

Flight International

18-24 July 2017

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Emir-mates

Will Dubai's two carriers get closer together to bridge gulf between their operations? **15**

A grade for C

Why Swiss and Air Baltic are singing CSeries' praises, on first anniversary of service entry **22**

Hybrid vision

How industry's giants can drive innovation in charge towards viable electric airliners **26**

PROCUREMENT

Smoke and mirrors

Austria hits Eurofighter with Typhoon replacement plan



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COVER IMAGE

We chose this striking image – taken at Zeltweg air base in Austria in 2011 by Geoffrey Lee – for our cover article on Vienna's plans to retire its fleet of Eurofighter Typhoons **P16**



BEHIND THE HEADLINES

Flight International deputy editor Dominic Perry went to Milan to catch up with Leonardo Helicopters, a visit which included extensive briefings and a flight on an AgustaWestland AW189 (P8)



NEXT WEEK SAFETY

We make a half-year check on commercial aviation safety. Plus, our report from Moscow's MAKS air show

NEWS

THIS WEEK

- 6 Australia, USA hail hypersonic flights
- 7 Three-year low for first-half deliveries as suppliers stutter
- 8 Norway, UK lift Super Puma flight ban. AW189 proves to be less thirsty than thought
- 9 F-35 costs soar as acquisition cuts bite

AIR TRANSPORT

- 10 O'Leary warns Brexit could halt EU-UK operations for 'months'. ATC shutdown causes 230 flight cancellations. E-Jet deliveries rise, but orders fail to keep up
- 11 Engine fire sparks call for CF6 checks. EASA approval paves way for ATR to receive navigation system upgrades. GKN ice sensor sheds light on critical surfaces
- 12 Non-standard approach led to SpiceJet Q400 runway excursion. LOT targets Hungary's appetite on US access. More Beluga XL sections moving toward assembly for Airbus
- 13 SSJ100 shows short-runway capability. FedEx to deliver 777 freighter for Boeing green test effort. Strategy Award winners lauded

NEWS FOCUS

- 15 Emirates could bridge gulf to Flydubai

DEFENCE

- 17 US Navy transmits plan for low-band frequency jammer. Air force highlights risk of UAVs near its bases. Thailand picks a further eight T-50TH trainers
- 19 German industry sizes up CH-53K

BUSINESS AVIATION

- 20 Airvan 10 gains Australian, US approval. Bell boosted as crash-hit 525 Relentless returns to the skies
- 21 Production-ready E1000 set for debut. Embraer reports fall in its first-half shipments



Bell 525 back in testing, a year after fatal crash **P20**

COVER STORY

16 Vienna bids goodnight to Eurofighter

Commission report indicates fleet switch could save €2 billion by 2049, as legal wrangling over type's acquisition mounts

FEATURES

22 CSeries Flying start

Bombardier's clean-sheet CSeries has been in service for a year with launch operator Swiss, plus Latvia's Air Baltic; so far, its introduction is proving smoother than expected

26 ELECTRIC PROPULSION Volts from the blue

Disciples of electric flight may be disappointed that neither Airbus nor Boeing expect to plug in airliners any time soon, but the limits of battery power should come as no shock

29 Power switch

Solid financial backing and the promise of a fuel-cell technology breakthrough underpin an Israeli start-up's bid to build and certificate an all-electric GA workhorse by 2020

REGULARS

- 5 Comment
- 33 Straight & Level
- 35 Letters
- 37 Classified
- 39 Jobs
- 43 Working Week



Raptors encounter risks from UAVs **P17**. FedEx to provide 777 Freighters for ecoDemonstrator tests **P13**



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Image of the week

Lockheed Martin F-16s from the US Air Force's Thunderbirds aerobatics team are captured in early July taking fuel from a KC-135 Stratotanker. The squadron was in the UK ahead of a Bastille Day display in France and a visit to the Royal International Air Tattoo

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The week in numbers

↓ 75%

Flight Dashboard

Reduction in state subsidy Aerolineas Argentinas expects this year from the record \$670m it needed to survive 2015

\$1.71

Flight Dashboard

The average Q2 fuel price per gallon paid by Allegiant Air; American Airlines paid just \$1.60-1.65 on mainline services

↑ 1,100

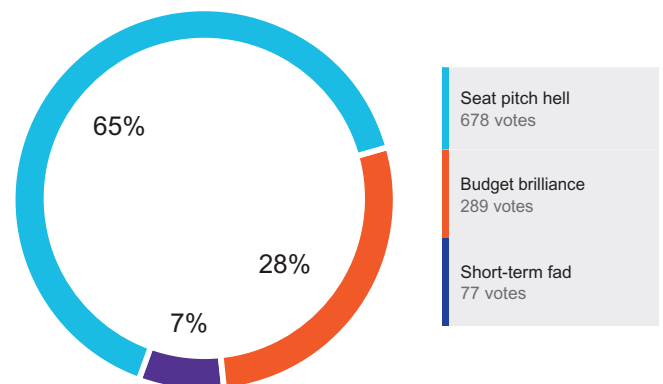
Flight Dashboard

Hourly passenger capacity at Russia's Anapa International airport, which has almost doubled thanks to a new terminal

Question of the week

Last week, we asked: **Transatlantic flight on a single-aisle?**
You said:

Total votes: 1,044



This week, we ask: **How is UK industry prepared for Brexit?**

- ☐ Heading for cliff-edge
- ☐ Government direction needed
- ☐ Bright future ahead

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Mid-life crisis

Until now, narrowbodies have had no part to play at Emirates, but that is set to change as the 32-year-old Gulf carrier reappraises its strategy amid mounting commercial pressures

Emirates has been finding itself seemingly under attack from all sides, amid geopolitical shocks, travel restrictions and the rising threat of terrorism. Declining demand in key markets has hurt its business, as the airline endures its first serious crisis since birth.

Amid the realisation that its no longer one of the “new boys”, three decades after its creation, Emirates is examining a bold change of course in its fleet and network strategy.

“You have to take what comes at you,” says the airline’s long-standing chief, Tim Clark. “We’ve had 31 very good years. We’re going through a tough patch at the moment – actually beyond our control.”

So the Dubai carrier is scrutinising all previous business assumptions, including the logic of having a sister airline competing head-to-head on short- and medium-haul routes. It is also facing up to the notion – dare we say it – that it is a bit old-fashioned in its thinking.

Three decades on, Emirates is examining a bold change in its fleet and network strategy

That’s a fact not lost on Clark: “Compared to the new breed of business model, I’m afraid we are slightly legacy in our approach,” he says. “And that is the death knell for people like me. So we have to adapt our business model to what is going on out there.”

One certain change is its relationship with Dubai’s low-cost airline, Flydubai. Both airlines are owned by the government, and the increasing amount of head-to-head competition must stop, the carrier insists.

So what Clark describes as “a closer-knit working of



Bigger is better?

the two airlines” could in fact see the two become one – he is not ruling anything out.

Such a move would make sense. It’s how Emirates’ two local rivals operate. And the competitive landscape – as well as the trading conditions – have changed dramatically since Flydubai was conceived a decade ago. If the logic of Emirates having an all-widebody fleet is beginning to look fuzzy, then the idea of a sister airline competing on a third of its routes is distinctly unpalatable now.

Clark admits that the Emirates widebody-only business model happened more by accident than design. It was a quirk of the 1980s operating environment that the airline hatched into. Without access to regional markets, it set off building its network with a fleet of Airbus widebodies, and later Boeings.

A merger – if that is what it is – with Flydubai would create a mega-carrier in the region operating a fleet of 300-plus aircraft seating from 170 to over 600 passengers. It is an opportunity it cannot ignore. ■

See News Focus P15

Answers on Brexit

Brexit means Brexit, UK prime minister Theresa May famously explained. What Brexit means for aviation and aerospace is far from certain.

What we know is that, following the June 2016 referendum and the triggering of Article 50, in less than 90 weeks’ time the UK will no longer be a member of the EU. Without a deal between London and Brussels, that could mean a departure from the open skies agreement that allows UK-based airlines and their passengers to fly anywhere within the bloc.

For aerospace manufacturers, it will end the UK’s membership of the customs union and their ability to import and export their products without tariffs, quotas or border formalities. The remit of the European

Aviation Safety Agency in the UK will similarly expire. Airline bosses such as Ryanair’s Michael O’Leary have warned of chaos if there is no settlement. The aerospace trade body ADS has likewise said a “hard Brexit” that leaves suppliers unable to access the single market would be a disaster for UK manufacturing.

Ministers, meanwhile, are resorting to that trusted wartime mantra: “Keep calm and carry on”. In other words, we cannot tell you much, but fear not – we have your interests at heart and it will work out in the end.

For many, patience with platitudes is running out. Industry needs visibility on what will happen after March 2019 now – not days before the Brexit deadline. ■

See Air Transport P10



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BRIEFING

AIR TRANSAT SELECTS LONG-RANGE A321S

LEASING Canadian leisure carrier Air Transat is to lease 10 long-range Airbus A321LRs from AerCap. The single-aisle aircraft will be taken on 12-year terms, says the carrier, and replace its twin-aisle Airbus A310s. Air Transat has not indicated an engine selection for the twinjets; deliveries will run from 2019 to 2020. Air Transat will configure the aircraft with 200 seats in two classes.

MARINES INVESTIGATE KC-130T LOSS

ACCIDENT The US Marine Corps is investigating the factors behind a 10 July accident involving one of its Lockheed Martin KC-130T tanker/ transports. Sixteen personnel were killed when the aircraft came down in Leflore County, Mississippi, during a flight between MCAS Cherry Point, North Carolina and El Centro in California. Contact was lost with the aircraft while it was flying at cruise altitude, the USMC says.

A350-1000 ACES HOT-WEATHER TESTING

TRIAL Airbus has completed the hot-weather testing of its A350-1000 in the United Arab Emirates. The airframer says it wrapped up the testing on 7 July after three days in Al Ain. Airbus sent cabin-equipped test aircraft MSN65 to the location in order to undertake checks on system behaviour, "with a focus on the cabin", it states. This included cooling performance checks while the aircraft was stationed on the ground.

ARJ21 FINALLY GAINS PRODUCTION APPROVAL

PROGRAMME Comac has gained production certification for its ARJ21 regional jet, more than two and a half years after the aircraft received type approval. Awarded by the Civil Aviation Administration of China, the milestone means that Comac can now begin serial production of the twinjet.

AIRASIA BOARD CLEARS A320 TOP-UP

ORDER AirAsia has received approval from its board to buy 14 Airbus A320 – a deal announced at last month's Paris air show. The low-cost carrier says it signed the purchase agreement on 7 July. An initial 10 aircraft will be delivered in 2018, with the rest to arrive the following year.

FIBRE-OPTIC DISRUPTOR RECEIVES SAFRAN CASH

FINANCE Safran is investing in a company which specialises in fibre-optic communications, with a view to developing the technology for civil aviation purposes. It has acquired a stake in the "disruptive start-up" company, Cailabs, through its corporate ventures arm, which led a financing round of €5 million (\$5.7 million) in which it, and other shareholders, participated. Safran sees the technology as a weight-saving solution to increased demands for data transmission.

RAAF TO UPGRADE SUPER HORNET FLEET

SYSTEMS The US State Department has approved a potential electronics upgrade for the Royal Australian Air Force's fleet of 24 Boeing F/A-18E/F Super Hornets. Florida-based Harris is to provide new tactical radios, plus countermeasures systems, says the US Defense Security Cooperation Agency. It values the deal at \$101 million, which will be concluded via the Foreign Military Sales process. Canberra says the modifications will enhance the interoperability of its Super Hornets with US forces.

TECHNOLOGY GREG WALDRON SINGAPORE

Australia, USA hail hypersonic flights

Canberra says HiFIRE programme trials at Woomera test range achieved major milestones on design and avionics

Australia and the USA have concluded a series of hypersonic test flights at the Woomera test range in South Australia.

The activity was conducted under the auspices of the hypersonic international flight research experimentation (HiFIRE) programme, says Australia's Department of Defence.

Defence minister Marise Payne says the tests achieved "significant milestones, including design assembly, pre-flight testing of the hypersonic vehicles and design of complex avionics and control systems".

Canberra and Washington DC are drafting plans for future hypersonic work, she adds. The defence department statement also identifies the programme's partners as BAE Systems, Boeing and

the University of Queensland, with the project led by Australia's Defence Science and Technology Group (DST) and the US Air Force Research Laboratory.

Previous HiFIRE launches have achieved speeds of Mach 7.5. The tests involve the ballistic launch of a vehicle that includes hypersonic inlet, a scramjet combustor (through which air flows at supersonic speeds) and a nozzle. It carries instruments to transmit test data to researchers on the ground.

Boeing declines to comment on the launch, but BAE Systems Australia says: "We were pleased to support the DST with the successful flight trial; the most complex of all HiFIRE flights conducted to date, to further the fundamental scientific understanding of hypersonic flight." ■



Pilatus Aircraft

DEVELOPMENT

Pace picks up on PC-24 production

Pilatus is accelerating serial production of its PC-24 business jet, with wing and fuselage mating on the first customer aircraft – serial number 101 – completed on 12 July. Cabin installation and testing of aircraft systems will now follow, it says. US fractional ownership company PlaneSense is the launch customer for the PC-24 and is scheduled to receive its first aircraft in the fourth quarter, immediately after European and US type certification of the superlight twin. The Swiss airframer says its three prototypes have accumulated more than 1,700h of flight testing across 1,080 sorties.



Norway, UK lift
Super Puma flight
ban
This Week P8

OUTPUT STEPHEN TRIMBLE WASHINGTON DC

Three-year low for first-half deliveries as suppliers stutter

Total of 662 aircraft handed over by airframers shows fall of 3.4% against 2015 peak, but Airbus narrows gap on Boeing

Deliveries of large aircraft fell to a three-year low in the first half of 2017, as the supply chains for Airbus, Boeing and Bombardier struggled to keep up with production rate targets on key programmes – even as demand for some older models began to recede.

Including deliveries of four Bombardier CS300s in the period to 30 June, the three manufacturers in the single- and twin-aisle segments combined to hand over 662 aircraft. With the Canadian manufacturer handing over a modest total over the course of the six months, it was not enough to alter the downward trend: overall deliveries are down 3.4% since the industry recorded a modern peak of 685 in the first half of 2015.

Fewer deliveries of 737s and 777s allowed Airbus to narrow the gap with Boeing. The European manufacturer delivered a total of 306 aircraft, compared with 352 for Boeing. The 46-aircraft difference represents the slimmest margin between the two companies since 2014, when the robust demand for A330s closed the split to 39 aircraft.

Airbus delivered 239 single-aisles, including 180 A320- and 59 re-engined A320neo-family jets, in the first half, or five fewer jets combined than the same period a year ago. Pratt & Whitney has accelerated deliveries of PW1100G geared turbofan engines – one of the A320neo family's two engine options – in the first half, but still remains behind the pace required to support Airbus's planned ramp-up.

Boeing was forced to halt 737 Max flight tests for a week in

early May to investigate a batch of flawed disks in the CFM International Leap-1A engines.

