed Industry 4.0 ‘smart’ transformation

by Curt Epstein

For the aviation industry, the Covid pandemic has taken place in the midst of what some refer to as Industry 4.0: the ongoing transformation of traditional manufacturing and industrial practices combined with the latest smart technology.

How businesses experience the so-called digitization revolution varies from company to company. Speaking in the Supply Chain 4.0 webinar as part of FIA Connect on July 21, Pratt & Whitney COO Shane Eddy addressed some of the challenges and benefits his company has experienced during the crisis, which has seen demand on the commercial application side decrease between 40 and 50 percent depending on the sector and the region. With the downturn, the focus on cost has been much more intense.

“This lower investment in today’s Covid environment...is even more important for us,” said Eddy. Through digitization, the Connecticut-based engine maker has managed to adapt to the new realities with lean automated and connected production cells. “The data accumulated from these machines these days is unprecedented,” Eddy said. “So all the ingredients are there for a full digital value stream.” The adoption of new technology has allowed the company to serve demand with a much smaller industrial footprint than would have been possible a decade ago.

He noted that the use of automation and robots assist in challenging processes such as fitting large engines together, particularly parts with tight tolerances. Such automation has contributed to increased yields, improved on-time delivery, and

cost-performance improvements as well as better safety. “By connecting machines, people, networks, and data to drive visibility, efficiency, quality, and predictability on the shop floor, we’ve seen a step-change in the productivity of our factories,” said Eddy, adding the manufacturer has already offset hundreds of millions of dollars of investment that it would have otherwise required.

For Ben Adams, president of South Korea-based Hanwha Aerospace’s U.S. division, the journey towards digitization has resulted in 30 percent growth for the company each year for the past several

years. Adams was formerly president and CEO of U.S.-based aircraft engine component manufacturer EDAC Technologies, which Hanwha purchased last year and whose integration Adams described as a transition from a job shop to a high production manufacturing facility.

As the companies continue to integrate, he describes them as a tale of two geographies. While the U.S. facility had engaged primarily in manufacturing and research and development activities, its focus centered more on the point of creation and less on automation. The location relied heavily on machine-side sensors monitoring their health and manufacturing accuracy.

When he visited the new parent company’s facility in Changwon, South Korea, which opened in 2018, he found it to be more advanced than the U.S. operation, with a “tremendous amount” of RFID technology and automation. “I think

what they’ve done from an automation standpoint is commendable and successful,” said Adams, adding that the company will work to share best practices among its divisions. “I think we’ve implemented some good product in machine health monitoring systems here in the U.S. that will also benefit our teams in Asia.”

The digital transformation, which some companies viewed as a somewhat esoteric concept, has quickly taken on new urgency amid the upheavals felt by the industry, according to Rob Heys, a senior business development manager with customer relationship management software provider Salesforce. Digitization becomes particularly crucial with the current drop in commercial aircraft deliveries resonating through the supply chain. Under such circumstances, Hayes said there must be more collaborative partnerships between OEMs and system integrators and suppliers through, for example, leveraging technology to create collaborative environments where companies can share information such as change notes across the entire supply chain in real-time.

Eddy reported that Pratt & Whitney now uses a dedicated portal to enable two-way data exchange with its suppliers, allowing them to share scheduling information. What excites him now, he said, is the ability for the company to use model-based engineering design and flow the models directly through to the supplier’s factory, which has proved particularly beneficial to Pratt & Whitney’s joint venture with Hanwha in Singapore.

On the supplier side, Adams said having the capability to receive model-based definition allows the company to speed estimating process, fixture design, and capital acquisition. One of the biggest challenges Adams sees in supporting Pratt & Whitney and other OEMs resides in continually refining the customer interface to allow them greater visibility to the process and enhance communication. ■



As part of its Industry 4.0 digital transformation, engine maker Pratt & Whitney launched a connected factory pilot project at Pratt & Whitney Component Solutions in Singapore.

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could benefit from a smart factory. One critical factor, Shepley noted, is a high technology readiness level, in which case “the comfort level to implement a smart factory is quite high.”

Companies that might be ready should consider the following factors, he said:

- » Focus on value and results and don’t get mired in technology and hope that technology will create the solutions to your problems.
- » Determine the burning issues (laser focus on the desired outputs). Think about user experience. If you want people to adopt new solutions, you must make it easy to use.
- » Don’t just involve technologists in solutions but get front-line workers involved and get their feedback into the design. Establish an ecosystem (this is not a silver bullet).
- » Bring in partners, take full advantage of

the cloud, use sensors to bring in data, all on a common platform or ecosystem of technology.

- » Build a roadmap of use cases (a larger basket of implementations allows a company to hedge the risk over a larger population of processes).
 - » Plan for scale. You might pilot the smart factory with one use case, but don’t build on an environment that doesn’t scale. If you can’t scale larger, it’s not worth it. Think big, start small, but scale fast once you see results.
- “This isn’t the only way to do a smart factory,” Shepley said. “But a cloud provider is critical, particularly for scale. It allows you to put all the data into a single structure and gain benefits at one plant and apply them to another facility.” Deloitte worked with Amazon Web Services to create Smart Factory Fabric, a pre-configured suite of cloud-based applications to facilitate development of smart factories. “They’re

willing to partner and they have a spirit of innovation, which allows the solutions to grow with the manufacturer,” he said. “It gives us a chance to continue to innovate.”

In one example of a smart factory that Deloitte helped establish, a U.S. aerospace manufacturer faced a big problem with material shortages and getting workers aligned with the work that needed doing. The company had planned to build new facilities to improve the situation, but the smart factory eliminated the need for a new plant.

Berckman explained that the first step centered on helping the company improve asset tracking. “Workers felt like they were on a treasure hunt to get what they needed,” she explained. Deloitte helped the company create RFID tagging and more comprehensive tracking to improve visibility and tracing of parts.

The next step involved making sure workers were in the right place at the right time. The smart factory setup included a

dynamic scheduling system that replaced whiteboards and sticky notes filled with tasks and made it much easier to reschedule tasks and reassign workers efficiently.

It was important to include the employees in the design of the smart factory, she added. “The feedback was incredible.”

The result was a vastly more efficient factory, and no more looking up tasks on sticky notes, plus the company managed to apply the smart factory technology to many other use cases, further improving efficiency.

It takes about 16 weeks to implement smart factory processes, according to Berckman. The exercise includes about two weeks developing the business case, six weeks building a prototype to solve the particular problem at hand, then eight weeks running a pilot to prove the value of the system. Once the first process gets created, it can expand to other areas of the factory. “Think about the next use case to give better lift, efficiency, and metrics,” she said. ■

EmbraerX simulator testing new 4-seat eVTOL aircraft

by Charles Alcock

EmbraerX recently made the first flight in a simulator it is using to develop its planned new eVTOL aircraft. The advanced technologies division of the Brazilian business and regional aircraft manufacturer has also flown scale models of the new design and has conducted wind tunnel testing, but has yet to say when it expects the all-electric, four-seater to enter service.

According to Andre Stein, EmbraerX's head of strategy and urban air mobility, the simulator trials use real flight control parameters and control laws to gather the information that will prepare the way for

eventual type certification flight testing. Engineers have been testing the aircraft's fifth-generation fly-by-wire controls, which will initially support piloted operations while being compatible with later plans to progress to autonomous flight.

Embraer has been quite secretive about its plans for an eVTOL, despite Uber's naming it as one of eight partners supporting the ride-hailing group's plans to launch air taxi services from 2023. Stein told *AIN* that it continues to work with Uber, while stressing that Embraer remains focused on supporting the wider "eco-system" for urban air mobility



Embraer is one of eight partners supporting Uber Elevate's plans to provide aerial ride-hailing services using eVTOL aircraft. Uber hopes to launch services in 2023.

(UAM), including air traffic management and ground infrastructure. He added that the manufacturer's agreement with Uber is not exclusive and that it remains open to possible partnerships with other operators and infrastructure providers.

The new design shows eight propellers installed on four beams attached to two narrow, parallel wings protruding from the top of the fuselage to provide vertical lift. At the rear of the aircraft, there are a pair of ducted fans for cruise flight.

Embraer believes that its extensive experience in certifying 26 new aircraft over a couple of decades places it to deliver the right performance, safely to the market. Stein pointed to its achievement with the latest E2 airliner, which won certification on time and with better-than-projected performance, as evidence of the depth of the aerospace engineering capability it is now tapping to accelerate the flight test campaign.

"One of the things we have talked about is how to leverage our know-how to develop new aircraft, and [we saw this] when we did the first flight in the E2 because we broke records in expanding the flight envelope," he said. "A lot of [eVTOL] startups rush to fly something just to have something to show investors."

The EmbraerX team is using the flight simulator at the company's Sao Jose dos Campos headquarters to evaluate the man-machine interfaces of its new eVTOL design, using both experienced test pilots and relatively inexperienced pilots. Its eVTOL engineering manager, Luiz Valentini, said that the company works on the assumption that the UAM market will need to rely on pilots who do not come from an air transport background, leading it to consider the use of very user-friendly control interfaces.

The simulator work also lays the groundwork for capabilities needed for

autonomous operations, such as detect and avoid systems. "We are trying to create a vehicle that we can show will have the flexibility to operate in different airspaces around the world, and it gives us the confidence to be able to facilitate autonomous flight capabilities before we fly the aircraft," Valentini explained.

Meanwhile, EmbraerX is accelerating work on urban air traffic management, which started in 2011 when it bought a stake in a specialist company called Atech. Since publishing its FlightPlan2030 white paper to define requirements for UAM in June 2019, the company has worked closely with two undisclosed air navigation service providers (ANSPs) and L3 Harris Technologies to develop a concept of operations.

"Our goal is to make it [UAM] more accessible and scalable, taking account of both hybrid-electric and electric aircraft," said David Rottblatt, leader of EmbraerX's urban air traffic management project.

By the first quarter of 2021, EmbraerX intends to have incorporated the results of its studies with the ANSPs (located in both Eastern and Western hemispheres) into a consultation document. At the same time, it will seek to build "community support" from prospective early UAM adopter cities and then go to the regulators with what it calls a data-driven case for how operations could start.

With the right infrastructure in place, EmbraerX sees potential for UAM services to grow rapidly as eVTOL aircraft change the scope of air transportation in and around cities. "In London alone, we see the potential for two million users with around 1,500 eVTOL aircraft on the basis that each person would use them about once per month," Stein told a webinar during the FIA Connect event on July 23. ■

Collaboration of 'Old' and 'New' key to UAM success

by David Donald

While start-up companies enjoy an advantage in developing the technologies driving the urban air mobility (UAM) revolution, there is still a crucial role to play for the incumbent aerospace industry giants, according to panelists speaking during an FIA Connect session.

With a forecast requirement for about 200,000 vehicles over the next 20 years, and with most of them being eVTOL aircraft, the incumbents certainly have an interest in the UAM marketplace. While their relative inertia to innovate internal processes might give start-ups the edge in terms of rapidly prototyping and maturing technological innovations, those generally smaller companies typically do

not have the internal expertise to oversee regulatory compliance for either the air vehicles or their manufacture. That's where companies such as Airbus, Boeing, and Embraer play a major role.

As a result, many have been making significant investments themselves in start-ups that are tackling some of the key technological issues, such as sense-and-avoid and traffic management systems, as well as the electric air vehicles themselves. Battery technology remains one of the limiting factors to the performance and financial viability of the UAM sector, and investments have come from Boeing and others in this area.

"You have to have that collaboration with

that fast, disruptive thinking not bounded by pre-conceived notions that might exist in a 104-year old company," said Brian Schettler, senior managing director with Boeing HorizonX. "But how do you bring and accelerate development when you get to the tough things of certification, regulation, and even manufacturing? It's bringing the best of both worlds together."

Gary Cutts, director of the UK government-backed Future Flight Challenge project, also noted that while start-ups drive the sector, they need to form consortia to present more rounded cases that encompass the entire "ecosystem" surrounding UAM. That includes the involvement of regulators, operators, and local city governments, as well as an embrace of airspace, communications, and infrastructure requirements.

The Covid-19 pandemic has affected the development in the UAM sector, and many see that as positive insofar as it has ushered in a new era of an appetite for change and to accelerate

its implementation. Moreover, regulatory flight waivers during the crisis have allowed development to be undertaken more freely with regard to flight-testing. Covid-19 has also given some companies a chance to demonstrate the benefits of electric aviation. China's EHang, for instance, has been using its autonomous air vehicles to deliver medical supplies and personnel to hospitals during the crisis.

It has not been good news for everyone, though. "This is a world of haves and have-nots," said Kristen Bartok Touw, co-CEO with Air Finance. "I haven't seen people being able to raise the capital that we would like during Covid. I do have a fear that it will be a world in which the start-ups that were able to raise significant capital prior to Covid are still able to innovate and get their work done, and those are the companies that will benefit and accelerate." Those not able to raise capital will struggle, she added.

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New study projects UAM market at \$80 billion by 2050

by Charles Alcock

More than 160,000 eVTOL aircraft are expected to be carrying passengers in urban air mobility (UAM) services by 2050, according to new research by aviation consultants Roland Berger. In a report presented for the FIA Connect event on July 23, the company said that it expects such operations to be evenly divided between what it defined as “city taxi” (on-demand flights of 15-50 km), “airport shuttle” (also 15-50 km, or up to around 30 miles), and “intercity” (scheduled flights of between 50 and 250 km, or up to around 150 miles).

Of the \$80 billion annual value projected for the new UAM market by 2050, Roland Berger calculates that airport shuttle and inter-city flights will account for most of that amount (respectively 50 and 40 percent), while city taxi journeys take the remaining 10 percent.

“To start with we think [UAM] services will be quite highly-priced and exclusive, but in the longer term [as operating costs become more scalable] it will be more like



Germany's Volocopter is one of a group of eVTOL pioneers looking to develop not only eVTOL aircraft for urban air mobility operations but also the necessary supporting infrastructure.

today's premium public transport services, such as taxis,” said Manfred Hader, head of Roland Berger's aerospace and defense practice.

Some of the many contenders to enter the eVTOL market are pushing hard for early service entry, perhaps as soon as 2023. However, the vast majority of some 2,100 aerospace industry executives surveyed by Roland Berger indicated that they do not find that timeframe credible, with 51 percent saying they expect it to happen in between 5 and 10 years, 34 percent predicting more than 10 years, and just 13 percent expecting it within five years. Two percent said that UAM will never happen.

Roland Berger's Center for Smart Mobility also has tracked through its UAM Radar the status of 100 UAM launch projects around the world to identify where the early adopter communities will appear. It identified 54 prospective city-based UAM projects in Europe, 25 in the Asia-Pacific region, 21 in North and South America, six in Africa, and two in the Middle East.

In Dallas ride-hailing group Uber says it will be ready to launch revenue flights with one or more of its eight eVTOL manufacturing partners in 2023. Test flights could start by the end of 2020, and Uber continues to actively lay the infrastructure groundwork needed to support operations.

In the Chinese city of Guangzhou, eVTOL pioneer EHang has conducted demonstration flights since 2018, including some carrying passengers. The company has not yet announced a timeline for full revenue services to begin but the Civil Aviation Administration of China has



South Korean automotive group Hyundai has committed to investing \$1.5 billion to get its new eVTOL aircraft into service.

allowed it significant latitude for the trial operations.

In Paris, Airbus is partnering with city public transportation agency RATP to launch pilot eVTOL operations during the 2024 Summer Olympic Games, due to take place in the French capital. Many suggest that full-scale services might not get underway until 2030, however.

“The startup companies are typically being more bullish for operations to start by 2025 at the latest because their funding depends on having good news to attract investors,” said Hader. “The legacy aerospace companies are being more cautious and are looking at the late 2020s or early 2030s.”

Roland Berger's research has confirmed its view that public acceptance is a major barrier to UAM adoption. It pointed to recent research by Airbus showing that almost 56 percent of 1,500 respondents have concerns about the safety of individuals on the ground while 49 percent expressed concern about noise.

The consultancy endorsed the growing consensus that eVTOL operations might gain more early traction with

cargo-carrying operations that could prove the safety and noise case for passenger applications. Its study showed that the German capital Berlin might be able to support around 1,200 unmanned aircraft delivering 4 million packages each year.

Overall, Roland Berger does not expect the Covid-19 crisis to significantly affect the timeline for the emerging UAM sector. However, the report did suggest that some companies might now struggle to find the funding they need for type certification.

Eric Allison, head of Uber Elevate, confirmed that viewpoint. He told a separate FIA Connect webinar that some eVTOL developers at the earlier stages of “prototyping” their aircraft might struggle due to Covid disruption and increased difficulty securing funding. However, he stressed that several companies are now making good progress towards type certification.

Allison said that Uber is now prioritizing service entry for all-electric eVTOLs, as opposed to hybrid-electric models. He said that battery technology can now support the relatively short flights envisioned by its planned Uber Air urban and suburban networks. ■

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This may or may not be a blessing in disguise for the sector as a whole. Most in the industry consider the figure of at least 292 electric platforms in development far too great, and it is those with more mature, more consortium-driven user cases that appear most likely to find traction.

Other speakers also raised concerns that Covid had introduced uncertainties, mainly at the societal level. The nature of the “workplace” and that of business travel in the future is far from certain, nor are the best uses for electric aviation. Local authorities might not consider short-range, intra-urban travel as attractive a proposition as using eVTOL machines to bring commuters into the city from outlying areas to relieve some of the burden on ground transportation.

While the focus now centers mainly on the vehicles themselves, the question of infrastructure is increasingly becoming the main topic as teams build their

business cases. That not only presents obvious issues such as vertiports, communications, and air traffic management, but also encompasses acceptance by the public. The question of whether UAM is considered as mass transport available to all, or a high-premium service for the few, has yet to be answered and has a bearing on social and political acceptance at a local level. It also seems unlikely that governments would commit large investments to UAM infrastructure, leaving a void for the private sector to fill.

Nevertheless, following a number of studies underway on a city-by-city basis, the question of infrastructure is now beginning to be tackled at an active level, with investment imminent to lock up properties that are ideal for vertiports in the most promising cities. New York and Vancouver figure prominently in the list of potential lead cities that have long-established and publicly-accepted urban helicopter operations. ■



Chinese startup EHang has shown agility in its approach to advancing early adoption of urban air mobility, as it continues efforts to certify its eVTOL aircraft.

Data shows average drop in scheduled flights by airlines

by Charles Alcock

Sadly, it almost goes without saying that the Covid-19 pandemic has caused unprecedented disruption to the aviation industry. No part of it, so far, has been more damaged than the airline sector. On a rolling basis as the virus spread around the globe from March, airlines were either completely grounded by government lockdowns or saw demand collapse due to an unwillingness or inability of passengers to make trips.

After at least 12 months of misery, July has brought some signs of a tentative uptick in traffic as some restrictions have lifted. But the picture is far from uniform, and, as the saying goes, the devil is in the detail.

To try to provide a snapshot of how flight activity has fluctuated in the face of Covid headwinds, **AIN** asked air traffic data specialist Spire Aviation to analyze activity at seven international airports in North America, Europe, Africa, South America, the Middle East, Asia, and Australasia. The company tracks individual aircraft via its own constellation of 88 satellites. It generated data showing all flights in and out each of the following airports on a series of three Wednesdays over the past 12 months (July 10, 2019, Feb. 12, 2020 and July 8, 2020): Chicago O'Hare (ORD) in the U.S., Germany's Frankfurt Main International (FRA), Johannesburg O.R. Tambo International (JNB) in South Africa, Brazil's São Paulo Guarulhos (GRU), Dubai International (DXB) in the United Arab Emirates, Singapore Changi (SIN), and Sydney (SYD) in Australia.

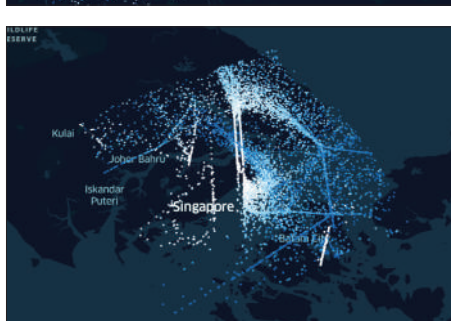
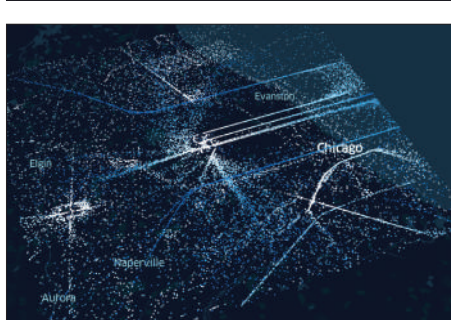
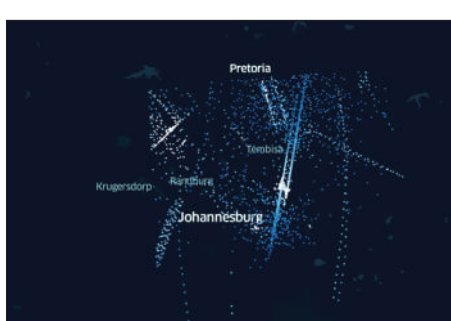
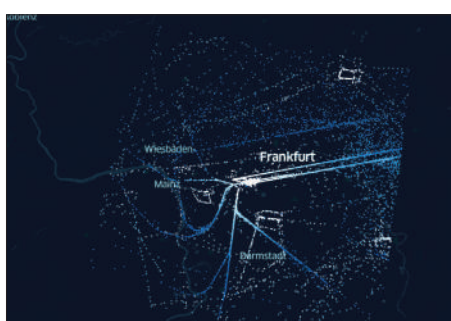
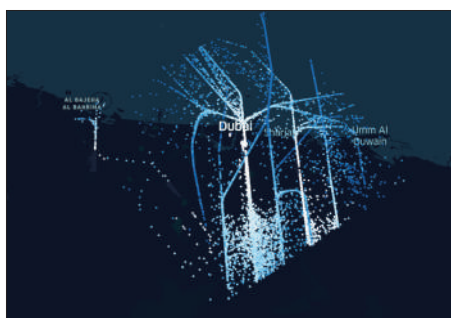
Spire's data shows two key elements—the total number of unique aircraft tails (including multiple trips in and out of the same airport on the day in question) and the total number of scheduled flights.

