



DREAM CHASER
SIERRA NEVADA IS
STILL AIMING HIGH
WITH MINI SHUTTLE
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FLIGHT

INTERNATIONAL

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INVESTIGATION

PICKING UP THE PIECES

Dutch report confirms Buk missile
downed MH17, but gaps remain



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COVER IMAGE

Wreckage from Malaysia Airlines flight MH17 was brought together at the Netherlands' Gilze-Rijen air base to support the work of Dutch investigators P10



BEHIND THE HEADLINES

James Drew (left) joined up with **Stephen Trimble (right)** for the **US Army's** annual gathering at the **AUSA** event in **Washington DC (P16)**. And **Dominic Perry** was in **Turin**, for an update on the **Italian air force's** future **maritime patrol aircraft (P19)**



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IMAGE OF THE WEEK

A Grumman C-2A Greyhound assigned to the US Navy's 40th fleet support squadron lands on the aircraft carrier USS Harry S Truman during training ahead of the vessel's operational deployment. The USN intends to eventually replace its 35-strong Greyhound fleet with Bell Boeing V-22 Osprey tiltrotors

View more great aviation shots online and in our weekly tablet edition:



US Navy

THE WEEK IN NUMBERS

55%

Avolon Capital Partners

Premium on lessor Avolon's shares since its 2014 IPO; an agreed sale to Bohai Leasing values company at \$7.6bn

£2.7m

EasyJet

EasyJet's investment in a new training centre at London's Gatwick airport. It is recruiting 1,100 pilots and cabin crew

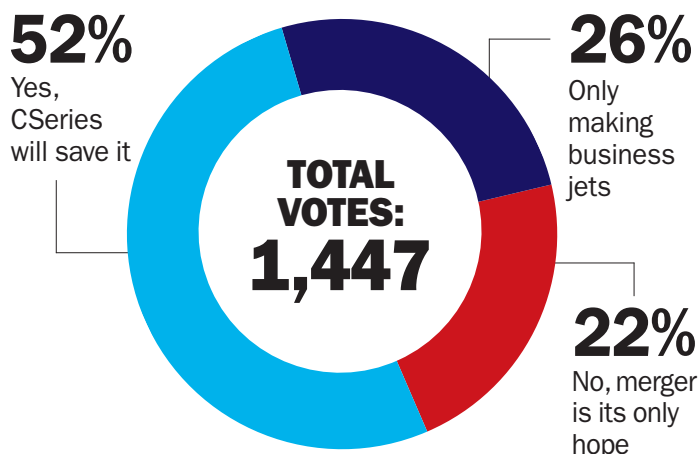
35m

Flightglobal dashboard

Total number of passengers expected this year at Doha's new Hamad International airport – half the 2020 forecast

QUESTION OF THE WEEK

Last week, we asked: **Will Bombardier Aerospace survive on its own?** You said:



This week, we ask: **Has airline safety improved using lessons from MH17 loss?**

- ☐ Yes, carriers have better threat awareness
- ☐ No, aircraft still at risk over conflict zones
- ☐ Technology needed for self-protection

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And justice for all?

Formal confirmation that Malaysia Airlines flight MH17 was downed by surface-to-air missile may comfort some, but Moscow's intransigence leaves little hope of finding those to blame

The long-awaited Dutch Safety Board investigation into the July 2014 crash of Malaysia Airlines flight MH17 in eastern Ukraine makes for sombre reading.

The Dutch investigators concluded, of course, that the Boeing 777-200 was shot down by a surface-to-air missile, and specifically by the warhead of a weapon fired from a launcher of the Buk M1-2 missile system in separatist-controlled territory.

There could hardly have been any doubt before the report was released about the role that the Buk system played in the crash, as a multi-national joint-investigation team conducting a criminal investigation had already established the raw facts.

Earlier this year, the team released a video of their evidence – obviously drawn from intelligence sources – showing shaky mobile phone footage of a Buk system in the area where MH17 crashed. Audio clips of intercepted calls between Ukrainian rebels confirmed the

The Russian action leaves the joint investigation team with few options to seek justice

threat's presence, along with a frantic effort to shuttle the vehicle across the Russian border hours after the Malaysian airliner crashed.

The release of the safety investigation report now turns the international focus to the criminal inquiry. The joint investigation team is expected to release the final criminal investigation report in mid-February 2016.

Ideally, a criminal investigation should go beyond identifying the weapon system involved. It should also assign specific blame to an individual or group who committed the crime, along with those who helped.



Fuselage reconstruction yielded many clues

Unfortunately, this seems impossible in the case of the MH17 inquiry. The Russian government vetoed a UN resolution last July that would have set up an international tribunal. The terms of the UN charter would have compelled Russian authorities to co-operate with such a court, turning over any evidence or documents identifying individuals responsible for the disaster.

That action leaves the joint investigation team with few options in order to seek justice. In theory, the team could pursue charges through the International Criminal Court or via a commission of nations with passengers on board MH17 – which includes Malaysia, the Netherlands, Australia, the UK and others.

But unlike in the case of a UN-sponsored tribunal, Russian authorities would have no legal obligation to participate or cooperate in such a process.

The MH17 safety report reliably explains what happened to the aircraft and its 298 passengers and crew. Barring a change at the top of the Russian government, we may never know specifically who did it – or why. ■

See This Week P6, News Focus P10

Back to the future

When the US Army exited the Vietnam War, there was a vision for its aviation branch. A breakthrough, high-speed helicopter – Lockheed's AH-56 Cheyenne – was already cancelled, but the seeds of a comprehensive modernisation strategy had already taken root. Within a decade, it fielded the Sikorsky UH-60 and Boeing AH-64 helicopters.

While conventional in terms of speed and hovering performance, both types remain relevant among their peers almost 40 years later.

Army aviation is now at a similar crossroads. After winding down operations in Afghanistan and Iraq, it has a vision for a family of Future Vertical Lift rotorcraft with breakthrough speed and survivability. It also faces a

huge bill to modernise the Black Hawk and Apache in order to keep them effective on an increasingly lethal battlefield for relatively low-flying and slow helicopters.

But keeping this two-pronged strategy on track will cost more than the army can afford, and at some point it will have to make a choice: either sacrifice near-term readiness or delay future capability.

The defence industry claims otherwise, pointing to a new crop of demonstrators in the Bell Helicopter V-280 Valor, Boeing-Sikorsky S-97 Raider and Sikorsky/Boeing SB-1 Defiant. Except for niche roles, however, these platforms must be scaled up with new engines if they are to replace the AH-64 and UH-60. ■

See Show Report P16



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BRIEFING

HOGAN RULES OUT ETIHAD ORDER SPREE AT DUBAI

FLEET Etihad chief executive James Hogan has ruled out placing any aircraft orders at next month's Dubai air show, but says the carrier will announce some engineering packages at the event. The airline placed major orders at the show two years ago, including substantial deals for the Boeing 777X and 787-10, and the Airbus A350. "We are not signing for any aircraft at the air show," says Hogan.

THIRD-QUARTER DELIVERIES RISE AT EMBRAER

MANUFACTURING Embraer delivered 51 aircraft during the third quarter ended 31 September. Of these, 21 – the vast majority E175s – went to the commercial segment, with the rest going to the business aviation market. The total is a 50% increase on the same period last year, when a combined 34 aircraft were handed over. So far this year, the Brazilian airframer has delivered 68 regional jets and 75 business aircraft, for a total of 143 units.

EASA APPROVES ATR 72-600 COMBI VARIANT

PROGRAMME ATR has received European Aviation Safety Agency certification for the passenger-cargo combi version of the ATR 72-600. First delivery to launch customer Airlines PNG of Papua New Guinea, which ordered eight at June's Paris air show, will take place by early November. ATR says the new cabin configuration, which is also retrofitable to existing aircraft, gives capacity for cargo weighing nearly 3t. The 44-passenger turboprop is equipped with four 2.16m³ containers after the removal of its forward seven seat rows.