Ultimately, Boeing's combined deliveries of 737NGs and the 737 Max 8 totalled 236 aircraft in the six months ended 30 June. That represents the lowest number of 737 deliveries in five years, despite the airframer's ongoing attempts to raise production rates beyond the current level of 42 per month.

P&W's struggles with the geared turbofan engine programme also hindered Bombardier's plans for CS300 deliveries, which amounted to only four in the first half.

WIDEBODY SEGMENT

The widebody segment presents a different narrative for the period, however, in which Boeing was dominant.

The 65 787 deliveries it made in the first half alone came very close to matching Airbus's total output of 67 twin-aisle aircraft. Boeing also handed over 42 777s, five 767s and four 747s – compared with 31 A330s, 30 A350s and six A380s.

Despite the supply chain issues, Airbus's 306 total aircraft deliveries sets a new first-half record for the manufacturer.

Boeing is doing better in the rivalry with Airbus on the order front, although in recent years the European airframer has often won the full-year result.

In the period to 30 June, Boeing collected 381 net orders, opening a wide margin over Airbus's total of 203. Indeed, the vast bulk of the latter figure was generated by a single 100-unit commitment from lessor GECAS for A320neo-family jets. ■

First-half orders and deliveries

Deliveries	2017	2016	2015	2014	2013
Airbus					
A320	180	236	238	237	233
A320neo	59	8	0	0	0
A330	31	28	49	53	54
A350	30	12	4	0	0
A380	6	14	13	13	8
Total	306	298	304	303	295
Boeing					
737NG	230	248	249	239	228
737 Max	6	0	0	0	0
747	4	3	9	6	12
767	5	5	9	1	12
777	42	51	50	48	47
787	65	68	64	48	17
Total	352	375	381	342	316
Bombardier					
CS300	4	0	0	0	0
Total deliveries					
Single-aisle	479	492	487	476	461
Twin-aisle	183	181	198	169	150
Overall	662	673	685	645	611
Orders					
Airbus	203	183	348	290	722
Boeing	381	288	281	499	690
Total orders	584	471	629	789	1412

Source: Manufacturers/Flight Fleets Analyzer

ANALYSIS DAVID KAMINSKI-MORROW LONDON

CFM powers past P&W as Leap spools up

Airbus handed over only a single Pratt & Whitney-powered A320neo during June, out of a total of 11 of the re-engined aircraft family.

Ten of the 11 aircraft delivered – seven A320neos and three A321neos – were fitted with CFM International Leap-1A powerplants. The single Pratt & Whitney PW1100G-powered A320neo was delivered to lessor AerCap for delivery to China Southern Airlines.

Airbus's latest backlog data, covering the first six months of this year, show that it delivered 59 A320neo-family aircraft – of which five were A321neos.

It was aiming to hand over some 200 this year, but deliveries have been hampered by continuing efforts to resolve technical snags with the PW1100G engine.

The manufacturer has also identified Timaero Ireland as the customer for a previous order of

20 A320neos, revealing the company as a customer for the aircraft, originally ordered in December 2013, the data shows.

Airbus has not listed any other orders against Timaero and has not given further details about the A320neo order.

But Timaero is also a customer of Boeing, with orders for 22 737 Max jets and six 737-800s.

In addition, analysis of Airbus's backlog data shows that Qatar Airways has cancelled four of the A350-900s it had on order.

It has not specified the reason for the decision but Qatar Airways has previously opted to lease four -900s from Latin American carrier group LATAM.

Its cancellation nevertheless leaves it with 39 ordered A350-900s – of which 15 have been delivered – and outstanding orders for 37 A350-1000s, the first of which is due to be handed over to Qatar this year. ■



SAFETY DOMINIC PERRY LONDON

Norway, UK lift Super Puma flight ban

Regulators believe that manufacturer's modifications will allow safe operation of helicopters, but caution on service return

Civil aviation regulators in Norway and the UK are to lift their flight ban on the Airbus Helicopters H225 and AS332 L2, ending a grounding in the North Sea region that has lasted over a year.

All Super Pumas were pulled from service following a fatal accident on Norway's west coast on 29 April 2016 in which 13 people were killed.

European regulators banned the type in early June last year based on safety concerns raised by Norwegian crash investigators.

Although that restriction was relaxed in October 2016, grounding orders remained in place in Norway and the UK, effectively discounting Super Pumas from one of the offshore industry's key regions.

Norwegian investigators have also yet to identify the root cause of the 2016 crash, but have linked the failure of a gearbox component to another fatal accident in 2009.

But the UK Civil Aviation Authority (CAA) says its decision to rescind the ban follows "exten-



Lorette Fabre/Airbus Helicopters

Offshore workforce will need convincing of type's airworthiness

sive investigation, testing and changes to the helicopter and its maintenance" that have resulted in "enhanced safety measures".

However, it notes that "flights will not resume immediately" and each operator will be required to submit a "safety case" proving they have all the necessary processes, training and equipment in place.

It adds: "It will also be for opera-

tors and their customers to decide whether they wish to reintroduce the helicopters to service."

With the oil and gas sector mired in a continuing downturn, it is doubtful if the Super Puma fleet will be immediately required, with the Sikorsky S-92 and super-medium types such as the AgustaWestland AW189 having proved capable replacements.

In addition, the offshore work-

force will have to be convinced that the H225 and AS332 L2 are safe to fly in; suspicion of the type had emerged prior to the 2016 crash following a pair of ditchings in 2012, and another fatal accident in 2013.

Already several oil companies have spoken up to rule out a return for H225s to service their operations, including Norway's Statoil, on whose behalf the ill-fated helicopter was operating.

Changes made to the Super Puma by Airbus Helicopters include: the removal from service of one of the two versions of the second-stage planet gear that failed in the Norwegian crash; earlier replacement of gearbox parts; shorter inspection intervals; and a lowering of replacement thresholds.

John McColl, head of airworthiness at the UK CAA, says: "We would not have made this decision unless we were convinced that the changes to the helicopters and their maintenance restore the required airworthiness standards." ■

OPERATIONS DOMINIC PERRY LONDON

AW189 proves to be less thirsty than first thought

Leonardo Helicopters will shortly revise downwards the official fuel consumption figure of its AgustaWestland AW189 super-medium-twin.

Based on operational feedback and information sourced from flight-recorder and helicopter usage monitoring system data, the new figure will show an improve-

ment of between 4-7%, depending on the mission profile, it says.

The manufacturer has conducted a series of test flights to validate the figure in conjunction with GE Aviation, which supplies the helicopter's CT7 engines.

Fabio Nannoni, senior vice-president of engineering, says the fuel-burn figure falls from near 480kg/h to around 440kg/h, based on a typical oil and gas mission with engines at 80% torque. This, he says, is an improvement that is "closer to 6-7% than 4%".

Daniele Romiti, managing director of the division, says it initially "undersold" the AW189: "Operators have been asking

why we published such penalising figures when they have seen fuel consumption which has been better than expected."

Leonardo Helicopters will update the AW189's flight manual in the coming weeks, allowing operators to make more accurate performance calculations.

In addition, the airframer is to deliver further improvements as part of its "phase 5" software update at the beginning of 2018.

This will include both localiser performance with vertical guidance and oil rig approach capabilities – the latter derived from the mission system on the search and rescue AW101s being developed for Norway. ■



Leonardo Helicopters

Operators report 4-7% improvement versus official fuel-burn figures



O'Leary warns Brexit could halt EU-UK operations for 'months'
Air Transport P10

ANALYSIS LEIGH GIANGRECO WASHINGTON DC

F-35 costs soar as acquisition cuts bite

Official report notes that lower procurement quantities will raise development and purchase charges by 7% through 2044

Lower procurement rates for the Lockheed Martin F-35 have reversed the programme's positive gains since 2015, raising overall development and acquisition costs by almost 7% through fiscal year 2044.

After years of stabilising and reducing total programme costs under Joint Programme Office (JPO) executive officer Lt Gen Christopher Bogdan, lower planned acquisition rates over the next 27 years have driven up overall, inflation-adjusted costs from \$379 billion to just over \$406 billion, according to a Selected Acquisition Report (SAR) summary released on 11 July.

The US Air Force has cut its maximum annual aircraft procurement rate from 80 F-35As per year to 60. The change extends planned purchases of F-35s by the Department of Defense by six more years, from FY2038 to FY2044.

The decreased production quantities and procurement phase extension not only lead to higher



US forces will buy a combined total of 2,443 Joint Strike Fighters, a sizeable reduction on initial quantity

programme costs, but also an increase in unit recurring flyaway estimates over the programme's lifetime, and an increase in average procurement unit cost and programme acquisition unit costs, according to the JPO. It maintains

that research, development, test and evaluation costs have remained steady, and that negotiated near-term unit recurring flyaway costs continue to decline.

At the start of the Joint Strike Fighter programme, the June 2002

SAR estimated total acquisition costs at just over \$226 billion, or \$312 billion in current dollars.

The USAF, US Marine Corps and US Navy had also planned to order a combined 2,866 of the aircraft, but the navy later lowered its purchase, reducing the DoD's expected total F-35 acquisition to a current 2,443.

INVESTIGATION

Tailwinds and over-reliance on automation fuelled F135 blaze

US Air Force investigators have blamed a September 2016 engine fire aboard a Lockheed Martin F-35A at Mountain Home AFB, Idaho, on strong tailwinds.

Winds as high as 30kt (56km/h) blew as the Pratt & Whitney F135 engine began a start sequence, forcing hot air into the Honeywell-supplied integrated power package's (IPP) inlet, an service accident report states

As air temperatures rose inside the IPP – which performs a similar role to an auxiliary power unit – a series of malfunctions occurred. The lower density of the air produced insufficient torque needed to start the engine, slowing the rotation of the turbine section.

At the same time, fuel continued to be supplied the engine at

an increasing rate, which spurred an engine fire that burst from the exhaust. The tailwind spread the fire across the fuselage and caused significant damage to a portion of aircraft's aft section. The fire surrounded the engine's exhaust nozzle, damaging several nozzle segments as well.

The pilot escaped but sustained minor injuries, including burns on his head, neck, face, and ears, the report says. The USAF has not yet determined the total cost, but estimates aircraft damages will rise above \$17 million.

The report also lays blame on a lack of pilot awareness and training for tailwind conditions during an engine start. A pilot checklist included a warning that strong tailwinds during the procedure

could cause an IPP failure, but gave no tailwind limit.

The heavily automated F-35A engine start process also led pilots to abdicate responsibility for the process, says the report

"Preponderance of evidence shows if there had been an expectation of engine start-up problems with a tailwind, the [pilot] may have relied less on aircraft automation, and may have identified an abnormal engine start earlier," writes USAF Col Dale Hetke, who conducted the investigation.

"This vague awareness led to inadequate training for engine starts with a tailwind," he writes. "Training also resulted in complacency and an over-reliance on aircraft automation." ■

CONTRACT VALUE

The overall cost estimate was released a day after the DoD awarded Lockheed a \$4.49 billion undefinitised contract adjustment for 91 aircraft, with a \$5.57 billion ceiling, to allow production of the fighters to continue while a contract for the 11th lot of low-rate initial production (LRIP) is hammered out.

Unit prices for LRIP 11 will be settled when the deal is completed, but the overall contract value to Lockheed and its suppliers should hover at around \$13 billion for 141 airframes and Pratt & Whitney F135 engines.

The negotiations are expected to be completed by the end of 2017; deliveries under the LRIP 11 deal are scheduled between 2019 and 2020. ■



DISRUPTION EDWARD RUSSELL WASHINGTON DC

ATC shutdown causes 230 flight cancellations

The shutdown of an air traffic control centre after fumes were reported caused the cancellation of more than 230 American Airlines, Southwest Airlines and United Airlines flights on 10 and 11 July.

Apparent fumes caused by construction work in the control room of Washington Center, which handles high-altitude flights over the five-state mid-Atlantic region that includes Washington DC, shut the facility for nearly 2h until 21:30 local time on 10 July.

Ground stops at Baltimore/Washington, Ronald Reagan Washington National and Washington Dulles – three of the busiest airports in the USA – halted flights for the duration of the shutdown and into the following day.

American, which operates a hub at Washington National, cancelled 60 flights. Southwest, which operates one of its largest bases at Baltimore/Washington airport, cancelled 95 flights.

United axed 79 flights and de-



DDP/USA/REX/Shutterstock

United axed 79 services and delayed 120 more at Washington Dulles

layed another 120 to and from its Washington Dulles hub.

Cancellations were felt by carriers without hubs in the DC area as well. Delta Air Lines cancelled five flights due to the shutdown.

Operations at the airports began returning to normal on 11 July.

An air traffic control centre fire near Chicago in September 2014 disrupted over 600 flights and cost airlines \$350 million. ■

BACKLOG
STEPHEN TRIMBLE
WASHINGTON DC

E-Jet deliveries rise, but orders fail to keep up

Embraer delivered 35 commercial jets in the second quarter, a 35% improvement over the same period a year ago.

The E175 regional jet accounted for all but four of Embraer's commercial deliveries in the quarter, totaling 31, with the remainder two each of the E190 and E195.

The rate of deliveries outpaced incoming firm orders during the second quarter. Embraer's firm order backlog declined to 417, or 15 fewer than it held at the end of the first quarter.

Despite the orderbook erosion, Embraer scored multiple new orders and commitments that, if firmed up, could add a total of 51 aircraft to its backlog.

With 53 E-Jets delivered so far this year, Embraer is keeping pace with 2016's delivery total of 108. ■



Embraer

E175 proved popular in quarter

REGULATIONS OLIVER CLARK LONDON

O'Leary warns Brexit could halt EU-UK operations for 'months'

Airline chief outlines consequences if country leaves bloc without open skies agreement

Ryanair chief executive Michael O'Leary sees a "real prospect" that there will be no flights between the UK and the EU for a period following Brexit.

Addressing the European Parliament's transport and tourism committee on 11 July, O'Leary warned that flights could cease for "weeks or months" once the UK exits the bloc in March 2019.

If the UK "sticks to its position" of having "red lines" on the jurisdiction of the European Court of Justice and on freedom of movement, he says, "they are going to leave the EU and they are going to leave open skies".

Gaining readmission to the European open skies regime or agreeing a separate bilateral access deal with the 27 remaining EU members is an "impossibility", he believes, because "there's no goodwill in Europe towards Britain and [towards] allowing them back in on preferential terms to open skies or its equivalent".

O'Leary says that the desire of Air France and Lufthansa to gain a competitive advantage from



Eric Lohmand/Belga/Zuma Press/REX/Shutterstock

Ryanair boss says that services could be axed without legal clarity

Brexit should not be underestimated. His own airline intends to cancel flights from the UK unless legal certainty over operating rules is established by September 2018. Aircraft would be reallocated to European regional airports from April 2019, says O'Leary.

TUI Group's director of international public policy, group corporate and external affairs Ralf Pastleitner spoke at the same committee hearing, and quoted a report produced for the leisure group that estimated the cost of a "hard Brexit" at a combined €210

billion (\$241 billion) in lost GDP for Europe and the UK.

Acknowledging this to be an "extreme scenario", Pastleitner says the forecast assumes EU-UK air traffic will come to a stop, with only a certain portion substituted by other modes of transport.