Comparing the average volume of scheduled flights across the seven airports on July 8, 2020, reveals a decline of 67 percent compared with July 10, 2019, and 70 percent compared with Feb. 12, 2020. Making the same comparison for total aircraft shows average reductions of 50 percent compared with July 10, 2019, and 54 percent compared with Feb. 12, 2020.

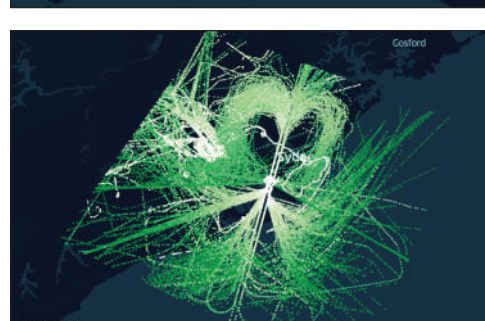
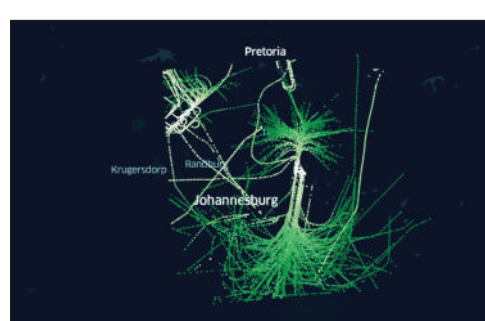
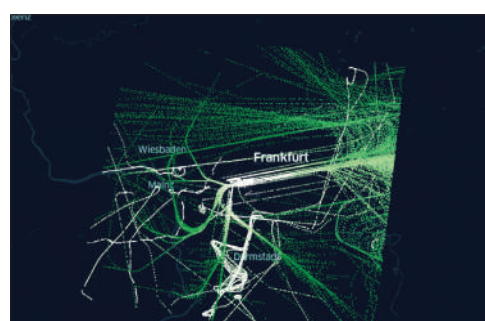
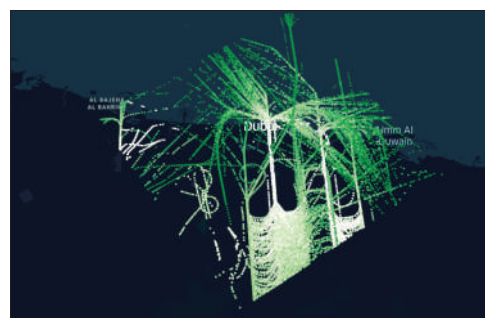
Johannesburg recorded the largest dip in scheduled flights, at 85 and 86 percent down compared with the respective dates.

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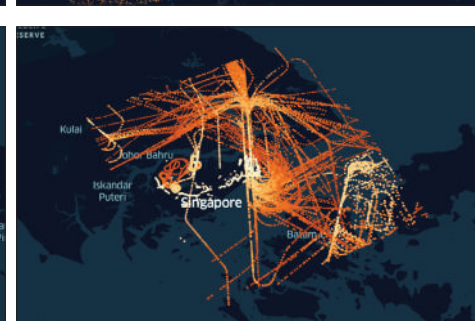
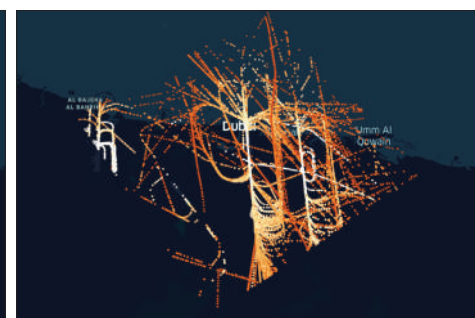
July 10, 2019



Feb. 12, 2020



July 8, 2020



85 percent aircraft recycling not enough

by Curt Epstein

There could be anywhere between 6,000 and 17,000 commercial aircraft retirements over the next decade, according to industry calculations. Some fleets are seeing accelerated downsizing in the wake of the Covid-19 pandemic and its chilling

effect on air travel, and limited space in aircraft boneyards is prompting further consideration of how to recycle airframes.

Sven Koechler, managing principal and general manager of North American Aerospace Industries, said that around 85 to 90

percent of each aircraft is being recycled, but he believes that proportion should be higher. “First, we need to increase that number to 100 percent and recognize that instead of placing the remaining 10 to 15 percent in landfills where it has negative

effects on our environment, we can give those materials a new life, which in turn will help give a new life to those in need,” he noted.

Koechler is investing \$100 million in the development of a modern recycling facility slated to open mid-2021 at a 2,500-acre airport industrial site in Kinston, North Carolina, and he is challenging the industry to start thinking and acting to create a more sustainable and socially-minded view of aircraft recycling. “There’s no reason why remaining materials from retired aircraft can’t be recycled to produce footwear, clothing, hats, coats, gloves, and even tiny homes for those in need,” he said.

Even before the pandemic, the industry was seeing the retirement of several hundred airliners each year. “An average commercial aircraft has an estimated 800 to 1,000 parts that can be recycled,” explained Koechler, noting the most valuable are the engines, landing gear, avionics, and electronics. “Once these components and parts are removed, overhauled, tested, and recertified, they can be repurposed back into aviation.”

Other metal parts can be melted down and returned to the raw material supply chain. “That leaves many interior components such as seating, overhead bins, cabinets and walls, largely comprised of composite materials such as carbon-reinforced polymers, [which] can be responsibly recycled to meet critical social needs,” said Koechler.

He is not the first to have such ideas. Back in 2006, Airbus launched its own aircraft recycling initiative named PAMELA (Process for Advanced Management of End-of-Life of Aircraft), which aimed to increase the percentage of recycled parts from the then-industry standard of 60 percent to today’s 85 percent. Southwest Airlines has introduced its own “Repurpose with Purpose” program, which has upcycled one million pounds of seat covering leather into goods such as shoes, bags, and ponchos while establishing new jobs and training opportunities for veterans, individuals with disabilities, human trafficking victims, and indigenous artisans. ■

Strata delivers 100-shipset order for composite A350 flap assemblies

Strata Manufacturing has delivered to Airbus 100 shipsets of A350-900 inboard flaps assemblies made of lightweight composite materials. Strata is an aerostructures manufacturer owned by Mubadala Investment and located in Al Ain, United Arab Emirates, at the Nibras Al Ain Aerospace Park.

Airbus assembles the A350-900 out of 53 percent composite materials, with the fuselage consisting of carbon-fiber-reinforced plastic. Strata makes the wings’ inboard flaps with hot drape forming and automated tape layup machines.

The manufacturing process begins with carbon-fiber material being pre-formed

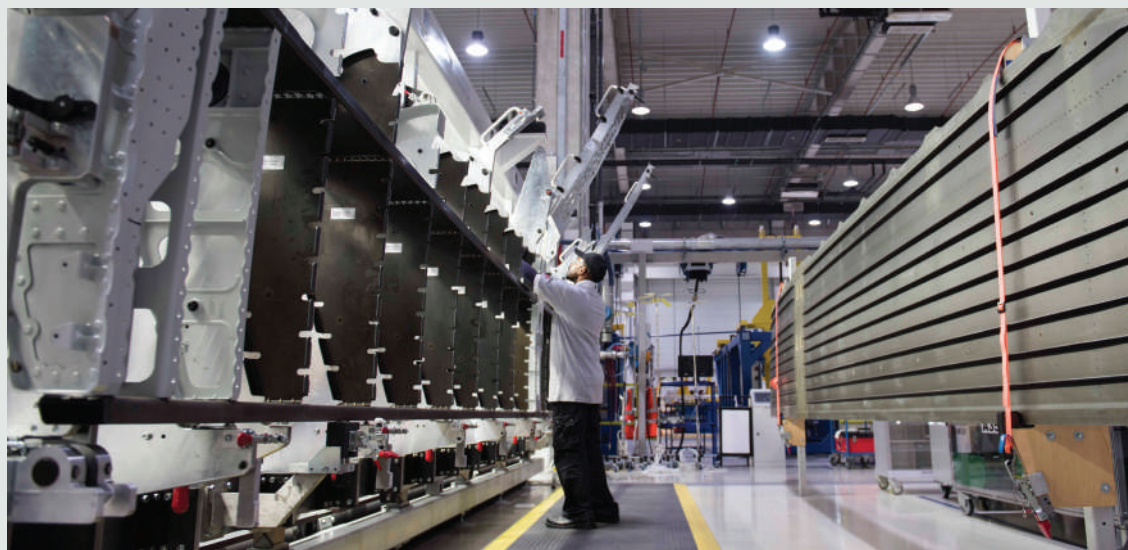
using hot drape forming, which heats the material with infrared radiation to soften the material quickly and uniformly. That delivers “accurate parts free from stress-wrinkling,” according to Strata.

The facility has two automated tape layup machines, both computer-controlled. The machines lay unidirectional prepreg composite materials onto a flatbed, Strata explained. Workers then transfer them to a mold and perform additional processing. The automated tape layup machines have a work envelope measuring 2.5 by 10 meters, which enables “automated processing of large

composite layups, eliminates the need for a separate ultrasonic cutting machine, and drastically reduces processing times,” according to Strata.

“Strata is constantly looking to expand its technical manufacturing capabilities by investing in cutting-edge technologies and nurturing its employee’s abilities,” said Strata CEO Ismail Ali Abdulla. “This ensures better efficiencies and quality across our production lines and empowers us to advance within a highly-competitive global aerospace sector. In addition, we have successfully moved from assembling to fabricating [inboard flaps] components. This is a testament of our capabilities and focus to elevate our status as a sole supplier alongside Airbus of the wing part.”

M.T.



At the Strata Manufacturing plant in Al Ain, United Arab Emirates, the company has developed significant capabilities in carbon-fiber composites manufacturing, including hot drape forming and automated tape layup.

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Data shows drop in airline flights

Total aircraft fell 62 percent compared with Feb. 12, 2020, and 55 percent from July 10, 2019. The numbers would appear to reflect the fact that the Covid outbreak took longer to reach South Africa but has increased markedly in recent weeks.

In Singapore, scheduled flights saw declines of 81 and 80 percent for the dates in question, while total aircraft numbers were 57 and 60 percent lower. The Southeast Asian city-state felt the virus’s effects far earlier than did Europe and the Americas.

Sydney, Australia, saw a similar decline in scheduled flights of 82 and 81 percent, but with total aircraft numbers down by 45 and 54 percent. Like its neighbor New Zealand, Australia has sought to maintain a protective bubble by effectively barring all international flights to and from the country. However, given the large size of its territory, Australia, like the U.S., has seen domestic traffic sustained to a degree.

In Dubai, one of the world’s fastest-growing airline hubs over the past two decades, scheduled flights were down by 73 and 74 percent, respectively. Total aircraft numbers dropped by 62 and 64 percent.

In Germany, which like the whole of Europe experienced tough lockdown restrictions that barred all but the most

essential travel, scheduled flights in and out of Frankfurt were down by 64 percent for both sets of dates. Aircraft numbers declined by 55 and 51 percent.

Over the past few weeks Brazil, along with other parts of South America, has emerged as a serious Covid hotspot. Scheduled flights at São Paulo’s main airport were down by 69 and 76 percent, while aircraft numbers dipped by 53 and 61 percent.

Significantly, Chicago’s numbers bucked the trend in a country that was relatively slow to lock down and has sought to lift restrictions at the earliest opportunity, apparently resulting in an uptick in infection rates in several states. Scheduled flights only declined by 17 and 31 percent on the dates tracked by Spire

for AIN, while aircraft numbers were down by 21 and 24 percent.

On the charts presented here (opposite page), the darker colored shading indicates flights at higher altitudes, while lighter shading indicates lower-altitude movements. Colored lines indicate multiple aircraft arriving, departing, or in a holding pattern. White lines demarcate runways at the various airports.

Spire Aviation is part of the Spire Global group, which is part of the Space-tech company based in San Francisco. Based on its own satellite constellation, it identifies, tracks, and predicts the movement of multiple sets of resources and weather systems to support decisions by companies and governments. ■

Brazil begins manufacturing Saab Gripen E fighter

by David Donald

Saab Aeronáutica Montagens (SAM) has begun the production of sections for the Gripen E/F fighter at its facility at São Bernardo do Campo, in the southern suburbs of São Paulo in Brazil. Initially, the aero-structures plant is producing tail cones and front fuselages for the single-seat Gripen E, which will be dispatched to both the Swedish assembly line in Linköping and the Brazilian line. The latter is located at the Embraer plant at Gavião Peixoto to the northwest of São Paulo.

Production has been established with around 70 employees, many of whom have undergone training in Sweden prior to establishing the production plant in Brazil. The creation of the SAM facility is an element of the 100 percent technology transfer agreement made when Brazil signed a contract to build and produce the Gripen E/F for the Força Aérea Brasileira (FAB, Brazilian air force) in 2014.

By 2024 SAM expects to have around 200 employees. The plant will expand its

sub-assembly work to include the front and rear fuselage sections, airbrakes, and center wing box for the two-seat version, for which Brazil is leading the development through the Gripen Design and Development Network (GDDN) center opened at Gavião Peixoto in November 2019. The first two-seater is currently under assembly in Sweden by a joint Brazilian/Swedish team.

Under current plans, the FAB will receive 28 single-seat Gripen Es—to be designated F-39E in FAB service—and eight two-seat F-39Fs. Follow-on batches could add a further 72 aircraft to the figure. The first F-39E for Brazil—which was also the first production Gripen E—took to the air on August 26, 2019, and was formally handed over last September, although it stayed in Sweden for tests. It is due to be transported to Brazil shortly to begin the operations of the new flight test center established next to the GDDN facility. The first Gripen F two-seater is



The first of 28 F-39Es for Brazil makes its first flight in 2019. Having been employed on trials work in Sweden, the aircraft is shortly to be transferred to the flight test center in Brazil.

expected to fly at Linköping next year.

After this initial pair for Brazil, the next 11 are due to be built and assembled in Sweden for delivery to the FAB in late 2021. The remaining 23 aircraft on order will be assembled at Gavião Peixoto, of which the first eight will mostly be built in Sweden before being shipped in sub-assembly form for completion.

In the meantime, the Linköping-based Gripen E test fleet has grown to seven aircraft, comprising three development aircraft

(39-8, -9, and -10) and the first four production machines. The latest, 6004, made its first flight on June 30. According to Mikael Olsson, head of flight test and verification, the trials fleet is currently engaged in an intensive envelope expansion campaign, while at the same time testing the aircraft's operational systems. Olsson also noted that, in addition to trial flights beginning soon in Brazil, a third test location would be established in Sweden by the air force and the country's FMV defense materiel administration. ■

Project Mosquito will add combat mass to RAF fleet

This summer the UK's Defence Science and Technology Laboratory (Dstl) has completed the initial one-year phase of Project Mosquito, a program to develop a flyable technology demonstrator of an unmanned air vehicle that could provide "additive capability" to manned combat aircraft. The aim is to reduce the costs of adding combat mass to the RAF's manned fleet to roughly one-tenth those of manned platforms.

The initial phase focused on exploring "novel design, development, prototyping, manufacture, and support," with the aim of a future unmanned combat air system (UCAS) that can develop and evolve rapidly and at a low cost. In July 2019, the Dstl announced that Phase 1 contracts had been awarded to three teams, led by Blue Bear Systems Research, Boeing Defence UK, and Callen-Lenz. The latter is part of Team Blackdown, which brings in the expertise of Northrop Grumman and Bombardier Aerospace's UK division headquartered in Belfast. Dstl and its partner agency, the Royal Air Force's Rapid Capabilities Office (RCO), expect to make a down-select to one or two teams imminently.

For Phase 2 of Project Mosquito, the successful team(s) will each further refine their design and conduct a limited flight test campaign. The project itself is due for

completion in mid-2023, and flight-testing of the competing vehicles could begin sometime in 2022. The aim of Mosquito is to produce a technology demonstrator rather than an operational vehicle.

Project Mosquito is part of the wider Lightweight Affordable Novel Combat Aircraft (LANCA) program, initiated in 2015 by Dstl to study innovative technologies and concepts and how they might be harnessed to provide additional combat

air capability with greatly reduced development times and costs. LANCA was subsequently brought into the RCO's Future Combat Air System Technology Initiative (FCAS TI), although Dstl retains oversight of the technology demonstration project.

Within the FCAS TI framework, the LANCA project involves the production of an unmanned "loyal wingman" that adds operational capability to manned aircraft such as the Typhoon and F-35A Lightning and ultimately the FCAS platform itself being developed under Project Tempest.

LANCA is similar in scope to other programs. The U.S. Air Force has launched its Skyborg UCAS program

and is evaluating the Kratos XQ-58A Valkyrie—which has already flown several times—as a "loyal wingman." Boeing Australia has designed a similar Airpower Teaming System vehicle that the Royal Australian Air Force will evaluate in its Loyal Wingman advanced development program. In Europe Airbus is leading the development of "remote carriers" as part of the Franco-German-Spanish SCAF/FCAS effort. Russia has a manned-unmanned teaming project with the low-observable Sukhoi T-70 Okhotnik UCAS, expected to partner with the Su-57 manned fighter.

All of the projects seek to create a transonic, networked vehicle that makes heavy use of artificial intelligence so that it can make its own decisions within the wider framework of a planned mission and even fly some missions autonomously if desired. Vehicles can be used to augment the manned aircraft in terms of weapons or be used for reconnaissance and defense suppression tasks. The use of multiple air vehicles in coordinated swarms can saturate defenses.

Unmanned vehicles are also well-suited to the more dangerous missions, and the much lower cost of the UCAV means that it can be considered "attritable": while it is a valuable asset intended for re-use, the loss of one in combat is far less of a setback than that of a manned aircraft.

In the meantime, the RAF has re-established No. 216 Squadron at RAF Waddington to develop "swarming drone" technologies and capability. **D.D.**



LANCA air vehicles could significantly increase "combat mass" by undertaking networked, coordinated missions with manned aircraft such as the F-35.

Embraer takes long view following failed Boeing deal

by Gregory Polek

As Embraer emerges from what it might want to consider a forgettable period in its history, the Brazilian company has turned its attention to restructuring the business at a time of upheaval throughout the industry. Since its planned deal with Boeing to sell 80 percent of its commercial airplane division to Boeing fell apart, Embraer has begun to reintegrate the unit with the rest of the company and named a new division CEO to replace John Slattery, who has accepted the top position at GE Aviation. Meanwhile, the company continues to ready its case for a lawsuit it filed against Boeing for wrongful termination of the \$4.2 billion transaction.

Answering written questions from **AIN** on the eve of FIA Connect, Embraer CEO Francisco Gomes Neto noted that the company has already reintegrated commercial aviation's service and support with the division dedicated to those functions and that he expects the company to "recover synergies" over the next few months.

"We made some changes in top management as part of the review of strategic planning and reintegration of the commercial aviation business," explained Neto. "We consolidated the vice-presidencies of engineering and strategy and changed the leadership in the areas of operations, commercial aviation, and [advanced technology division] EmbraerX. We are working on reviewing the strategic plan and we will have more clarity in the coming months. Since the beginning of June, all

administrative areas have already started to work in a more integrated way."

On addressing the wider issue of the effects of the Covid pandemic on the business, Neto stressed the need foremost to preserve liquidity. The company in June finalized the terms of contracts providing for up to \$600 million in working capital and export financing. The Brazilian National Bank of Economic and Social Development (BNDES) has committed to providing half of the financing, up to a value of \$300 million, while the balance comes from private and public banks under the condition that the financing plan maintains a 50/50 split between BNDES and the other banks.

"This type of operation is exclusively debt and does not alter the shareholding structure of Embraer," stressed Neto. "In parallel, we are reviewing our strategic planning to incorporate current market conditions and establish strategic initiatives, potential partnerships, goals, and indicators as well as a structured execution process focused on growth, cash generation, and profitability."

Part of the growth plan could involve alternative partnerships with other aerospace companies on engineering or products, added Neto. On June 1 Embraer confirmed its interest in discussions with more than two potential partners for its commercial aircraft business as part of a five-year strategic plan still under development. Speaking during the company's first-quarter earnings call with securities analysts, Neto named companies in China,



Francisco Gomes Neto, Embraer CEO

"We made some changes in top management as part of the review of strategic planning and reintegration of the commercial aviation business."

India, "and others" as potential partners. "There is nothing defined yet," he noted last week, however.

Now preparing for a 2021 introduction of the E175-E2, the last and smallest of its family of Pratt & Whitney GTF-powered jets, Embraer will eventually need to consider what comes next in terms of product development. For his part, new Commercial Aviation CEO Arjan Meijer won't rule out a new large turboprop after Slattery in January basically rejected the possibility absent a deal with Boeing.

"As market leader in the up-to-150-seat segment, Embraer is always assessing the market," Meijer told **AIN**. "Being pragmatic, Embraer is open to discussing partnerships aimed at specific projects, such as the development of a new-generation turboprop."

On the prospects for its current regional jet lineup, Meijer expressed confidence—as one might expect—that

the E-Jets will play a vital role in airlines' recovery from the Covid crisis.

"We are continuously evaluating the scenario and talking to customers," he said. "Regional aviation has been a key element in maintaining essential services and the airline network during the crisis and it is already possible to observe some airlines gradually resuming commercial flights using E-Jets in the United States, Europe, and other parts of the world."

During the pandemic, Embraer has yet to suffer an order cancellation, although deferrals undoubtedly will force it to adjust production rates significantly downward. Still, Meijer wouldn't estimate just how far deliveries will fall.