BLACKJACK PAYLOAD SELECTION IS NO GAMBLE

SENSORS Logos Technologies will develop an advanced sensor suite for the Boeing Insitu RQ-21 Blackjack unmanned air system under an \$18.2 million contract awarded by the US Office of Naval Research. The Virginia-based contractor must develop and integrate four different sensors, including an infrared hyperspectral imager, into a package weighing less than 17.8kg (39lb) by March 2020.

EVA AIR DREAMS BIG WITH 787-10 ORDER PLAN

AIRLINES Taiwan's Eva Air plans to purchase up to 24 Boeing 787-10s and two additional 777-300ERs, in a deal worth more than \$8 billion at list prices. "We look forward to welcoming EVA Airways as Boeing's newest member of the 787-10 Dreamliner launch customer group," says Boeing Commercial Airplanes chief executive Ray Conner. The Taiwanese carrier had also been evaluating the Airbus A350-900 for its medium- to long-haul requirements.

ITALY TAKES DELIVERY OF 250TH NH90

ROTORCRAFT Three-way consortium NH Industries has delivered the 250th NH90 helicopter, with the milestone rotorcraft a TTH troop transport variant for the Italian army's special forces aviation branch. Rome's armed forces already operate a fleet of 30 TTHs and 17 naval NFHs, from orders for 59 and 46 respectively.

WING DELIVERY FOR FIRST SPANISH A400M

PRODUCTION Madrid's first of a contracted 27 A400M tactical transports is on track for delivery to the Spanish air force by mid-2016, says Airbus Defence & Space. The wings for lead example MSN44 were recently delivered to the manufacturer's San Pablo final assembly line in Seville using an A300-600ST Beluga transport. The completed aircraft will be handed over to the Spanish customer in the second quarter of next year, Airbus says.



The 777 was downed days after an An-26 had been hit at 21,300ft

INQUIRY DAVID KAMINSKI-MORROW LONDON

Restriction belied risk to civil flights

Multiple carriers flew over area in run-up to shootdown, with aircraft at high altitudes presumed safe, say investigators

Investigators have disclosed that, in the three days before Malaysia Airlines flight MH17 was shot down, 61 carriers flew through the same sensitive region of airspace.

The three-day period followed the introduction of altitude restrictions on 14 July 2014, ordering civil aircraft to operate above 32,000ft in eastern Ukraine.

On the same date, a military Antonov An-26 had been downed from a height of 6,500m (21,300ft) – indicating an attack by a sophisticated weapon. But Ukrainian authorities told the Dutch Safety Board that this attack, while accelerating the closure, had not triggered it.

Despite the An-26 attack and the tighter restrictions there was "no noticeable change" in air traffic behaviour, says the Dutch Safety Board in its inquiry into the loss of MH17.

Over the three days between the altitude limitation and the destruction of the Boeing 777 on 17 July, it says, 61 operators from 32 countries – including Russia and Ukraine – flew over the area.

Investigators have disclosed that 160 flights operated through the critical area of the Dnipropetrovsk flight informa-

tion region on the day of the shootdown.

The airspace had not been closed above 32,000ft and MH17, operating at 33,000ft, was not subject to any restrictions.

"Ukraine had sufficient reason to close the entire airspace over the eastern part of Ukraine as a precaution," the inquiry says.

However, Ukrainian air traffic service UksATSE told the inquiry that the airspace could only be closed if there had been an official request from competent authorities or if there was information relating to a risk to civil aviation.

"Neither of these scenarios applied," says the inquiry, pointing out that the Ukrainian authorities believed there were "no grounds" to suspect a threat to civil aircraft above 26,000ft, taking into account an additional buffer which set the limit at 32,000ft.

Attacks on civil aircraft were "not considered as a realistic scenario" by military authorities, the inquiry says, partly because they believed armed groups in the region possessed shoulder-launched weapons with a maximum altitude range of 4,500m. ■

See News Focus P10



C-Series holds no appeal for Embraer
THIS WEEK P8

DERIVATIVE DAVID KAMINSKI-MORROW LONDON

Extending A350-900 range may be easy win for Airbus

Airframer outlines minor changes needed for long-distance variant as SIA eyes 19h flights

Airbus expects to make only minor modifications to the A350-900's fuel system in order to develop the longer-range version launched by Singapore Airlines.

The airframer's formal A350 characteristics document, for airport planning, gives the usable fuel capacity of the -900 as 138,000l.

But Airbus's disclosure on the longer-range version puts this baseline capacity at 141,000l.

Modification for the new variant, designated the -900ULR, will increase this to 165,000l.

Airbus says that developing the -900ULR will involve "some very localised" reinforcement of the -900 structure.

But the main changes will centre on adapting fuel system computers to increase the accessible capacity of the -900's existing fuel tanks.

Airbus states that it will also amend air-venting and inert-gas distribution pipes in the wing. The overall change will enable the fuel volume to rise by some 25,000l.

Some modifications will also be made to the aircraft's aerodynamic performance, although Air-



Singapore Airlines' first of 67 examples has now received its livery

bus has yet to unveil details. Maximum take-off weight will also rise, to 280t.

Neither Singapore Airlines nor Airbus has disclosed the number of seats with which the -900ULR will be configured.

"Those details will only be announced closer to the start of service," says the airline.

It is planning to use the type on long-haul non-stop routes from Singapore to New York and Los Angeles after delivery in 2018.

SIA had previously used Airbus A340-500s with a reduced seat-count for non-stop US flights. It

operated the type with a 181-seat configuration – including 64 in the business-class cabin – around 60% of the A340-500's typical capacity.

A similar reduction of the A350's standard accommodation would give it some 180 seats.

SIA converted its A340-500s in 2008 to carry just 100 all-business seats to take advantage of premium demand on the US routes.

It says the range of the A350-900ULR will be around 8,700nm (16,100km) – close to the 9,000nm Airbus gives for the A340-500 – and the twinjet will be able to fly for around 19h. ■

DEVELOPMENT MAX KINGSLEY-JONES LONDON

Stretched -1000 appeals to Qatar, but only if it beats 777X

Qatar Airways would be interested in buying a stretched A350-1000 derivative should Airbus decide to build one, but only if it offers enough of a capability step over the rival Boeing 777-9X.

The airline is already a major customer for the A350, holding orders

for 80 examples and being launch operator for both the -900 and -1000. However, at the Dubai air show in 2013, Qatar Airways was among the airlines signing up for Boeing's larger, revamped 777X. It placed orders for 60 aircraft for delivery from 2020.

Qatar Airways Group chief executive Akbar Al Baker tells *Flight International* that he believes Airbus must develop a larger A350 to compete effectively with Boeing.

"We would be interested in a stretch of the A350-1000. Airbus has no alternative – to be competitive it will have to do something that is bigger and better than the 777-9X," he says.

To achieve this, Al Baker says the A350 stretch will need to incorporate "new engine technology" and doubts that the twinjet's existing Rolls-Royce Trent XWB engine could be adapted for the larger variant, as the powerplant "is already at its [limit]" for the A350-1000. ■

See Air Transport P13



Current Trent XWB may need replacing for larger A350 model

Non-stop flights to New York are viable, probably

Singapore Airlines' previous non-stop flights from Changi airport to Newark Liberty were stopped primarily because of the high cost of running the service, and the restricted customer demand for premium seats, writes Henk Omblet, consultant at Flightglobal's Ascend operation.

This was exacerbated by the countless cheaper alternatives available which, while taking only 2h longer and involving a stop, connected through other hubs in China, Japan, Europe, and the Middle East.

However, the current lower fuel price, improvements in aircraft technology – especially fuel efficiency – and a generally increased demand could make the service more viable now.

But a 19h flight is still a long stretch to sit through, and you wonder whether even now there will be enough passengers willing to pay a premium high enough to cover the cost of running the service. Its launch could be partly driven by the prestige of having a non-stop service to New York.

Ultimately, the willingness of passengers to pay will decide whether the route is successful, or whether customers show a preference for cheaper stopping services and the chance of a break in their journey.