He says there will be a "reduction in round-trips, for sure" following Brexit, and possibly less competition on remaining routes. Bilateral agreements signed before the liberalisation of European aviation in 1992 are an "insufficient basis for the future", he argues. ■



LOT targets Hungary's appetite on US access
Air Transport P12

INCIDENT JON HEMMERDINGER BOSTON

Engine fire sparks call for CF6 checks

Manufacturer recommends regular inspections of HPT disks after 2016 uncontained engine failure wrote off 767 at Chicago

GE Aviation has issued a service bulletin calling on airlines to perform regular inspections of first- and second-stage high-pressure turbine (HPT) disks on some CF6 turbofans in the wake of a 2016 uncontained engine failure.

In addition, the US Federal Aviation Administration may also issue a related airworthiness directive, according to documents released by the National Transportation Safety Board (NTSB).

The details are contained in the NTSB's latest investigation update into the uncontained failure of a CF6-80C2 engine on an American Airlines Boeing 767-300 at Chicago on 28 October 2016.

The accident and subsequent fire badly damaged the aircraft (N345AN), and caused serious injuries to one passenger. The NTSB

has not yet issued a determination of probable cause, however.

GE's service bulletin, published in late June, recommends that airlines perform ultrasonic inspections at regular shop visits on all CF6-80C2 first- and second-stage HPT disks made before 2000.

Some 4,000 of those disks were produced between 1984 and 2000, by which time manufacturing processes for the Inconel 718 material had improved, says GE. As many as half of those disks have been retired, but "approximately 1,000" CF6s produced during that period remain in operation.

"We don't believe the inspection programme will impact the operation of [the] CF6-80C2 fleet in service," GE says.

The NTSB says that the second-stage disk in the 767's star-



Debris penetrated wing and punctured fuel line, triggering blaze

board engine ruptured as the aircraft, bound for Miami, accelerated to near 100kt (185km/h) along runway 28R at Chicago O'Hare.

The captain aborted the take-off and all 161 passengers and nine crew members evacuated using emergency slides.

However, the failure sent disk,

blade and vane fragments through the wing which triggered a fire after puncturing a fuel line.

The blaze left the aircraft a write-off, destroying the right wing and damaging much of the fuselage. The twin-aisle had accumulated 50,632h and 8,120 cycles at the time of the accident, says the NTSB. ■

OPERATIONS DAVID KAMINSKI-MORROW LONDON

EASA approval paves way for ATR to receive navigation system upgrades

ATR has secured European regulatory clearance for a new version of the avionics suite for its -600 series turboprop.

The new "Standard 3" suite – developed jointly with Thales – will be fitted to the turboprop family from the end of this year. It will also be available as a retrofit through a software change.

It enables navigation performance to RNP-AR 0.3, following provision of a Thales inertial navigation system, improving the missed approach and departure accuracy to 0.3nm (0.5km) rather than 1nm.

Air New Zealand operates ATRs through its Mount Cook Airline regional subsidiary and had disclosed last year that it was aiming to upgrade the navigation capability on the type.

ATR adds that the avionics in-



Enhancement will allow carriers to operate the -600 in high terrain

stallation features synthetic-vision capability, additional high- and low-speed protection plus customisable checklists.

It says the equipment is intended to improve situational awareness and approach capabilities and provide a "more user-

friendly" interface for the crew.

ATR says the navigation enhancement, which has been certificated by the European Aviation Safety Agency, will allow carriers to operate the -600 in "stringent" conditions, including regions of high terrain. ■

TECHNOLOGY DAVID KAMINSKI-MORROW LONDON

GKN ice sensor sheds light on critical surfaces

UK aerostructures specialist GKN Aerospace has test-flown an optical ice probe intended to use laser light to detect accretion on critical surfaces.

The probe was flown by the Facility for Airborne Atmospheric Measurements, which uses a British Aerospace 146-300 research jet operating from Cranfield airfield in the UK.

GKN says the sensor is carried in a housing produced through additive manufacturing.

The detector picked up "numerous" ice-accretion events, it adds, confirming the presence of ice and measuring its thickness and accretion rate.

GKN says the optical detector uses fibres to transmit laser light, and analyse reflections. ■



SCHEDULES DAVID KAMINSKI-MORROW LONDON

LOT targets Hungary's appetite on US access

Polish flag-carrier LOT is to open long-haul services from the Hungarian capital Budapest, operating to two US cities.

It will station a Boeing 787 at Budapest from May next year, the Star Alliance carrier states, and will operate to both New York and Chicago. LOT says it is opening the routes in response to "enormous demand" for services.

Hungary has no scheduled flights to the USA, according to FlightGlobal's routes database. While the country has a well-established short-haul operator in

Wizz Air, its flag carrier Malev collapsed five years ago.

No transatlantic services to the USA from Hungary have existed since 2011, states LOT.

"Our strategy assumes taking up every business opportunity and we cannot waste such potential," says LOT chief Rafal Milczarski. "Transatlantic connections from Budapest will supplement the offer of flights from Warsaw – however, they will not be in direct competition."

LOT says it will operate the Budapest-New York route four



AirTeamImages

Gap in transatlantic market follows flag carrier Malev's demise

times weekly, while Chicago will be served twice-weekly.

It already operates several services to the USA, linking its War-

saw hub with Los Angeles and New York JFK, and Chicago O'Hare served by flights from the Polish capital and Krakow. ■



Airbus

Stelia has already shipped nose

PRODUCTION
DAVID KAMINSKI-MORROW
LONDON

More Beluga XL sections moving toward assembly

Airbus's A330-based Beluga XL transport is set to receive its initial upper fuselage section following completion of the structure by Stelia Aerospace.

The component's transit to Toulouse involves its being transported, by road, from the Stelia facility to the nearby Rochefort port.

It is being taken by barge to Langon before being transferred to road vehicles for transport over the remaining 124 miles (200km) to the Toulouse final assembly line.

The upper fuselage is 8m (26ft) long and 8m high and weighs 2.1t.

Stelia, which has handed over the Beluga XL's nose section, says it will deliver the 140m² (1,500ft²) cargo door in September. ■

INQUIRY FIRDAUS HASHIM SINGAPORE

Non-standard approach led to SpiceJet Q400 excursion

Challenging weather conditions exacerbated by crew errors, Indian investigation finds

The loss of visual cues and pilot errors contributed to a runway excursion at Hubli airport in which a SpiceJet Bombardier Q400 was written off, Indian investigators have determined.

Registration VT-SUA was operating a Bengaluru-Hubli flight on 8 March 2015. It was attempting to land at Hubli at 19:15 local time in rainy conditions and darkness, says India's Aircraft Accident Investigation Bureau (AAIB) in its final report into the incident.

The aircraft veered to the left after touchdown and hit protruding concrete-encased runway edge lights, causing the main landing and nose gear to collapse. Its left propeller blades subsequently struck the runway surface and were sheared off at the root. The aircraft exited the left side of the runway, halting 52m (170ft) from the centreline.

Investigators also noted extensive damage to the aircraft's fuselage – including a rupture of the forward pressure bulkhead and

warping of all frames – and to both its left and right wings.

The AAIB says several flight-crew lapses contributed to the event, including inappropriate handling by the commander in order to maintain directional control after landing, allied to a non-standard call-out by the first officer as he attempted to correct the aircraft's trajectory.

"The AAIB says several lapses by the flightcrew contributed to the event"

As the aircraft left Bengaluru for Hubli at 18:45, visibility at the destination was reported as 4.3nm (10km). This fell to 1.6nm after contact was made with Mangaluru air traffic control, which informed the crew of heavy rain.

An initial descent was made, but the turboprop was held for

20min because of deteriorating weather conditions. However, on resuming their approach, the crew failed to ascertain the runway conditions, and ATC did not offer an update.

In addition, the captain opted to perform a VOR/DME trial approach, a procedure that India's Directorate General of Civil Aviation only permits in visual meteorological conditions during daylight hours, and only by an examiner or instructor. SpiceJet's internal policies did not adequately reflect this instruction, says the AAIB.

On landing slightly to the left of the centreline, reverse thrust was not evenly applied, analysis of the flight-data recorder revealed. In addition, only inputs to the ailerons – rather than the rudder – were detected, "which was ineffective to control the aircraft at that speed," the report states.

No injuries were reported among the four crew and 78 passengers onboard the aircraft. ■



Emirates could
bridge gulf to
Flydubai
News Focus P15

OPERATIONS MICHAEL GUBISCH LONDON

SSJ100 shows short-runway capability

Russian regional jet cleared for operations at Stockholm's Bromma airport after upgrades to engines and control systems

Operations of Sukhoi Superjets to Stockholm Bromma airport have begun after the aircraft were upgraded to connect with the Swedish capital's downtown gateway.

The Russian manufacturer says modified Superjets have been flying to the airport – which has a 1,660m (5,450ft) runway – since earlier in July.

In May, the airframer disclosed that it had completed European Aviation Safety Agency certification work for a higher-thrust ver-

sion of the aircraft.

The upgrade includes adjustments to the type's PowerJet SaM146 engines, avionics software optimisation, and improvements to the lift-devices control system in order to increase take-off performance, says Sukhoi.

It adds that the aircraft requires a landing distance of 1,425m at maximum landing weight, and that the twinjet fully meets noise requirements at Bromma airport.

FlightGlobal schedules data indicates that Irish carrier CityJet is

the only Superjet operator serving Bromma airport.

CityJet received its first Superjet last year and remains the type's only western European customer, with six of an eventual 15 aircraft in service. Under a wet-least contract, the Dublin-based airline operates three Superjets for Brussels Airlines, as well a similar deal for four aircraft for Air France; the Irish carrier hopes both agreements can be renewed.

Meanwhile, Russian start-up carrier Azimuth Airlines has

shown off the first Superjet 100 to carry the new operator's livery. It states that the aircraft arrived at Rostov-on-Don airport in the new colour scheme, developed by St Petersburg-based branding specialist Asgard.

The aircraft is being leased from Russian state transport lessor GTLK for a 12-year period. Azimuth will put it into operation on domestic routes, as part of a fleet of the twinjets. ■

Additional reporting by David Kaminski-Morrow in London

ENVIRONMENT STEPHEN TRIMBLE WASHINGTON DC

FedEx to deliver 777 for Boeing green test effort

A 777 Freighter owned by FedEx Express will be provided to Boeing for three months next year as the fifth in a series of ecoDemonstrator testbed aircraft used to evaluate new technologies in flight.

"We're proud to work with Boeing and use our 777 Freighter to play a key role in bringing future benefits to the entire aviation industry," says FedEx Express chief executive David Cunningham.

After previously operating an Embraer 170, 737-800, 757-200 and 787-8, the 777F will be the

largest aircraft assigned to the ecoDemonstrator effort.

The 2018 programme includes tests of a compact thrust reverser, new avionics and software to streamline airport approaches, and new components made using additive manufacturing techniques, says Boeing.

Such technologies could be applied to Boeing's proposed New Midsize Aircraft, a concept for a 200-270-seater with 5,000nm (9,260km) range that could enter service around 2025 if launched within the next year. ■



Kingsley-Jones (centre left), Joyce (centre) and Pinto (middle right)

LEADERSHIP

Strategy Award winners lauded

The top honours at 2017's Airline Strategy Awards went to Qantas chief executive Alan Joyce and TAP Portugal counterpart Fernando Pinto.

Joyce was recognised for executive leadership, while Pinto was presented with the *Flight Airline Business* award.

The 9 July ceremony in London was the 16th edition of the awards, organised by *Flight International's* sister magazine *Flight Airline Business*, in partnership with the civil aviation practice of human-capital solutions provider Korn Ferry.

Joyce earned his victory by overseeing Qantas's transition from a dire financial position to

record results in only a few short years, culminating in a A\$1.53 billion (\$1.16 billion) profit for 2016.

"Alan is among a small group of airline chiefs who have overseen an airline's transition from the worst financial results in its history to record profits," says Max Kingsley-Jones, executive director content at FlightGlobal and host of the Airline Strategy Awards.

In winning the *Flight Airline Business* award, long-serving TAP chief Pinto was acknowledged for his leadership of a medium-sized flag carrier in a European market that has proven relentlessly challenging for such a business model. ■



Freighter will be the largest aircraft used for ecoDemonstrator trials

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Vienna bids
goodnight to
Eurofighter
Defence P16

STRATEGY MAX KINGSLEY-JONES LONDON

Emirates could bridge gulf to Flydubai

Region's changing dynamics may drive sister carriers closer together, but questions on route overlap and fleets persist

News that Emirates and Flydubai are working on closer collaboration – with “nothing off the table” – raises the distinct possibility that the two businesses could merge to create an even more powerful mega-carrier in the Gulf region.

Emirates Airline boss Tim Clark outlined the group's current thinking at the recent Paris air show, pointing out that Emirates flying head-to-head with so much of Flydubai's network “doesn't add to the whole equation” and that work is under way “to accelerate a greater joining at the hip”.

He added: “Nothing is off the table, but with Flydubai we have a short-haul fleet and we can do a better job of making the two work together, and that's what we are going to try. We are owned by the same people.”

LONG-HAUL LEGACY

Not long after its launch, in 1985, Emirates began to concentrate on a widebody-only fleet. Currently its lowest-capacity aircraft – other than a solitary Airbus ACJ319 – are its Boeing 777-200LRs, which have 266 seats. The rest of the fleet seat upwards of 354 passengers, with some A380s configured with a two-class, 615-seat layout; Flydubai's 737-800s accommodate 174 passengers.

Clark says that the widebody focus at Emirates harks back to its original business plan. “If you roll back to when Emirates first started, we were not given access to any regional markets whatsoever, so it shaped our business model,” he says. “We went all-widebody long-haul, more by accident than design. But it proved to be a very good business case.”

However, Clark says that with the dynamics in the Gulf changing dramatically, now “there is a lot of competition and capacity in the single-aisle area... it would be foolish of us to ignore it.



Single-aisle operator has ordered 75 examples of re-engined 737 Max 8; first delivery is due in 2017

“Compared with the new breed of business model, I'm afraid we are slightly legacy in our approach. And that is the death knell for people like me,” he adds. “So we have to adapt our business model to what is going on out there.”

Both Emirates and Flydubai are owned by the Dubai government, and the idea of combining the two operations could make good sense. Data from Flight Fleets Analyzer shows that if Flydubai's all-737 fleet were integrated into Emirates' all-widebody operation it would create a carrier with about 300 aircraft in service and a similar number on order. Flydubai operates 54 737-800s and has 75 Max 8s on order.

Such a move is not that radical an idea. Both of Emirates' rival Gulf carriers – Etihad Airways and Qatar Airways – have always operated a mix of single- and twin-aisle aircraft across their networks.

FlightGlobal schedules data shows that just over a third of Flydubai's 88 routes from Dubai overlap with the Emirates network. It is a curious situation for two airlines owned by the same parent to find themselves in, but Clark says the reasoning that led to the current state of affairs made sense at the time.

“Flydubai was a response to the growth of the likes of Jazeera and Air Arabia [and] the pres-

ures that [Emirates group chairman] Sheikh Ahmed [bin Saeed Al-Maktoum] was facing with regards to carriers [such as] Jazeera, which wanted to establish a huge hub in Dubai. Emirates did the original business case and we identified that there was a very good case,” he says.