"Embraer received some requests from customers to postpone deliveries," he confirmed. "We are adjusting our production to the new delivery schedules for 2020 and 2021. At the moment, the situation is stable and we cannot anticipate delivery guidance for the year yet."

With Bombardier's exit from the regional airliner business, Embraer stands as the last regional jet maker in the Western world, and with Mitsubishi's troubled SpaceJet program facing yet another delay, analysts have reasoned that the Brazilian company might benefit from the Japanese airframer's latest stumble. Nevertheless, Meijer thinks Mitsubishi eventually will become a competitive threat.

"We believe that the lower pace of development of the Mitsubishi aircraft is only temporary," he said. "During the next years [China's] ARJ21 and the E175 will be the main aircraft to be delivered but most of those deliveries were already contracted in previous years, during the time of extremely aggressive competition against Bombardier. By the time that the market recovers we will probably see Mitsubishi accelerating again their product development." ■

Air Baltic stays nimble in face of Covid uncertainty

After completely exiting Boeing 737 and De Havilland Dash 8-400 turboprop flying following its March 17 Covid closure, Air Baltic has turned attention to maximizing the efficiency of its Airbus A220 fleet as it adds one airplane per month since resuming operations two months later. During a July 20 FIA Connect Spotlight Session, Air Baltic president and CEO Martin Gauss said he and his team adapt schedules every Wednesday to account for a Covid-related need for flexibility, given changes in the virus situation in various EU countries and government opening of new destinations. Still, he noted, the company continues to concentrate on short-haul routes, many within a Baltic state "bubble" created at the start of service resumption.

Now flying 11 of its 22 A220-300s, Air Baltic restarted with its strongest routes,

but quickly found it needed to adapt to support utilization rates. The airline still cannot serve destinations such as Stockholm, Moscow, and St. Petersburg, although tentative plans now call for resumption of service to the Russian capital on August 1. This week it plans to resume service to Keflavik, Nice, and Madrid.

"Technically we fly 11 aircraft but we use 16," explained Gauss. "The reason is we have a minimum turnaround time of 60 minutes because of the disinfection [of the cabin]. But yes, utilization is nowhere where it should be. That is one of the prices you have to pay for the kind of operation we do."

The company, said Gauss, has removed 40 percent of its capacity for the year, but he noted that removing the turboprops in favor of the A220s—effectively lowering



Air Baltic now flies what amounts to a uniform fleet of 11 Airbus A220s after shedding its Boeing 737s and De Havilland Dash 8-400s.

frequency and increasing capacity on the same number of routes—has proved an advantage.

"We think we'll be back in 2022," said Gauss. "As we don't really fly long-haul... we have an advantage because that part of the business is really not working at the moment. Short-haul within Europe and

also rebuilding the hub function in Riga is working for us at the moment. Nine weeks in we are satisfied and a little bit above what we wanted to achieve. I think toward the end of the year we will also see business travel come back if we don't have several countries going back into a more severe Covid situation." **G.P.**

► continued from page 1

Farnborough Online

From now through 2021, it sees a “transition” phase during which it advocates companies should address their strategy with a dispassionate reassessment, followed in short order by course correction. The Roland Berger team said it consciously chose to describe that phase as a transition rather than a recovery, which it does not consider a given in the short term.

However, FIA Connect delivered some glass-half-full sentiment too. For a start, it is clear that the defense and security sectors of the wider industry have not felt the effects of Covid as severely and, indeed, they potentially stand to gain from mounting global tensions.

The industry increasingly views sustainability—the challenge to make aviation carbon-free—as a platform for growth, with opportunities for companies to advance technology supported by significant amounts of government financial support. Panelists presented moves to replace jet-A fuel with electricity generated by renewable means or hydrogen as a welcome foundation for aviation’s future between now and 2050, rather than a distracting annoyance forced on it by a hostile environmental lobby.

Similarly, increased automation of aircraft, leading along a spectrum to increased adoption of fully autonomous flight, now appears an important magnet for investment and an opportunity for companies to get a competitive edge. Roland Berger expects investment in the field to continue despite Covid’s squeeze of cash, albeit at a slower rate than for sustainable technology.

Several webinars delivered an impressive breadth of expertise addressing the potential for profound change right across the aerospace supply chain, as if the Covid emergency has somehow galvanized attitudes toward an urgent need for such shifts. Some speakers referenced disruption to the globalization trend, seeing production moving closer to home. Others saw opportunities for national industries showing the greatest initiative to pull ahead of less agile rivals in a potentially historic shift in the balance of power.

Along with its friendly rival Paris, Farnborough International has long been one of the two truly global air shows. In its diminished FIA Connect format, however, there appeared to be a more self-conscious UK focus as the country’s aerospace industry grapples with the task of reinventing itself in response to the twin challenges of Covid and its Brexit departure from the European Union.

This brought repeated interventions by members of the UK government eager to accentuate perceived opportunity over pitfalls. There were no promises of further specific financial support for the industry, beyond previously announced commitments some speakers compared unfavorably to the much larger amounts pledged by rivals like France.

UK industry group ADS has been diplomatic but firm in its insistence that the government must provide tangible, long-term support for a sector facing a defining and still potentially damaging moment in its illustrious history. The FIA Connect discussions highlighted tensions between cheerleaders bearing slogans and battle-hardened realists looking for substance and resolve.



UK mulls Puma replacement plans

Originally developed as part of the wide-ranging Anglo-French helicopter agreement that also produced the Lynx and Gazelle, the Sud Aviation SA 330E Puma was built by Westland in the UK and entered service with the Royal Air Force in 1971. Despite 24 of the fleet having undergone the HC.Mk 2 upgrade program that added a glass cockpit, new tailrotor and gearbox, improved defenses, and more powerful Makila engines, the 50-year-old Puma is now nearing the end of its service life, which is currently set to expire in 2025.

Faced with that proposition, the UK Ministry of Defence is examining a number of options. Earlier in July, James Heappey, previously minister for defense procurement but now minister for the armed forces, visited Washington to sign a wide-ranging cooperation agreement with U.S. Army secretary Ryan McCarthy concerning modernization. Part of the agreement covered UK interest in the Army’s Future Vertical

Lift program, which includes the Future Long-Range Assault Aircraft (FLRAA) element that pits the Sikorsky/Boeing SB-1 Defiant compound helicopter against the Bell V-280 Valor tiltrotor for the right to replace the Army’s UH-60 Black Hawk.

While the UK MoD might harbor ambitions to one day operate FLRAA aircraft, it likely won’t enter service until the 2030s, leaving a considerable capability gap. One answer could involve a further extension of the Puma’s service life to around 2035.

One party that does not think a second Puma upgrade represents the best way forward is the OEM itself. Leonardo UK, the successor to Westland, might find a place if the UK eventually procures the FLRAA, but meanwhile, it is proposing its AW149 9-tonne multi-role medium transport helicopter as the ideal solution for the Puma replacement and one that it promises it would assemble at the former Westland plant in Yeovil.

D.D.

► continued from page 1

Game-changer

manufacturing director-air at BAE Systems. “It’s important for the national skills base.” Tempest has to “drive a step-change in pace [of development] as well as in capabilities,” he added.

At the core of the development program is a far greater accent on collaboration than on earlier combat air projects, not only between UK companies but also internationally. The UK’s Team Tempest now benefits from the industrial expertise of Italy and Sweden in a tri-national effort. Working together draws innovations from all parts of the industry, including SMEs and greatly reduces the duplication of efforts and, therefore, costs.

Work on FCAS technology continues on a national basis, but the three partner nations are rapidly establishing a robust platform to merge efforts in the near future to kick-start the main development phase of the program. A trilateral study revealed encouraging results in terms of benefits for the partner nations, permitting them to retain their national skills bases and to



The Tempest fighter serves as the centerpoint of a wider future combat air system.

ensure their global standing in the defense industry for years to come, while still maintaining their national freedom of action.

What became clear at an early stage of study was that the three countries share close alignments in terms of a national vision for industry and economy, and combat air requirements. The industries and air forces themselves are also closely aligned in many ways: the UK and Italy, for example, both have rated the same

primary aircraft types in recent decades—Tornado, Typhoon and F-35—and have both worked closely as major partners in the multinational industrial programs that developed and produced them.

As far as the UK is concerned, Team Tempest has already achieved considerable successes in a rapid time period and is on track to meet its objectives as it prepares to submit an outline business case to government around the end of the year to

secure more funding. Since the launch of the combat air strategy program at Farnborough in July 2018, the nation has over 60 technology demonstrations underway, some of which are already showing levels of maturity beyond their objectives, with design engineering tasks exhibiting at least a ten-fold reduction in times. Others have achieved desired results on as little as 10 percent of the manpower required for similar tasks using traditional methods. Around 1,500 people now work on the Tempest project in the UK.

Tempest’s new approach to development involves bringing in innovations from outside the defense sector, drawing on commercial technology brought in from power, nuclear, and automotive industries, for example.

The Tempest development program will also see technology cascading into industries outside defense and aerospace, as well as into current combat aircraft such as the Eurofighter Typhoon and Saab Gripen. The latter is important not only in terms of operational effectiveness but in maintaining the credibility of those types in the export market until the Tempest itself can be exported.

Wizz Air proves ‘cash is king’

by Gregory Polek

To privately-owned Hungarian airline Wizz Air, “cash is king,” as CEO Jozsef Varadi quipped during an FIA Connect Spotlight Session. Carrying enough liquidity during the Covid crisis to last it years rather than months, the LCC’s management believes in cash preservation precisely for lean times such as these. The airline hasn’t enjoyed the kind of government support many flag carriers have received, leaving it with little choice but to rely on its own resources to survive the Covid pandemic.

“We entered March with €1.5 billion of free cash and most of it has been preserved ever since the start of the crisis,” said Varadi. “The very worst situation for us is when we don’t operate. This is when we burn the most cash. At the moment we only operate on a cash contribution basis, so actually we are creating cash. So not only are we preserving, we are adding to our liquidity.”

Varadi explained that managers of publicly-traded airlines typically run their businesses on a “pay-for-profit” basis because of their mindfulness of the stock market. “You have to run this business for the long run,” he said. “And liquidity and cash are critical components of this business model.”

In terms of operations, Wizz Air has managed to recover 77 percent of its 2019 capacity compared with the European average of 38 percent. However, as countries begin to reintroduce travel restrictions and flight bans due to surges in Covid cases, Varadi worries that industry gains might reverse. “I think the next period of time is going to be full of uncertainties in terms of the operating environment,” he said. “I think it will impose a challenge to the industry in how to be flexible and if you have to adapt your network design and capacity plan, you should do that. This is what



A WizzAir Airbus A320 takes off from Budapest in 2015.

we’re learning through this period, that if we get stuck in one country or one market because of restrictions, how do you redeploy capacity in other markets?”

The answer lies with operational agility, and Wizz Air has restructured its network and opened “six or seven” new bases, explained Varadi. Still, Wizz Air harbors no intention to change its operational or financial philosophies, notwithstanding fears that Covid could change the fundamentals of the industry forever.

“I don’t think the industry will change in the long run fundamentally,” he insisted. “I think these concepts will prevail. Yes, in this point of time you have more guidance when it comes to health and safety and those sort of measures, but you recall in 2001, when safety was at stake, a lot of people believed that would change the industry forever and people will not fly. You look at it now and ever more people have elected to fly. I think the same is going to continue going forward.” ■

Innovation key to helping aerospace climb out of Covid-caused downturn

Though the Covid-19 pandemic has delivered a “body blow” to the aerospace industry, it will come back better and stronger thanks to companies’ innovative spirit, High Value Manufacturing Catapult CEO Dick Elsy said during a Tuesday FIA Connect webinar titled Innovations in Response to Covid-19.

As proof of the industry’s flexibility, Elsy pointed to the “ventilator challenge” in the UK this spring. “In mid-March, the government saw a need for 20,000 ventilators to treat Covid patients, but had only 1,000 on hand,” he said.

Thus, the government tasked non-medical industries to help source parts for and build more ventilators. The aerospace industry rose to the challenge, supplying parts for and assembling more than 13,400 ventilators in just 12 weeks, despite its lack of expertise in the medical field.

“Aerospace moved into a completely new area in a very short time and showed its adaptability to work across industries,” Elsy explained. “We also had incredible supply chain support for the effort. Overall, the industry has incredible strength, and coming out of the Covid crisis is just another challenge. We’ve seen the spirit of the aerospace industry and just need to redirect it to the current situation.”

Aerospace Technology Institute CEO Gary Elliott agreed, adding that several “disruptors” coming to the industry will require such innovation, including urban air mobility/air taxi, sustainable regional aircraft, sustainable alternative fuels (SAF), new propulsion systems, and connectivity.

Elsy named electrification as an area where he said the aerospace industry has an opportunity to cooperate with the automotive sector, which took the lead in the field and has already set battery technology standards. “Electrification is a good place to cooperate—there is a lot of common ground, and aerospace plus auto is a terrific value add,” he said.

But UK government funding for aerospace research to produce such innovation is a huge concern to both. “Nations compete for aerospace,” noted Elliott. “So the UK government needs to lean-in hard on how we fund the industry, particularly funding intensity.”

Every £1 invested by government into aerospace research spawns £12 of investment from the private sector, according to Elliott. “We must take a bold approach to funding aerospace research.” He added that the UK’s Jet Zero initiative to field zero-emissions aircraft by 2050 is a bold national program that requires equally bold funding from the government.

Elsy echoed those thoughts. “The government needs to keep its foot flat on the accelerator when it comes to aerospace funding,” he said.

While the Covid-19 crisis is certainly a challenging time for the industry, Elliott and Elsy maintain that it also has presented an opportunity. “Aerospace will come back, and innovation will help us meet these challenges and new opportunities,” concluded Elsy. “A team of diverse people can achieve almost anything.” **C.T.**

UK aviation orgs seek help with scrappage scheme

by Kerry Lynch

UK aviation organizations are encouraging the UK government to consider an aircraft scrappage stimulus scheme to help boost the struggling sector while helping facilitate the industry’s move toward the goal of achieving net-zero emissions in 2050.

Roland Berger partner Robert Thomson detailed the Aircraft FIRSt proposal during an FIA Connect 2020 webinar, saying a study on the scheme suggests that it could help the sector if some of the key issues get resolved.

The plan aims to encourage UK airlines to replace aging aircraft—those 25 years or older—with new, more efficient aircraft. The Roland Berger report, conducted with the support of a number of major aerospace companies, estimated that such an incentive would create a demand for 90 new aircraft with the associated retirement of 90 aircraft. Such turnover could reduce CO₂ emissions by some 4 percent, Thomson said.

He cautioned that while that amounts to a “moderate” environmental benefit, the primary value would lie with economics. In addition, the proposal alone will not erase the sector’s financial woes, but it would help provide much-needed support.

The report illustrates the depths of the downturn, noting that aircraft deliveries likely will drop by half through 2020, while maintenance, repair, and overhaul spending falls by 70 percent. At its low point, traffic in the UK alone plummeted

90 percent.

In the UK, aerospace remains a critical sector, the report highlights, noting that the industry contributes £34 billion (\$43 billion) to the UK annually, supporting 114,000 jobs.

Under the scheme, aircraft more than 25 years old would be scrapped. However, a number of issues would need addressing.

They include not only economic incentives for purchase but compensation for affected companies such as suppliers and MRO providers that operate under business models the premature retirement of aircraft would harm. Further, the scheme should be tailored to ensure that airlines that have already invested in newer aircraft don’t suffer a disadvantage.

Furthermore, the scheme would need to be harmonized with other jurisdictions to ensure trade fairness. But Thomson noted that other countries have provided various forms of assistance to the industry. Any such scheme should ensure the investments aid the UK industry through parts content of new aircraft and through job support.

When asked about the scheme, Rachael Everard, head of sustainability for Rolls-Royce and a panelist during Wednesday’s session, said her company saw potential in the scheme but wanted to further explore the ramifications on MRO and to ensure funding remained available for further green research. ■

Women in defense panel aims to foster inclusiveness

by Jennifer Leach English

How can the defense industry promote diversity and gender equality among its ranks? How can it use the lessons learned from the pandemic to improve inclusivity and productivity? Those were just a few of the questions raised by Sophie Thomas, Zephyr program manager at Airbus and industry co-chair of the Women in Defence Charter, who led a thought-provoking FIA Connect 2020 seminar on July 22. The Women in Defence Charter launched in September of 2019 in London and received signed commitments from industry leaders and the Ministry of Defence to work toward gender balance and opportunities for women to succeed at all levels in the defense sector.

Morag Stuart, director of transformation for the Ministry of Defence and co-chair for the Charter, began the discussion by commenting on the professional challenges the pandemic has presented. She shared her own stressful experience of trying to teach school to two small children at home while holding down a full-time job but noted that her team at MoD showed “great resilience [in being able to] change and react” to the new normal of the pandemic.

Her colleague, Dwayne Branch, deputy director of transformation for MoD, noted that forced remote offices and teamwork could help to promote diversity because companies might no longer need to hire based on the geographical location of their candidates. He stressed the ongoing importance of recruitment from all parts of the world to create diversity not only of gender, but of “thought, background, and socioeconomic class.”

Andrea Thompson, managing director-Europe and international for BAE Systems Air, noted that the pandemic

allowed her company to become “agile and flexible in how to work from home” as it became quickly reliant on new and existing technologies to keep things running smoothly. Thompson also said the pandemic has shown that “we no longer need traditional hours of working. You don’t have to be online from nine to five because you may be juggling home-schooling and family commitments, so maybe twelve to eight is better, and we can have that flexibility.”

Still, the founder of Women in Defence UK and co-chair for the Charter, Angela Owen, was quick to serve a dose of reality in stating that men and women don’t equally share childcare responsibilities, and until they do, women will face an unfair disadvantage in the workplace. Her concern is that even with flexible hours becoming more acceptable, “if remote working is seen as something fantastic for women, but that men aren’t so keen on, it could make the divide bigger. Until we get to the stage that childcare responsibilities are shared more equally, [working from home] will not be seen as the norm and not just something women do.”

Owen pointed to recent data from the Royal Armed Forces, noting that some one out of 10 women took advantage of its recently offered “alternative working arrangements,” but only one out of 100 men. “It’s a question of destigmatizing,” said Owen, because even though many companies might put in place paternity leave policies, it remains more socially acceptable for women to shoulder child-rearing burdens.

Anna Keeling, managing director of Boeing Defence UK, referred to the pandemic as “an amazing equalizer for us all,” noting that regardless of title, everyone

has “faced the same challenges during these 100 days of lockdown,” including “the ways you communicate, the ways you build relationships and trust, and the ways that you work together as a team.” Keeling pointed out that in many ways the defense industry was well poised to handle an unforeseen crisis because it has always placed utmost value on “the importance of the mission and the customers and their needs.”

Most on the panel agreed that the pandemic has brought an unforeseen intimacy and trust to teamwork and allowed many who would perhaps not have spoken up in a large conference room to find

their voices within the more comfortable rooms of Zoom.

When asked what one lesson she hopes to bring with her into the post-Covid workplace, Thompson might have said it best: “Each and every one of my team is on an equal playing field in terms of who can bring ideas forward. No longer is this a top-down environment. This is an environment where everyone should contribute and has a lot to offer, and I see that now [because of] the last 100 days. I want that culture and mindset to be taken forward and not lost.” ■

Women leaders stress diversity and inclusion

by Kerry Lynch

While acknowledging that maintaining diversity and inclusion goals might be difficult as workforces reshape during the Covid-19 pandemic, industry leaders believe that the issue must remain a priority to prepare organizations to better prepare for the future. Four women senior executives and officials stressed that view July 23 during an FIA Connect 2020 session led by the Women in Aviation and Aerospace Charter, an initiative launched during the 2018 Farnborough Airshow and one that has attracted more than 200 companies signing on to work toward more gender balance across all levels of the industry.

“We believe it’s more important than ever to highlight this subject as companies in the sector look to restructure in response to the crises. Diverse, forward-looking, and collaborative workforces, we believe, will be integral in helping organizations to recover and face the future with confidence,” said Rolls-Royce chief customer officer for civil aerospace Jacqui Sutton, who moderated the panel on behalf of the charter.

Sutton said a recent McKinsey and Company study underscores that belief, finding companies that rank in the top quartile for gender diversity on executive teams were 21 percent more likely to outperform on profitability and 27 percent more likely to generate superior “value creation.”

Kelly Tolhurst MP, the UK Department of Transport minister for aviation, maritime, and security, agreed. She noted that the job reports have made “for very difficult reading” and emphasized her focus on working to retain as many jobs as possible. “Against this backdrop, it can be hard to look forward, but we must. We will recover from this pandemic and as we do the urgent need for technical skills will increase,” Tolhurst said. “As our sector recovers from the impact of

the coronavirus, we must ensure we pave the way for an industry that is diverse and inclusive.”

She added that the topic “remains as urgent now as ever before,” pointing to statistics showing that women pilots represent just 6 percent of the total pilot population. While piloting is just one position, it represents wider challenges throughout the industry, she said.

She expressed support for the charter initiative and noted other ongoing efforts such as the Reach for the Sky program, designed to inspire future aviators. Despite the pandemic, those initiatives continue, she said, with events moving online and ambassadors being named and actively involved.

“The whole world has plunged into crisis and our industry is one of hardest hit,” added Adefunke Adeyemi, regional director for advocacy and strategic relations for Africa for the International Air Transport Association (IATA). She acknowledged the numerous furloughs but expressed the belief that the industry is resilient and will adapt through strong communications and an understanding that industry stakeholders share in the struggles.

Given those struggles, she said IATA has shifted its goals toward fostering inclusiveness and diversity through mentorship and promotion from within rather than hard metrics.

On that front, IATA initiatives have seen successes, she said, one of which was the “25by2025” campaign launched in September of 2019. Participating airlines make a voluntary commitment to increase the number of women in senior positions by either 25 percent or ensure women fill 25 percent of those jobs by 2025. By the end of last year, nearly 60 airlines had committed.