Interestingly, the direct flight will compete with Singapore's existing service from Changi to New York via Frankfurt, among many others.

The pricing for the new operation will therefore be benchmarked against its other routes.

STRATEGY STEPHEN TRIMBLE WASHINGTON DC

C-Series holds no appeal for Embraer

Brazilian airframer plays down possibility of tie-up with Bombardier on rival programme to its developmental E-Jet E2 family

Embraer has played down the possibility of a collaboration with Bombardier on the C-Series programme, following reports that the Canadian firm was to make an approach to its Brazilian rival.

The news emerged a little over a week after the revelation that Bombardier and Airbus had been in talks, now ended, over some form of co-operation.

Toronto's *Globe and Mail* newspaper reported on 13 October that Bombardier executives plan to approach their Brazilian competitor with a similar deal, citing a "senior aerospace executive" outside of, but "close" to Bombardier. It said a similar proposal may also be offered to Boeing.

But Embraer is showing little interest. "Embraer has not been approached by Bombardier regarding a partnership on the C-Series and remains fully committed to the development of its E-Jet E2 family of aircraft," it says.

Although the C-Series could be considered as complementary to the E2 range – not least through a common engine supplier – there is a clear rivalry in the market between members of each aircraft family.

The \$1.7 billion E-Jet development programme includes one model, the stretched E195-E2, with 132 seats in a single-class cabin with 31in (79cm) seat pitch. That places the re-engined and re-winged aircraft in a similar segment as the CS100, with 120 seats in a single-class layout.

On the other hand, the E195-E2 offers significantly less range than the five-abreast CS100.

But the CS100 is now competing against the E195-E2 for a potential United Airlines order, pending the outcome of contract extension talks with the Air Line Pilots Association. Pay scales for both models are included in United's current contract with ALPA, and United has dangled an offer to buy one of the models if the union agrees to extend the contract.

For several years, Embraer executives have ridiculed Bombardier's decision to launch the C-Series into a market that competes directly with existing and future re-engined versions of the Airbus A320 and Boeing 737.

The programme has struggled to meet schedule goals – it is now two years late, with 243 firm orders accumulated since 2008. ■



The 132-seat E195-E2 is in a similar class to the 120-seat CS100

PROGRAMME

CS100 close to certification milestone

Bombardier's CS100 has completed over 90% of its certification programme, and is soon to enter function and reliability testing ahead of a planned certification by end-2015.

The new stage of testing will subject the prototype to operations in airline-like conditions. This is to validate its readiness to enter service, the manufacturer says.

"This function and reliability testing will include airfield performance; landings and airport turnarounds;

and on-ground operations – all to ready the CS100 aircraft for operation with Swiss in the first half of 2016," says Rob Dewar, Bombardier's vice-president C-Series Aircraft Programme.

"The function and reliability test flights, which will be conducted using typical airline flight routings and operational procedures, will include about 15 representative airports in Canada and a further 20 in the United States." ■

MUNITIONS JAMES DREW WASHINGTON DC

US Army Longbows gain APKWS precision rockets

The US Army has ordered its first batch of 70mm laser-guided rockets from BAE Systems to equip its Boeing AH-64D Apache Longbows "for immediate deployment" following the Advanced Precision Kill Weapon System's (APKWS) qualification on the attack helicopter last year.

APKWS converts standard, unguided rockets into light and relatively cheap precision-guided munitions by adding BAE's Distributed Aperture Semi-Active Laser Seeker (DASALS) and wing section between the warhead and the rocket motor. Although conceived as an army programme,

the US Navy and Marine Corps have been pursuing the APKWS for the Bell Helicopter AH-1, UH-1 and more recently the maritime Sikorsky MH-60 Seahawk.

BAE director of precision guided systems David Harrold says

fielding on the Apache returns the army back to the programme, and boosts its export potential for international AH-64 operators.

"We've been doing testing and demonstrations and qualifications, but [the army] bought these

for operational use," Harrold said at the Association of the United States Army conference in Washington DC. "The army is trying to figure out what their long-term plan now is for acquisition."

APKWS has so far been demonstrated on 15 platforms, and BAE is also pursuing integration with US Air Force combat aircraft to provide an additional close-air-support weapon. Typical US launch tubes carry 19 or seven rockets, and each APKWS unit is about one-third the cost and weight of the Lockheed Martin AGM-114 Hellfire missile, says Harrold. ■

See Show Report P16

BAE laser-guided weapon system qualified on the AH-64D gunship last year





**Buk missile strike
downed MH17, but
questions remain**
NEWS FOCUS P10

COMPETITION MICHAEL GUBISCH LONDON

Europe examines MRO contracts for unfair practices

European Commission questionnaire sent to 40 companies focuses on “competitive conditions” of maintenance deals

European regulators have confirmed they are “closely monitoring” competitive conditions in relation to engine and component maintenance contracts.

Media reports suggest that the European Commission has written to airlines and aircraft component manufacturers to request information about how aircraft servicing contracts are drawn up, with a view to determining whether those agreements unfairly limit choice for operators.

European regulators have not officially announced a specific investigation into service contracts. However, the Commission says that it is “closely monitor-

ing competitive conditions as regards maintenance of engines and components for large commercial aircraft”.

Engine manufacturers GE Aviation and Rolls-Royce both confirm they have been contacted by Commission experts, who have sent documents to around 40 manufacturers and airlines.

“In September, GE received a questionnaire from the European Commission that broadly addresses MRO activities in the aviation industry,” says the US-based firm. “So GE is in the process of responding. We’ll co-operate in helping the EC understand the dynamics of the aviation industry.”



Cultura Rex Shutterstock

Engine manufacturers and airlines say they are “co-operating”

R-R also confirms that it has received the questionnaire, and says it is supporting the investigation, which it adds is still in the early stages.

Mario Lobato de Faria, executive vice-president for Portugal’s TAP Maintenance & Engineering, says it has also been sent the questionnaire, but remains relatively sanguine about the probe. He suggests most MRO contracts are awarded based on the financial strength of the bidder, rather than on pure technical competence.

Icelandair vice-president technical operations Jens Thordarson told delegates at-

tending the MRO Europe conference in London that manufacturers’ increasingly “dominant” aftermarket role risks “stifling innovation” in aircraft maintenance. Thordarson adds that manufacturers are “not always the best” party to provide MRO services.

Earlier this year, speaking during a panel debate at IATA’s annual general meeting in Miami, IAG chief executive Willie Walsh voiced concerns about maintenance costs.

“We need to start pushing back on our costs where they are driven by a limited number of suppliers,” he said. ■

SATELLITES DAN THISDELL LONDON

NASA signs trio for CubeSat launches

NASA has signed up three US-based launch start-ups to perform a series of CubeSat missions, due to fly in 2017 and 2018, to provide the agency with a dedicated route to orbit for the tiny satellites.

Rocket Lab USA, based in Los Angeles, and Firefly Space

Systems of Texas are both developing vertical launch systems. Virgin Galactic is set to fly some of the missions with its air-launched rocket, LauncherOne.

This first tranche of Venture Class launch contracts, valued at \$17.5 million – \$6.95 million to Rocket Lab, \$5.5 million to

Firefly and \$4.7 million to Virgin – may be followed by further small satellite contracts, says NASA. The agency says the price of each flight, which can orbit 15 to 30 CubeSats, “is one-tenth the cost of the least-expensive traditional launcher”.

Virgin Galactic expects a first test flight of its air-launched system before mid-2017. It won its first contract earlier in 2015, for 39 flights and 100 options, from UK-based OneWeb.

RocketLab signed a contract on 1 October with Moon Express for three flights to the Moon, starting in 2017. Those flights are part of a bid to win the Google Lunar XPRIZE for the first private mission to the Earth’s satellite.

In September, Firefly first tested the liquid oxygen and methane, or RP-1, engine that will power its two-stage Alpha rockets.

See Feature P26

UNMANNED SYSTEMS

Japan set to enforce UAV regulations

The Japanese government is to begin enforcing new regulations surrounding the use of unmanned air vehicles in national airspace in December, with its action prompted by a threat to its prime minister last April.