FINANCIAL CRISIS

“Unfortunately then there was the financial crisis. Demand tanked and so Flydubai then put itself on top of us in markets that were fairly well established, and that we had built up over many years. At the same time, they opened multiple new points that we would never go to – in the 'Stan states, the Russian Federation and parts of Africa.”

Clark also points out that Flydubai has “a huge operation” in Saudi Arabia, where it flies to a number of airports that Emirates cannot serve with its widebody fleet because the runway pavement strength is insufficient.

Clark says the exercise to move closer to Flydubai is designed to “extract greater value for the shareholder where we have an element of competitive forces at play”. The move could also unlock important opportunities for the group's network development strategy across the region. ■

Emirates/Flydubai passenger fleet

	In service	On order	Seats
Narrowbody			
Boeing 737-800	54	0	174
Boeing 737 Max 8	0	75	174*
Sub-total	54	75	
Widebody			
Airbus A380	95	47	489-615
Boeing 777-200LR	10	0	266
Boeing 777-300	6	0	364
Boeing 777-300ER	133	18	354-428
Boeing 777-8/9	0	150	N/A
Sub-total	244	215	
Total	298	290	

Source: Flight Fleets Analyzer *estimated



PROCUREMENT DOMINIC PERRY LONDON

Vienna bids goodnight to Eurofighter

Commission report indicates fleet switch could save €2 billion by 2049, as legal wrangling over type's acquisition mounts

Austria plans to replace its fleet of 15 Tranche 1 Eurofighter Typhoons from 2020, amid a deepening row with the four-nation consortium over the cost and capability of its aircraft.

Vienna in February began legal proceedings against Airbus Defence & Space and Eurofighter over alleged fraud and deception related to its near €2 billion (\$2.28 billion) acquisition of the Typhoons in 2003. Airbus and the industrial consortium deny the accusations, but the nation's proposed exit from Eurofighter operations from the end of the decade reveals the depth of its dissatisfaction with the Typhoon.

Vienna selected the Tranche 1-standard Typhoon in 2001 to replace its Saab Draken interceptors. The Austrian defence ministry describes the fighters – which it received between 2005 and 2008 – as possessing “limited equipment and significant cost uncertainty”. It says retaining the 15-strong fleet for the next 30 years would see it incur costs of between €4.4 billion and €5.1 billion.

Figures produced by a special commission appointed to examine the issue suggest the fleet switch would generate potential savings of between €100 million and €2 billion in the period to 2049.

SINGLE-TYPE AMBITION

At present, Austria conducts airspace policing missions with its Typhoons, as well as an aged fleet of 17 Saab 105s, which will require replacement from 2020. By aligning the out-of-service dates, Vienna says it expects to move to a one-type fleet, with 15 single-seat fighters and three twin-seat trainers.

“Those who say yes to Austrian neutrality and sovereignty must also say yes to modern, high-performance supersonic aircraft capable of round-the-clock operations,” says defence minister Hans Peter Doskozil. “At the same time, we need to get the escalating costs



Austrian government says Tranche 1 jets have “limited equipment and significant cost uncertainty”

of the Eurofighter under control and minimise the enormous cost risks associated with it – in the interests of the taxpayer, and also in relation to the other branches of the armed forces.”

Austria has based its decision on a report generated by the special commission it set up in March, headed by air force chief Brig Karl Gruber.

The report concludes that the air force requires a new fleet of supersonic fighters, able to operate around the clock, and equipped with guided missiles and an advanced self-protection system. It says the new aircraft should be acquired via a government-to-government deal and could either be purchased or leased. A separate commission has now been established to examine candidate aircraft and acquisition methods, says the defence ministry.

Among the 19 options analysed by the commission was upgrading the nation's current Typhoon fleet and acquiring three used two-seaters. Austria had initially planned to acquire a trio of trainers, but abandoned this in favour of instead installing a simulator at Zeltweg air base.

“Those who say yes to Austrian sovereignty must also say yes to high-performance supersonic aircraft”

Hans Peter Doskozil
Defence minister, Austria

“Continued operations with the existing Austrian Eurofighter fleet would involve cost risks that are difficult to quantify at present,” says Gruber, noting the gradual replacement of Tranche 1 examples by the consortium's partner nations Germany, Italy, Spain and the UK. “Consequently, it appears likely that there will be no uniform Eurofighter Typhoon Tranche 1 system in the future.”

Eurofighter declines to comment on the detail of the Austrian report, although it says: “This is an Austrian defence procurement discussion and it is not for us to comment. However, the Eurofighter works very well for all other customers.”

Flight Fleets Analyzer shows that nine of Austria's Eurofighters were originally ordered for

the German air force, including six which were transferred after their delivery to the Luftwaffe. Its Tranche 1 examples are limited to carrying only Diehl Defence IRIS-T short-range air-to-air missiles and a Mauser 27mm cannon.

TRAINER FOCUS

As the Saab 105s are also used for training missions, the report signals Austria's possible intention of replacing its fleet of Pilatus PC-7 turboprop trainers at the same time. If the PC-7s are phased out it will look to buy training hours from a European partner in the short term, while in the longer term Vienna would upgrade its simulator training and purchase a “high-efficiency trainer” aircraft. It does not specify if this would be jet- or turbo-prop-powered.

Austria has previously shown interest in Leonardo's Aermacchi M-346, including sending trainee pilots to the Italian air force's Lecce air base to fly the type, while the company is also now seeking potential buyers for its M-345 basic trainer. ■

Additional reporting by Craig Hoyle in London



German industry sizes up CH-53K
Defence P19

TECHNOLOGY LEIGH GIANGRECO WASHINGTON DC

US Navy transmits plans for low-band frequency jammer

Service releases draft statement outlining its objectives in second phase of development for electronic attack system

The US Navy is moving ahead with a Next Generation Jammer (NGJ) increment 2 activity, to develop a low-band jamming pod for use with its Boeing EA-18G Growler electronic-attack aircraft and complement ongoing work on a mid-band frequency jammer.

A draft statement of objectives was released by the US Naval Air Systems Command (NAVAIR) on 29 June to potential bidders for a preliminary demonstration contract. This asks industry to show that existing technologies can meet its requirements for a new

low-band transmitter, which will generally be used to jam early warning radars and voice communication frequencies.

However, the contract will only be used to demonstrate – rather than mature – technology for increment 2, according to an earlier notice on the US Federal Business Opportunities website. The USN plans to release a request for proposals by early fiscal year 2018.

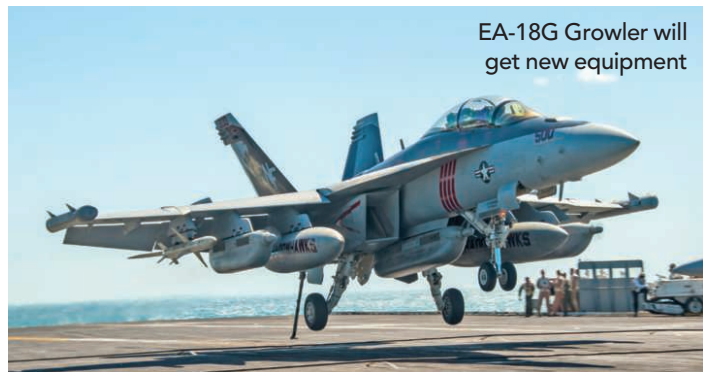
In its notice, NAVAIR did not release the draft objectives publicly, but described the dem-

onstration as to explore frequency coverage, effective isotropic radiated power, spatial coverage and spectral purity.

The navy had scheduled increment 2 studies to begin in FY2014 and FY2015, but funding shortfalls postponed the start date to FY2016, the US Government Accountability Office disclosed in March. That funding schedule pushed the start of development activities from FY2018 to FY2020, although programme officials indicate the date could change as studies move ahead.

The US government's FY2018 budget, if approved, would allocate \$66.6 million for increment 2 research and development. The technology demonstration contract was added to the schedule for the fiscal cycle, budget documents state.

In 2013, Raytheon won a four-way competition to launch development of the NGJ programme's increment 1 phase, defeating rival bids by BAE Systems, ITT Exelis – which has since been acquired by Harris – and Northrop Grumman. ■



EA-18G Growler will get new equipment

US Navy

SAFETY LEIGH GIANGRECO WASHINGTON DC

Air force highlights dangers of small unmanned air systems near its bases

Air Combat Command (ACC) Chief Gen Mike Holmes has detailed the threat posed to advanced fighters by small unmanned air systems operated near US Air Force bases.

In one day in early July, the USAF counted two reports of small UAS interfering with operations at an ACC base, Holmes

told an audience in Washington DC. In one incident, a Lockheed Martin F-22 almost collided with a small UAS during final approach; in another, a gate guard watched a drone fly over the top of a gate and tracked the vehicle as it flew over the flight line.

"I have no authority given to me by the government to deal

with that," Holmes says. "Imagine a world where somebody flies a couple hundred of those and flies one down the intake of my F-22s with just a small weapon on it."

While the ACC has no authority to disable or track small UAVs near its bases, the air force's nuclear sites are working towards government approval to deal with such a threat. Earlier this year, the head of the USAF's Global Strike Command, Gen Robin Rand, lamented the complex web of government agencies that must approve a drone defence strategy.

"It's not a military authority: it's a civil authority that can be executed by military forces," Holmes says. "The rules are basically the same as if it were a civil aircraft. If it was a civil aircraft, I could track it back to where it started from and I could admonish that pilot or take their licence." ■



US Air Force

Two recent incidents involving F-22 Raptors have alarmed service

ACQUISITION GREG WALDRON SINGAPORE

Thailand picks a further eight T-50TH trainers

Bangkok has approved a plan to buy another eight Korea Aerospace Industries T-50TH advanced jet trainers for Thailand's air force.

Local media reports suggest the deal is valued at around Bt8.8 billion (\$259 million), with a contract signing expected later this month.

Bangkok ordered an initial four T-50TH jets in September 2015, for \$110 million. Flight Fleets Analyzer shows the first pair of aircraft as scheduled for delivery in December 2017, followed by two more in June 2018.

Powered by a GE Aviation F404 engine, the T-50TH is being acquired as a replacement for the Royal Thai Air Force's 35 Aero Vodochody L-39s, which Fleets Analyzer records as having an average age of almost 24 years. ■

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[Business Aviation P20](#)

ROTORCRAFT LEIGH GIANGRECO WASHINGTON DC

German industry sizes up CH-53K

Sikorsky welcomes potential support partners to production site as Berlin readies for future heavy-lift helicopter contest

Sikorsky hosted German aerospace companies during a recent two-day event at its West Palm Beach site in Florida, discussing the US Marine Corps' CH-53K and the German air force's "Schwerer Transporthubschrauber" (STH) heavy-lift helicopter programme.

Berlin is looking to replace a fleet of 81 CH-53GA/GS helicopters originally delivered in the 1970s. A request for proposals is scheduled for release in mid-2018, with a contract award due the following year. Deliveries would begin in 2023, as the Luftwaffe begins to retire its aged fleet.

Sikorsky is pitching the King Stallion, in development for the

USMC, but faces competition from Boeing's CH-47F Chinook.

At the Paris air show last month, Sikorsky officials emphasised their budding relationship with German manufacturers, but would not elaborate on specific partnerships.

"It is Sikorsky's intent to be heavily involved as the original equipment manufacturer, but to have German suppliers accomplish the majority of the work when it comes to platform sustainment," says Nathalie Previte, vice-president of Sikorsky's strategy and business development. "We have several suppliers with whom we are finalising exclusive relationships,



Lockheed Martin

The King Stallion faces competition from Boeing's CH-47F Chinook

and who will form the foundation for the Sikorsky STH team in Germany."

Boeing is promoting its Chinook as a proven model for the German requirement, but Sikorsky president Dan Schultz used the Paris air show to counter suggestions that the King Stallion will lack readiness.

"The idea that this is a prototype, and people saying we're still developing the '53K is really wrong," he said, adding: "We're in full production."

A first of four engineering development model-standard rotorcraft was flown from West Palm Beach to NAS Patuxent River in Maryland on 5 July, where the type will undergo flight testing. The 6h transfer included refuelling stops at NAS Mayport, Florida, and MCAS New River, New Carolina, Sikorsky says.

The USMC plans to field 200 CH-53Ks, with the service expecting to achieve initial operational capability by 2019.

Airbus Helicopters, which pro-

vides maintenance support for the Luftwaffe's current CH-53 fleet, identifies seven other German companies which it is working with in support of the STH requirement, including Diehl Aerospace, Liebherr Aerospace Lindenberg, MTU Aero Engines and Rohde & Schwarz.

"Due to the procurement volume and the expected lifecycle of the aircraft, this will be the formative industrial project for the military helicopter sector in Germany over the next few decades," Airbus Helicopters says.

"This strong team is able to offer competent support to the Bundeswehr across all lifecycle phases of the chosen model," the manufacturer adds, identifying activities such as procurement, certification, maintenance, modifications and upgrades.

Pointing to the collective experience of the German rotorcraft industry, the Airbus Group company cautions: "If it isn't supplied with new contracts, then it will decline significantly in just a few years." ■



Stephan Widmer

TRAINER

First French PC-21 makes its debut

Pilatus has performed a low-key first flight of a PC-21 turboprop trainer for the French air force, with the service's lead example taking off from its Stans site in Switzerland on 10 July. The aircraft, test registration HB-HVA and serial number 293, is the first of 17 PC-21s for the French air force's FOMEDEC programme, ordered via Babcock Mission Critical Services France on 30 December 2016. Deliveries will start next year, with the company to also provide ground-based training.

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DEVELOPMENT GREG WALDRON SINGAPORE

Airvan 10 gains Australian, US approval

GippsAero targets Rolls-Royce M250-powered type at remote rural community service operators and paramilitary users

Mahindra Aerospace's Australian GippsAero unit has received certification for its Airvan 10 single-engined turboprop from both Australian and US regulators.

The approvals from Australia's Civil Aviation Safety Authority and the US Federal Aviation Administration came within the last month, says David Wheatland, chief test pilot for the programme.

European certification is not immediately envisaged, but is likely to come after the 10-seat aircraft, previously named the GA10, has been in the market for a few years.

Wheatland, who also handles product support and other duties for GippsAero, is confident of the type's prospects. He says the Airvan 10, which is powered by a Rolls-Royce M250-B17/F2 engine, fills a niche between GippsAero's Airvan 8 piston-single, and the larger Quest Kodiak, powered by the Pratt & Whitney Canada PT6A turboprop.

The company is targeting sev-



Mechanical flaps allow pilots to easily land 10-seater on rough terrain

eral segments with the Airvan 10. Wheatland declines to name customers, but says there has been significant interest in the aircraft.

"I can't say who is squabbling over the first aircraft — we take things deliberately and carefully," he says. "Customers include rural and remote community operations and services in Australia and the USA — and not necessarily in contiguous 48 states. This is an area where we've had good success with the Airvan 8."

He hints that an important

market for the type will be Alaska. Apart from passenger and cargo transport — the Airvan 10's cargo door is large enough to accommodate a pallet — other civilian applications include sightseeing and skydiving.