The idea centers on the use of analytics to focus on how the industry can better



Diversity is a requirement, not an option, in the defense industry.

engage and take a deliberate approach to ensure that businesses attract, retain, and promote women to senior-level positions, she said. That does mean “playing of the gender card kind of metric,” Adeyemi said. “It is designed to address problems of conscious bias, as well as the tendency of women themselves not to lean in.”

The program must be intentional to work and ensure that organizations not only express their approval but “walk the talk.”

“If it is not done this way, the needle wouldn’t move,” she said. Pointing to the increasing participation, she said she has seen progress.

However, “with the pandemic, everything came to screeching halt,” she lamented. As a result, IATA will not concentrate on the metrics involved as much for the time being, but rather on efforts such as its “Mosaic” initiative designed to foster inclusion and diversity. It designed that effort to encourage the promotion of women who meet criteria and have merit, as well as encourage others to achieve with the help of coaching and mentoring.

Such issues apply to racial diversity needs as well. “We need to think about how we include racial minorities into the mainstream for the industry,” said Adeyemi. As with gender diversity, the efforts must be intentional but can’t be



By International Women’s Day in March, more than 200 organizations had signed on to the Women in Aviation and Aerospace Charter.

a simple gender-card play. Rather, they must ensure competency through training to ensure an available workforce, she said.

Victoria Foy, CEO of UK-based Safran Seat GB, agreed that like other companies, Safran has faced “a wave of changes” during the pandemic that has made the ability to keep diversity and inclusion top of mind challenging. However, she added

that Safran already has positioned itself well, paving paths on meeting UN inclusion benchmarks. As such it has managed to maintain a focus through several means, including outreach and surveys to ensure an understanding of concerns during the pandemic.

Long-term though, data can benchmark the gaps and areas that need

targeting, whether at the applicant level, through recruitment, or through promotion, said Martine Gagne, chief technology officer for Meggitt. Organizations should rely on multiple sources to determine whether they have made a difference, including examining the executive suite to make sure good role models occupy it. ■

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Bombardier UK manufactures composite Airbus A220 wing assemblies at its plant in Belfast, Northern Ireland, using the sophisticated resin transfer injection process—a first for commercial aircraft wing manufacturing.

UK Aerospace could lose market share to better-funded rivals in other countries

by Charles Alcock

The UK aerospace industry risks losing significant market share as rivals with more support from their governments aggressively pursue recovery from the Covid-19 pandemic through growth. The blunt warning came on July 21 from former Airbus chief operating officer Tom Williams, speaking at an Aerospace Growth Partnership webinar as part of the FIA Connect event.

Williams, who has come out of retirement to be seconded from Airbus to the UK Aerospace Supply Chain Taskforce established by industry group ADS, said that urgent, sustained, and targeted support is needed from the UK government to deal with a crisis that will prove to be “more dramatic and of longer duration” than crises such as the 9/11 terrorist attacks, SARS, the Gulf War, and the financial crisis of 2008. He warned that the UK’s Brexit departure from the European Union has added to the strain that the country’s industry will feel as it pursues recovery from the steep dip in demand on the civil aviation side of its business.

In the same webinar, UK business, energy, and industrial strategy minister Nadhim Zahawi hailed financial support that his government has provided to the sector, mainly through the short-term assistance provided to all companies to

endure the immediate effect of Covid. He pointed to some £2.6 billion (\$3.3 billion) in joint government-industry investment in research and development committed since 2013, which includes £400 million (of which £200 million came from the government) of funds committed since 2019 for the country’s Aerospace Technology Institute to advance the development of carbon-neutral aircraft. But none of those funds have been specifically committed to addressing the unprecedented Covid crisis, prompting the unfavorable comparisons with the response of other countries.

French Aid

In June, the French government committed a €15 billion (\$17 billion) aid package for the country’s aviation industry, and around €1.2 billion of it provides short-term help for the damaged supply chain. Williams said that he expects to have a similar scheme in place before the end of 2020 and claimed that industries in those countries are under less pressure after their governments extended furlough-support assistance for two years. The UK government is now winding down funding for furloughed workers.

“We [the UK] are going to have to find a solution that fits the [country’s] different social and political model,” Williams

commented. “In France, the industry has a higher strategic priority and the danger is that [French companies] have an ambition to grow their business through the current cycle and that means they will have to gain [market share] from elsewhere. In the post-Brexit environment, the UK could be seen as a sitting duck to be picked off and so that has given us an added challenge on top of this crisis.”

Mandy Ridyard, finance director with UK flight controls and components manufacturer Prosumax, told the webinar that its business dropped by 30 percent in the immediate wake of Covid and that it had quickly redirected efforts to produce ventilators for the National Health Service. She expressed appreciation for government job retention assistance but called for a more “nuanced” and longer-term approach to supporting investment in SMEs, while at the same time boosting demand by encouraging travelers to start flying again and through government procurement.

The UK Aerospace Supply Chain Taskforce has engaged with around 187 aerospace suppliers and is currently focusing on 20 or 30 companies that it feels need the most immediate help available through existing ADS programs like SC21 (set up a few years ago to modernize

the country’s supply chain) and Sharing in Growth. According to Williams, consolidation is a necessary step to make the industry leaner and better able to weather the rapid contraction in demand. “It is clear that we are now talking about an industry that could be 30 to 40 percent smaller in the next few years so we will need to reshape the supply chain to improve its liquidity and solvency so that it is ready for a return to decent business at the end of this cycle,” he said. “We are encouraging mergers and combinations of suppliers to make sure [the UK] has the right group of suppliers to emerge in a strong supply chain.”

Williams pointed out that before Covid hit, many aerospace companies had been making big investments to support rapidly growing production rates for airliner programs like the Airbus A320neo and the Boeing 737 Max. He said that the high levels of investments made in the past couple of years make it hard for firms to now take on more debt to get through the current crisis.

The industry veteran called for a patient and a long-term perspective on sourcing capital for the sector and said the government could play a role in shaping an industrial policy to support that approach. At the same time, he cautioned against the prospect of opportunistic interventions from private equity investors who he said could “pick the carcass like vultures.”

Giles Wilkes, a senior research fellow with the Institute for Government, said that the next phase of the UK government’s involvement in helping the aerospace industry could prove more challenging than its immediate Covid relief efforts. “It’s easier to act fast when you don’t have to discriminate [over] which companies to help,” he said in describing how the UK’s Conservative government had temporarily abandoned its free-market instincts in the immediate fallout from Covid. He called on those calling for larger, longer-term financial support to be more patient, warning that it will not be easy to stimulate a short-term recovery in demand for an industry that has always had to work with long investment cycles.

Zahawi said that for the government “nothing is off the table” in terms of further assistance now being considered for the UK aerospace sector. He pointed to Airbus’s decision to keep wing manufacturing for the new A321XLR narrowbody in the UK (despite Brexit) and Rolls-Royce’s continued investment in new Ultrafan engine technology as reasons for optimism. “This industry doesn’t just lie down and say ‘Covid has beaten us’ because it hasn’t and it never will,” he proclaimed. ■



Boeing pilots are conducting the current T-7A trials from St. Louis. Saab test pilots might join later test campaigns, having flown the T-7 during the demonstration phase.

All systems are ‘go’ for Boeing’s Red Hawk trainer

by David Donald

Boeing’s two T-7A Red Hawk advanced trainer development aircraft have completed around 80 percent of Phase 1 testing, according to Thom Breckenridge, vice-president of Boeing Defense global sales and marketing, strike, surveillance, and mobility. “We are on track for achieving initial operational capability in 2024,” he said in a press briefing on July 14, “with first delivery in 2023.” Full operational capability is slated for 2034.

T-1 and T-2, the first two Red Hawks, have now flown more than 200 times, at some points achieving six flights a day between them. Currently, the aircraft are engaged in clearing a series of test points that explore the T-7A’s full envelope, as well as testing the aircraft’s systems.

Boeing’s chief test pilot for Air Force programs, Dan “Dragon” Draeger, reported that the aircraft has been flown to its highest speed and has proved its fuel-flow system in inverted flight. It has exceeded its threshold angle-of-attack requirement of 20 degrees, and also its objective target of 25 degrees. It meets requirements of both instantaneous and sustained turn rates, and has been demonstrated at loads above the threshold figure of 6.5 g as it approaches the objective of 7.5 g. It is also “very well-behaved in a crosswind environment,” reported Draeger.

Hot-weather trials now are getting underway, taking advantage of the high

temperatures that are being experienced in St. Louis, where the T-7A is assembled and undergoing manufacturer’s tests. Engine re-start trials are upcoming, as is a campaign of high angle-of-attack trials using aircraft T-2, for which the instrumented nose boom normally fitted for tests will be removed.

Draeger noted that the requirements of social distancing amid the Covid-19 pandemic had demanded some operational procedures to be modified, particularly with regard to briefing, debriefing, and launch/recovery. This has led to only one T-7A being flown at any one time and a slightly reduced rate of testing. “Some opportunities have been lost,” he said.

Boeing, with partner Saab, is producing the T-7A for the U.S. Air Force’s advanced trainer requirement to replace the aging fleet of Northrop T-38 Talons. The current requirement stands at 351 aircraft. The partners took a clean-sheet approach to take full advantage of innovations in design, development, and manufacturing technologies. A key driver involved making the aircraft as close in character to modern fighters as possible while keeping operating and acquisition costs low. “It was designed to perform like a fighter, with precise high angle-of-attack maneuverability, something our competitors just don’t have,” said Breckenridge.

Draeger elaborated further: “Performance is squarely in the center of where fourth- and fifth-generation operate.” Moreover, the aircraft’s systems feature mission computers separated from the triplex flight-critical systems. That feature allows the aircraft to be digitally tailorable to synthetically mimic different aircraft types in terms of cockpit displays, radars, sensors, weapon systems, and defenses. For the student, that translates into an ability to see information presented in the cockpit in the same fashion as in the front-line aircraft, with its specific capabilities also replicated onboard synthetically.

The T-7A is part of a wider training system that Boeing is developing. A

ground-based training system (GBTS) is on course to be delivered to the Air Force ahead of the first aircraft arriving, comprising an array of components from desk modules to flight simulators, and including an egress trainer.

A key element of the GBTS is that it uses the same operational flight program (OFP) software as the aircraft, enabling it to maintain concurrency with the actual aircraft through simultaneous software uploads. It also employs the same brief/debrief system, making the transitions between GBTS and aircraft as seamless as possible. Available from the first day is a live-virtual-constructive (LVC) capability that allows simulators to be networked with flying aircraft in joint training operations. At present, there are no plans to network the T-7A with other aircraft types, although the simulators can be.

Boeing and Saab are currently focused on the U.S. Air Force requirement, but the T-7 is drawing strong interest from potential export customers. There is flexibility in the production system to cater for additional orders without interrupting production for the USAF, which is expected to reach 48 units annually. Saab is producing the aft fuselages for the Red Hawk, the first seven of which are being built in Linköping, Sweden, before production shifts to a new factory at West Lafayette in Indiana.

While the aim of the T-7 in the first instance is advanced training, the type has obvious applications to other tasks, such as light attack. “We’re confident it can fulfill the role,” said Breckenridge. “It was designed for growth from its inception.” The aircraft has a single centerline hardpoint for the carriage of stores such as practice bomb carriers, but it could be modified with underwing hardpoints for additional pylons. Another role to which the T-7 could be adapted is carrier training as an answer to the U.S. Navy’s UJTS requirement for a T-45 Goshawk replacement. ■

New members announced for team Tempest

UK Secretary of State for Defence Ben Wallace on July 20 helped open the FIA Connect event by naming seven additional UK companies that had joined Team Tempest, which is developing a future combat air system (FCAS) for the RAF and other European air forces and for export.

The principal members of the team—BAE Systems, Rolls-Royce, Leonardo UK, and MBDA—are being joined by General Electric UK, QinetiQ, Thales, Martin-Baker (ejection seats), GKN Aerospace, and Bombardier UK. Collins Aerospace, which has a number of facilities in the UK specializing in inertial and terrain-based navigation systems and reconnaissance sensors, also has joined the team. The companies would also

bring with them further subject-matter experts and medium-sized companies as part of their supply chains, along with academic institutions.

Italy and Sweden are joining the UK in the Tempest program, with the potential for other national partners to participate. Earlier on July 20, Sweden’s Saab said it is opening an office in the UK to develop FCAS technologies. “Saab took the decision to create a new FCAS center so that we can further develop the close working relationship with the other FCAS industrial partners and the UK Ministry of Defence,” said Saab’s president and CEO, Micael Johansson. “This emphasizes the importance of both FCAS and the United Kingdom to Saab’s future.” **D.D.**



Rolls-Royce's Trent 1000 is reaching new levels of durability, with zero Boeing 787 AOGs achieved in early July. A combination of technical solutions and provision of more spare engines for airlines has helped improve the AOG situation.

Rolls reaches single-digit AOG goal with Trent 1000

by Matt Thurber and Gregory Polek

Rolls-Royce continues to report “good progress” on fixing durability problems plaguing the Trent 1000 engine, adding that it has achieved the target of single-digit numbers of aircraft grounded by the end of the second quarter.

Soon after issuing a July 9 trading update for the first half of the year, the company revealed its Dreamliner AOG figures. “We have now reached a position where there are zero Boeing 787 aircraft on the ground (AOG) due to Trent 1000 durability-related issues,” it said.

The effort to improve Trent 1000 support has centered on a number of measures, the UK-based engine manufacturer said. They include technical solutions as well as increasing the availability of spare engines at the operator level, so airlines can more quickly swap engines and maintain flight schedules when a problem arises.

Rolls-Royce said it has introduced the solutions on a “fast-track basis” to improve the Trent 1000’s in-service durability. More than 99 percent of the flying fleet has received the improved intermediate pressure turbine blade. Engineers are fitting Trent 1000 TEN and Package C engines with redesigned intermediate pressure compressor blades, which the company expects to make available for the Package B engines in the fourth quarter. Rolls also reported that it should complete the Trent 1000 TEN and Package C blade roll program by the end of next year. For the Package B and C engines, it has upgraded more than 50 percent of the fleet to the new, enhanced high-pressure turbine blades.

Rolls continues endurance testing a final

durability issue with the Trent 1000 TEN’s high-pressure turbine blades, identified during a “rigorous root cause investigation and design process,” according to the company. “We are now over three-quarters of the way through this test and remain on track for its incorporation into the fleet by the end of H1 2021,” it reported.

During the coronavirus pandemic, Rolls-Royce has trained airline technicians to conduct certain Trent 1000 inspections using Librestream’s digital visualization technology. The program eliminates the need for Rolls-Royce to send an inspector to the airline or the airline to send technicians to Rolls-Royce’s Derby facility for training. “The ability to continue performing these inspections

allowed a number of our customers to avoid AOGs and is changing the way we support our customers,” Rolls-Royce said. Eventually, the company hopes to use Librestream to teach customer technicians how to conduct other engine inspections, which should give the airlines more operational flexibility.

“We have been intensely focused on addressing the Trent 1000 issues that have caused unacceptable disruption to our customers,” said Chris Cholerton, Rolls-Royce’s president of Civil Aerospace. “We deeply appreciate the understanding and cooperation of our customers who have been impacted by this situation for a long time. Reaching zero AOGs is an important milestone for us and our focus will be sustained to help our customers return aircraft to regular service as they recover from the impact of Covid-19, and to complete the fitment of upgrades throughout the fleet. This will deliver the performance that we and our customers expect.”

Meanwhile, in its trading update,

Rolls-Royce said it expects a gradual recovery of its end markets as travel restrictions ease in the coming months, but it acknowledged an “elevated” level of uncertainty in the industry outlook. It now forecasts widebody engine flying hours to decline by about 55 percent this year, as more long-haul routes open in the fourth quarter. The company continues to plan for about 250 widebody engine deliveries in 2020, based on announced build rates from its airframer customers.

The company also reported anticipating a reduction in cash burn resulting from “cash mitigation actions” including supply chain management and a one-third cut in its civil aerospace workforce. Last month Rolls opened voluntary severance in the UK, including an “enhanced” early retirement scheme. The company said it has received more than 3,000 expressions of interest for voluntary severance in the UK and that it expected about two-thirds of those employees to leave by the end of August.

Meanwhile, an anticipated full-year free cash outflow of some £4 billion reflects an “unwind” of inventory in the second half, a gradual improvement in engine flying hours, and an acceleration of cash savings.

During the first half, the business saw a severe decline in demand due to a drop in widebody engine flying hours by some 50 percent, including a 75 percent decline in the second quarter, due to Covid-19 effects. Since the low point in April, when flying hours had fallen 80 percent compared with April 2019, the company has seen a marginal improvement in May and June led by an increase in flights in China, Asia-Pacific, and the Middle East. Business jet and regional flight activity has begun to recover more quickly due to lower exposure to cross-border routes, said the company.

MRO activity in the first half remained broadly stable compared with the same period in 2019 but lower than the pre-Covid-19 first-half schedule.

In terms of production, output of new widebody engines proved consistent with the company’s revised guidance of 250 engines for the full year, as it shipped 130 engines in the first half. ■

SR Technics introduces remote table inspections for engine work

Zurich-based MRO provider SR Technics is now offering remote table inspections (RTI) for engines at its facility. The new offering, which uses a video streaming portal, can apply to any engine type or shop visit.

According to the company, the use of RTIs can help diminish waiting times, cut travel costs and processing time, and eliminate bottlenecks in the process. Because items do not need to be blocked as in a physical table inspection, the remotely conducted process does not affect the flow of engine materials.

“The advantages of RTI are various, and it is possible to manage the engine history

through video recording which is part of RTI and shorten the engine repair duration,” explained Seahee Cho, a powerplant engineer for engine maintenance with Asiana Airlines, which has used the procedure as a customer and expects it to foster improved cooperation between clients and the MRO. “In addition, live streaming technology can be used for various issues that are not limited to table inspection and require further discussion.”

SR Technics noted that development of the innovation had already gotten underway when the Covid-19 pandemic struck in March, and it went live the following

month. All of its repair customers can now follow the progress of inspection work on their engines, components, and modules remotely from their home bases.

“SR Technics is one of the first engine MRO providers to use video streaming technology for remote table inspections,” said Owen McClave, the company’s senior vice president for engine services. “Given the great reduction in travel and face-to-face interactions in recent months, this is yet another example of how our company has rapidly adapted to market demands while prioritizing the health of our customers and personnel.” **C.E.**



Despite the drop in aviation traffic due to the global Covid pandemic, Air bp still sees the widespread adoption of sustainable aviation fuel as crucial to meeting the industry's carbon reduction goals.

Amid the Covid pandemic, Air bp optimistic about SAF

by Curt Epstein

With severe reductions in aviation traffic due to the Covid-19 pandemic, all sectors of the industry have felt an effect, among them fuel providers such as Air bp. The UK-based company has taken an active role in the push for the adoption of sustainable aviation fuels (SAF), with its parent BP Group committing back in February to becoming a net-zero carbon emitter by 2050 or sooner. That goal aligns with the aviation industry's greater aspirations, adopted in 2009, to achieve carbon-neutral growth from 2020, and in the long-term halving 2005 levels of net CO₂ emissions from the sector by 2050.

"There will be some slowdown in aviation traffic over the next few years compared to where it would have otherwise been, but the trend is still very clear that aviation will continue to grow over that long-term picture, while also needing to reduce its CO₂ emissions substantially," said Tom Parsons, Air bp's commercial development manager for biojet.

Sustainable fuels derive their environmental benefits not from their actual burning, in which the carbon emissions are nearly indistinguishable from conventional jet fuels, but from their production lifecycle. "SAF typically saves up to 80 percent of the CO₂ over the lifecycle, so what that means is it's using feedstocks that either have taken CO₂ out of the atmosphere or that are already wastes within the system," explained Parsons. "You turn that back into useful fuel and thereby avoid the additional production of crude oil, which is taking stored carbon out of the ground and adding to the net atmospheric CO₂."

The industry has gathered momentum as volumes of renewable fuel increase with the approval of new production pathways. Championed by Fulcrum BioEnergy, the most recent involves the use of a synthetic crude oil derived from municipal waste, which can be co-processed with petroleum at the refinery level.

This latest approval moves the inclusion of SAF further upstream in the process and will allow any standard petroleum refinery to use the synthetic crude oil along with regular crude oil. Most

previous alternative jet fuel processes involved blending a refined SAF with conventional Jet-A at the refinery gate.

In 2016, the two companies signed an agreement giving BP a \$30 million equity investment in Fulcrum, which expects to bring its first major production plant online this year near Reno, Nevada. The two companies also agreed to terms on a 500 million gallon jet fuel offtake agreement that will provide Air bp with 50 million gallons per year of low-carbon, drop-in jet fuel. That deal is in addition to BP's long-standing partnership with European SAF provider Neste, and Parsons noted there are other agreements in the works.

But such plans, in the short term, might suffer from the effects of Covid. "We're in that phase of moving from occasional one-offs into more continuous supply and I think in commercial aviation we've probably had to defer activities by three or four months," Parsons explained.

"I think we were coming into 2020 with encouraging momentum, and a lot of interest in sustainable aviation fuel from both commercial airlines and general aviation customers," he explained. But with the pandemic has come a slowdown in operations and, for many customers, a possible "reset" in their thinking.

Yet, unlike in the aftermath of the global economic meltdown more than a decade ago, where some companies shied away from sustainable activities, Parsons told *AIN* he believes this crisis is different. "We have been encouraged by many of those conversations continuing through this challenging period," he said.

As an example, Parsons cited government bailouts offered to airlines, some of which are being linked to carbon emissions reduction. Aside from those financial incentives, he noted that public pressure might also play a role.

Even as the effect of the pandemic continues to be felt, there is evidence from the SAF producers that their efforts to increase SAF supply continue unabated. "If anything, there have been more new announcements than ever for new production options over the last six months," said Parsons. ■

UK collaboration eyes sustainable composites

by Kerry Lynch

As the aviation industry increasingly looks to incorporate composite materials into aircraft designs, UK researchers are launching an initiative to drive the development of sustainable materials and recycling technologies.