A DJI Phantom UAV carrying traces of radiation landed on the rooftop of Shinzo Abe’s residence, triggering the Japan Civil Aviation Bureau to develop a set of regulations for a sector that had previously operated to voluntary standards.

Although there have been no established regulations, the Japan UAV Association and Agricultural Aviation Association had set up voluntary standards for UAV use. Under these, some 2,600 air vehicles and 11,000 pilots have been authorised. ■



Virgin Galactic

Virgin Galactic will be making use of its LauncherOne design



INVESTIGATION DAVID KAMINSKI-MORROW LONDON

Buk missile strike downed MH17, but questions remain

Weapons manufacturer Almaz-Antey disputes Dutch Safety Board's finding that 777 was downed by Russian munition

Malaysia Airlines flight MH17 was shot down over eastern Ukraine by a Russian-built surface-to-air missile, investigators have formally concluded.

The Boeing 777-200ER – transporting 298 occupants from Amsterdam to Kuala Lumpur – was destroyed on 17 July last year as it passed over hostile territory.

In its final report into the event the Dutch Safety Board states that the crash was caused by the “detonation” of a warhead of the type 9N314M, from a Buk missile system, launched from eastern Ukraine.

“None of the parties involved recognised the risk posed to overflying civil aircraft by the armed conflict,” says the inquiry. It states that Ukrainian authorities had “sufficient reason” to close the affected region of airspace before the date of the 777’s destruction.

The missile was launched from a 320km² (124 miles²) region of Ukraine – determined by simulations – and detonated above and left of the 777’s cockpit.

The aircraft was penetrated by “hundreds” of high-energy objects from the warhead, says the inquiry, killing the three crew members “immediately”. The aircraft subsequently broke up with the loss of all on board.

Investigators state that “no other scenario” than the Buk warhead explosion explains the combination of evidence.

This includes identification of the weapon system based on fragments in the 777’s wreckage, the crew, the damage pattern to the jet, and the manner of the in-flight break-up.

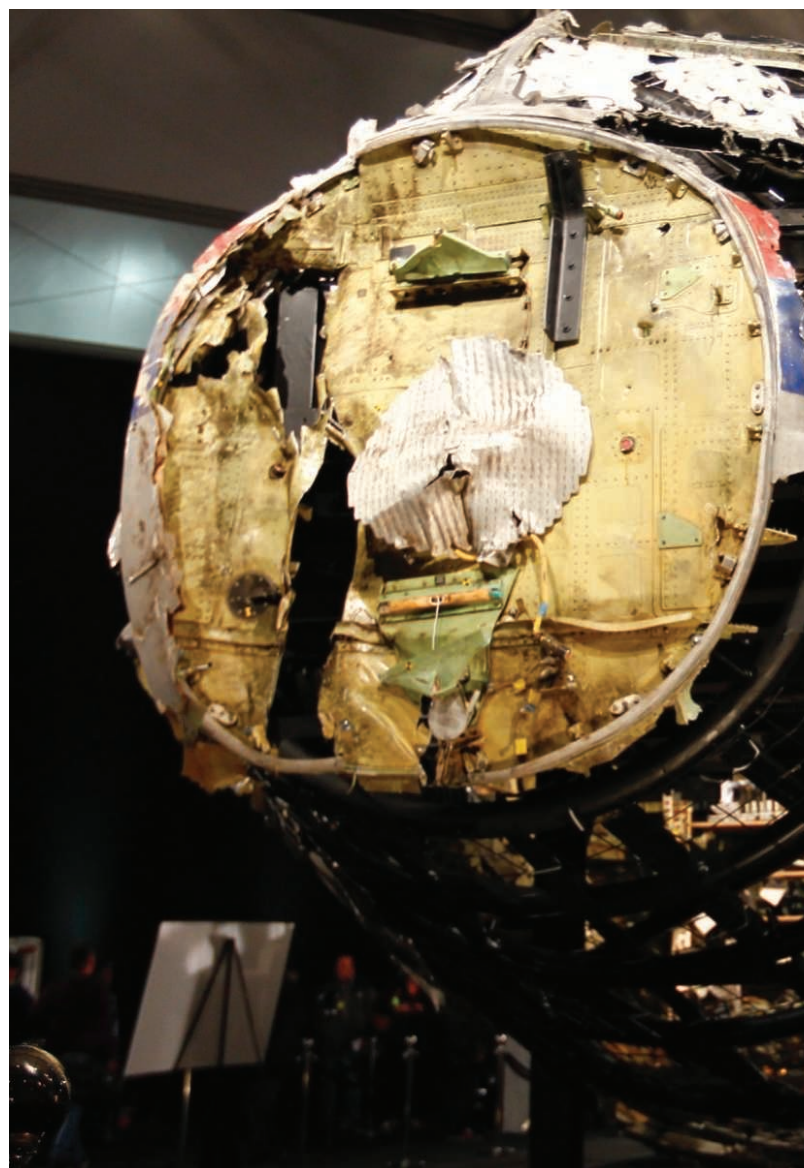
Cockpit-voice recordings detected a “sound peak” during the final milliseconds before the de-

“None of the parties recognised the risk posed to overflying civil aircraft by the armed conflict”

DUTCH SAFETY BOARD

struction of the aircraft, says the inquiry, while traces of paint on missile fragments match those of parts of a missile recovered from the region.

“Other potential causes, such as an explosion inside the aeroplane or an air-to-air missile, have been investigated and excluded,” says the inquiry, which adds that additional forensic investigation is needed to narrow down the launch site.



Missile maker Almaz-Antey tested the effects of a Buk explosion

Russian defence firm Almaz-Antey, which builds the Buk missile system, has been carrying out “full-scale” experiments to study the destruction of the 777.

During these tests it destroyed an Ilyushin Il-86 cockpit in an attempt to prove that a Soviet-era weapon, rather than a modern Russian one, brought down flight MH17.

The Dutch inquiry identified the warhead as a 9N314M, carried by a 9M38-series missile. Almaz-Antey has carried out tests, including the detonation of a 9M38M1 missile placed above and to the left of a cockpit section taken from an ex-Armavia Il-86. This is the same location derived by investigators for the position of the warhead that struck MH17.

The defence firm says the test explosion was conducted at the Bakhirev engineering research institute in Nizhny Novgorod on 7 October. It claims that the resulting concentration of damage to the Il-86 structure, and the types of warhead fragmentation shrapnel, differ to those inflicted on the 777.

Almaz-Antey says the damage indicates that an older 9M38-type weapon was used, one which is no longer in service with Russian forces but used by Ukraine’s armed forces.

It claims there is a “high probability” that this “outdated” ammunition was involved in downing flight MH17, and adds that it believes the launch site was close to Zaroshchenskoye, west of Torez in Ukraine’s Donetsk region. ■



**EASA highlights
de-icing fluid
worries**
AIR TRANSPORT P12



The investigation carried out a partial reconstruction of the airframe at Gilze-Rijen air base in the Netherlands

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VICTIMS

Oxygen mask mystery still unresolved

Investigators have been unable to explain conclusively why a passenger on the ill-fated Malaysia Airlines flight MH17 was found wearing an oxygen mask following the Boeing 777's destruction over Ukraine.

The Dutch Safety Board states that the aircraft was shot down by a Russian-built surface-to-air missile, but it has not been able to determine the situation in the passenger cabin following the initial detonation.

Dutch prosecutors disclosed in October last year that a single passenger had been found with a mask during the recovery operation.

Investigators determined that electrical power to the aircraft was abruptly lost – halting the aircraft's surveillance transmissions and both flight recorders – at 16:20:03 local time on 17 July 2014.

The aircraft's internal cabin altitude had been 4,800ft before the

missile detonation, indicating that the oxygen system would not have activated prior to the explosion.

While the sudden depressurisation of the fuselage should have triggered the deployment of masks, the inquiry found that this was prevented by the loss of electrical power.