A key feature, Wheatland stresses, is the Airvan 10's mechanical flaps, operated by a cable in the floor. He says pilots flying in and out of rough fields like the ability to move the flaps "up or down in a second".

The Airvan 10 will also be

pitched for paramilitary applications such as littoral surveillance and border patrol, and police work. Weapons, however, are not envisaged.

"As soon as you weaponise something, it is subject to stricter export controls," he says. "The Airvan 10 has a lot of US equipment. We can't just go around putting guns on it."

The Airvan 10 will not make it to this July's AirVenture general aviation showcase in Oshkosh, Wisconsin, Wheatland says, but could make an appearance at the Singapore air show in February 2018. The type appeared in both the static and flying displays of March's Avalon event near Melbourne.

As for production, Wheatland says this will start off slowly and gradually ramp up.

"We started with a low production rate, working with lead customers to incorporate benefits and enhancements," he says. "Carefully identifying lead customers is important, as we progress into deliveries." ■

RESUMPTION STEPHEN TRIMBLE WASHINGTON DC

Bell boosted as crash-hit 525 returns to the skies

Flight testing of the Bell Helicopter 525 Relentless super-medium-class rotorcraft on 7 July — a year and a day after a fatal crash grounded the test fleet.

The US Federal Aviation Administration agreed to renew the 525's experimental certificate to allow Bell to resume flight tests.

The crash on 6 July 2016 near Italy, Texas, killed two test pilots. The first of Bell's three 525 prototypes (N525TA) broke up in flight, according to the US National Transportation Safety Board. The accident, in visual flying conditions, remains under investigation.

"The team is focused on certifi-

cation in 2018 and we are committed to bringing this innovative and high-performing helicopter to market," says Bell chief executive Mitch Snyder. Service entry is due in 2019.

According to flight-tracking website Flightradar24, the second flight-test prototype (N525BK) was the first of the two remaining flight-test articles to return to the air, performing a 32min low-level sortie from Bell's Arlington, Texas facility on 7 July.

The GE Aviation CT7-powered 525 is racing Leonardo Helicopters' AW609 tiltrotor to become the first civilian rotorcraft to enter service with fly-by-wire controls. ■



Test flights restarted one year after fatal crash grounded the type



Flying start
Anniversary P22

DELIVERIES KATE SARSFIELD LONDON

Embraer reports fall in its first-half shipments

Continued weakness in the market for executive aircraft resulted in a 20% decline in Embraer's business jet output for the first half of 2017.

For the six months ended 30 June, the Brazilian airframer shipped 39 aircraft. These consisted of 27 light jets – seven Phenom 100EVs and 20 Phenom 300s – and 12 large jets: five Legacy 450s, four Legacy 500s, a pair of Legacy 650s and a Lineage 1000E.

This performance compares with 35 light jets – 26 Phenom 300s and nine Phenom 100s – and 14 large jets – eight Legacy 500s and six Legacy 650s – delivered during the first half of 2016.

Second-quarter output was more promising, with Embraer

shipping 24 business jets between April and June, compared with 26 units during the same period in 2016.

This was largely due to the absence of the Legacy 450 from last year's tally. The superlight business jet underwent a minor upgrade in the first half of 2016 to boost its range by 325nm (600km), to 2,900nm. Deliveries resumed last July, and 12 examples were handed over during the rest of the year.

The second quarter of 2017 marked the handover of Embraer's 1,100th business jet, a Phenom 300, 15 years after it informally entered the business aviation market with the shipment of a VIP-configured ERJ-135 airliner. ■



Didier Wolff/Happy Design Studio

LIVERY

Global 6000 gets Happy Design

Happy Design Studio has teamed with engineering company RUAG and paint specialist ASAP Aviation to create a bespoke livery for the owner of a Bombardier Global 6000 – which it describes as “the most powerful design seen on a jet aircraft”. The project, called Carboneum, is the brainchild of Happy Design owner Didier Wolff, and took 2,500h to create. The company, headquartered in Strasbourg, France, says the honeycomb patterns and the “Ferrari grey colour” create a sense of speed and power. “The concept of Carboneum is that the white colour of the aircraft is not a paint option, but the painter's canvas on which a design can evolve,” says Happy Design. “Making other jets look naked was not the goal of the creation,” it adds, “but it sets the bar to a new level for private aircraft livery design.”

PROGRAMME KATE SARSFIELD LONDON

Production-ready E1000 set for debut

Airframer prepares conforming prototype of single-engined turboprop to get airborne, as it pushes for 2018 certification

Epic Aircraft is planning to fly the first production-conforming E1000 test aircraft later this year, as structural testing on the single-engined turboprop nears completion at the airframer's Bend, Oregon base.

“We are making steady progress with the aircraft, but development is taking longer than we anticipated,” says Epic's director of sales, Mike Schrader, in reference to a two-year delay to the E1000's certification timetable.

Epic had originally pegged validation for 2016, but a series of unforeseen hurdles and stringent US Federal Aviation Administration certification requirements have pushed this approval to 2018, says Schrader. “It is a very lengthy and costly process bringing a certificated aircraft to market, but it will be worth it in the end,” he adds.

Structural testing of the production-conforming parts – including

the wing, horizontal stabiliser and control surfaces – is almost complete, with only a handful of tests on the fuselage remaining. “We hope to have this wrapped up this quarter, then we will complete the production-conforming test aircraft,” Schrader says.

The first prototype, FT1, made its maiden flight in late 2015, and has been used to evaluate the E1000's handling qualities and

flight envelope. “It has flown around 400h to date. Everything has gone to plan,” says Schrader.

When FT2 joins the campaign later this year, it will be used to assess interior and cabin functionality, as well as the fuel, hydraulic, avionics, navigation and environmental systems, he adds.

The E1000 will be a certificated version of the LT kit plane, which Epic stopped taking orders

for in 2013, after selling 54 units. Some LT customers have upgraded to the E1000, for which Epic has secured 76 orders to date, mainly from US-based buyers.

E1000 position holders are also upgrading from piston singles from the Beechcraft, Cessna, Cirrus and Piper stables, says Schrader. Some owners are transferring from business jets and turboprops such as the Embraer Phenom 100 and Pilatus PC-12, respectively. Epic will begin deliveries of the six-seat aircraft shortly after certification.

The Pratt & Whitney Canada PT6A-67A-powered E1000 has a maximum range of 1,650nm (3,060km) and a maximum cruise speed of 325kt (600km/h). Equipped with a Garmin G1000NXi flightdeck, the all-composite aircraft is priced at \$3.25 million: about \$1.3 million more than the LT. ■



Epic Aircraft

Lead test aircraft has flown around 400h since maiden sortie in 2015



Flying start

Bombardier's clean-sheet CSeries has been in service for a year with launch operator Swiss, plus Latvia's Air Baltic; so far, its introduction is proving smoother than expected

MICHAEL GUBISCH LONDON

A year after Bombardier's CSeries entered service, the aircraft's two operators – Swiss and Air Baltic – report that the clean-sheet twin-jet's introduction has gone more smoothly than they expected.

Swiss became the CSeries programme's launch operator when it started revenue flights with the CS100 in July 2016. The Lufthansa Group carrier initially ordered 30 CS100 jets, but later converted 20 orders to the larger

CS300. Flight Fleets Analyzer shows Swiss now has eight CS100s and one CS300, configured with 125 and 145 seats respectively.

Air Baltic began regular passenger flights with its first CS300 in December 2016. The Latvian carrier now has five in use, and another 15 on order for delivery through 2019 – and chief executive Martin Gauss has repeatedly said the airline is evaluating further orders for the Pratt & Whitney PW1500G geared turbofan-powered aircraft.

Swiss's deputy CSeries fleet chief, Sven Thaler – a pilot who converted to the type in

March from the BAE Systems Avro RJ100 regional jet – tells FlightGlobal the airline was prepared for the aircraft's introduction to bring up technical issues. "As launch operator, you expect this, you have to plan for it," he says. But he adds: "It went better than expected. There are no topics that restrict us in any way."

Air Baltic operations chief Martin Sedlacký uses similar terms to describe the aircraft's introduction: "To be honest, it went surprisingly well." With dispatch reliability between 99.3% and 99.4%, the airline's first four CS300s performed at a similar level to its

Swiss commenced revenue service with the CS100 last July



Bombardier Q400 turboprops, he says, adding: "That's not bad, because the Q400 is an established programme."

The carrier's Boeing 737 Classics – which will be replaced by CS300s – operate at 99.8% dispatch reliability, Sedlacky says. But he argues that this higher level of performance is partly a result of the 737's long-established presence. "If you fly to Paris and something happens with a 737, you have tonnes of technicians who can fix it. If you fly state-of-the-art [equipment] and something happens with the avionics on this aircraft, there are not so many people in every corner of Europe."

Availability of trained staff and ground equipment has been a key factor in selecting suitable routes for the CSeries, he acknowledges. "You need to think wisely, especially in the beginning. What's your support network? Are technicians flying on board the aircraft or not?"

Sedlacky expects dispatch reliability to further improve as more aircraft join the fleet. Air Baltic is scheduled to have eight CS300s by year-end, and it expects to receive another eight in 2018. "I am not targeting in the first

two years to be better than Boeing. I think that is unachievable... but if I get to 99.5% dispatch reliability, I would be happy."

The PW1500G engine has not been affected by the start-up and bearing problems of the PW1100G variant that powers the Airbus A320neo, because the CSeries powerplant has a different wing-mounting fixture that results in less strain on the rotor assembly. But – as with the A320neo – premature combustor degradation has been an issue.

BORESCOPE INSPECTIONS

One result is that Air Baltic and Swiss each replaced two engines on their CSeries fleets before June. The airlines conducted borescope inspections, as recommended, before each engine reached 2,000 flight hours: an activity which must be repeated at 200h intervals after that point.

Bombardier's vice-president for the CSeries programme, Rob Dewar, tells FlightGlobal that with its initial CS100 Swiss was able to operate the engines to around 2,400h, but then replaced them in May. Swiss says its next engine changes have been scheduled for the coming months. Air Baltic, meanwhile, replaced two engines on its fleet before June.

P&W acknowledges that "engine maintenance has been in line with expectations, which anticipated that some issues would be uncovered". It notes: "In order to ensure that the dispatch reliability of the engine remains high, Pratt & Whitney has added a combustor panel inspection to its scheduled maintenance programme. We do expect that the maintenance requirements of the engine will both reduce and simplify as the fleet matures and we fully deploy our EngineWise prognostic health monitoring capabilities."

Dewar says an updated combustor liner has been developed, which has a limit of 6,000-8,000h, and P&W is working on a third genera-

tion – to be rolled out in 2018 – that will raise the limit to 20,000h in benign environments.

Sedlacky says that Bombardier and P&W have swiftly provided support for the engine issues. But he says Air Baltic will not invest in its own spare engines until the problems –

"You need to think wisely. Are technicians flying on board the aircraft or not?"

Martin Sedlacky

Chief operations officer, Air Baltic

which he describes as "design issues" – have been resolved. He says improvements are scheduled to be rolled out in mid-2018, but adds: "I would be less optimistic. I would say it takes two years to get the engine to where I say: 'OK, that's the asset that I would order.'"

FUEL BURN

P&W insists that "the initial entry into service of the PW1500G engine has been very good". The 14 in-service CSeries jets have accumulated a total of more than 28,000 engine hours, and the manufacturer says the powerplant has reached a dispatch reliability of 99.9%.

Swiss and Air Baltic both say they were surprised to find that CSeries fuel consumption was lower than had been forecast. "I didn't expect fuel burn would not only be better than the agreement [with Bombardier], but also than the [aircraft's] marketing material," says Sedlacky. "I am a pretty sceptical guy; I was an ex-consultant... But the fuel burn is lower than the marketing material by about 1%."

Dewar says the performance boost is "more significant than 1%", with the aircraft beating targets throughout the operating range, rather than on individual routes or at certain speeds. He declines to provide further detail, with >>



Air Baltic has received five CS300s from a fleet which is likely to grow beyond 20 examples

» Bombardier intending to update its performance specifications later this year.

Swiss admits it had issues with the cabin management system – specifically the safety video demonstration and public address system – and problems with starting up onboard systems. Thaler says crew members had to switch off and reboot equipment, and Dewar acknowledges that Bombardier delivered software updates to rectify problems. In Thaler's view, however, the cabin issues represent "comfort items", rather than significant issues.

Initially, Swiss deployed its CS100s for about six sectors a day, with the aircraft returning to its Zurich base overnight. But now the aircraft are used for up to nine flights a day. Average daily utilisation across the CSeries fleet – for both Swiss and Air Baltic – is around 14h, says Dewar. He points out that Air Baltic's flight time averages around 3h because of Latvia's location, while Swiss's flights tend to average around 1h 15min.

Swiss says it has no intention of adding new destinations to its network with the CSeries. But Thaler says the aircraft's range –

1,970nm (3,650km) for the CS100 – makes the type an "all-rounder" that can operate the routes of both the retiring RJ100 and of the airline's A320-family fleet.

In Geneva, Swiss decided to entirely replace a locally-based A320-family fleet with the CSeries, in a bid to raise the profitability of operations in Switzerland's second city. The airline's market share there has been reduced to around 20%, largely as a result of competition from EasyJet, Swiss chief executive Thomas Kluhr told FlightGlobal in 2016.

Kluhr said the carrier had considered withdrawing from Geneva and serving the city with Lufthansa Group's budget unit Eurowings, but he favoured a solution with Swiss in order to avoid the flag carrier becoming "Zurich Air Lines".

"Fault notifications are very accurate and support our maintenance operations well"

Stephan Regli

Head of maintenance, Swiss

Thaler says Swiss will station seven CS300s in Geneva and, for a route to London City airport, a CS100. The baseline model was certificated in April for the steep approach to the UK capital's downtown gateway, and Swiss intends to start serving the destination during the third quarter of this year. In addition to installing a software package required for the UK airport, Thaler says Swiss's CSeries jets will receive a software update to increase landing capability in low visibility from CAT II to CAT IIIA in the autumn.

Air Baltic, for its part, ordered the CS300 as a 737 replacement. But Gauss revealed during the Paris air show in June that the airline was



Pratt & Whitney claims its PW1500G engine has produced a dispatch reliability of 99.9%



Bombardier has gained approval for CS100 to make steep approaches to London City airport

Average utilisation across the CSeries fleet is around 14h a day



considering a follow-up order for a mix of CS100s and CS300s to replace its Q400 twin-turboprops. For Air Baltic, the CSeries' range represents an opportunity to expand its network to destinations that could not be served with the 737. The Riga-based carrier will start flights to Abu Dhabi in October. The airline previously unveiled a service to the Gulf state in 2013, which was to be operated with A319s, but the economics did not meet its expectations.

Gauss has said that leisure routes to Spain's Canary Islands would become feasible, and Air Baltic might expand its network to more distant destinations in Russia with the CS300.

MAINTENANCE

By the end of June, the in-service fleet had undergone a total of 11 A-checks, Dewar says. The maintenance event, scheduled after 850 flight hours, is designed to be accomplished within an 8h shift. Dewar says the initial A-check took 5h, but this has since been reduced to less than 3h. "There have been no findings to date on any of the A-checks, outside of damage on one cargo panel due to impact from baggage [handling]," he notes.