The Sustainable Composites initiative brings together industry, academia, and government to collaborate on research that participants hope will address complexities involved with recycling composites and build on a rapidly expanding £2 billion global market for end-of-life recycling. The National Composites Centre (NCC) and the Centre for Process Innovation (CPI) lead the initiative, announced earlier this month by Nadhim Zawahi, UK undersecretary of state for business, energy, and industrial strategy.

"As home to some of the world's lead-



Composite parts like those manufactured by GKN will need eventual disposal, something that the Sustainable Composites initiative hopes to facilitate.

ing researchers and pioneering research and development facilities, the UK has a fantastic opportunity to create value from waste across a whole range of sectors," Zawahi said. "The initiative we're launching today will help develop light, durable, and recyclable composite materials—not only saving vast amounts of energy but opening up new opportunities for some of our most critical industries."

In aerospace, the recycling rate of metallic aircraft is as much as 85 percent. The value of end-of-life market for aerospace alone—including recycling and component resale—totals more than £1.5 billion annually. Over the next two decades, some 12,000 airliners will reach the end of their useful life. The UK share of the market amounts to about £300m per annum, Sustainable Composites partners estimated. ■

Composites, which are in demand for their lightweight, strong, and durable qualities, will become an increasing part of the retirements. Airliners with carbon-fiber materials are beginning to enter the waste stream. But organizers of the initiative say the path for recycling such materials is not as developed or understood. Composites makers produce some 110,000 tonnes of carbon-fiber materials in the UK alone each year for various industries, but an estimated 15 percent will get reused or recycled.

Typically, composites have been composed of layers of materials and resin that are heated and compressed. While they can have a longer lifespan, "unpicking these elements in a recycling process is difficult, and current recycling techniques often degrade the material's performance, reducing their value and offering limited applications," organizers said. "In addition, more than 95 percent of composites are made from raw materials and resins that are derived from oil, making them unsustainable."

The partnership will look at composites lifecycles to try to accelerate development of new recycling technologies and create new sustainable composites made from materials such as vegetable waste, corn, nutshells, and algae.

Work already is advancing on composites recycling. NCC has developed a process with Oxford Brookes University that dis-bonds composite materials through heat. CPI, meanwhile, has explored means to develop sustainable products using municipal solid waste. Others include West Midlands, UK-based ELG Carbon Fibre, which is the world's first commercial recycler of carbon-fiber composites.

The Sustainable Composites partnership plans to develop a series of research and development projects through coordinated efforts across the composites supply chain, including materials and other manufacturers, chemical suppliers, and recycling companies. The projects will be designed to advance new technologies, investigate feedstocks, and develop product design and manufacturing processes.

One such project involves a steam process developed by B&M Longworth that could be used to reclaim resin and fibers. Then, team members will eye the use of HiPerDiF technology developed at the University of Bristol to realign fibers.

"We have the expertise in the UK to take the lead in developing the technologies and processes that make composite materials a net-zero carbon alternative," said NCC chief executive Richard Oldfield. "We need to accelerate that innovation and lock in sustainability from design to end-of-life." ■



DAVID MCINTOSH

The Global 7500 is the first business jet to carry a published Environmental Product Declaration disclosing detailed information about its lifecycle, such as CO₂ emissions, noise, water consumption, and other key environmental impact indicators.

Global 7500 environmental declaration marks bizav first

by Kerry Lynch

Bombardier Aviation's Global 7500 has become the first business jet to receive an Environmental Product Declaration (EPD) through The International EPD System. Third-party verified to international ISO standards (ISO 14025 and related—for Type III environmental declarations), the EPD discloses detailed environmental information about the Global 7500's lifecycle, such as CO₂ emissions, noise, water consumption, and

other key environmental impact indicators. Based in Sweden, The International EPD System has a library of published EPDs for products from 31 countries in an effort to foster transparency about environmental lifecycles.

"We are proud to collaborate with Bombardier in its effort to provide full transparency about the environmental performance of its Global 7500 jet from a lifecycle perspective," said Sebastiaan

Stiller, director of business for The International EPD System. "With the publication of the first business jet EPD in our system, Bombardier is striving to provide customers and stakeholders with the full environmental picture."

Bombardier called the publication of the Global 7500 EPD an important milestone in the company's environmental sustainability strategy, which also has involved the increased adoption of sustainable alternative fuels (SAF), a reduction in its CO₂ footprint, expanded aircraft recyclability, and the further sustainable sourcing.

The publication of the EPD is an outgrowth of efforts that Bombardier incorporated throughout the development of the Global 7500, the company said. In a first for the company, a Bombardier

Eco-Design team applied product innovation lifecycle processes throughout development to ensure that the ultra-long-range business jet minimizes its effect on the environment from design to the aircraft's end-of-life. That involved a focus on involved health, safety, and environmental considerations during design, production, support, and end-of-life. In addition, the approach involved years of collaboration with the supply chain.

The team considered operational lifecycles, including an evaluation of noise and fuel burn. Further, Bombardier considered recyclability and recovery rates for end-of-life, reporting that material recycling and energy recovery aggregate to an 85 percent recoverability rate by weight for the Global 7500.

"The EPD for the Global 7500 business jet embodies Bombardier's commitment both to the environment and to the sustainable advancement of the aviation industry," said Bombardier Aviation president David Coleal. "We are thrilled to offer a comprehensive environmental footprint and performance overview of the Global 7500 throughout its lifecycle. By making this information available to our stakeholders, including operators, this EPD supports the business aviation industry's broader approach to fight climate change through clear, transparent goals and associated multipronged plans that encompass technology and sustainable fuels." ■

Microbial contamination of fuel an industry concern

by Curt Epstein

The International Air Transport Association has raised safety concerns about possible microbial contamination of fuel stored in aircraft grounded during the Covid-19 pandemic. In a recent webinar hosted with Airlines for America (A4A) and the Joint Inspection Group (JIG), IATA also warned that the dangers could extend to fuel storage units that are seeing less demand as a result of some 16,000 airliners being inactive due to the crisis.

JIG is the organization responsible for the development of aviation fuel supply standards covering the entire supply from refinery to aircraft. Lee Taylor, a member of its technical team and a qualified inspector, explained that the three sides of the microbial growth triangle are jet fuel, microbes in the surrounding environment as the result of downstream contamination, and water, which creates and sustains a viable environment for organisms to grow and thrive.

Due to the prevalence of microbes, eliminating them from the system is virtually impossible, so the goal, Taylor said, is preventing the conditions that can

cause rapid proliferation of the microbes, which can lead to fuel system fouling and corrosion.

Onboard the aircraft the problems can include malfunctioning of fuel gauges, rapid filter clogging, corrosion throughout the wing tanks and fuel system, and the necessity of increased maintenance while in fuel farms. Microbe proliferation also can result in poor filter performance and so require more frequent cleaning to remove the accumulating biofilm. Since water is heavier than fuel, most microbial growth will be found at the bottom of the tank or at the water/fuel interface layer.

Taylor noted that while always a part of the routine daily assessment of fuel quality, visual inspection of samples during this time is even more crucial. "Not only does it provide an early indication of general contamination such as dirt and water, but also the presence of severe microbial contamination," he commented, adding that removing the water by good housekeeping techniques such as routine sampling and system flushing is the best way to inhibit microbial growth.



BARRY AMBROSE

Microbes could contaminate fuel in airplanes grounded during the pandemic.

For airports with hydrant fueling systems, Taylor said it is also vital to conduct effective routine maintenance of below-ground piping, where sediment and water can accumulate.

When it comes to testing for microbial contamination, the more sampling and testing the better, according to Amy Carico, A4A's director of fuel services and technical standards. She told the webinar that results can be different depending on the location in the tank from which the sample came.

Carico said that water is present in all fuel, and there is no way to avoid having

it in the system. She explained that as the fuel cools, any water molecules suspended in it will fall out of solution to accumulate at the lowest points of the tank or system, and that is from where samples should be taken. Signs of contamination can include foul odors, brownish water, particulate matter, a lacy foam between the water and fuel layers, slime or sludge, and discoloration on filters, but as Carico noted, a contaminated system might exhibit none of those symptoms. Once a sample is taken it should be tested as soon as possible because the amount and types of microbes present can change in just a few hours. ■

USAF places first order for Boeing F-15EX Eagle Fighter

by David Donald

The U.S. Department of the Air Force on Monday awarded Boeing a contract to supply eight F-15EX multi-role fighters. The contract, worth just under \$1.2 billion, specifies the “design, development, integration, manufacturing, test, verification, certification, delivery, sustainment, and modification of F-15EX aircraft, including spares, support equipment, training materials, technical data, and technical support.”

The award of the first F-15EX order to Boeing follows a \$101.3 million contract issued on June 30 to General Electric to provide 19 F110-GE-129 engines for the eight aircraft, including three spares. Alternative engine provider Pratt & Whitney did not compete for the initial engine requirement because the F-15QA Advanced Eagle (for Qatar), upon which the F-15EX is based, is engineered solely for the F110 turbofan. However, in May the Air Force opened follow-on engine supplies to competition.

Restarting F-15 production for the U.S. Air Force instead of increasing F-35 procurement has been the subject of considerable debate in recent times. “The F-15EX is the most affordable and

immediate way to refresh the capacity and update the capabilities provided by our aging F-15C/D fleets,” said General Mike Holmes, Air Combat Command commander. “The F-15EX is ready to fight as soon as it comes off the line.”

Funding for the first eight F-15EXs comes from the Fiscal Year 2020 budget, with another 12 requested for FY21. The Air Force plans to acquire 76 over the five-year Future Years Defense Program. An indefinite-delivery, indefinite-quantity contract with a ceiling of almost \$23 billion for 200 aircraft is being announced as well, and Boeing understands that future requirements will likely reach 144 aircraft. The Air Force bought the last of its current fleet 19 years ago, when it acquired the final handful of F-15E Strike Eagles in the FY01 budget.

The first pair of F-15EXs is already at an advanced stage of construction inside Boeing’s St. Louis factory, with delivery scheduled for the first quarter of 2021. Plans call for all eight aircraft from the initial batch to be delivered by the end of 2023 and assigned to Eglin AFB in Florida for test and evaluation, with six aircraft being designated as



The first F-15EX takes shape in the St. Louis factory. It wears the Air Force serial 20-0001.

trials aircraft. Some, if not all, will return to operational status at a later date. Subsequent operating locations will be selected to receive the type under the USAF’s Strategic Basing Process.

F-15EXs will replace the oldest F-15C/Ds in the inventory, which are nearing the end of their structural lives. Due to the commonality between the C/D models and the EX, the switch will require “minimal” transitional training and infrastructure changes. “When delivered, we expect bases currently operating the F-15 to transition to the new EX platform in a matter of months versus years,” said Holmes.

The Air Force initially plans to operate them primarily as single-seaters in the

air defense role, leaving the rear cockpit empty but available for growth and other missions, such as working with air vehicles in manned/unmanned teams. A decision was taken to use the two-seat F-15QA as the basis for the F-15EX to minimize delays in getting the aircraft into production.

F-15A and two-seat TF-15A Eagles first entered USAF service in January 1976, but the F-15EX is a very different beast. The type has undergone considerable development, especially in recent years, driven by the demands of the export market. The two-seat F-15EX features a high-speed fiber-optic backbone and an open mission systems architecture that permits rapid insertion of technology. It has an enhanced structure, APG-82 AESA radar, fly-by-wire flight control system that caters to greater load-carrying options, sophisticated electronic warfare capabilities, and advanced cockpit systems centered on wide-area screens in both cockpits. It is compatible with the Legion Pod infrared search and track system.

“The F-15EX’s digital backbone, open mission systems, and generous payload capacity fit well with our vision for future net-enabled warfare,” said Dr. Will Roper, assistant secretary of the Air Force for Acquisition, Technology and Logistics. “Continually upgrading systems, and how they share data across the Joint Force, is critical for defeating advanced threats.”

Prat Kumar, Boeing’s F-15 program manager, commented that, “F-15EX brings together benefits of digital engineering, open mission systems, and agile software development to keep it affordable and upgradable for decades to come.”

Boeing describes the increased payload capacity as “best in class” and the airplane includes additional underwing pylons that allow it to carry 12 air-to-air missiles compared with the F-15C’s eight. For now the Air Force is happy with this configuration, but if the aircraft is fitted with Boeing’s Advanced Missile and Bomb Ejector Rack (AMBER), that could increase weapon carriage to more than 20. Critically, the F-15EX can also carry large weapons on its centerline hardpoint, including hypersonic missiles, measuring up to 22 feet in length and weighing up to 7,000 pounds. ■

Qatari Typhoon simulator to use CAE’s Medallion Mission Reality e-Series visuals

BAE Systems has selected CAE’s Medallion MR e-Series visual system for the full-mission simulators it will supply to the Qatari Emiri Air Force. Announced in early July, the deal involves the provision of four Medallion systems under contracts to be awarded in the third and fourth quarters

of CAE’s 2020 fiscal year.

CAE’s Medallion MR (Mission Reality) e-Series is a fully integrated vision system for fast-jet training. It can offer 270- or 360-degree dome capability depending on requirements, and offers a realistic, immersive environment that supports all

facets of flight training, including complex tasks such as target identification, inflight refueling, formation flying, and low-level operations. Active eyewear provides 3D depth perception, and the system compensates for head movement. The modeling definition of targets or points of interest at range corresponds to normal eye limits. It employs industry-standard interfaces such as the Open Geospatial Consortium Common Database and the Common Image Generator Interface.

“BAE Systems did an exhaustive evaluation of the latest visual display systems available for fighter simulators, and we are excited by their selection of the Medallion MR e-Series,” said Thibaut Trancart, CAE’s defense and security managing director for the Middle East. “The exceptional realism and immersion offered by the Medallion MR e-Series helps deliver significant training value by allowing complex and challenging fighter aircraft tasks to be rehearsed in a safe virtual environment.”

Qatar is acquiring 24 Typhoons with BAE Systems serving as prime contractor. The deal includes in-service support and a training package. Qatari pilots are already getting experience in a jointly staffed Royal Air Force unit, No. 12(B) Squadron at Coningsby. Formed on July 24, 2018, the unit began joint flying operations on June 19 this year.

D.D.



The Medallion MR e-Series is a fully immersive simulation vision system that CAE says greatly reduces eye-strain and fatigue.

UK Navy aircraft carrier on course for deployment

by David Donald

HMS Queen Elizabeth, the first of two 65,000-tonne aircraft carriers for the Royal Navy, and her 1,100-strong crew have been busy in 2020 as the work-up toward operational capability progresses. Recently the vessel returned to its home base at Portsmouth after a 70-day Operational Sea Training campaign in UK waters and is now undergoing planned maintenance ahead of the next round of trials.

Having earlier conducted trials in U.S. waters with U.S.-based aircraft, Queen Elizabeth undertook operations with UK-based F-35 Lightnings for the first time in home waters in January, flown by pilots from the Lightning Force training unit, No. 207 (Reserve) Squadron. Captain Angus Essenhigh had only taken command of the vessel weeks before.

The ship sailed again in late April for Exercise Crimson Ocean, which began with basic crew sea training and inspection, before embarking the Merlin helicopters of 820 Naval Air Squadron in mid-May. After a 48-hour return to Portsmouth to replenish stores and to embark engineers and equipment from the Lightning Force, Queen Elizabeth put to sea again to await the arrival of the F-35Bs.

On June 9 the F-35Bs from the joint RAF/Royal Navy No. 617 Squadron—the famous “Dambusters” unit—landed on the carrier, marking the first time that operational UK jets had flown from the carrier. Following an initial qualification phase, the aircraft began training in more operational tasks, such as launching aircraft to mount combat air patrols to defend the carrier and its strike group, and short-notice launches of up to four aircraft. Queen Elizabeth returned to Portsmouth on July 2.

Now the carrier is being prepared for another phase of work-up in which it will exercise with forces from the U.S. and other NATO allies in a Joint Warrior Group Exercise. As part of the campaign, the vessel’s ability to act as a task group flagship will be put to the test. From the air side, a key component of the exercise will involve the joint embarkation of F-35Bs from both No. 617 Squadron and the U.S. Marine Corps’ 3rd Marine Air Wing. Five UK aircraft will be partnered by 10 from Marine squadron VMFA-211, supported by six Merlins. The U.S. aircraft will deploy to RAF Marham in the late summer for shore-based training with their UK counterparts. The carrier itself will require the addition of some Marines-specific equipment. The Corps has been operating the F-35B from assault carriers since 2018.

Exercise Crimson Warrior is due to follow, involving F-35Bs from both nations undertaking simulated combat operations together from Marham. Meanwhile, the

carrier will have its defenses upgraded with the addition of 30-mm cannons and an additional Phalanx close-in weapon system.

All the activity involves preparations for the Carrier Strike Group (CSG) to undertake its first operational deployment in May 2021. At present Queen Elizabeth will be accompanied by a submarine, two Type 45 destroyers (Diamond and Defender), two Type 23 frigates (Kent and Richmond), the royal fleet auxiliary Fort Victoria, and a Tide-class tanker. Plans call for the air wing to consist of eight UK F-35Bs and six Marine Corps jets, nine Merlin Mk 2s, and a number of AW159 Wildcat helicopters equipped to fire the Thales Martlet light missile.

Three of the nine Merlin Mk 2s are expected to be fitted with developmental Crowsnest radar sets to give the air wing a measure of airborne early warning capability while the Navy waits for initial operational clearance of the radar equipment, which is scheduled for September. Merlin Mk 4 assault transport helicopters will deploy as part of the CSG for carrier onboard delivery duties, and Marine Corps MV-22 Ospreys and CH-53E Sea Stallions might also operate from Queen Elizabeth’s



Four F-35Bs from No. 617 Squadron (“Dambusters”) and a single Merlin stand on the flight deck of Queen Elizabeth during carrier trials in June.

deck at some point during the deployment.

Details of the tasking for the CSG have yet to be finalized, but it is expected to sail to the Mediterranean and further east.

In the meantime, sister-ship HMS Prince of Wales arrived in Portsmouth in November last year, being commissioned into the Royal Navy the following month. It is expected to achieve operational capability in 2023.

However, the UK’s carrier strike capability build-up has not all been smooth sailing. In late June the National Audit Office (NAO), a government watchdog, published a report in which it questioned whether the carrier force could realize its full potential due to delays in ordering equipment. In particular, the NAO highlighted the failure to have ordered

more F-35Bs, of which only 48 are under contract. That translates to a typical air wing of just 12 aircraft, with the ability to embark 24 in emergencies. As each carrier is designed to operate up to 36, the shortage represents a significant loss of potential airpower.

Another procurement failure concerns the Fleet Solid Support ship program, which is intended to provide three support vessels. No orders have yet been placed, leaving Fort Victoria as the only suitable vessel in the fleet to support modern carriers. Other shortcomings are noted in delays to the Crowsnest radar, and no sign of a replacement for the Merlin Mk 4 for intra-theater transport, which was due to be replaced in that role at the end of next year. ■

UK Ministry of Defence signs first Protector order

The UK Ministry of Defence has placed an order for three General Atomics Protector RG.Mk 1 vehicles for the RAF’s remotely-piloted aircraft system (RPAS) force, Defence Secretary Ben Wallace announced on July 15. The initial contract is worth £65 million (\$81.6 million) and includes three ground control stations. The deal includes an option for a further 13 Protector air vehicles to meet the RAF’s planned total requirement for 16.

“Protector will provide the RAF with vast global reach, meeting the UK’s defense and security needs for decades to come, and provides another increase to the unmanned inventory for the armed forces,”

said Wallace. “This aircraft will upgrade a whole range of lethal capabilities allowing us to control, protect, and manage the battlespace from the air for hours on end.”

Plans call for Protector to enter service in mid-2024 from the RAF’s ISTAR (Intelligence, surveillance, target acquisition, and reconnaissance) hub at Waddington. With 16 aircraft in service, that will more than double the RPAS capability offered by the current General Atomics MQ-9A Reaper fleet. Protector is a development of the Reaper, offering a 40-hour endurance. Crucially, it is the world’s first certified RPAS, enabling it to fly in unsegregated airspace

due to its “sense-and-avoid” capability, in turn permitting its use in civilian airspace for missions such as search and rescue and disaster response. Protector also has anti-icing and lightning protection, allowing for extreme weather operations. Planned weaponry includes the MBDA Brimstone missile and Raytheon UK Paveway IV laser-guided bomb.

Protector operators will take advantage of a new training initiative announced on July 1 for the current Reaper fleet. Initial training will now happen at the General Atomics test and training center at Grand Forks in North Dakota, where students will receive ground and basic aircraft operation instruction. Meanwhile, prospective Reaper operators will continue to undergo training at the CAE-operated U.S. Air Force training establishment at Holloman AFB, New Mexico.

After the initial training phase, operators join the RAF’s No. 39 Squadron at Creech AFB, Nevada, which absorbed the RAF-specific training task from No. 54 Squadron’s Reaper Training Flight. Once the Grand Forks activity is fully operating, the RAF will have complete control of its training syllabus, negating the need for a conversion course that teaches UK-specific tactics, techniques, and procedures. D.D.



During 2019 the SkyGuardian/Protector development vehicle flew to Creech AFB in Nevada for introduction to RAF personnel based there with Nos 13 and 39 Squadrons.

FAA leader says airline pax must wear face coverings

by Charles Alcock

Airline passengers need to play their part in making flights safe and restoring confidence in the air transport system in the wake of the Covid-19 pandemic, according to FAA deputy administrator Daniel Elwell. Giving a keynote address as part of the FIA Connect event on July 23, he called on all travelers to wear face masks at every stage of their journey, including onboard the aircraft and in airports.

“The recovery [of airline service] needs to be a team sport and we can’t have some passengers only wearing masks some of the time or not following social distancing rules,” said Elwell, who is the U.S. representative on the ICAO Council’s Aviation Recovery Taskforce. “All of us have to be vigilant to ensure that all guidance is followed. The U.S. government’s Runway to Recovery policy echoes this and the public are critical to [its implementation].”