Investigators recovered some 50 oxygen generators from the crash site, all but one of which had been activated – which normally occurs as a passenger dons the mask, tugging it and pulling the generator's firing pin. However, the board says this could have been triggered by the missile detonation or during the crash sequence.

One passenger was found to be wearing a mask strap around their neck, with the mask at their throat. But no DNA or fingerprint analysis could be conducted, says the inquiry, to explain its presence. ■

Original surveillance data of crash sequence deleted by Russian authorities

Russian authorities provided no original surveillance data to the investigators examining the destruction of flight MH17 over Ukraine, the inquiry reveals.

The Ukrainian air navigation service, UksATSE, transferred raw and processed secondary-surveillance radar data to the Dutch-led inquiry. UksATSE also supplied automatic dependent surveillance-broadcast (ADS-B) information pertaining to the Boeing 777-200ER, which had been operating through Ukrainian airspace at the time of its loss.

It was unable to supply civil or military primary radar data, claim-

ing that none of the stations in the region was operating at the time, owing either to maintenance or the absence of military traffic.

But the Dutch Safety Board has disclosed that Russia's state air traffic management authority did not hand over any original surveillance data from sources including primary and secondary radar and ADS-B.

The authority supplied video footage of a radar screen replay apparently showing processed primary and secondary data.

"No other data was received," says the inquiry. "Due to the absence of raw data, it was not pos-

sible to verify the video radar replay." But it acknowledges that the Russian video information is "consistent" with the Ukrainian surveillance data.

While Ukrainian radar showed no other targets in the vicinity of MH17 in the moments before its loss, the Russian replay indicated a primary target generated close to MH17 on two occasions.

Russian authorities told the inquiry that no radar data was saved because there was no national requirement to retain the information, given that MH17 had crashed outside of Russian territory – although close to the

Ukrainian-Russian border. The jet was due to be handed to Rostov area centre controllers after leaving Ukrainian airspace.

But the inquiry notes that Russia's federal regulation on radar-data recording "does not mention an exception" to storing this data when it relates to external regions.

ICAO standards require retention of surveillance data, for accident investigation and training purposes, for at least 30 days. Countries are obliged to report deviation from these standards to ICAO, but Russia has not filed any such notification.

REGULATION DAVID KAMINSKI-MORROW LONDON

Airlines' pitot protests fail to move A320 deadline

The compliance period for replacing pitot tubes on Airbus A320-family jets has been halved, after European safety regulators rejected complaints about the shorter deadline.

The revised schedule cuts the compliance time from 48 months to 24 months, bringing the required completion date forward to 12 November 2016.

Orders to replace the pitot tubes followed concerns that some Thales-made devices were not performing adequately in high-altitude icing conditions.

The European Aviation Safety Agency says it is shortening the deadline after analysis determined that the compliance time



Air Canada hoped to begin the changes to coincide with C-checks

"has to be reduced in relation to the risk assessment".

But this has met objections from several operators. British Airways has told EASA that it is "concerned" with the change, not just from the point of view of re-

fitting 130 aircraft, but with the fact that it means "eliminating the possibility" of fitting newer-specification pitot probes available from the third quarter of 2016.

Air Canada says it had planned to begin modifications

next month, timed to coincide with C-checks, which would have enabled it to finish a year before the previous deadline. But the new timetable will leave about half of its fleet requiring modification during line-maintenance visits, it says.

"[This] will put a major burden on operations," says the carrier in a formal response to the revision.

Russian carrier S7 Airlines' engineering arm told EASA that, given its fleet of 42 A320-family jets, the change is "not optimal", and proposed that the 24-month period be counted from the date of issue of the revised directive.

EASA has not amended the directive despite the protests. ■

SAFETY DAVID KAMINSKI-MORROW LONDON

EASA highlights de-icing fluid worries

Safety regulator advises airlines to review operating manuals and use flight-data monitoring to calculate risks at take-off

Europe's safety authority is encouraging operators to use flight-data monitoring to quantify the potential risk of de-icing fluid on aircraft take-off performance.

The European Aviation Safety Agency highlighted the results of an in-depth study, led by Canada's National Research Council, that used wind tunnel testing to understand the effects of such fluids on horizontal stabilisers.

The study particularly focused on turboprop aircraft including the Dornier 328, Bombardier Dash 8-200 and the British Aerospace ATP.

EASA's studies have been spurred by a serious incident involving an ATP freighter departing Helsinki, Finland in January 2010. The pilot of the West Air Sweden aircraft could not pull back the control column at rotation speed, and therefore the take-off was aborted.

The Swedish Accident Investigation Authority (SHK) determined that de-icing fluids containing thickening agents, and a narrow gap between the stabiliser



An incident involving a West Air Sweden ATP spurred the studies

and elevator, had contributed to several incidents involving the same aircraft type.

The SHK also concluded that specification processes for de-icing fluids were "to a certain extent, controlled by trade organisations", with practically no oversight by pan-European aviation safety authorities.

The study, published in March 2014, found the fluid greatly af-

fected aerodynamics of the horizontal stabiliser in most cases.

Peak control-column forces, applied by the pilot to move the elevator, doubled while the lift generated by the stabiliser diminished by 20% at rotation compared with a dry take-off.

"These effects would add together and delay [aircraft] rotation," says EASA, adding that this would reduce runway margins.

Heavier aircraft with a forward centre of gravity were more likely to involve "penalising" results, it says, owing to higher required elevator deflection and slower acceleration, giving more time for fluid to flow off and contaminate the underside of the elevator.

Low-viscosity fluids "did not have an appreciable effect", it adds, but the link between viscosity and aerodynamic performance penalties "is not linear".

While EASA is not issuing a formal directive on the matter, it has outlined concerns in a bulletin suggesting operators should assess – by considering their fleet type and operating conditions – whether operating manuals need revision or their crews should receive additional training.

It adds that flight-data monitoring could be used to determine if forces applied by pilots during take-off are exceeding the normally-accepted range, or examine whether rotation speeds or take-off distances have deteriorated substantially after aircraft have been treated with de-icing fluid. ■



SJI rejects supplier substitution plan
AIR TRANSPORT P15

STRATEGY MICHAEL GUBISCH LONDON

Boeing relaxed on mid-market launch

Current engineering workload means airframer has little capacity to begin new development programme in short term

Boeing has “some” time before having to decide on the launch of a “middle of the market” aircraft that would fit between its 737 narrowbody family and the twin-aisle 787 range.

Speaking to *Flight International* in London, the airframer’s marketing vice-president Randy Tinseth said Boeing had been talking to customers about a clean-sheet design “for a while” as, he says, “there is a lot of tension in the middle of the market”.

He indicates the discussions have been focused on potential aircraft configurations, performance specifications, technologies, and the commercial outlook for such a programme.

However, he adds that talks are



757 replacement market could total around 500 to 2,000 aircraft

“still in the relatively early stages”, and such a new aircraft is unlikely to become available before 2023: “With all of the things [new

aircraft programmes] we have on the table today, we have got some time.” The development backlog already includes the 737 Max, the

787-10 and 777-9X, respectively scheduled to enter service in 2017, 2018 and 2020, with the smaller 777-8X set to follow in 2022 or 2023.

Nonetheless, with development programmes taking between five and seven years to bring to serial production, there is a limited window in which Boeing can launch a new programme if it hopes to deliver by the middle of next decade.

“We have got a lot of things to do – and I know our competition does as well,” says Tinseth.

There appears to be a growing feeling in the industry that Boeing will eventually launch the programme, however. A majority of delegates surveyed at the recent ISTAT Europe conference in Prague forecast a market of 500-1,000 units for any 757 replacement, with nearly 25% believing demand would be in the range of 1,000-2,000 aircraft.

Speaking at the event, Tom Chandler, TUI Group director of fleet management and finance, said a new jet could serve as a replacement for both the 757 and larger 767.