Swiss's head of maintenance Stephan Regli thinks it is too early to judge how maintenance of the CSeries compares with other aircraft, because A-checks represent "no great challenge". Nevertheless, he says technicians have predominantly voiced positive feedback and say that the aircraft is easy to maintain.

Owing to automated transfer of data from aircraft systems, Swiss has much more techni-



cal information on the CSeries than on earlier types in its fleet. Regli adds: "This is not being optimally analysed yet. We are still on a learning curve and need more empirical data. But the fault notifications are very accurate and support our maintenance operations well."

C-checks are scheduled after 8,500h – typically three-and-a-half years of operation. However, based on in-service experience, Bombardier intends to increase the intervals for A-checks to 1,000h, and for C-checks to 10,000h. Dewar says: "It looks like we can do it sometime toward the end of 2019."

In terms of pilot training, Air Baltic senior vice-president flight operations Pauls Calitis says there was initially "apprehension" among flightcrew as regards transitioning from the 737

or Q400 to the CSeries: "We were expecting to have difficulties... going from a less-automated to a highly-automated aircraft."

However, Calitis says the move turned out not to be as challenging as expected, and that the aircraft has become very popular among the airline's pilot corps. "We've really not had any issues in terms of transitioning people. And actually the success rate is higher than on training that we have done previously."

"We've not had any issues in terms of transitioning people – the success rate is higher"

Pauls Calitis

Vice-president flight operations, Air Baltic



Riga-based Air Baltic is expanding its route network as a result of CS300's range performance

In Thaler's view, the CSeries is easy to fly, and the aircraft's systems and handling are intuitive and straightforward. He says the pilots receive a range of automated information through the cockpit systems: "You have the best support that you can expect from the aircraft. The aircraft will tell when something is going in a different way [than] you like it to be."

"It is not like that we are operating a machine or that a computer is flying us. It's like an interaction, rather like a third crew member. The aircraft posts to us certain messages... and expects a reply."

Thaler says the cockpit interface is designed in a way that leaves the pilots in charge and does not demand the crew to work through checklists or instructions in a particular, predefined sequence. Pilots can opt to disregard checklists that are being suggested by the system, and instead decide on an alternative action if they consider it more appropriate.

"That's really a bit different to checklists on other aircraft... the pilot is always at the centre of the decision-making process," says Thaler. "[The pilot] must receive from the system the information that he needs, he must be ideally supported. But the decision is ultimately taken by the pilot. However, the aircraft warns me if I exceed a limit."

Calitis sums up his experience with Bombardier's first fly-by-wire aircraft without a traditional control column by saying: "Having come from conventional controls and going to the sidestick, the sidestick flying on this aircraft is easy and intuitive... it flies like an aeroplane, it is not a computer you are flying." ■

Volts from the blue

Disciples of electric flight may be disappointed that neither Airbus nor Boeing expect to plug in airliners any time soon, but the limits of battery power should come as no shock

STEPHEN TRIMBLE WASHINGTON DC

Elon Musk co-founded Tesla Motors in 2003 to make electric cars, a technology at that time largely ignored by the world's biggest automakers. Fourteen years later, Tesla's market capitalisation has surpassed Ford's and General Motors'. On 9 June 2017 its market cap zoomed past BMW to make Tesla, for several weeks, the third-most-valuable company in the automotive industry – despite producing fewer than 70,000 electric cars last year, compared with 10 million each by Toyota and Volkswagen.

On the same day, coincidentally, Airbus hosted a news briefing in Toulouse by chief technology officer Paul Eremenko, who revealed more details about the company's enthusiastic pursuit of electric-powered flight. He compared the coming decade to previous "golden eras" in aerospace innovation, when the industry made leaps in the range and speed of powered flight in the 1920s and 1950s: "I think they will be some of the most exciting years in aerospace engineering work

in a half-century, and that is the third golden age I'm willing to sign up for."

A week earlier in Seattle, Boeing vice-president of product development Mike Sinnett offered a similar briefing. On 5 April, Boeing's HorizonX venture capital arm and JetBlue Technology Ventures partnered to finance Zunum Aero, a Seattle-based start-up aiming to develop an electric aircraft for general aviation and, possibly, a hybrid-electric-powered 50-seat regional jet.

As Zunum's projects move forward, Boeing Commercial Airplanes plans to introduce electric propulsion technology in the unit's ecoDemonstrator flying testbed programme.

OPPORTUNITIES

"In 2021, we are looking at the potential for doing additional work with small electric aeroplanes, with hybrid electric aeroplanes, with small autonomous aeroplanes, all meant to increase our knowledge about autonomy but also to increase our knowledge about all-electric aircraft and hybrid-electric aircraft," Sinnett says.



Boeing is backing Seattle-based Zunum Aero and its bid to develop all-electric GA aircraft



The unspoken subject of both presentations was clear: Airbus and Boeing are not going to sit back and allow an aerospace version of Tesla to capture the stock market's affection in 14 years. However, despite rising enthusiasm for electric-powered aircraft ranging from intra-urban flying taxis all the way up to 150-seat airliners, it is not clear that the world's largest aerospace manufacturers should be worried.

Alan Epstein, Pratt & Whitney's vice-president for technology and environment, has emerged as perhaps the most outspoken critic of proposals to develop hybrid-electric propulsion systems to replace gas turbines in aircraft the size of an Airbus A320 or Boeing 737. "My personal view, since I used to be in the battery business somewhat, is that it will take a chemistry discovery worthy of a Nobel prize to give you the energy density you need for a battery-powered commercial aircraft," Epstein said at a May presentation at the Washington DC chapter of the Royal Aeronautical Society.

To Epstein, an all-electric single-aisle is an absurd notion within a decade, even with generous assumptions of improvements in battery technology. The issue comes down to a basic mismatch in the energy density properties of



All-electric E-Fan got Airbus off the ground; now it will pursue vertical take-off and landing, and hybrids

INVESTA Kent Media/REX/Shutterstock

hydrocarbon fuels and lithium ion batteries.

Epstein analysed a 737-sized aircraft and removed the weight of the fuel. He replaced that weight with batteries offering 50% higher energy density than commercially available today. A traditionally-fuelled 737 can fly nearly 3,000nm (5,560km), but the battery-powered version lacked enough energy even to take off. “You can’t really taxi out to the end of the runway and you’re certainly not allowed to lift the nose wheel,” Epstein says.

Battery technology is rapidly improving, however, so Epstein revised his analysis. Instead of only a 50% improvement in energy density, Epstein assumed the 737 would carry a battery load 10 times more powerful than those that exist today. Despite the more generous assumption, this hypothetical 737 would still have limited appeal to airlines expecting transcontinental range.

UPHILL STRUGGLE

“If I had 600% improvement in the electrical equipment and factor of 10 in the batteries, I can just get to the point where the aeroplane can take off, circle the field and then land,” Epstein says. “So it looks like a hard thing to do.”

All-electric aircraft are not the only option. Aircraft manufacturers can design a hybrid-

electric vehicle, using gas turbines as an electric generator, or for thrust in cruise. Batteries or a fuel cell would be used as an emergency back-up or to augment thrust in take-off and climb. But the hybrid-electric design requires an aircraft to carry redundant propulsion systems, making that part of the aircraft twice as expensive.

“[Hybrids are] interesting enough for me to think there could be something there”

Mike Sinnett

Vice-president of product development, Boeing

“This will double the cost of the propulsion system, which is really good news for United Technologies,” Epstein jokes. “I’m going to assume the aerospace primes aren’t going to absorb this, but pass it on to their customers.”

Epstein further analysed the costs to answer a fundamental question: To offset acquisition and operating costs of a redundant propulsion system, how much more efficient must a hybrid-electric 737 be to lower the airline’s net costs?

“The price of fuel is about \$1.56 [in April],

then you need a 42% improvement in fuel burn to break even,” Epstein says. “If the fuel goes up to \$4 a gallon – certainly something that might happen – then you’ve got to be 20% better in fuel burn to break even.”

COST ISSUE

Both Eremenko and Sinnett have heard Epstein’s objections to electric propulsion technology and – for the most part – do not disagree.

Despite Boeing’s interests in Zunum, Sinnett agrees a hybrid-electric aircraft faces a difficult cost challenge. “A hybrid requires you to double up on equipment,” Sinnett says. “I’m not convinced that that’s the best way to go. However, I understand that there are certain missions where the electric aids you in a period of time where you need it, and then you go into longer-mode operation on a traditional fuel. So I would say the jury is still out and we have got a lot of work to do – but it’s interesting enough for me to think there could be something there.”

Asked about Epstein’s argument, Eremenko also concedes that the P&W executive has a point. But, Eremenko adds, Airbus is still pursuing electric propulsion as a research and technology (R&T) effort – not a long-term product strategy. “Our conclusion is, it’s in- ➤

» teresting enough that we should look at it at the level of R&T projects and the level of flight demonstrators.”

In his presentation, Eremenko outlined an R&T objective to produce a 20MW-class single-aisle-sized demonstrator with a hybrid-electric propulsion system, with several advanced features, such as boundary layer ingestion, blown wings and yaw control using differential thrust.

“Let’s be clear: the hybrid power chain today is less efficient than a conventional gas turbine engine because it includes the additional steps of converting to and from electrical energy,” Eremenko says. “For it to make a desirable product we must eke out efficiencies in other areas. For the first time since the jet age... we are really thinking of opening up the design trade space beyond the tube and wing.”

SMALL IS BEAUTIFUL

Epstein’s presentation came almost a month earlier, but he seemed to anticipate this possibility. Noting his 20% fuel burn improvement requirement with fuel at \$4 a gallon, a hybrid-electric propulsion system with blended-wing configuration and other exotic features could compete well against a gas turbine-powered aircraft relying on a conventional tube-and-wing configuration. However, Epstein suggests that the potential efficiency benefits of alternatives to a conventional configuration should not be reliant on electric propulsion. That is, the same benefits would apply to a gas turbine-powered aircraft – where the acquisition cost would be cheaper without the redundancy of a hybrid-electric system.

“We believe we could demo a 2MW... hybrid-electric power system in about three years”

Paul Eremenko

Chief technology officer, Airbus

In contrast to his scepticism about hybrid-electric large aircraft, Epstein is open to the potential benefits of electric-powered small aircraft, and even flying cars. One of the key drawbacks of flying car designs has been the lack of an engine with aviation-grade reliability, and electric power can help mitigate that problem. “It strikes me that the electric propulsion means you could take a not-so reliable engine like an auto engine, have some batteries on there and if the prime engine fails you have enough batteries to let it automatically land safely someplace,” he says.

Interestingly, Airbus and Boeing are also investigating developing small, electric-powered aircraft.

For Boeing, the interest became public only on 5 April, with the announcement of the



CityAirbus electric-powered concept for urban mobility could enter flight testing next year

company’s investment in Zunum. As the investment came from HorizonX, Boeing Commercial Airplanes (BCA) is not directly involved, according to the corporation organisation chart. HorizonX reports directly to Boeing chief financial officer and executive vice-president Greg Smith. But, as Sinnett explains, BCA is heavily involved in the project: “I work very closely with HorizonX and Zunum. We are providing the technical talent to help and then we are involved in the discussions on the strategy.”

BCA’s focus is on developing and manufacturing products, not exploring potentially disruptive ideas that fall outside the large transport aircraft market segment. Using HorizonX to manage the programme “gives them an ability to explore a market space that’s very different from the core BCA mission right now,” Sinnett says.

Airbus’s interests in electric propulsion have been well known for years. The company’s journey started humbly in 2010 with a French home-built aircraft called the Cri-Cri. Airbus replaced two piston engines with four small electric motors and launched a series of flight tests. That was followed with an electric-powered version of the Diamond Aircraft DA36 E-Star motor glider. By 2013, the company was ready to start experimenting with the E-Fan series.

Airbus exhibited three versions of the E-Fan – 1.0, 1.1 and 1.2. But the E-Fan project was abandoned earlier this year, which ended a proposal to launch a pilot training service using a follow-on, electric-powered aircraft.

Instead, Airbus has replaced the E-Fan with

a two-track effort for electric-powered aircraft: vertical take-off and landing for urban mobility, and fixed-wing for the transport mission. It plans to perform the first hover flight of the Vahana demonstrator, an all-electric, autonomous, vertical take-off and landing air taxi with eight motors and a tilt-wing. It will be followed into flight testing next year by a series production design called the CityAirbus.

HYBRID APPROACH

On a separate track, Airbus will continue pursuing the ultimate goal of a hybrid-electric, single-aisle-sized aircraft. The next step came with the launch of the E-FanX flight demonstrator, sized as a small commuter jet. “We believe with a strong push we could demo a 2MW flight-weight hybrid-electric power system in about three years,” Eremenko says. “We see this as the upper limit of what is attainable with more-or-less conventional power distribution technology without having to master superconductivity or other exotic approaches.”

By using a twin-engined commuter jet, Airbus will be able to replace one or both of the wing-mounted engines with electric motors driven by an integrated turbine generator embedded in the fuselage.

“Of course, the ultimate prize for us is to enable hybrid electric propulsion architecture for a single-aisle aircraft at the scale of the A320 family,” Eremenko says. “I’m reluctant to put a date on such a demonstrator – much less a product. But it’s becoming increasingly clear to us that such an aircraft is not only feasible, but very likely desirable.” ■



Nine-seat Alice will be offered as an all-electric alternative for mainstream GA missions

Power switch

Solid financial backing and the promise of a fuel cell technology breakthrough underpin an Israeli start-up's fast-dash bid to build and certificate an all-electric GA workhorse by 2020

STEPHEN TRIMBLE PARIS

In a corner of the sun-drenched Paris air show static display, Israeli start-up Eviation Aircraft co-founder and chief executive Omer Bar Yohay could look to his right and see the French air force's corral, featuring Dassault Rafale and Mirage fighters. If he looked far enough to his left, he could see all the stars of the modern aviation industry lined up on display, including a Lockheed Martin F-35A fighter, Embraer KC-390 tanker/transport, an Airbus A350-1000 and a Boeing 787-10.

By comparison, Bar Yohay's offering seemed a bit less glamorous, with just a few couches perched under a sun tent that provided little relief from a rare Paris heat wave. Outside the canopy sat the streamlined shape of the Eviation Orca, a tri-motor,

all-electric unmanned air vehicle designed to function as a proof-of-concept vehicle.

"I'm the one selling a Prius in a Ferrari shop," Bar Yohay jokes, as the whoosh of an Airbus A400M on final approach passes over his sun tent.

The comparison works, but is not quite accurate. The Toyota Prius is, after all, a hybrid-electric. And the Eviation stand did not exist to promote a small, electric UAV. Eviation made its debut at the Paris air show to publicly unveil a new aircraft concept called Alice; a nine-seat, all-electric alternative to such general and business aviation stalwarts as the Beechcraft King Air 350, Cessna 402 and Pilatus PC-12.