Elwell’s comments come as political divisions in the U.S. deepen over the wearing of face masks, with lawmakers divided as to whether to legally enforce their use.

For example, Georgia governor Brian Kemp is taking legal action against Atlanta mayor Keisha Lance Bottoms in a bid to stop her from enforcing a requirement to wear masks in public across the city.

Nonetheless, Elwell expressed optimism for an accelerated recovery in airline traffic, pointing to rising passenger numbers on some domestic services. He said that the ICAO taskforce’s recovery road map is practical and consistent with medical standards and depends on a social contract with all stakeholders.

Separately, Elwell said that unmanned aircraft technology now ranks as a matter of the highest priority for FAA, which is increasingly focusing not only on smaller drones but the new larger passenger- and freight-carrying models that the agency categorizes as Advanced Air Mobility (AAM). “Unmanned aircraft are now accepted as a vital sector of aviation and we have to work across borders to ensure that what works in one country will work in another,” he said.

On July 8, the FAA and Switzerland’s Federal Office of Civil Aviation announced that they have agreed to harmonize domestic and international safety standards for unmanned aircraft systems. The two agencies will work together to engage in research and development, exchange ideas, personnel, and information as well as coordinate with other government entities and stakeholders.

Elwell also pointed to the FAA’s new rules for remotely identifying drones, which he said the agency should finalize by the end of 2020. The technology will give unmanned aircraft service providers and the FAA an exact location and identification for every drone covered by the rule.

The FAA has now registered more than 1.6 million drones, of which 1.2 million are small recreational drones. So far, the agency has approved two commercial drone operations: UPS FlightForward, which delivers supplies to an assisted-living facility near Orlando, Florida, and Wing Aviation, which makes retail deliveries in the small community of Christianburg in Virginia.

“We have to make sure that safety propels innovation, and AAM epitomizes the most exciting innovation since the Wright brothers,” said Elwell.

The FAA official cautioned that it won’t be easy to safely implement the fruits of such innovation, stressing that the



Daniel Elwell,
FAA deputy
administrator

agency has committed to taking a “crawl, walk, run” approach. “We’re still crawling with drones and when we graduate to high-density urban operations we will be at the walking phase. We’re not there yet, but we’re close,” he commented. “AAM will follow the same route and to reach the running phases, entrants will have to meet high safety standards that customers have come to expect. We must do it right.”

In his comments to the FIA Connect event, which has replaced the usual Farnborough International Airshow, Elwell said that the FAA continues to consider the UK a valued partner in the wake of the country’s Brexit departure from the European Union. He reported that the U.S. agency recently started a new innovation workgroup with the UK’s Department of Transport and Civil Aviation Authority to introduce innovation more rapidly and safely into aviation. ■

Collins seeks new defense business to bolster income

by Jerry Siebenmark

Collins Aerospace is turning heavily to defense as it attempts to offset the effects of the Covid-19 pandemic on commercial aviation, a primary industry for the Iowa-based aerospace supplier. About 75 percent of Collins’s business involves commercial aviation, which has been hammered by the pandemic both domestically and internationally from travel restrictions, closed borders, and a steep drop in passenger demand.

“The impact has been significant,” said Collins president Steve Timm. “Today, our key focus is on recovery and maximizing the opportunities on the defense side of our business.” That effort includes the recent announcement that the U.S. Air Force is joining the U.S. Navy’s tactical combat training system Increment II (TCTS Inc. II) program to field the next-generation air combat training provision from Collins. It also includes a contract awarded to Collins for the development of an enhanced visual acuity (EVA) system for Navy and Marine Corps helicopter and tiltrotor pilots.

Other opportunities in defense include aircraft modernization and connected battlespace programs, as well as ISR and training solutions and new aircraft programs such as the T-X trainer and Army

Future Vertical Lift. “Our defense portfolio continues to perform well and includes several of our company’s largest business opportunities,” Timm said.

Collins also is applying products developed on the civil aircraft side to military use such as its Pro Line Fusion avionics. Originally developed for business aircraft, Pro Line Fusion now appears on a number of

military aircraft, as do some of its airline and business jet cabin products, Timm added.

“Continuing to expand the portfolio of applied commercial technologies for defense applications is especially important in light of the challenges we face on the commercial side of our business,” he explained.

At the same time, Collins continues to explore ways to accelerate recovery in commercial aviation, which still accounts for a big part of the company’s business. To that end, Collins has formed a 40-person internal Redefining Air Travel Task Force to explore what commercial aviation can do collaboratively to hasten some sort of return to normalcy in the face of the pandemic, said v-p and general manager of



Collins Aerospace’s Pro Line Fusion avionics appears on the flight deck of an Airbus C295 tactical airlifter. Collins is turning to more defense work as a way to offset a decline in its commercial aviation business.

information management services LeAnn Ridgeway, who leads the task force.

“There are things with the pandemic that we can’t control; we certainly understand and appreciate that destinations have to open up and people have to feel a certain level of security to even want to get on an airplane,” she said. “But there are things we can control, which will improve the confidence and have more people getting back on airplanes faster.”

With task force members working with customers from airlines, airports, OEMs, and government agencies and regulators, the committee aims to help the industry coalesce around a set of standards and promote its efforts with a single voice. “And then we’ve got to communicate that out there to the general public,” she said. “Because right now...if you were the average flyer you’d be confused about ‘what can I expect when I go to an airport now? What can I expect between the different airlines?’”

Over the past few weeks, she said, the task force has made inroads toward meeting its communication goals, Ridgeway said. The resulting unified messaging, she hopes, will raise public awareness of measures already in place such as aircraft disinfecting, anti-viral coatings, HEPA filtration of cabins, and technologies such as touchless ticketing kiosks and biometric screening meant to further reduce “touchpoints” for travelers.

“I think the commonality and coming together is what’s going to be the most crucial part of it in getting that message out,” Ridgeway said. ■



Airline capacity in China, which had fallen 80 percent year-over-year in early February, has recovered to about a 30 percent deficit this month compared with 2019 levels.

New report predicts slow recovery for civil aerospace

by Charles Alcock

Airline capacity may not return to 2019 levels until 2024, as a possible “new normal” level of revenue passenger kilometers (RPKs) reaches no more than 80 percent of last year’s numbers by around the summer of 2022, according to the latest projections from aviation consultancy Roland Berger. Presenting its updated projections at the FIA Connect event on July 22, the company predicted that the traffic declines will result in demand for new airliners falling by as much as 43 percent over the next 10 years.

“It is now clear that [the Covid-19 pandemic] is not a temporary crisis, it’s a structural crisis,” said Roland Berger senior partner Manfred Hader. In its latest report, the company has rejected as unrealistic two earlier scenarios that it considered: the first being a return to 2019 airline capacity by the end of 2020 and the second a recovery by the summer of 2021 and at 90 percent of 2019 capacity.

Ahead of the anticipated decline in new aircraft orders, Roland Berger warned of a more immediate dip in demand for maintenance, repair, and overhaul (MRO) services. In 2020, it expects airlines to spend between 60 to 75 percent less on MRO for large airliners due to the steep decline in long-haul flights.

One significant anticipated medium-term outcome from Covid-19 is that major OEMs will slow plans to launch new aircraft as they cut back on investments, expects Roland Berger. Hader said he now does not expect to see the next single-aisle airliner until the mid-2030s, pointing to recent statements from Airbus that imply its next major new product could be a carbon-free aircraft in around 2035.

Roland Berger also predicts greater pressure for consolidation in the civil aerospace sector. Furthermore, it anticipates a trend for companies to keep production closer to home, reversing, or at least slowing, the shift to increased globalization of the supply chain over the past couple of decades.

“If you lose 30 to 50 percent of [market] capacity, [a correction] has to come from somewhere to maintain prices,”

Hader said. “It only works if you reduce capacity and overhead, and this means we will see more job losses and more bigger companies.”

One group of winners in the post-Covid realignment of the industry, Roland Berger predicts, will be Chinese OEMs, which it feels are better placed than Western rivals to take advantage of areas where demand might recover. “Airbus and Boeing are now losing time since [their main markets] are not developing,” Hader said. “But Comac and Avic are accelerating and

they will be ready with new aircraft by the time the crisis is over. They will have caught up and so we will see a quicker drive towards the ‘Chinese decade’ at the latest in the 2030s.”

At the same time, the Roland Berger team concluded that the industry will have no choice but to maintain investments in technology to make aviation more environmentally sustainable. “Demand for sustainability will not disappear because more people will now want the improved air quality that they have enjoyed [during the Covid reduction in flying],” Hader commented.

The company also sees the need for continued investment in the increased automation of aircraft. However, in its view, such spending might slow in the near term as priorities shift.

The new Roland Berger report titled “The New Normal Emerges: How the Aerospace Industry Can Weather This Perfect Storm” concludes that the initial crisis-management phase is now largely complete. This saw most companies acting quickly to preserve financial liquidity through aggressive downsizing.

It expects the next phase of transition to run through the rest of 2020 and into 2021, as companies prepare for an “efficient restart after the crisis” through, possibly, further changes to the size and efficiency of operations. Roland Berger adopted the term “transition” after

rejecting “recovery” on the grounds that it does not expect the industry to get back to 2019 levels during that phase.

Roland Berger principal Neranjana de Silva told the webinar that the “new normal” will come beyond 2021 and will require companies to ready themselves to reshape their supply chains and operating models. “We are in uncharted waters, and strategies will need revisiting even for those companies who did this as recently as last year,” she concluded.

According to Roland Berger managing partner Robert Thomson, the effect of Covid-19 on civil aerospace will prove at least as bad as the SARS outbreak, which was effectively confined to Asia. “This truly is a perfect storm compared with previous shocks,” he concluded, on the grounds that it involves a convergence of economic downturn, a public health crisis, fear of travel, and government restrictions on travel—and all on a global level.

On the brighter side, he reported that airline capacity in China, which had fallen 80 percent year-over-year in early February, had returned to about 30 percent down on 2019 levels by early July.

Thompson noted that airlines in North America and Europe have achieved increased capacity in recent weeks, but predicted that even by the fourth quarter of 2020 overall industry capacity might return to no more than 50 percent of 2019 levels.

Industry poised for rising competition and lower profits

The aerospace market is positioned for a significant transformation with smaller, more focused companies expected to emerge from a stark market that might take at least five years to recover, analysts from Deloitte United Kingdom said.

Market metrics have painted a grim short- and medium-term picture for the commercial aerospace market. Global passenger demand has plunged by 70 percent, 18,000 aircraft have been parked, and deliveries appear likely to finish down by half this year compared with 2019, Deloitte United Kingdom senior manager Matthew Davy said July 21 during an FIA Connect webinar titled “Transforming to be Competitive in the New Normal.” Aircraft deliveries could take five or more years to recover, he said.

Airline traffic could take up to a decade to fully recover, according to some models, added Jonathan Thomson, Aerospace & Defense leader for Deloitte. To highlight the gravity of that drop, Thomson noted the 5 percent slides following 9/11 and the global financial downturn in 2008 and the fact that traffic had returned after both of those crises within 12 months.

The aerospace market will face rising

levels of competition and lower profits, Davy added. “Coupled with raised levels of volatility and uncertainties around the eventual market structure, size, and dynamics, this will be a challenged sector for some time,” he said.

Deloitte further believes that V-shaped recovery is now unlikely. Optimistically, the market could see a U-shaped recovery, but that is contingent on widespread testing and a vaccine by late 2021. Complicating the matter, geopolitical tensions portend “significant consequences to the aerospace market.”

The market has first focused on survival and shoring up liquidity, but now companies are looking to adapt and change to what is becoming the new business normal so they can once again position to grow, Thomson said.

However, without a clear consensus on the challenges and paths to recovery, companies are reacting in different ways, said Tim Archer, senior risk advisory partner for Deloitte United Kingdom. The first action has been to cut costs, and the scale of job losses “could be quite large.” The level of cost reductions might be much greater than seen in the past, Archer said.

In the future, along with reduced workforces, increased efficiencies, higher levels of productivity, and increased flexibility will be necessary. “Change management will need to be taken seriously,” he said, opening the door to new systems such as



Aerospace businesses face a long recovery and a reshaping of focus.

smart factories, robotics, and other digitization efforts.

Duncan Johnston, industrial products and construction leader for Deloitte United Kingdom, agreed, saying the industry could see a period of selloffs of non-core businesses. Some manufacturing done in-house might get sold and necessary components outsourced. In the past, OEMs have taken on component manufacturing where a supplier might be struggling, but Johnston sees that tactic as less common as companies see less cashflow.

But in the short term, aerospace businesses will grapple with supply-chain distress and will need to reevaluate pricing once structured around larger production flows. The industry likely will look at outside industries for lessons-learned, such as the automotive business, which has long focused on such issues, he said.

K.L.



Assembly of the wing and forward section of the NASA/Lockheed Martin X-59 Quiet SuperSonic Technology (QueSST) demonstrator is underway as NASA strives to demonstrate the feasibility of quiet supersonic travel over land.

NASA, LockMart progress toward SST demonstrator

by Kerry Lynch

NASA's quest to reshape the landscape for supersonic aircraft remains on track as assembly progresses on the X-59 Quiet SuperSonic Technology (QueSST) demonstrator. Developed by Lockheed Martin under contract with NASA, the partners will use the X-plane to test public perception of a sonic "thud" that new supersonic designs create.

In recent months Lockheed Martin had begun to build the wing and flight deck sections of the X-59 QueSST at its Skunk Works factory in Palmdale, California, and program officials say the aircraft is on schedule to fly toward the end of 2021.

"The aircraft is looking like the X-59," said Peter Iosifidis, who recently retired as Lockheed Martin's program manager for X-59 QueSST, at the American Institute of Aeronautics and Astronautics (AIAA) Aviation Forum in June. The forward fuselage and empennage were "coming together," he said, adding that all the structure was completely installed on the wings, including some of the skins.

"We're very far along with the aircraft," Iosifidis said. "Everything has gone pretty much as we had planned—nothing has happened thus far on this effort that has jeopardized any of our critical milestones."

Once complete, the X-59 will measure 96 feet long, have a span of 29.5 feet, reach speeds of Mach 1.4, and fly at an altitude of 55,000 feet. A key design requirement of the X-59 is to replicate the noise effects of larger supersonic aircraft so that it can be used to conduct a series of trials over communities in the U.S. to assess the public's sense of noise.

But unlike the Concorde, the X-59 will not emit what is commonly known as a sonic boom. Instead, the partners hope to

demonstrate that new designs and technologies will result in a softer, quieter sonic "thud," or low boom, that might prove more acceptable to the public and pave the way for supersonic flight over land.

The effort is "all about" the ban on supersonic flight over land, Iosifidis said. "All of us are flying commercially slower today than we were decades ago," he said. "Across the globe...technology has moved forward and faster, but we seem to have gone backward."

"The idea is a future where simple supersonic flight contributes to the transformation and the decrease in the time required to travel to distant places around the globe," added Peter Coen, the low boom flight demonstration mission manager for NASA's Aeronautics Research Mission Directorate.

NASA's vision is to research possibilities to make supersonic available to all segments, Coen said. But such travel suffers a perception issue. "We hear often that supersonic aircraft...being described as the son of the Concorde. That fuels a misconception on some people's part that future aircraft will be like the Concorde."

While like the Concorde, future supersonic aircraft will represent "amazing technological achievements," Coen added. "They will be very unlike the Concorde in their impact on the environment and their impact on the communities in which they operate."

The developers envision supersonic travel that is not only fast, he said, "but available to a broad spectrum of people and that is also efficient, affordable, and environmentally responsible." However, to get there, the aviation community must overcome public perception barriers.

If successful, the X-59 would prove that low boom does exist and at levels that will be acceptable to the general public, Iosifidis said.

"We've been working on this type of technology—low-boom technology—for decades now," he said, noting the "aha moment" came in 2011 when a joint effort with NASA demonstrated the feasibility of design methods to move forward with an aircraft that could meet the necessary noise requirements. "We found results of [wind-tunnel tests] were in lockstep with predictions we had made for that design," Iosifidis said. "Having that knowledge and our confidence in those design methods is what really started the wheels of full-scale effort to go build what ultimately is known as X-59 now."

X-59's Aggressive Schedule

NASA awarded the contract in April of 2018 and Lockheed Martin has worked on a "very aggressive schedule" since then, said Iosifidis. A lot of factors have played into the ability to keep a quick turn-time from contract to first flight in 2021.

They include taking unusual approaches to the manufacturing of a one-off vehicle. Lockheed Martin began cutting metal on its first parts by November 2018 and loaded the first parts into the jig by June 2019. But the company has been doing concurrent engineering and manufacturing, Iosifidis said. "You have to start building a lot of your parts before the final design is complete," he explained. "Otherwise, the program could take an additional few years to bring it to completion. That is really not the kind of program NASA wanted. That increases cost."

In addition, Lockheed Martin has applied technologies typically used in large-scale manufacturing efforts, such as the use of robots capable of drilling thousands of holes rapidly, to gain cost and schedule benefits. The robots are "not typically used on one-off aircraft," he added.

In an effort to further help with the timeline, NASA established the

requirements early on for the X-59 and has "remained steadfast on those requirements," Iosifidis added. "We have not had a lot of changes and certainly no major change in requirements for the aircraft since the actual beginning of X-59."

Substantial high- and low-speed wind tunnel testing, conducted in advance, also kept the program on schedule. "All these tests validated the fact that the design was sound and the aircraft was safe and it was going to achieve all the performance requirements that were established for the program," explained Iosifidis. "It reduces risk as you move forward through the design and the manufacturing cycle of the aircraft."

Work has continued despite the complexities involved with operating during the Covid-19 pandemic, he added. Although Lockheed Martin has encountered some delays, particularly in some parts delivery, none have affected any of the critical milestones, he said. "Every delay we've been able to accommodate by shifting work around."

Once the airplane takes to the air, it will undergo a series of flight tests to expand the envelope. Those tests will take place initially out of the Palmdale facility and then at NASA's Armstrong Flight Research Center at Edwards Air Force Base in California, Coen said. Once the aircraft has demonstrated it has met the performance characteristics, it will undergo tests for acoustics to ensure the noise signals are as expected in various atmospheric conditions. This is important for the validity of the planned community trials, he said.

The partners expect those tests to last between 15 to 18 months. Plans call for initial noise trials to begin near Armstrong by late 2022 or early 2023, before the vehicle flies trials over different communities throughout the U.S. The trials will involve general public surveys to measure response to sound exposure. NASA has staged a "dry run" in Galveston, Texas, using an F-18 jet to test its survey and data collection methods.

The goal is to complete the trials before the end of Fiscal Year 2026, in time to have data prepared for delivery to the International Civil Aviation Organization (ICAO) by early 2027, Coen said. The partners hope ICAO would be ready for offering a proposal on supersonic flight by early 2028.

The effort fits with the central role that national research agencies and policy agencies play in developing new markets, he said, "providing fundamental data—scientifically validated fundamental data that can underlie the development of new rules and new standards that enable innovation in the market but also protect the public both traveling and on the ground."

That's why NASA chose the X-plane approach, he said. "[Validation] could only be achieved through flight," noted Coen. "By using an X-plane, we can focus on defining a minimum set of requirements so we can achieve our goals." ■

ADS: UK aerospace needs urgent, long-term support

by Charles Alcock

ADS, the UK's aerospace, defense, security, and space industry association, has called for the country's government to significantly increase long-term financial support for research and development. In response to the dual threats posed by the fallout from the Covid-19 pandemic and Britain's departure from the European Union (EU), the group's CEO, Paul Everitt, also urged the government to step up public procurement spending as part of a long-term defense and security strategic review now due to be concluded by the end of 2020.

"This is a very challenging period for aviation and aerospace and we are seeing major businesses reducing the number of employees and resizing their companies in a way that has a very dramatic impact and in anticipation that it will take time to restore confidence and for demand to return," he said in an interview with **AIN** on the eve of the FIA Connect online event.

While acknowledging recent commitments to support initiatives such as the Aerospace Technology Institute, ADS expressed concern that the support could prove to be no more than a short-term response to the crisis. "The supply chain will need additional financial support and it needs to be long-term and more patient," Everitt insisted.

"France, Germany, and the U.S. have responded in a big way [to support their aerospace industries]. If we aren't able to match their ambition, the UK risks falling behind and not having the right technology available when it's needed," he said. "This is even more important now because



Paul Everitt,
ADS CEO

“I am absolutely confident about the strong future of this industry”

many companies are cash-strapped and so public support is critical.”

Underlining the fact that other major aerospace nations have seen billions of dollars of new government funding announced in recent weeks while the UK government has largely focused on helping sectors such as retail and hospitality, Everitt said that more support for the entire industry supply chain is imperative. In March, before anyone could predict the full effects of Covid, ADS supported calls for public investment in research and development to increase from 1.7 percent of GDP to 2.4 percent by around the 2024-25 financial year.

According to ADS, the challenge posed by the need to decarbonize aviation to reduce the industry's environmental footprint presents an opportunity for UK expertise to shine. Given that, Everitt

welcomed Prime Minister Boris Johnson's public support for the so-called JetZero plan to introduce an electric-powered widebody airliner into commercial service by 2050.

Before Covid struck, ADS's biggest concern centered on the looming effect of the end of the Brexit transition period for the UK's departure from the EU on Dec. 31, 2020. Everitt confessed to feeling anxious about the apparent failure of ongoing negotiations to agree on the terms for future trade relations. He said he most worries about the possibility that the UK and EU will not manage to settle the Bilateral Aviation Safety Agreement (BASA) intended to set the framework for future aviation regulation when the UK leaves EASA at the end of this year.

"The priority is to see an ambitious agreement to create certainty," explained Everitt. "We would have preferred for the UK to remain part of EASA because it has served everyone very well. Our concern is for what would happen if we don't get an agreement and so [at this point] we would prefer to see the Bilateral Aviation Safety Agreement lifted out of the wider negotiations. [Aviation regulation] would not traditionally be part of a free trade agreement, and we feel that safety and competitiveness is more important than the political issues around the free trade agreement."