“For us, it is less a question of a ‘757 replacement’; it is more about an aircraft that is actually below the 787 models,” says Chandler. ■

Additional reporting by Olivier Bonnassies in Prague

DEVELOPMENT MICHAEL GUBISCH LONDON

Seattle expects successor to ‘compromised’ A350-1000

Boeing marketing vice-president Randy Tinseth expects Airbus to add a further, large derivative to its A350 widebody family. “Based on the [A350]-1000, it would be hard to believe they wouldn’t do something,” Tinseth tells *Flight International*.

Tinseth labels the in-development A350-1000 a “disaster”, arguing it has “compromised” engines and wings. This, he says, is partly down to the decision to increase thrust through changes in the Rolls-Royce

Trent XWB engine core without enlargement of the powerplant’s nacelle when Airbus redesigned the variant in 2011. The A350-1000 – a stretched version of the baseline -900 – competes with Boeing’s in-development 777X family. “I don’t think they can live long with being outsold... in that segment,” says Tinseth. But he believes a larger derivative than the A350-1000 would not pose a threat, because such a move would be “something we contemplated early in

the [777X development] process”.

Boeing launched that programme in 2013 with the -9X set to enter service in 2020. The A350 was envisioned as a three-aircraft family centred on the -900, including a shrunk -800 since abandoned for re-engining the A330. At the Paris air show, Airbus chief operating officer for customers, John Leahy, said the -900 was not the A350 programme’s centre of reference, with its middle point moving “toward the -1000”. ■

FLEET MICHAEL GUBISCH LONDON

Airline brands to vanish as TUI updates liveries

German tour operator TUI has started abandoning its airline brands – such as Arke, Jetairfly and Thomson Airways – as part of a group-wide reorganisation.

Dutch-based Arke has become the first group carrier to receive the TUI brand, with one of the airline’s Boeing 787s painted with the updated livery for a for-

mal rebranding this month. By 2017, the TUI brand is to be rolled out across the entire group, says the tour operator. TUI’s French units, excluding Corsair, are to be rebranded by year-end. TUI tried to divest Paris Orly-based Corsair to Groupe Dubreuil earlier this year but an agreement could not be reached. ■



The German company will cover all jets with its two-tone livery

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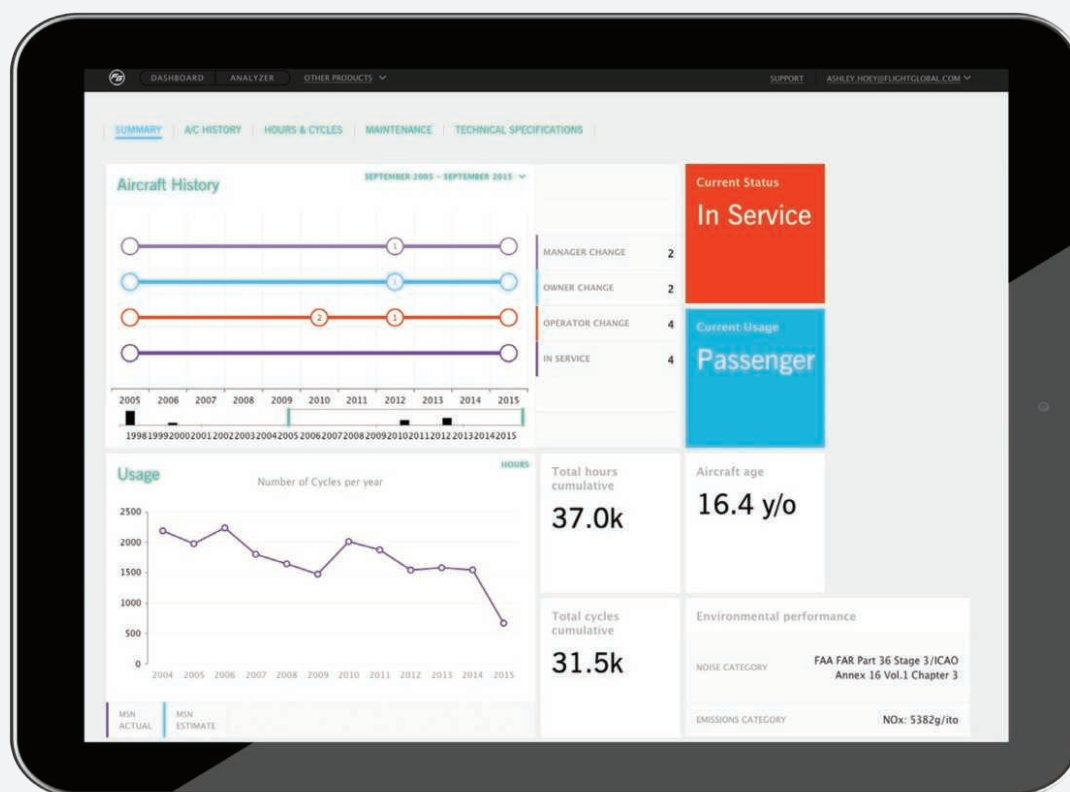
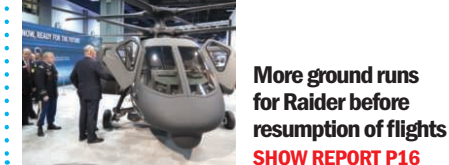


Illustration shows conceptual data only



PROGRAMME MURDO MORRISON VENICE

SJI rejects supplier substitution plan

Russian alternatives to Superjet's Western suppliers is "impossible", says CEO of Sukhoi-Alenia Aermacchi partnership

It would not be feasible to replace North American and European suppliers with Russian ones on the Sukhoi Superjet programme, according to the executive charged with leading Western sales campaigns for the regional airliner.

Citing both recertification costs and the risk of damage to the brand, Superjet International (SJI) chief executive Nazario Cauceglia concludes: "This possibility is impossible."

In August, Sukhoi Civil Aircraft (SCAC) disclosed a plan to reduce the cost of producing the 100-seater by \$2.6 million per aircraft by introducing Russian suppliers that would be paid in roubles.

"The Russians know what it would mean in terms of investment," Cauceglia told *Flight International*. "But it is near-impossible given we say the Superjet is a global product. I don't think it is a problem we will have."

Alenia Aermacchi and Sukhoi have had a fractious relationship since partnering to set up SCAC and the sales and support venture SJI, with Russia's plunging currency and political crises over Moscow's foreign policy compounding tensions.

But Cauceglia says Sukhoi and SJI intend to work closer by merging their separate sales operations. Until now, both have maintained a strict division of



Deliveries of Interjet's 30 aircraft will be complete by late 2016

sales territories, although the Italian unit is responsible for global training and support.

"Shareholders have decided to review the partnership model, and the aim is to become more in-

tegrated and not show ourselves as two companies any more," he says. "It will no longer be important if a sales contract is signed by SuperJet International or SCAC."

SJI bolstered the backlog for the type on 13 October, when it gained a firm order from Irish regional carrier CityJet for 15 aircraft with 10 options. Deliveries are due to run from 2016 to 2017. Previously SJI had secured just one Western customer, Mexico's Interjet, with deliveries of its 30 Superjets to be completed by the end of next year.

In total, 75 Superjets have been delivered, the majority to airlines in Russia and the CIS. ■

APPOINTMENTS DAVID KAMINSKI-MORROW LONDON

Former United Engine chief to take United Aircraft civil role

Russia's United Aircraft has confirmed it is appointing former United Engine chief Vladislav Masalov to head its civil aviation operation.

His appointment follows the adoption of a strategic review of United Aircraft's development activities, says the firm.

Masalov had led United Engine since 2012, and has also held senior positions at Salyut and power-plant firm Saturn.

Masalov's position was formally created in September after United Aircraft reviewed aspects of its business strategy. This review included a

programme to reduce the cost of producing Sukhoi Superjet 100s.

Alongside his civil aviation vice-president post, United Aircraft also set up new management positions such as vice-president of international co-operation and vice-president of special-purpose aviation. ■

PROPULSION DOMINIC PERRY LONDON

PW306B to power Turkey's regional jet ambitions

Turkey's TRJet has selected the out-of-production Pratt & Whitney Canada PW306B turboprop to power its developmental TRJ328, a modernised variant of the Dornier 328 Jet which used the same engine.