The Israeli business may be a start-up, but it has solid financial support. In addition to Bar Yohay, Eviation was co-founded by Aviv

Tzidon, a well-financed Israeli inventor of a potential breakthrough in electric propulsion technology. Eviation has a long-term plan to integrate the air-metal fuel cell invented by Tzidon in the Alice, but intends to go to market within four years with a nine-seat aircraft powered by conventional lithium-ion batteries.

"We aimed at this point because we believe this is probably the most cost-effective entry point to this market that can be certificated under today's regulatory environment," Bar Yohay says.

NEXT STOP OSHKOSH

Eviation's next stop on the air show circuit is the Experimental Aircraft Association's annual AirVenture fly-in in Oshkosh, Wisconsin, later this month. There, the Orca proof-of-concept drone and the Alice con- »

» cept will join fields of conventionally powered Cessna 402s, King Airs and PC-12s – along with a growing list of proposals and concepts for electric and hybrid-electric aircraft.

By announcing in Paris a schedule to complete US Federal Aviation Regulations Part 23 airworthiness certification by 2020 and start commercial flights in 2021, Bar Yohay advanced the Alice to near the front of the queue. As such, the Alice could become as much a regulatory test case as a leap in propulsion technology. If allowed to proceed, the Alice and the new class of hybrid- and all-electric aircraft must clarify a host of still-murky regulatory issues for airworthiness certification.

Bar Yohay is well aware of the regulatory questions that face any company hoping to introduce electric-powered aircraft in non-experimental categories. Since the company's foundation in 2015, Eviation has participated in all of the major forums, including the General Aviation Manufacturing Association's electric propulsion and innovation committee, ASTM's F39 committee developing consensus standards for electric wiring on small aircraft and the F44 committee working on basic standards for all aircraft weighing less than 8,620kg (19,000lb) and carrying fewer than 12 passengers.

That experience has persuaded Bar Yohay that the US and European regulators are open to approving the airworthiness of small electric aircraft. Last December, the US Federal Aviation Administration approved a rewritten Part 23 rule. The new regulation replaces original language prescribing the use of only petrol engines with a standard open to any propulsion technology.

But some details about how the rewritten rule will be interpreted by the FAA's regulatory officials are not yet clear. Perhaps the biggest

question mark surrounds the certification of the propulsion system. In the USA, kerosene- and avgas-fuelled aircraft require an engine that has been independently certificated under FAR Part 33 rules. It is not clear whether or even how a hybrid- or electric-powered aircraft would comply with Part 33 standards. Bar Yohay is optimistic that the FAA will apply the most lenient approach, allowing Eviation to certificate the aircraft and electric propulsion system together under Part 23, avoiding the need to qualify the engine under Part 33.

"Technically, [the Part 23 rewrite] allows us to certificate the motors as part of the type certification of the aircraft and not specifically [the propulsion system], so in theory we could do it – just certificate the whole thing, and not have the specific certification of the motors," Bar Yohay says.

"We get a lot of speed for the thrust we are using. Not many 300hp aircraft can do 240kt"

Omer Bar Yohay

Co-founder and chief executive, Eviation Aircraft

Bar Yohay's assumptions are perhaps too optimistic for the regulatory community, though. The FAA has allowed only light-sport aircraft to enter service without engines that were certificated independently under Part 33, but such aircraft face severe weight and operating restrictions, including a prohibition on instrument flight rules flight.

Without such an approval, the Eviation Alice faces an uncertain path to regulatory approval by 2021.

The Alice design features three electric motors powered by a bank of 30,000 Panasonic lithium-ion battery cells. To use the most ma-

ture technology, the initial Alice aircraft intends to rely on batteries and motors developed and proven in the automotive industry. Indeed, the Alice propulsion system resembles the electric configuration of a Tesla sedan, but with about 10 times the electric power, Bar Yohay says. Eviation currently plans to use motors developed by UK-based Yasa motors, but is also interested in technology developed by Siemens. Both are primarily automotive suppliers with little experience of the aviation industry's regulations.

AVIATION REGULATION

"I'm not sure the companies will go through the process of certificating their own motors," Bar Yohay says. "So it's either I take some of the load from them or I just go through with my type certification and have this approved for my specific motor inside. So it will be interesting to see how this plays out."

Indeed, accommodating electric propulsion in small aircraft means aviation regulators will likely encounter a supply chain and a technology dominated by a rapidly growing list of applications in the automotive industry. Compared with gasoline engines, electric motors are far less complex, making them easier to maintain.

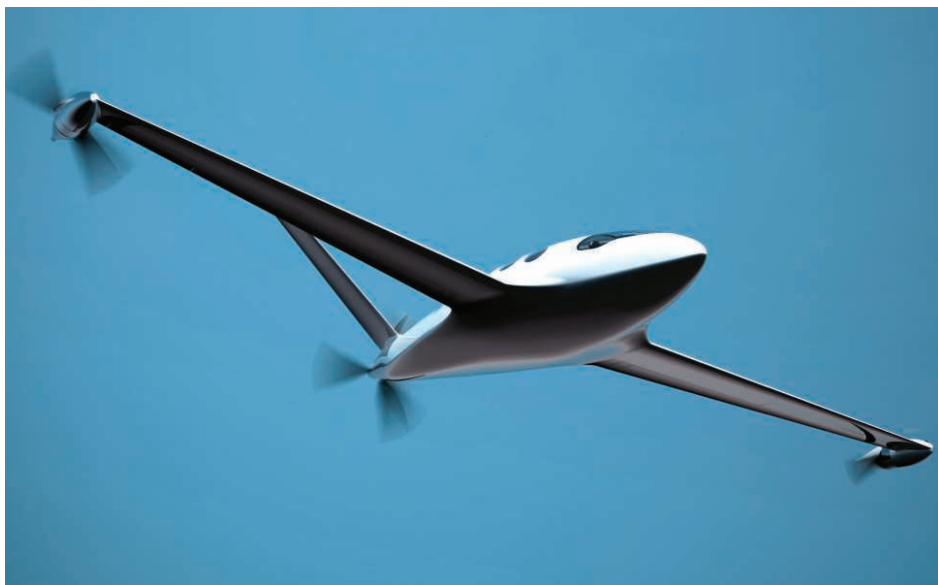
"There's one moving part. It's very simple," Bar Yohay says. "So will the [aviation] industry make us go through the process of certificating motors separately? I seriously doubt it. I think it would be a mistake for electric, because you're going to have a lot of different motors. It's not going to be [like the general aviation industry, where] everybody uses a Rotax or whatever."

There may be another path forward to certificating electric motors for the aviation industry, according to Bar Yohay. Instead of relying on automotive technology, the Alice and other electric-powered aircraft could use technology that has already qualified for use in aviation.

The industry's engine suppliers already produce electric motors used to power on-board systems. In the case of the A350 and 787, the industry has adopted highly advanced electric power and distribution systems, replacing pneumatic and hydraulic power to activate landing gear, de-icing and cabin pressurisation. Leveraging that technology as propulsion systems for smaller aircraft may help regulators as electric motors make the transition.

"One of the approaches that could be looked at is that companies like Honeywell and GE and Rolls-Royce can take their existing generators and say this is aviation standard anyway and use them moving forward," he says.

Although the path to certification could still be tricky, the Alice was designed to mini-



Alice has two motors on its wing and a third mounted aft, promising impressive speed



Eviation Aircraft

Originally built to mature the Alice configuration, Orca has found a niche in the UAV market

mise questions from sceptical regulators. A future version of the aircraft powered by co-founder Tzidon's metal-air batteries would offer significantly better performance, but Eviation is focused on taking a practical route to certification within five years.

The Orca proof-of-concept drone offers a case in point. The scaled-down copy of the Alice was designed simply to mature the aerodynamic and electric power configuration of the Alice, but Eviation has found a market niche for the speedy little aircraft as a commercial-rated UAV.

"After we built it and started flying it a lot of the drone operators of the world – especially seeing us as an Israeli company – said: 'Hey, can you sell us a drone?' So it got a name. We saw it as a model. The world saw it as a UAV, so why not?" Bar Yohay says.

Equipped with a synthetic aperture radar, the Orca now flies missions for Israeli national water company Mekorot.

Meanwhile, the design of the first full-scale Alice test aircraft is nearing completion of a critical design review. Two suppliers, including Israel-based FBM Composite Materials, are fabricating the aircraft's structure. Eviation is concentrating on integrating the propulsion system. A still-undisclosed risk-sharing partner in Italy is expected to join the certification campaign, which will be conducted in Italy and Israel. First flight of the Alice version with lithium-ion batteries is scheduled in mid- to late-2018, followed by certification two years later and entry into service in 2021.

The batteries under consideration are Panasonic 18650s, the standard lithium-ion cells used by the automotive industry, including Tesla. "We want to get [a battery] that can be built repeatedly with the kind of supply

chain management that can go to market within the next two to three years, not the next five to 10," Bar Yohay says. "It's extremely difficult to do anyway, so we don't want any uncertainties in the battery."

BATTERY POWER

The lithium-ion version of the Alice aircraft still boasts solid performance. Flying below 10,000ft, the unpressurised aircraft should be capable of a range of 520nm (963km) plus a standard power reserve. With two wingtip thrusters and an aft-mounted thruster, the streamlined, all-composite aircraft should offer impressive speed.

"We get a lot of speed for the thrust we are using," Bar Yohay says. "240kt [445km/h]

we achieve at roughly 250, maybe 260kW. Think about it: Not many 300hp aircraft can do 240kt."

Ultimately, Eviation hopes to move beyond lithium-ion as a fuel source – and it has the inside track on a coveted new breakthrough in battery power. In 2008, Eviation co-founder Tzidon received a patent for a new aluminium-air fuel cell, which offers almost double the energy density of lithium-ion batteries. Tzidon launched an Israeli-based start-up called Phinergy, which last year closed a \$50 million round of financing led by aluminium giant Arconic.

Phinergy's aluminium-air fuel cell consists of the lightweight metal as the anode, which reacts with an oxidiser cathode to produce energy. Tzidon's patent suggests he has overcome two drawbacks of metal-air fuel cells. Phinergy solves the problem of supplying the oxidiser by harvesting the gas from the ambient air, making the fuel cell inhale oxygen like a fish in water, instead of a scuba diver. It is also designed to prevent carbon dioxide from entering the cathode, which has led to metal-air battery failures in the past.

When powered by the Phinergy fuel cell, the Alice-Extended Range (ER) will be pressurised and fly at 270kt at 30,000ft for 850nm, plus a reserve, Bar Yohay says.

"I believe that in the seven- to 10-year time-frame we will see it integrated into our airframes after the certification basis becomes more clear," Bar Yohay says. "At the moment it doesn't make sense to sort of link the two risks until they plan on doing a new battery system. But we are the owners of the [intellectual property] for that and we work very hard to do this integration." ■



Tesla

Eviation may build Alice with automotive-standard Panasonic batteries, as used by Tesla

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Swiss bids sad adieu to Avros

Swiss – arguably the highest-profile operator of the BAE Systems Avro RJ100 – has been withdrawing the last of its 20-strong fleet of the stocky quadjets, which have been in service since the mid-1990s.

In its blog – <https://blog.swiss.com> – the airline details the “emotional phase-out” of the Jumbolino with the description of a ferry flight from Zurich to Cranfield in early May to return HB-IYQ to its lessor.

Much as we love Hatfield’s high-winged Whisperjet – which, lest we forget, is the UK’s most successful airliner – it is the perfect chance to revisit the best BAe 146/RJ jokes such as: Why does it have four engines? Because they couldn’t fit six/Two to get you there; two to get you home. Or: the 146: the only aircraft with five APUs.

Pratt-fall

One corner of Pratt & Whitney’s website may need an overhaul. The top item on the “Looking ahead” section is the PW1200G-powered Mitsubishi Regional Jet, which a caption proclaims “enters service” in 2017.

In January, Mitsubishi confirmed a two-year delay to the programme, the fifth since its 2008 launch. The first MRJ90 will now be delivered to All Nippon Airways in mid-2020, from a former goal of mid-2018.



“If I eat my greens, maybe I’ll grow up to be an A380.”
[One of India Yankee Quebec’s last sorties in Swiss colours]

Eagle-eyed

Boeing posted a most apt image on Twitter on 4 July (*right*), noting: “This bald eagle stopped by for a freedom inspection on a US Navy P-8 at Boeing Seattle. Passed with flying colours.”



I’m on your tail, Boeing

Lack of luxury

On its website, Bering Air has a fascinating account of how it pioneered public flights, three decades ago, between Alaska and the then-Soviet Union’s far-east Chukotka region.

Although just a short hop across the Bering Straits, transporting US citizens into what was then – and still is – a “closed” part of Russia involved stifling levels of bureaucracy.

Despite that, since launching in May 1988, Bering’s service

has proved popular with both tourists and locals visiting extended family.

However, the website cautions that trips to the port of Providniya can still be a challenge for those used to a bit of comfort in their lives.

“Warning: This is not a luxury trip,” is the tell-it-like-it-is advice. “There are limited shopping opportunities, public restaurants and services or entertainments in the forms that you may be used to. There are no facilities for the physically challenged. Every building has long flights of cement stairs.”

Chem off it!

God save Her Majesty’s Press. After someone posted a video of dramatic contrails from an aircraft over Russia, one of the UK’s biggest tabloids ran this headline on its web site. Perfect for the tin-foil-hat theorists who suspect vapour trails are in fact mind-control chemicals.

Better than US

The machines we and the French are using are far more suitable for their purposes than anything that has been evolved in America.

America must be content to build to our designs and take full advantage of our experience in the war.

Blown to pieces

American heavy bombers have joined our Wellingtons in attacks on the ports of Tobruk and Benghazi.

One crew scored a hit on a supply ship in the harbour. Explosion followed explosion, and large pieces of the ship were seen to be flying through the air.

Prepared to pay

Mr James Scarlett, route licensing manager of BEA, told the Board that when BEA began 20 years ago, fares were

beneath the economic level to encourage people to fly. “We have now reached the stage where air travel is a part of everyday life. Passengers, in our view, are prepared to pay the economic level.”

Virgin territory

Virgin Atlantic could buy up to eight new Boeing 777s,

says the airline’s chairman, Richard Branson. “I wish to fly to

the 12 major cities in the world and not get any bigger... get any bigger and you lose the magic of being small,” he says.

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It’s a contrail-spiracy



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No surprise that they subsidise

Regarding your article "Trade row over CSeries threatens Super Hornet buy" (*Flight International*, 30 May-5 June): given its size, why is Boeing getting so worked up because Bombardier is getting some help from the Canadian government?

I expect it is because its monopoly has been rocked by a smaller company, and it is losing face. Considering how many commercial aircraft builders there are in our very turbulent world, it is interesting to see that there is still enough pie to go around – particularly given Airbus and Boeing's dominance of this market.

What is clear is this. They all need to get their act together, stop bickering amongst themselves and stop running off to their respective governments for a taxpayer-funded hand-out when they run into difficulties.

Likewise, governments should think very carefully before using public money to support these aircraft programmes.

Stephen Ryder
Cambridge, UK

PROTEST

Cost complaint fell on deaf ears

After you published my letter "Boeing has questions to answer" (*Flight International*, 14-20 February) concerning the overrun of development costs by Boeing on the KC-46A tanker, you received two letters from Americans supporting the USAF and Boeing, which was to be expected.