From ADS's perspective, the continued uncertainty over Britain's post-Brexit position in the world economy makes it harder for its member companies to forge partnerships and attract investors. According to Everitt, the wider tensions between the U.S, the UK, and China and between the U.S. and Europe have not helped the situation at all.

"It is not the easiest time to sell investment into the UK," he told **AIN**. "We have tremendous experience and capability and so there are always opportunities here, but some who have traditionally invested in

the country over the long term are now less enthusiastic about making big commitments until they have a clearer view. That's why we need a quick and a good deal."

While acknowledging the real hardship the air transport sector now endures, Everitt feels the fundamental drivers for demand to return remain in the background. "We expect to see demand accelerating through 2021 and beyond," he stated. "Airlines need to rebuild their finances before they can generate demand for new aircraft, but we are seeing patches of blue sky ahead."

So far, the civil aviation and aerospace side of ADS's membership has endured the most pain from Covid. While defense, security, and space companies have all endured the wider disruption, their sectors have felt less of an effect to date and there has even been some increase in demand for technology associated with cybersecurity.

Earlier this month, the UK government surprised many in the industry when it suddenly made around \$500 million available to buy a stake in struggling satellite technology group OneWeb. Critics characterized the deal as an ill-conceived move to provide cover for the controversial circumstances under which the UK has been forced out of the Galileo global navigation satellite system as part of the Brexit settlement. It has been criticized as another example of the UK having to needlessly reinvent the wheel to hold a stake in established technology for reasons driven by politics rather than business expediency.

"We welcome the investment but what we want to see now is how it impacts the shape of the UK's National Space Programme, where it fits in with GPS, our existing commitments, and what we are expecting to see invested in defense and national security capability," Everitt responded.

A key feature of the FIA Connect online event that ADS is co-hosting with its Farnborough International subsidiary from July 20 to 24 is Farnborough Friday, through which the association seeks to engage with young people about the career opportunities available in the industry. Despite all the anxieties that 2020 has brought so far, Everitt said he still relishes the chance to convince the next generation to join him and his colleagues. "I am absolutely confident and convinced about the strong future of this industry," he concluded. "Opportunities like the JetZero challenge will bring really important new products, programs, and activities that will be very exciting for young engineers. The last 20 years have been about the industry moving from being a niche to a large global industry. The next phase is about how we embrace much more agile and fast program development and for that we need a pipeline of new talent."



UK industry group ADS is calling for larger, longer-term public investment in research and development work at member companies such as Rolls-Royce.

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Airbus demos autonomous A350 taxi, takeoff, landing

by Charles Alcock

Airbus has completed two years of flight testing for its Autonomous Taxi, Take-Off, and Landing (ATTOL) project. The work culminated in a fully automatic, vision-based flight of an A350-1000 wide-body airliner, achieved through the use of on-board image-recognition technology, which the manufacturer described as a world-first in a June 29 press statement.

The program involved more than 500 test flights and the team used about 450 of them to gather the raw video data that Airbus engineers needed to support and fine-tune the algorithms for the autonomous technology. Six test flights evaluate autonomous flight capabilities, with each one including five takeoffs and landings in the airliner.

Under the direction of the Airbus UpNext team, ATTOL tapped technical

expertise from several Airbus divisions, including Acubed's Project Wayfinder team, which developed the Vahana eVTOL technology demonstrator, as well as Airbus Defence and Space and Airbus China. French national aerospace laboratory Onera also participated in the work.

According to Airbus, ATTOL was conceived to explore how autonomous technologies, including the use of machine-learning algorithms and automated tools for data labeling, processing, and model generation could help pilots to focus more on strategic decision making and mission management during flights, rather than on aircraft operations. The goal is to boost the operational safety of existing airliners, but also potentially allow for autonomous flights by new generation eVTOL urban air mobility aircraft.



Airbus's ATTOL project achieved several fully autonomous flights in which an A350 widebody taxied, took off, and landed without intervention by pilots in the flight deck.

"Many aircraft are already able to land automatically," explained ATTOL project lead Sebastien Giuliano. "But they're reliant on external infrastructure like instrument landing systems or GPS signals. ATTOL aims to make this possible solely using on-board technology to maximize efficiency and to reduce infrastructure cost."

Acubed's Wayfinder team developed the software that, based on computer vision and machine learning, allows an aircraft to

detect its surrounding environment and calculate how best to navigate within it. This is achieved using a combination of sensors, including cameras, radar, laser-based LiDAR, and powerful onboard computers.

"The key challenge for self-piloting capabilities is how the system reacts to unforeseen events," said Wayfinder project executive Arne Stoschek. "That's the big jump from automated to autonomous." ■

Boom preps for XB-1 supersonic rollout

by Kerry Lynch

Boom Supersonic will mark a significant step toward the development of a supersonic airliner with a planned virtual rollout event for its XB-1 demonstrator on October 7. Powered by three GE J85-15 engines, the XB-1 is a one-third scale demonstrator that will be used to pave the way for Boom's planned Mach 2.2 55-passenger Overture.

The announced rollout date comes as the XB-1 nears completion of assembly in preparation for the beginning of ground tests later this year and flight trials in 2021. Despite the difficulties involved with development in the Covid-19 environment, Boom continues to make progress on the demonstrator as major structures come together. Recently, Boom highlighted the completion of the vertical

stabilizer. The structure weighed in at just 125 pounds and withstood up to 4,800 pounds of force during testing, Boom said.

While work proceeded with the tail, Boom also was assembling the aft fuselage using Stratasys 3D-printed drill blocks to install the titanium panels. In May, the company celebrated the installation of XB-1's ogival delta wing to the forward fuselage, "effectively transforming the aircraft from a simple canoe shape to nearly assembled jet."

Still to come is the joining of the forward and aft fuselages, attachment of the engines to the aft fuselage, and systems and simulated flight tests.

XB-1 development is the culmination of years of research, including wind tunnel and structural testing, and hundreds

of simulations, Boom said. As for rollout, the entire event will be broadcast online.

"Our experiences in the Covid-19 pandemic underscore for all of us the fundamental human need for personal connection. Faster travel enables us to experience the world's people, cultures, and places, and XB-1 is the first step in bringing supersonic back to the world," said Blake Scholl, Boom founder and CEO. "With XB-1, we're demonstrating that we are prepared to bring back supersonic."

The XB-1 will be used to demonstrate technologies for the Overture such as carbon-fiber composite construction, computer-optimized high-efficiency aerodynamics, and supersonic propulsion systems. This includes "one of the highest-efficiency civil supersonic intakes ever tested," Boom said. "More than a scale replica, XB-1 provides insights into future cost-savings, safety, efficiency, and sustainability for Overture."

Boom has partnered with Flight Research, Inc. (FRI) on the flight test program. Plans call for an incremental expansion of the envelope of the XB-1 to supersonic speeds. Ground and low-speed taxi testing will occur at Centennial Airport in Colorado, while high-speed taxi and flight are planned at Mojave Air and Space Port in California.

Supersonic flights will take place over a supersonic corridor stretching across the Mojave Desert. FRI is providing a two-seat, twin-jet supersonic trainer to serve as a chase plane during the flight test program. Boom is subleasing a portion of FRI's headquarters to support the XB-1 tests. The

plan includes the development of a fully instrumented flight test control room and the use of one of FRI hangars for reassembly and maintenance of the XB-1.

The flight test program will be 100 percent carbon-neutral and the program partners plan to fly the full-scale Overture on 100 percent sustainable fuels. "Boom integrates sustainability considerations into every major company decision and is the first commercial airplane manufacturer to commit to a carbon-neutral test program," said the company. Boom last year had formed a partnership with Prometheus Fuels for the supply of sustainable jet fuel during the XB-1 test program.

While the XB-1 will serve as a demonstrator only, used in experimental flights, schedules call for the full-scale certification program for the Overture to start in 2025 and for the airplane to enter service in or about 2030.

While the aircraft remains in the conceptual design definition phase, Boom is evaluating key components such as engine choice. But the selection will "align with [Boom's] focus on transoceanic routes and providing a meaningful speed up for passengers at the lowest cost."

In addition, the engines must be capable of operating on 100 percent SAF. As for the need for aromatics, the company said, "We expect that Overture's engines will have less need for aromatics (for example, modern seals rely less on them), but we are evaluating the use of synthetic aromatics when possible."

"We're ensuring that the supersonic future is safe and environmentally and economically sustainable," Scholl said of the \$200 million airliner. Boom so far has raised \$160 million from investors for the program. ■



Boom Supersonic has almost completed its XB-1 demonstrator and will roll it out publicly on October 7. The company has scheduled flight testing to begin in 2021.

Sustainable future boosts case for electric aircraft

by Charles Alcock

The clear and continued damage being done to the air travel sector by the Covid-19 pandemic has prompted calls for a fundamental re-evaluation of the industry's business model. When, how, and whether airlines will be able to safely carry passengers in commercially sustainable numbers is very much in question. So too is the extent to which private aviation might play a larger and different role in the public transportation equation.

But the questions have run deeper, with amplified calls for a reassessment of aviation's longer-term environmental sustainability as part of public policy discussions headlined by slogans like "Green New Deal." In the UK, Prime Minister Boris Johnson has gone on record committing government support for the industry to make the move toward carbon-neutrality a key plank of its long-term survival strategy. On June 30, he pledged that the UK will lead efforts to get a long-haul, zero-emissions airliner in service by 2050 under an ill-defined project dubbed JetZero.

Electric aircraft, starting with hybrid-powered models, are viewed as a key element in fulfilling such ambitions. At the same time, some pioneers are advancing the case for hydrogen fuel cells as an alternative foundation for new-generation propulsion systems since they overcome the limitations of today's battery technology.

Much of the high-octane excitement around aviation's electric new age is focused on the potential for eVTOL aircraft to vastly expand the potential for what has become known as urban air mobility (UAM)—a vertical-lift niche in the air transportation sector that is already as old as the helicopter. Ride-hailing giant Uber has sought to lead the charge to make this a reality with its plans to launch app-based Uber Elevate networks in cities such as Dallas and Los Angeles from around 2023. The company insists that it is sticking with the plans, despite its well-documented loss of revenues from car services.

At last count, about 250 companies have plans to develop eVTOL aircraft of various shapes and sizes. Others seek early adoption of electric aviation through new fixed-wing models that would offer greater range than the short hops promised by the eVTOL crowd.

Of course, no one seriously believes that 250 eVTOL designs will make it to the market. On close inspection, many of those programs have wildly insufficient funding and are led by people who made a small fortune in unrelated technology ventures and who now seem hell-bent on risking the loss of those fortunes to the aviation bug.

Some have asked whether the surge of investment seen in this sector between 2017 and 2019 would continue this year, especially in the wake of the Covid crisis. Some more money has come into the



South Korean automotive group Hyundai has committed to spending \$1.5 billion to bring an eVTOL aircraft into service with Uber's planned air taxi network.

sector, with new fundraising completed by companies such as Lilium and even some more startups, such as California-based Archer Aviation.

There are possibly at most about a dozen other eVTOL pioneers who appear best set to make it to market—based on their sufficient funding, credible leadership, and a realistic timeline for achieving type certification. Given the limited payload of many of the eVTOL designs, autonomous (i.e. pilotless) operations are a key aspiration for many of the programs, which adds to the degree of difficulty for service entry. In the short- to medium-term, it seems that aircraft able to harness hybrid propulsion and enter service with pilots are most likely to prove the initial viability of urban air mobility and wider applications, such as providing connectivity on longer routes not well served by traditional airlines.

Since about the end of the first quarter of 2020 the pace has certainly not matched the Gold Rush-like atmosphere of the past

couple of years. It would now appear that the financial fallout from Covid might accelerate the natural selection process that seems likely to thin the herd more quickly than expected. This has made the availability of government support all the more welcome, and the U.S. Air Force's Agility Prime newly released proposals to work with companies to develop dual-use civil-military technology appears particularly timely.

Despite current uncertainties, progress is being made on many fronts and the 2020s still show promise to go down as the decade of electric aviation. Quite apart from the influx of hype-fueled startups, the sector has drawn the more measured, but nonetheless focused, attention of some leading aerospace groups, including Airbus, Boeing, Rolls-Royce, Safran, BAE Systems, and Honeywell (which in June formed a new division specifically to address the needs of the market).

On July 23, France's VoltAero plans to fly for the first time its 800-hp hybrid electric powertrain being developed for its Cassio fixed-wing aircraft. The company is working on a family of aircraft, including a four-seat Cassio 330, a six-seat Cassio 480, and a 10-seat Cassio 600. It says production could start in 2022 and estimates it will make an \$80 million investment to get to that point.

At Cranfield University in the UK, ZeroAvia last month flew a hydrogen-powered six-seat Piper M-Class light aircraft as part of the UK's HyFlyer program to advance zero-emissions aviation. The California-based company says it will have a 10- to 20-seat version certified with hydrogen propulsion by the end of 2023, and a 50- to 100-seat model by 2030. By 2040, it believes it could be possible for aircraft carrying 200 passengers to make flights of more than 3,000 miles.

In late June, Airbus completed a two-year schedule of flight testing for its Autonomous, Taxi, Take-off and Landing (ATTOL) project. That culminated in a fully automatic, vision-based flight of an A350-1000 widebody airliner, achieved using on-board image-recognition technology.

Several Airbus divisions have been involved in the work and the company appears to envision multiple applications



for the technology. The work could include incremental efforts to increase the degree of autonomy in the operation of existing fixed-wing aircraft. One of the Airbus subsidiaries contributing to ATTOL was Acubed, which was behind the Vahana eVTOL technology demonstrator. Meanwhile, Airbus Helicopters is this year due to complete flight testing of the CityAirbus demonstrator. The lessons learned from those programs are expected to shape the European group's longer-term plans for the eVTOL market, which it sees taking another full decade to come to fruition. Even after announcing unprecedented financial cutbacks on June 30, with the loss of around 15,000 jobs, Airbus indicated that it remains committed to making advances in electric aviation as part of its longer-term aspirations in carbon neutrality.

That said, in late April, Airbus and Rolls-Royce announced that they are abandoning their joint program to develop the E-Fan X hybrid-electric airliner based on a BAE RJ100 aircraft as part of a reassessment of priorities in the wake of Covid-19 disruption. As recently as February, the partners had said they planned to achieve first flight during 2021.

Boeing also has plans for the eVTOL sector. Over the past couple of years, it has been working on both a Cargo Air Vehicle and a Passenger Air Vehicle (the latter being a project of its Aurora Flight Sciences subsidiary). Last year, it partnered with startup Kitty Hawk to form a new venture called Wisk, which is developing the Cora two-seat eVTOL.

The all-electric Cora has completed more than 1,300 flight tests in New Zealand and California, offering a range of just over 60 miles and at speeds of about 112 mph. Wisk has yet to publish a timeline for service entry but indicated last month that it already has plans for larger versions of the aircraft.

There are currently eight partners in the Uber Elevate program, which is supposed to be laying the foundations for the ride-hailing group's planned Uber Air network. They include Jaunt Air Mobility, Boeing's Aurora subsidiary, Karem Aircraft, Joby Aviation, Hyundai, Pipistrel, Bell, and Embraer.

Jaunt Air Mobility is working on a "compound helicopter" design featuring a main rotor and a fixed-wing with propellers for cruise flight. The privately-owned U.S. company is partnered with Honeywell, Triumph Aerospace Structures, and BAE Systems and aims to get an aircraft certified under FAA Part 29 rules for commercial rotorcraft by the end of 2025, followed by an autonomous version by the end of 2029. Jaunt envisions several different applications for the all-electric eVTOL, including air taxi, emergency medical, freight deliveries, and military support.

In January 2020, Joby Aviation received a major boost for its eVTOL plans by raising a further \$590 million in capital, of which \$394 million came from the Japanese automotive group Toyota. The

California-based company claims it will be able to have its initial four-seat aircraft certified to start air taxi operations with Uber by the end of 2023.

Less than three months later, in April, South Korean car maker Hyundai announced its own plans to develop a four-passenger eVTOL aircraft that for now is designated as the S-A1. The company has committed to spending \$1.5 billion on its plans to enter the urban air mobility market through the end of 2025.

In Germany, two startups seem to be setting the pace among European eVTOL contenders. Both Lilium and Volocopter have ambitions not only to build aircraft, but also to operate them, which perhaps explains why they have not sought to partner with Uber.

Back in late March, just as the Covid lockdowns were beginning, Lilium completed a \$240 million fundraising round to take its total backing to \$340 million. It imminently expects to resume flight testing of its all-electric Lilium Jet, which promises a range of up to 186 miles, making it suitable for connecting cities, rather than just intra-urban short rides.

Volocopter claims it will have its two-seat VoloCity model certified and ready to start operations by early 2023. The all-electric design is intended for short hops of little more than 22 miles and the company is also developing a cargo-carrying version called the VoloDrone. In February, logistics group DB Schenker invested in Volocopter through an €87 million (\$99 million) Series C funding round, taking the total capital behind the company to €122 million. Other backers include Mitsui Sumitomo Insurance Group, MS&AD Ventures, TransLink Capital, Lukasz Gadowski, and Btov.

In the UK, Vertical Aerospace appears to be leading a pack of home-grown eVTOL contenders. The company is backed by Ovo Energy founder Stephen Fitzpatrick and in January launched a fundraising campaign to generate the further \$100 million it estimates it will need to get its first aircraft certified during 2024.

Vertical, which has recruited experienced aerospace engineers from companies including Rolls-Royce, BAE Systems, and Boeing, is now working on a full-scale prototype for a design featuring a wing and open rotors that it hopes to fly for the first time during 2020. The all-electric aircraft, which will feature a Honeywell flight control system, is expected to deliver a range of almost 100 miles and speeds of up to about 150 mph.

Another prominent eVTOL contender is China's EHang, which is working on single- and two-seat versions of its all-electric Autonomous Aerial Vehicle. The company continues to enjoy close cooperation from the Civil Aviation Administration of China, which is allowing it to conduct extensive flight trials in locations such as Guangzhou and Taizhou.

Despite having no published timeline for completing type certification, in 2019

EHang delivered 61 examples of its 216 AAV to several dealers and partners in countries including Norway, with a view to allowing them to be demonstrated to prospective customers. The company, which completed an initial public offering on New York's Nasdaq market in

December 2019, also has conducted flight trials in the U.S., but those plans appear to be on hold for now.



This story comes from FutureFlight.aero Wresource developed by AIN to provide objective, independent coverage of new aviation technology, including electric aircraft developments.



BAE Systems is working to produce control systems for new electric aircraft like Jaunt Air Mobility's planned family of eVTOL models. The systems need to be far smaller and lighter than the unit shown (inset) on a conventional turbofan engine.

BAE reduces sizes of energy systems

BAE Systems is reducing the size and weight of its energy management and engine controls technology to be used with propulsion systems for new hybrid-electric and electric aircraft. The company has already produced equipment that is 40 percent smaller and lighter than units now in service on much larger turbofans, while claiming that they will deliver 10 times the processing power.

The project, which BAE unveiled in June, is part of a wider effort by the group to partner with developers of new electric aircraft. The group is also offering flight controls and power conversion technology for programs such as Jaunt Air Mobility's family of eVTOL aircraft.

Just like the larger energy management and engine control units, the new reduced scale units use a series of sensors to monitor the performance of the propulsion systems. Based on the information collected, the controls can automatically adjust power settings as needed. The data is also used to predict when failures might occur and manage any required maintenance safely and efficiently.

UK-based BAE already has extensive experience in providing the technology for electrically powered buses, trucks, and ships. This aspect of its work with electric aircraft developers is being run by the Controls & Avionics Solutions business of its U.S.-based Electronic Systems division. BAE recently opened a new electrification lab at its facility in Endicott, New York.

Yeshwanth Premkumar, BAE's head of business development and strategy for aircraft electrification, told AIN that he

expects to see its equipment flying on various prototypes in development from about the middle of 2021. In addition to Jaunt, the group has publicly confirmed its partnership with Wright Electric, which is working with UK low-cost airline EasyJet to develop a hybrid-electric 186-seat airliner. BAE says it is working with several other new aircraft programs on a confidential basis.

As part of the eVTOL sector's ambitions to achieve autonomous flight, BAE is looking to develop new integrated flight controls for functions such as managing aircraft stability and redundancy. "Our work in this area is taking in all aspects of the aviate, navigate, and communicate functions and we are trying to consolidate all these controls in a single, smaller box with the reduced weight that these aircraft need," said Premkumar. One key challenge on which the company's engineers are focused is the need to avoid latency and lag in the operation of systems supporting increasingly automated and, eventually, autonomous flight.

The miniaturization process is also being applied to the power conversion units that the new generation aircraft will require for their electric propulsion systems. Back in the 1990s, BAE was among the first companies to use lithium-ion batteries for ground-based applications. Acknowledging the limitations of current battery technology in terms of power-to-weight ratios, Premkumar said that the company wants to prepare the way for more extensive use of new generation batteries in aviation, while for now focusing much of its effort on a hybrid-electric powerplant.

C.A.

Cabin germ-shield concepts raise feasibility issues

by Gregory Polek

Covid-19 has prompted several manufacturers of airliner interiors products to speed the development of systems to inhibit the spread of germs between passengers using seat partitions and transparencies. But certification experts and International Air Transport Association director general Alexandre de Juniac harbor doubts about their viability given the stringent requirements the FAA and the EASA impose on any modification to aircraft seating.

Companies marketing the products include Italy's AvioInteriors, whose fairly ambitious Janus product features a middle seat that faces in the opposite direction; Dutch firm Aviation Glass, which offers a less elaborate tempered glass divider that fits between seats; and Lyon, France-based Vision Systems, which offers a so-called "plug-and-play" transparency that does not require adaptation to the seats. Tier 1 suppliers that have joined the effort include Safran, which bills its Ringfence product as a simple and efficient removable partition; and Lufthansa Technik, which expects its rather rudimentary plastic transparency inserted into middle-seat magazine compartments to gain supplemental type certificate (STC) approval in two to three months.