In a memorandum of understanding, P&WC has agreed to modernise and resume production of the 6,970lb (31kN) thrust engine for the Turkish regional jet programme.

Activities are to commence at P&WC's Longueuil, Quebec facility in 2016, with first flight of the 32-seat TRJ328 anticipated in 2019, says TRJet.

When the programme was

launched in May, TRJet also proposed a modernised variant of the PW119 turboprop-powered 328, called the T328.

TRJet says in parallel with the modernisation effort on the PW306B "work will also be underway on a turboprop engine

for the T328 aircraft". However, the company offers no details of the supplier or the engine selection for the variant.

In addition, TRJet – a subsidiary of US manufacturer Sierra Nevada – plans, in partnership with Turkish industry, to develop a pair of clean-sheet, 70-seat regional aircraft, the TRJ628 and TR628, powered by turboprop and turboshaft engines, respectively. First flights for the two aircraft are planned for 2023.

Sierra Nevada acquired the type certificates for the Dornier models last February through its purchase of German company 328 Support Services. ■



TRJet is developing a modernised version of the Dornier 328 Jet

AUSA 2015

The US Army put on a brave front for its annual meeting in Washington DC from 12-14 October. Its aviation branch remains firmly committed to a dual-track strategy of modernising its existing fleet, while also pursuing breakthrough advances in rotorcraft speed, range and efficiency. But budget uncertainty lurks everywhere in the US Capitol, and not least in the ranks of the army. Association of the United States Army show report by James Drew and Stephen Trimble



James Drew/Flightglobal

MUNITIONS

Army seeks new weapons to arm Gray Eagle UAV

The US Army is interested in new weapon options beyond the Lockheed Martin AGM-114 Hellfire air-to-surface missile now carried by its General Atomics Aeronautical Systems MQ-1C unmanned air vehicle, and has asked industry to offer smaller, cheaper and more specialised alternatives for a future requirement.

Force commanders are currently limited to the Gray Eagle's four 48kg (105lb) rail-launched Hellfires while engaging targets. As a result, arming the type with new munitions has become more of a priority than adding weapons to its AAI RQ-7 Shadow UAVs.

The army is standing up Gray Eagle companies at a rate of two per year, with nine of an eventual 15 now established. UAS project manager Col Courtney Cote says it is also transitioning to General Atomics' Improved Gray Eagle, which has a maximum endurance of nearly 40h. The service has ordered an initial 19 of the extended-range type, for delivery by September 2018.

The new configuration increases the aircraft's maximum take-off weight from 1,630kg (3,600lb) to 1,900kg, with a wider airframe enabling it to carry more fuel. ■

PROGRAMME

More ground runs for Raider before resumption of flights

A total of 200h to be accumulated in rig tests as Sikorsky advances demonstrator effort

Sikorsky will conduct a significant amount of ground testing on its S-97 Raider before returning to flight trials, with just 2.2h of a total planned 110h flight test programme clocked since its debut last May.

S-97 chief test pilot Bill Fell says more work will be done with the ground-test rig at Sikorsky's plant in West Palm Beach, Florida ahead of further flights. This has already logged 40h of what is expected to be a 200h test run, he adds, and once the latter mark has been reached, the programme

will be given the "green light" to begin flying using an expanded flight envelope.

Sikorsky expects the design to achieve a top speed of 220-230kt (407-425km/h) by mid-2016.

Mark Miller, the company's vice-president of research and engineering, says the 110-120h flight programme is "robust", considering the S-97's forerunner, the high-speed X2, accumulated 23h over 23 flights.

The company has built two S-97 experimental demonstrators as a risk-reduction measure

leading into the US Army's upcoming Future Vertical Lift (FVL) acquisition. The coaxial-compound, rigid-rotor configuration is the basis for the Boeing-Sikorsky SB-1 Joint Multi-Role technology demonstrator.

Miller says the S-97 Raider has a slightly smaller footprint than the army's retired Bell Helicopter OH-58 Kiowa Warrior armed aerial scout, and could be put into development for an "FVL Light" requirement.

The fly-by-wire rotorcraft could also be made "optionally unmanned" by using Sikorsky's Matrix autonomous flight technology, which has been demonstrated on an S-76 technology demonstrator and UH-60 Black Hawk. "We have provisions for going an optionally-piloted route with this," he says.

Fell, however, believes that most missions will require a "human in the loop" – particularly the aerial scout role. "I don't think you can do that mission fully with an unmanned vehicle," says the former Kiowa Warrior pilot. ■



James Drew/Flightglobal

Sikorsky has built two experimental prototypes of the rotorcraft



ITEP bidders gear up for engine fight
NEWS FOCUS P18

AUSA 2015
SHOW REPORT

PROCUREMENT

Cuts threaten Apache, Chinook plans

Army's rotocraft acquisitions face severe potential cutbacks if US Congress fails to pass a new budget for fiscal year 2016

Boeing's AH-64 Apache and CH-47 Chinook programmes face severe cutbacks if the US Congress is unable to pass a new budget for fiscal year 2016, the US Army's assistant secretary for acquisition, logistics and technology Heidi Shyu has warned.

A request to buy 64 AH-64Es in the fiscal year that began on 1 October would be cut by half under a potential continuing resolution, while the service also would be forced to halve its purchase of new-build Chinooks and buy seven fewer remanufactured CH-47Fs.

The cutbacks would be part of a \$6.1 billion loss from the army's acquisition accounts in the event of a continuing resolution, says Shyu.

A request to buy 64 AH-64Es this fiscal year would be cut by half under a potential continuing resolution

A continuing resolution is a quirk of the US budgeting process encountered if lawmakers are unable to pass an annual appropriations bill. Instead, Congress can pass a measure which generally resets spending levels to the previous fiscal year.

The current uncertainty comes at a sensitive time for the AH-64 programme. The army is negotiating the terms for a new multi-year procurement deal, which is expected to be signed in FY2016 and take effect between FY2017 and FY2022. Col Jeff Hager, the army's project manager for the AH-64, says his office remains focused on securing approval for this from US Secretary of Defense Ashton Carter.

Any such deal is likely to involve dozens of aircraft ordered by foreign customers. Boeing is in talks with 10 such potential buyers for a combined total of more than 75 aircraft, says Mark Ballew, the company's head of business development for attack helicopters. ■



The service could be forced to buy seven fewer remanufactured CH-47s

US Army

UPGRADE

Standard data link required for MUM-T

A Lockheed Martin communications system will be replaced on the Boeing AH-64E Apache fleet as the US Army moves to standardise data links for manned-unmanned teaming (MUM-T): a central element of its strategy for replacing the scout role performed by the Bell Helicopter OH-58D Kiowa Warrior.

Currently, the AH-64E can only communicate with the Ku-band data link on the General Atomics Aeronautical Systems MQ-1C Gray

Eagle, using Lockheed's above-the-rotor unmanned air systems tactical common data link assembly. The D-model Apache can use the C-band data link on the AAI RQ-7 Shadow, with a below-the-rotor L-3 Communications MUM-T2 data link.

Last month, the army selected L-3's MUM-TX data link to replace both current systems with one above-the-rotor assembly which can transmit and receive data and video in four different frequency bands. ■

PARTNERSHIP

Lockheed's firewalls safeguard rival JMR-TD bids

Lockheed Martin's pending acquisition of Sikorsky has caused some contractual changes with Bell Helicopter for the development of the V-280 Valor, to ensure that there is no "cross-pollination" with its competitor, the Boeing-Sikorsky SB-1 Defiant.

Bell chief executive John Garrison says Lockheed is already following many of the firewalling policies now solidified in the contract. The companies have been partnered on the V-280 since 2013, with a first flight under the US Army's Joint Multi-Role technology demonstration (JMR-TD) programme planned for September 2017.

Lockheed is developing the third-generation tiltrotor's mission system, but its \$9 billion acquisi-

tion of Sikorsky will also place it on the opposing SB-1 team.