Since then, the delays and the cost overruns have continued. I appear to be the only person to think that these substantial sums of money are an illegal subsidy. I have therefore raised a formal complaint to the World Trade Organisation.

Guess what? They haven't replied. It appears a person does not have any clout with them. Any suggestions?

J McDermott
Almeley, Hereford, UK



US Air Force

Pegasus tanker faces delays and overruns

Time to look at turnarounds

In his letter "A turn for the better?" (*Flight International*, 27 June-3 July), John Davies suggests a turnaround time of 75min for the 737 Max 8.

Hmmm. At EasyJet we used to do 30min turnarounds for the 737-700, reducing to 20min on the shorter routes. That is possible, if a few corners are cut.

But it would have been nice to have a little more input and push-back by the UK CAA, on the subject of minimum turnarounds.

Rod Elliot
via email

Unfair criticism

With reference to Alan Curry's letter "A proofreading oversight?" (*Flight International*, 20-26 June): he is mistaken in his

criticism of the FAA's use of the word oversight in his letter, and your editor owes him no apology.

The word can have both meanings – as they have been defined in the *Oxford English Dictionary* for at least the last 25 years. An oversight on Alan Curry's part, perhaps?

Malcolm Bowden
via email

Modification miscalculation

In your article "Weight-neutral improvements will avoid range penalty" (*Flight International*, 27 June-3 July), the author states that the wing "...will undergo a camber modification, increasing the height by 3cm (11.8in)..." There seems to be an error with your conversion.

Rod Holdridge

Haywards Heath, Sussex, UK

Editor's reply: Well spotted; the latter figure should be 1.18in.

Nothing new

I happened on the image of a suggested future aircraft offering from Boeing, called the Sugar (subsonic ultra green aircraft research) Volt. It immediately brought back recollections of an aircraft I used to encounter regularly in the skies over France, more years ago that I like to count.

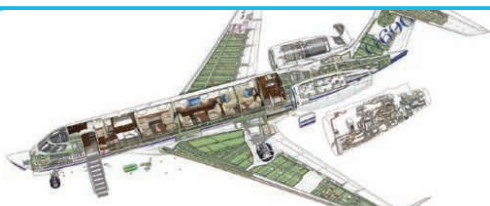
The Boeing offering bears a resemblance to the Hurel-Dubois HD.34, which was at the time operated by the French geographical service because of its unique (for an aircraft that size) low-speed handling. Sometimes there really is nothing new under the sun.

Richard Chandless
Crêches-sur-Saône, France



Boeing's Sugar Volt concept is reminiscent of past designs

Boeing



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Registered at the Post Office as a newspaper.
Published by Reed Business Information Ltd,
Quadrant House, The Quadrant, Sutton, Surrey SM2
5AS, UK. Tel: +44 20 8652 3500.

Newstrade distributed by Marketforce (UK), 2nd
Floor, 5 Churchill Place, Canary Wharf, London, E14
5HU, UK. Tel: +44 20 3877 9001.

Classified advertising prepress by CCM. Printed in
Great Britain by William Gibbons and Sons Ltd

Flight International published weekly 49 issues per
year. Periodicals postage paid at Rahway, NJ.
Postmaster send changes to Reed Business
Information, c/o Mercury International Ltd, 365 Blair
Road, Avenel, NJ 07001

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OVERALL ROLE DEFINITION

The position of Aviation Manager requires management of all aspects of Air Adelphi Limited (AA) including work in collaboration with the AOC holder and the Regulatory Authority to ensure that all operations are in strict legal compliance and are effectively and safely discharged.

The successful candidate will:

- Report to Managing Director and Directors of Air Adelphi Limited (AA)
- Formulate strategic direction and timeframes for AA.
- Develop policy for AA.
- Exercise duty of care and corporate responsibility on behalf of AA.

Main Role and Accountability

- Oversee the operation of the Air Operators Certificate (AOC).
- Oversee the operation of the Approved Maintenance Organization (AMO).
- Contribute to the maintenance of Safety Standards required by regulation.
- Ensure the Safety Management system is implemented.
- Oversee the regulatory Inspection System and the flight safety programme
- Oversee the Accident Prevention Programme.
- Maintain any additional standards required by AOC holder or AA
- Ensure all operations and maintenance systems are properly financed and carried out to the required standard.
- Liaise regularly with the Eastern Caribbean Civil Aviation Authority (ECCAA).
- Collaborate with AOC holder and those with statutory positions within that organization to achieve maximum safety standards, operational effectiveness and productivity.
- Liaise regularly with AOC holder's staff and Mustique Company staff engaged in wider aviation responsibilities e.g. Operations, Scheduling, Airport, Ground, Reservations, Villa Services, Promotion and Marketing.
- Manage and protect AA Company assets i.e. Aircraft and Equipment.
- Develop the commercial direction of Air Adelphi.

EXPERIENCE

A minimum of 5 years of professional experience as an aviation specialist, aircraft pilot, air traffic controller, certified flight instructor, airport manager, aviation consultant or professional experience equivalent to aviation safety, training, education, inspection or airport planning.

Applications with two references should be sent by July 30, 2017 to The Human Resources Manager, The Mustique Company Ltd, St Vincent and the Grenadines;

ccharles@mustique.vc or fax 784 488 8713.



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Senior Operations Officer (Senior Operations Inspector)

Salary: Master Pay Scale Point 45 (HK\$105,880 approximately US\$13,574*per month) to Master Pay Scale Point 49 (HK\$121,985 approximately US\$15,639* per month) (See Note 1)

(*Based on exchange rate of HK\$7.8 = US\$1) (subject to fluctuation)

Entry Requirements: Candidates should have (a) (i) a current Airline Transport Pilot's Licence (ATPL) (Aeroplane) with a current Class One Medical Certificate (See Note 2) and eight years' relevant post-licence experience and at least 5,000 hours of commercial transport flying experience of which a minimum of 3,000 hours should be on civil transport multi-engine aeroplanes; **OR** (ii) an International Civil Aviation Organization contracting state's Commercial Pilot's Licence (CPL) (Aeroplane) with Multi-engine Instrument Rating; and a minimum of seven years' post-licence experience in civil aviation management and operations or as a regulator; and have passed the ATPL examinations; **AND** (b) strong command of written and spoken English.

Notes:

- (1) Subject to the prevailing situation, candidates with additional experience may be granted increments for previous relevant experience in the civil aviation field in excess of the stipulated minimum. Please note that applications from the serving civil service Senior Operations Officers (Senior Operations Inspector) in the Civil Aviation Department would not normally be considered.
- (2) Applicants who do not have a current Class One Medical Certificate may also apply; if selected, appointment will be subject to their obtaining of the requisite Class One Medical Certificate.
- (3) For the purpose of heightening public awareness of the Basic Law (BL) and promoting a culture of learning of BL in the community, applicants for civil service jobs will be assessed on their BL knowledge. The BL test result will constitute an appropriate weighting in a candidate's overall assessment.
- (4) Candidates should submit their application forms together with an **Experience Resume** by mail to the enquiry address on or before the closing date for application. The Experience Resume can be downloaded from the Civil Aviation Department's website.
(<http://www.cad.gov.hk/english/recruitment.html>)

Duties: A Senior Operations Officer (Senior Operations Inspector) is mainly deployed on flight operations matters including – (a) conducting station facilities, ramp and base inspections, and other safety oversight inspections of the Air Operator's Certificates (AOC) holders to ensure that the operator's documentation with respect to operations and training manuals, and all other instructions to operating staff are in compliance with the established policies and standards; (b) observing professional pilot training, monitoring standards and ensuring that the training is carried out in accordance with all relevant legislation; (c) examining persons for appointment as authorized examiners for the grant of Private Pilot Licence and handling matters on Flying Training Organization and ground training courses; (d) investigation of aircraft accidents and incidents; and (e) assisting in the formulation of policies and requirements on flight standards and operations matters. (Notes: Post holders are required to travel extensively on duty and work irregular hours.)

Terms of Appointment: A new recruit will normally be appointed on civil service agreement terms for three years. A gratuity may be granted upon satisfactory completion of the contract with consistently high standard of performance and conduct. The amount of gratuity payable will be the sum which, when added to the Government's contribution to the Mandatory Provident Fund Schemes, equals to 15% of the total basic salary drawn during the contract period. He/she will be required to serve on agreement terms for at least 3 years before they can be considered for appointment on the prevailing permanent terms.

Enquiry Address and Tel. No: For enquiry or request for an application form, please write to the Administration Division, Civil Aviation Department, Level 5, Office Building, Civil Aviation Department Headquarters, 1 Tung Fai Road, Hong Kong International Airport, Lantau, Hong Kong S.A.R., People's Republic of China. (Fax.: (852) 2910 6399) or e-mail to <recruitment@cad.gov.hk>, quoting reference "CAD ADMD PR/5-25/62 (2017)".

Closing Date of Application: 4 August 2017

General Notes:

- (a) Persons who are not permanent residents of the Hong Kong Special Administrative Region (HKSAR) may also apply for this vacancy but will be appointed only when no suitable and qualified candidates who are permanent residents of the HKSAR are available.
- (b) As an Equal Opportunities Employer, the Government is committed to eliminating discrimination in employment. The vacancy advertised is open to all applicants meeting the basic entry requirement irrespective of their disability, sex, marital status, pregnancy, age, family status, sexual orientation and race.
- (c) Civil service vacancies are posts on the civil service establishment. Candidates selected for these vacancies will be appointed on civil service terms of appointment and conditions of service and will become civil servants on appointment.
- (d) The entry pay, terms of appointment and conditions of service to be offered are subject to the provisions prevailing at the time the offer of appointment is made.
- (e) The information on the maximum pay point is for reference only and may be subject to changes.
- (f) Fringe benefits include paid leave, medical and dental benefits, and where appropriate, assistance in housing.
- (g) Where a large number of candidates meet the specified entry requirements, the recruiting department may devise shortlisting criteria to select the better qualified candidates for further processing. In these circumstances, only shortlisted candidates will be invited to attend recruitment examination and/or interview.
- (h) It is Government policy to place people with a disability in appropriate jobs wherever possible. If a disabled candidate meets the entry requirements, he/she will be invited to attend the selection interview/written examination without being subject to further shortlisting.
- (i) Holders of academic qualifications other than those obtained from Hong Kong institutions/Hong Kong Examinations and Assessment Authority may also apply but their qualifications will be subject to assessments on equivalence with the required entry qualifications. They should submit copies of their official transcripts and certificates by mail to the above enquiry address.
- (j) Civil service vacancies information contained in this column is also available on the GovHK on the Internet at <http://www.gov.hk>.
- (k) Towards the application deadline, our on-line system would likely be overloaded due to large volume of applications. To ensure timely completion of your on-line application, it is advisable to submit the application as early as possible.

How To Apply: Application Forms [G.F. 340 (Rev. 3/2013)] can be downloaded from the Civil Service Bureau's website (<http://www.csb.gov.hk>). **Candidates must state clearly the details of professional qualification obtained on the application forms and attach the Experience Resumes.** (See Note 4) Completed forms, together with the Experience Resumes, should reach the above enquiry address of the recruiting department on or before the closing date for application. Please specify the title of the post being applied for on the envelope. Online application can also be made through the Civil Service Bureau's website (<http://www.csb.gov.hk>). Candidates who apply online should submit the **Experience Resumes within one week after close of application period** to the above enquiry address, and the online application number should be quoted on the envelopes and the Experience Resumes. **If candidates fail to provide the Experience Resumes as requested by the deadline, their applications may not be considered.** Applicants should ensure that the correct address is clearly printed or written on the envelope and sufficient postage is affixed before posting so as to avoid unsuccessful delivery of application. Any underpaid mail items will be returned or disposed of by the Hongkong Post. Applicants are encouraged to provide their email addresses on the application forms. Candidates who are selected for interview will normally receive an invitation (by email or by post) in about six to eight weeks from the closing date for application. Those who are not invited for interview may assume that their applications are unsuccessful. For enquiries, please contact the department via the means stated above.



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Born and raised in “the air capital of the world”, Christi Tannahill has spent her career in the aerospace industry. Today she works for Textron Aviation as senior vice-president interior design and engineering

Have you always been interested in aviation?

Growing up in Wichita, Kansas – the air capital of the world – I guess you could say I have always had aviation in my blood. My first job out of college was in aviation and every job thereafter. It is just such an exciting industry – connecting the world through flight.

Tell us about your career to date

The majority of my career has been centred on customer service and support. I started out managing Delta Air Lines’ customer support division, based in Wichita, and then moved to Koch Industries, also in Wichita, to lead the quality department for its aviation division. In 1999, I joined Raytheon Aircraft – which was the owner of the Hawker and Beechcraft business aircraft families – as director of the global parts organisation. During my career at the company, I took on additional roles and responsibilities in the service organisation and eventually became the senior vice-president of global customer service and support. Before moving into my current role at Textron Aviation, I served as senior vice-president of turboprop aircraft and interior design, where I was responsible for the development of our popular turboprop platforms and led the interior design team.

What are your current duties?

I’m responsible for the interior design and engineering for all of Textron Aviation’s broad product line-up. My previous experience



Tannahill says future cabins must be able to accept new technology

in customer support lets me see things from a customer point of view. I don’t have an engineering background, so I really challenge my team to think outside of the box and find ways we can incorporate customer input in everything we do. That’s how we are developing our new large-cabin [Cessna] Citation Hemisphere jet. We continue to engage regularly with our customer advisory board, which is comprised of industry executives operating various products in this class, to affirm what customers need in this segment. This input is a key influence as we continue to develop this world-class aircraft.

How is the business and general aviation sector faring today?

We are seeing excellent results with our new Citation Latitude, which has become one of the world’s best-selling business jets since entering the market in August 2015. It is now the leader in the midsize segment, with more deliveries in 2016 than any other aircraft in its category. This is encouraging and reflects the growth that we’re seeing across many of our product segments. We remain focused on investing in our products to help invigorate the business aviation sector.

Describe your typical day

No two days are ever really the

same for me, but the majority of my days are centred around our customers – that is, whether I am sitting in a design session and helping them to spec their aircraft, collaborating with our customer advisory boards, or working with my talented team to bring the next-generation of cabin technology and features to our customers.

What do you enjoy most about your job?

I really enjoy building strong relationships with our customers and incorporating their feedback in our class-leading aircraft. It is amazing when I see how excited our customers get when taking delivery of an aircraft that they helped design.

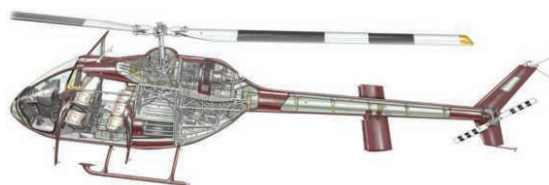
What are the challenges?

The challenge is really just trying to make sure we are keeping up to date with the latest technologies that are ever-evolving, while working with the regulatory authorities to ensure we can bring these new features to our customers in a timely manner. As we are designing the cabins of our future aircraft, we have to ensure they have the flexibility to accommodate a variety of technologies to stay state-of-the-art. ■



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