Speaking during a June 9 conference call on the financial state of member airlines during the pandemic, De Juniac specifically raised the potential difficulties associated with emergency evacuation requirements for gaining STCs for the more elaborate concepts. "I don't think airlines will implement this type of equipment that looks now not useful and could be difficult to certify," he said. In fact, most of the companies began to market the products when concerns began to spread over the potential for regulations that would require open middle seats in a three-abreast seat configuration, for example. Guidelines issued since then by the International Civil Aviation Organization's Council Aviation Recovery Task Force (CART) do not call for mandated empty seats, raising the question of whether part of the initial rationale for the partitions still exists.

Michael Rioux, the chief operating officer of technical services and consultancy firm JDA Aviation Technology Solutions, explained that several certification challenges could present practically impenetrable cost and time barriers.

Applying for an STC with the FAA, for example, would raise weight and balance considerations as well as the need for 16-g crashworthiness, flammability, and 90-second evacuation testing. Operator manuals would need adaptation to reflect installation, cleaning, and maintenance requirements. Finally, the

company marketing the product would need to prove its effectiveness in preventing airborne droplets from spreading from passenger to passenger and convince potential airlines of its utility.

"Most of the time, when someone submits a supplemental type certification plan in normal times, whenever that is, you're looking at a couple of years," said Rioux. "If you want to do it really fast, probably 18 to 24 months, and most of the time it's probably 24 to 36 months."

In terms of retesting seats to 16-g crashworthiness requirements, Rioux explained that several variables come into consideration, including how a glass or acrylic partition gets fastened to the seat. "If it's some kind of temporary fastening system, and I'm not saying that necessarily will be the case, but if you put a 16-g load on it, what happens if it comes off?" asked Rioux. "Does it become a projectile? Does it shatter?"

Also referencing the regulations highlighted by De Juniac involving emergency evacuation, Rioux questioned the ability of an entire load of passengers exiting an airliner within 90 seconds with seat partitions adding an extra obstacle to negotiate in a cabin filled with smoke. "When I worked in the airline industry, I actually went to [the Civil Aerospace Medical



AvioInteriors' Janus concept features a center seat of a three-abreast layout positioned in the opposite direction from those on the aisle and next to windows.

Institute in Oklahoma City], and went through an emergency evacuation," he said. "They filled the cabin up with smoke and you couldn't see your fingers right in front of your eyeball. And we had to get out in 90 seconds and it was tough. You literally have to crawl on your hands and knees."

STC cost considerations also come into play. Each airline customer could need separate approval or at least a variance to account for different airplane configurations and each aircraft type would need its own STC. Retired McDonnell Douglas and Boeing senior FAA certification engineer and DER Butch Gumm estimated an STC could cost, in total, as much as \$2 million. Whether or not such a cost renders a product unmarketable, said Gumm, boils down to simple economics and how the

cost gets shared between the manufacturer and the customer.

"I guess it comes down to how much the airline wants to spend and if the seat manufacturer is willing to absorb some of that cost, so that he's now the guy up front who says, 'Hey, Mr. Southwest, I've got this brand new [product]. I've already got it certified to this point and we want to put it into your airplane,'" said Gumm. "And then [the customer will] absorb the costs to do the certification for the airplane. So you've got to ask who's going to provide what funds to get things done. Now you go to, let's say United, which has a very diverse fleet of both Boeing and Airbus or whatever. You have to go through a certification process for each model of airplane. So if United is willing to spend, let's say another \$150,000 per model to get that put in their airplane, it's not cheap."

Responding to some of the certification concerns raised by De Juniac and Rioux, Aviation Glass managing director Jaap Wiersema noted that his company introduced its glass product in response to flammability issues associated with plastic shields. Calling AeroGlass "light in weight, scratch-resistant, and fireproof," Wiersema said it already has passed 60-second burn and heat-release tests and meets requirements related to smoke density and toxicity.

Wiersema didn't address the challenges of evacuation tests, however, noting that responsibility lies with the design organization in charge of the installation of the product. While conceding that certification could take up to two years "in normal circumstances," he said he expected that the parties involved—including the seat manufacturer and the engineering firm applying for the STC—can accelerate the process for this particular application.

"We are all aware that the Covid-19 crisis is not a normal situation," said Wiersema. "If the customers and industry need this safe solution for traveling and if EASA/FAA sees this also as a priority, the process can be accelerated. A lot of testing of the AeroGlass has already been performed in connection with other applications."

Covid guidelines: what the world's aviation authorities recommend

Global aviation authorities have largely adopted guidelines for Covid 19 mitigation recommended by the International Civil Aviation Organization's Council Aviation Recovery Task Force (CART). The CART—established in the spring as a means to advise member states, international and regional organizations, and industry on safety and "sustainably" restarting operations—issued guidelines consisting of four operational "modules" related to airports, aircraft, crew, and cargo.

Airport guidance includes recommendations for the terminal building, cleaning, disinfecting, hygiene, physical distancing, staff protection, access, check-in area, security screening, airside areas, gate installations, passenger transfer, disembarking, baggage claim, and arrivals areas.

The aircraft module contains specific guidance addressing boarding processes, seat assignment processes, baggage, interaction on board, environmental

control systems, food and beverage service, lavatory access, crew protection, management of sick passengers or crew members, and cleaning and disinfection of the flight deck, cabin, and cargo compartment. Recommendations include keeping passengers seated as far apart as possible, limiting or suspending food and beverage services, and restricting lavatory access, leaving one lavatory for crew use only where possible.

The crew module contains specific guidance addressing the contact of a crew member with a suspected or positive Covid-19 case, reporting for duty, dedicated end-to-end crew layover best practices, crew members experiencing Covid-19 symptoms during layover, and positioning of crew.

Finally, the cargo module addresses physical distancing, personal sanitation, protective barriers at the point of transfer to the ramp among other mitigation procedures.

The International Air Transportation Association, which participated in the CART, uses the ICAO guidelines as the basis for its own recommendations, as does EASA, while the FAA refers to Centers for Disease Control guidelines, which closely resemble those of ICAO. **G.P.**

Study: random boarding could reduce virus exposure

by Kerry Lynch

While many airlines have adopted practices such as keeping middle seats open and boarding from back to front in response to the Covid-19 pandemic, preliminary academic research suggests that random boarding may be a better approach to limiting exposure rates.

Still in peer review, the research suggests that random boarding could reduce exposure rates by 50 percent, reported Embry-Riddle Aeronautical University (ERAU), which participated in the study alongside researchers from Florida State University, the University of West Florida, and Arizona State University.

“[The findings] suggest that airlines should either revert to their earlier boarding process or adopt the better random process,” said Ashok Srinivasan of the University of West Florida, a co-author of the research paper.

An important aspect of this research is understanding how molecules travel, added Sirish Namilae, associate professor of aerospace engineering at ERAU and co-author to the study. Namilae previously researched how viruses spread in airport and airplane environments during the Ebola outbreak in 2017.

“While back-to-front boarding has been instituted by some airlines to try and reduce contact between people, our simulations show that high-density clusters can form as people stow their luggage while other passengers are still pushing toward the back of the aircraft,” Namilae said. “We hope that our research will prove useful to the airline industry in

navigating the current health crisis.”

Using about 16,000 simulations, the study looked at “person-minute” measures of contact, or the number of minutes a person stands within six feet of someone during boarding. The simulations involved varied parameters such as walking speed, proximity, and the number of people, and tested several boarding patterns, such as front-to-back, back-to-front, six boarding zones, and random boarding through one zone.

“It turns out the one-zone, random boarding model eventually results in a lower number of contacts,” Namilae said. “Other patterns tend to increase the time a passenger waits in close proximity to fellow travelers.”

Looking at an Airbus 320 at full capacity, the simulations recorded 43,000 person-minutes of contact. This compares with 60,000 person-minutes for six-zone boarding, and 90,000 person-minutes for back-to-front boarding, ERAU said.

“Our analysis indicates that airlines that changed to a back-to-front boarding

“While back-to-front boarding has been instituted by some airlines to try and reduce contact between people, our simulations show that high-density clusters can form as people stow their luggage while other passengers are still pushing toward the back of the aircraft”

— Sirish Namilae, ERAU associate professor of aerospace engineering



Several universities teamed on research that questions whether boarding from back-to-front is the most effective approach.

policy erred, exposing passengers to substantially higher infection risk than their original procedures,” said Srinivasan. “This result shows that good intention is not a substitute for good science when it comes to determining policies.”

Economics were considered throughout the simulations. For instance, other, more costly scenarios were evaluated and shown to be effective in significantly reducing risk. This included keeping middle seats unoccupied, which showed to be effective in significantly reducing infection risk. “The problem is, how long can

airlines afford to fly with empty seats?” Namilae asked. Also effective is the use of more, but smaller aircraft to transport the same number of passengers as one larger aircraft would carry.

But Namilae and his team saw a need to find a middle ground and believe the conversation should begin with boarding.

“There’s evidence of a lot of diseases, such as tuberculosis and SARS, being transmitted on airplanes and in air travel,” Namilae said. “Boarding is one of the critical aspects of air travel that contributes to the spread of diseases. Any steps we can take to reduce the spread would help.”

Tasvirul Islam of the University of West Florida served as lead author of the study. Other participants included Sadeghi Lahijani of Florida State University, and A. Mubayi and M. Scotch of Arizona State University. A National Science Foundation grant supported the research, conducted in part through the assistance of a supercomputer at Argonne Leadership Computing Facility, a U.S. Department of Energy Office of Science User Facility. ■

Cranfield research points to a smaller airline industry

by Gregory Polek

Research led by the UK’s Cranfield University has found that the Covid-19 pandemic will lead to a smaller, more consolidated air transport industry in the future. The study—involving a series of interviews with senior aviation industry executives along with analysis of flight and air freight data—provides an early assessment of the medium- and long-term effects of Covid-19 on both passenger and cargo traffic. Interviewees expressed concern about the possible differences in state aid and how those variations could affect competitive balance in a post-Covid environment.

The executives largely agreed that Covid will most likely affect full-service network carriers the most because the

recovery in international markets will prove slower than in domestic markets. Several also identified the potential entry of new airlines in international carriers’ home hub markets as a threat.

Meanwhile, interviewees identified regional airlines as possible short-term winners during the recovery period as they could help full-service carriers adjust feed capacity. They also expect low-cost carriers to concentrate their efforts in primary markets and possibly enter hub airports while reducing frequencies at the route level. As a result, regional and secondary airports will likely suffer as capacity opens in larger markets, attracting airlines and enabling

larger hub airports to reinforce their positions.

The executives also cited concern about the recovery of business travel, mainly due to the cancellation of meetings, incentives, conferencing and exhibitions events, and the uneven lift of travel bans. Meanwhile, many said they expect a faster recuperation of the leisure passenger segment; however, reduced disposable incomes would curtail propensity to fly and require significant support, such as route subsidies. They also identified fear and health concerns as more of a concern among leisure travelers than among business travelers.

Finally, all the interviewees believed that authorities would impose new health screening controls at airports, translating into higher costs for those facilities and passengers alike.

“We focused on identifying aspects that can structurally redefine the aviation industry in the medium and long term for both passenger and cargo traffic,

particularly around supply and demand, traffic resilience, passenger behavior, health regulations, and business ethics,” said Cranfield University senior lecturer Pere Suau-Sanchez. “Understanding these structural elements in an integrated way can provide more confidence in efforts to predict the future context. As the views of senior stakeholders might change as the crisis evolves, a record of their early assessments also represents a valuable reference for future analysis.”

Cranfield conducted interviews with 16 managers from across the airline and airport sectors (including major, low-cost, and regional carriers, large hub, medium-size, and regional airports, a pilots’ union, and an aviation insurance broker) between March 19 and April 17. Researchers also analyzed global flight supply and air freight data—including origin and destination airport, time of departure and arrival, number of seats supplied, aircraft type, and day of operation—for the first four months of 2020. ■

CTOs optimistic on net-zero 2050 target

by Matt Thurber

As the UK forms the Jet Zero Council and affirms its commitment net-zero carbon emissions for UK aviation and aerospace by 2050, a panel of chief technology officers from major aerospace companies discussed how to reach those goals during an FIA Connect conference.

“We’ve been taking the journey to net-zero seriously for a number of months,” said Rolls-Royce CTO Paul Stein during the CTO Summit session. But what is interesting is that the industry is accelerating the plans instead of “picking back up where we were,” he explained, adding that he is working closely with other companies’ CTOs to help reach those targets.

“[Sustainable aviation fuel] is one of biggest games in town for decarbonizing aviation,” he said. “Where CO₂ is emitted today is two-thirds of all fuel burn on journeys longer than 1,000 miles, pre-Covid. Most next-generation technologies for beyond 600 to 1,000 miles run out of steam. We don’t see a way of using third-generation technology for those routes. So we need SAF that doesn’t involve fossil fuel-based production.”

Eventually, the plan is to push today’s allowance of 50 percent SAF blended with jet fuel to 100 percent SAF. “If we had enough SAF today at the right price, aviation wouldn’t have a problem,” said Stein. “If we set a target of 100 percent



Paul Stein,
Rolls-Royce
CTO

decarbonization by 2050, assuming no offsetting, we’ll need 500 million tonnes of SAF by 2050. It’s achievable, but it’s a massive industrial undertaking.”

Rolls-Royce, meanwhile, is working on more efficient engines, and its massive UltraFan project will lower fuel burn by 10 percent, especially important for long-range airliners. For shorter-range aircraft, novel propulsion methods are key, such as pure electric, hybrid-electric, and hydrogen power. “Eventually some of those will work up into larger aircraft,” he said.

Airbus CTO Grazia Vittadini echoed Stein’s sentiments while issuing a note of caution. “Air travel is facing its biggest depression in history...it’s critical that technology and design innovations respond to customer and societal needs,” she said. “We’ll only be successful in decarbonization if we work together. And the pressure will rise even more when we get out of this [pandemic].”

Airbus is collaborating with the UK government and fully supports the net-zero program and already plans on a goal of a carbon-neutral aircraft by 2035. That will require Airbus “to continue investing in disruptive solutions,” she said, but will also require collaboration with other companies.

“There has been progress,” Vittadini said, in the three key elements of the effort, which include more efficient engines, further commercialization of SAF, and new aircraft and propulsion technologies. For example, Airbus is developing hydrogen as a clean fuel for future aircraft, but also examining novel design principles, air traffic management improvements, and much more widespread distribution of SAF.

“We need to take our inventiveness even further,” she said. “Sustainability is a key prerequisite for aviation. And this can only happen if we channel the power of the collective. The pandemic has not pushed sustainability down in the agenda. It’s quite the opposite. We need to continue full speed ahead with confidence that zero-emission aviation is possible. We see that in times of crisis, you activate resources and a level of creativity you didn’t think you had.”

“In spite of the crisis, we’re more than ever committed [to sustainability],” said Stéphane Cueille, Safran senior executive v-p research, technology, and Innovation.

“We’re leading a double life, cutting costs every day and working as hard as ever for plans for sustainable aviation.” While Safran concluded that some cuts were necessary during the pandemic, “We made sure some key actions were preserved,” Cueille noted. “Keeping the pace of innovation of future generations of engines is vital.”

Safran is participating with 40 other companies and universities in the next pan-European clean aviation research program. “We’re convinced we have a path [to achieve net-zero goals],” he said.

“Technology-wise, we intend to reduce energy consumption,” Cueille explained. “In parallel, we need to replace fuel by low-carbon-emission fuels, such as [SAF sourced from biomass], synthetic fuels, or hydrogen. SAF is a key element of the mix, not just a gap filler.”

Trying to reach 50 percent SAF use by the world’s airlines in 2050 will take massive investment, he noted, and part of the problem is the lack of incentive to switch to a more expensive fuel. “They’re fighting for their lives,” he said. “We need an element of a level playing field, which public policies can address.”

“The increasing influence of people like [the CTOs on the panel] shows this is not policy, it’s real-life solutions,” said Michael Gill, executive director of the Air Transport Action Group. While he acknowledged that governments need to help establish a policy framework that embraces such efforts, he added, more important are “real-life solutions like these companies are working on.” ■

Group sees value in UK cabin systems suppliers

by Curt Epstein

Despite the downturn in the aviation industry, the UK’s Aerospace Technology Institute (ATI) believes good opportunities still exist for the country’s cabin systems suppliers and manufacturers. Founded in 2014 with a mission to lead and stimulate technology in the UK’s air transport industry, the independent company enjoys the backing of both government and industry to serve as a focal point for the technology community. Its annual budget of £150 million provides for grant allocations to companies to develop innovations that will bring long-term value to the UK.

In its latest insight paper, the organization focused on the UK Cabin Opportunity in cooperation with industry consultancy Achieving the Difference and Cranfield University. ATI noted that the UK possesses a world-class industrial supply hub in London with a concentration of creativity and innovation. The UK cabin interiors supply chain last year generated £2 billion in sales, 3 percent of which came from aircraft seating alone.

Key capabilities include seating design and manufacture, galley systems, monuments, lighting, satcom and connectivity, and fabrics as well as electrical power systems, composites, and metallic structures.

Last November, before the onset of the Covid pandemic, ATI issued a forecast valuing the aircraft cabin interiors market at \$495 billion by 2037, steadily rising at 3.3 percent from \$19 billion in 2020 to \$35 billion in 2037. Highlighted growth areas in that prediction included inflight entertainment, which the forecast estimated will rise by 5.4 percent annually, and connectivity, which ATI said would grow 7 percent annually over that span, both driven primarily through the retrofit market.

The realities of the pandemic have changed that outlook, with ATI now anticipating a four-year recovery to return to 2019 market size. It reported that both the original equipment and retrofit markets felt particularly severe effects, the latter brought to “a near hard stop in demand and slow recovery,” according to Will McClintock,

the organization’s strategy manager. He added that airlines might currently lack financing for non-essential upgrades.

While ATI expects demand to return to near-previous forecast levels, it cautioned of a huge amount of risk and uncertainty due to several variables, including success in controlling the virus by international governments; industry support packages to prop up airlines and manufacturers; passenger fears of infection; the depth of any anticipated financial recession; and even the traveling population’s attitude toward sustainability, all of which could vary from country to country. The recertification process for the Boeing 737 Max and the evolution of the widebody airliner market also remain considerations, the latter of particular concern for the cabin interior segment.

While a widebody cabin is worth several times that of a narrowbody, as platform choices consolidate, ATI sees demand for the widebody segment waning with weak order books overall due to several factors. They include potentially reduced business travel as virtual meetings gain in popularity and capability, and for long haul routes, unease among travelers about extended periods in confined spaces. Meanwhile, according to ATI, the emergence of longer-range narrowbody aircraft will erode widebody market share.

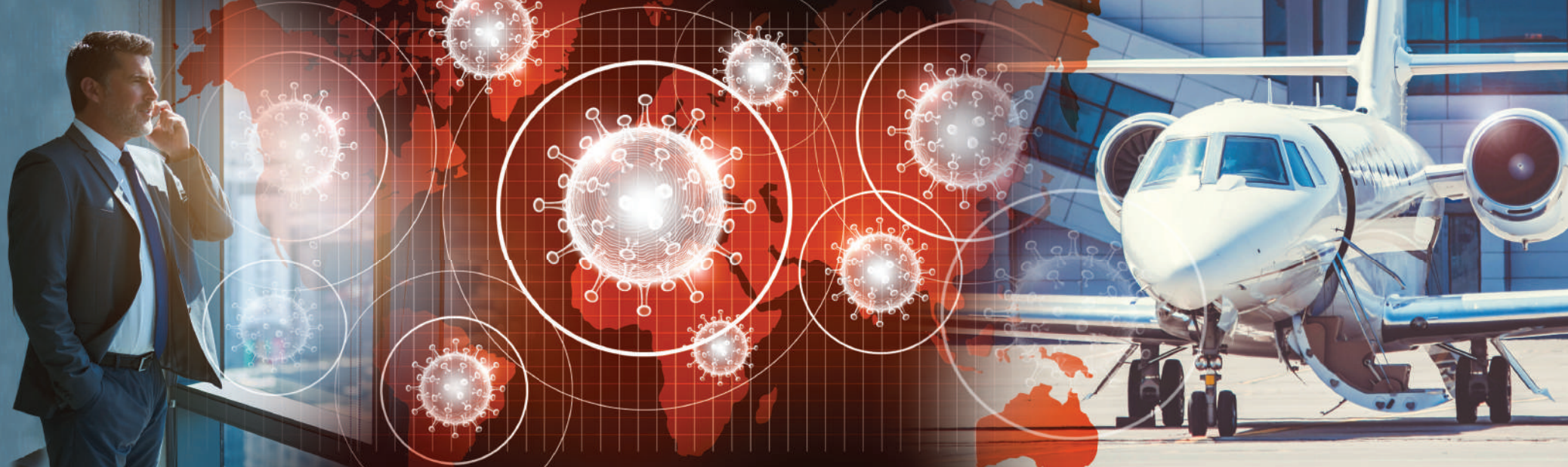
Airline customers seek equipment that



Will
McClintock,
ATI strategy
manager

is sustainable, light, and energy-efficient. Cabin equipment manufacturers face increasing pressure to deliver high volumes on time in a short timeframe, all while keeping down costs.

McClintock, who spoke in an FIA Connect session, sees a trend at airlines to buy direct from interior suppliers instead of choosing from aircraft manufacturer selections. To counter that, OEMs are looking to provide their own interior product lines and attempting to bring more products under supplier furnished equipment (SFE) contracts. Some say the trend harms the push for innovation, particularly among small and medium enterprises (SMEs), which have less spending power and fewer economies of scale. As a result, potential customers might overlook SMEs or consider them too risky to enroll in SFE contracts, or they might choose to go to a larger company for a more integrated offering. ■



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