Scott Donnelly, chief executive of Bell's parent Textron, and his Lockheed counterpart Marillyn Hewson are said to have discussed the issue when the acquisition was announced in July. "Lockheed called me and said,

'this is the world we operate in. We can put in firewalls. We compete on some programmes and co-operate on others'," Garrison says. "Lockheed has been a great teammate and done everything we've asked, plus – and we believe they'll continue to do that."

JMR-TD aims to mature two

competing rotorcraft designs in preparation for the army's upcoming Future Vertical Lift programme, planned for initial operational capability (IOC) in 2035.

Bell believes the V-280 could be delivered well ahead of that schedule. Spirit AeroSystems handed over the first composite fuselage to Bell's Amarillo plant in Texas last month, and the GKN Aerospace V-tail structure is due to arrive in 2016.

Garrison says his preferred timeline would place IOC in 2026 or 2027, with an engineering and manufacturing development phase to begin soon after the first flight. "There's a need for this capability and we can move faster than the current acquisition process is playing out," he says. ■



Bell Helicopter

Bell and Lockheed have been partnered on the V-280 since 2013



PROPULSION STEPHEN TRIMBLE WASHINGTON DC

ITEP bidders gear up for engine fight

US Department of Defense contest aims to address performance shortfalls with higher-thrust, less thirsty turboshafts

In Afghanistan, Boeing AH-64 Apache and Sikorsky UH-60 Black Hawk helicopters encountered a problem their designers never anticipated. Hovering at 4,000ft in 35°C (95°F) conditions had always seemed a sufficient performance level for a helicopter. But Afghanistan's mountains and hot summer raised the bar for hot-weather hovering by 2,000ft.

Even so, GE Aviation could have supplied more powerful versions of the trusty 2,000shp-class (1,490kW) T700 turboshaft, which has powered both helicopters since the 1970s.

But the army was not interested. If the service was going to launch a re-engining programme for about 2,135 UH-60s and 690 AH-64s, it was going to demand something else for its investment: a 25% reduction in specific fuel consumption, while increasing thrust by roughly 25-30% within the same footprint of a T700.

Thus, the improved turbine engine programme (ITEP) was born – the largest engine development now under way for the US Department of Defense.

The competition for the next phase of the 3,000shp-class propulsion system began in September. The army plans to select up to two bidders early next year to deliver a preliminary design with technical data in 2018. A single company will then be selected to start developing the engine, with



Around 700 US Army-operated Boeing AH-64 Apache attack helicopters will gain new powerplants

the ITEP powerplant entering the fleet beginning with the UH-60 in the early 2020s.

Opportunities of this size in the rotorcraft market come around very rarely, so the army is expecting robust competition, not least that it potentially feeds into future civil applications as well. In addition to the rival GE Aviation GE3000 and Honeywell-Pratt & Whitney HPW3000, army officials also say they expect additional bidders.

Among the likely candidates, Rolls-Royce has already declined to participate. Assuming the Russian Klimov TV7-117V is ineligible, that leaves only Turbomeca.

The French company began

tests of its Tech 3000 demonstrator this year, promising to lower specific fuel consumption in a new 3,000shp-class engine by 25%. Aside from civil sector demand, it appears aimed at replacing the RTM322 engines which power some NH Industries NH90s, AgustaWestland AW101s and the Westland/Boeing Apache AH1 attack helicopter – the British Army's version of the AH-64.

Turbomeca plans to finish test activities on the demonstrator in late 2015, but will only launch a development programme once a customer selects it. Little else is known of the Tech 3000 except plans to certificate the engine by the end of the decade, and Turbomeca declines to say if it will respond to the army's request for proposals for the ITEP preliminary design phase.

Of the known bidders, the competition reveals a clear split in design philosophy. The Honeywell-P&W joint venture, called ATEC, features a two-spool engine design. The GE3000, as with the T700, is based on a single-spool architecture.

According to Honeywell, the twin-spool offers an inherent 3-4% specific fuel-consumption reduction, by dividing the pressure and thermal loads carried by

each spool. It is also better suited to handling future thrust growth, as the army wants the ITEP design capable of reaching 3,750shp without major changes. However, GE responds that the single-spool architecture can accommodate higher thrust requirements, as the company's single-shaft GE38 engine in the 7,500shp power class

Opportunities of this size in the rotorcraft market come around very rarely, so the army is expecting robust competition

attests. The single-shaft also offers simplicity, with fewer parts than a dual-spool system.

The axial-centrifugal compressor for the GE3000 has already displayed the highest overall pressure ratio (OPR) among any of the company's gas turbine engines, including the 27:1 OPR planned for the massive GE9X for the Boeing 777X. The engine also features heat-resistant ceramic matrix composites in non-rotating parts, reducing cooling requirements in order to obtain better fuel efficiency. ■



Hot and high operations in Afghanistan led to the upgrade plan



UAE helicopter firm widens gunship conversion scope
DEFENCE P20

MODERNISATION ARIE EGOZI TEL AVIV

Upgraded Israeli Hercules returns to flight status

The Israeli air force's first extensively upgraded Lockheed Martin C-130H tactical transport has been returned to flight status, as part of a modernisation and life-extension programme launched in December 2012.

A first flight was performed in early October, and the aircraft is now at the service's Nevatim air base.

Led by Elbit Systems and also involving Israel Aerospace Industries' Bedek division, upgrade work included installing glass cockpit avionics, a new weather radar and a replacement centre wing box and main wing.

Elbit says the enhancements will boost the type's capabilities, including during operations conducted at low level and at night.

Following the completion of the modernisation programme, the air force's 10 H-model Hercules are planned to remain in use until at least 2040. They will be operated alongside Israel's new-generation C-130Js, with both types assigned to 131 Sqn, known as the "Knights of the yellow bird".

Flightglobal's Fleets Analyzer database records two C-130Js as being in current active use in Israel, with another two examples ordered so far. ■



Hagar Ambar/Israeli Air Force Magazine

The improved C-130H completed a first flight in early October

PROGRAMME DOMINIC PERRY TURIN

Final testing for Italian MPA with handover date in sight

Pair of adapted ATR 72-600s undergoing systems trials at Alenia Aermacchi's Caselle site

Alenia Aermacchi is nearing completion of a test and evaluation phase for the Italian air force's new P-72A maritime patrol aircraft.

The first of an eventual four examples of the ATR 72-600-derived type is due to be handed over to the service in March 2016 as it replaces its remaining fleet of Dassault Breguet ATL-1 Atlantics.

Two aircraft – MSN940 and MSN1031, built in 2011 and 2012 respectively – are currently at the manufacturer's Caselle facility near Turin for mission-system integration and testing, having already received airframe modifications at its site in Naples.

Changes to the baseline passenger aircraft include the addition of a Selex Seaspray 7200 search radar and ATOS mission system, a FLIR Systems electro-optical/infrared sensor turret, bubble observation windows, a rear door able to be opened in flight and a defensive aids suite. Four stations – two on either side of the fuselage – have also been incorporated, to eventually allow the addition of hard-



Dominic Perry/Flightglobal

Alterations have increased the fuselage length by around 1.5m

points for the carriage of torpedoes.

The most striking alteration is the addition of the defensive aids suite to the tail, which increases the fuselage length by about 1.5m (5ft).

So far, Alenia has completed tests of the aircraft's communication and navigation equipment, and its defensive aids system, which concentrated on the safe separation of flares. Mission system trials are still ongoing.

Although the airframe modifi-

cations worsen the twin turbo-prop's drag by about 5%, Alenia Aermacchi says that even when fully laden with a mission system and seven-person crew it is not near the type's maximum take-off weight. As such, it boasts a claimed endurance of around 8-10h.

A future B-model anti-submarine warfare variant may eventually be required by Italy, but there is no order in place yet. ■

See Italy Special next week

WEAPONS BARTOSZ GLOWACKI WARSAW

Warsaw seeks bids for MiG-29 'Alamo' missile

Poland wants a new batch of 40 R-27R1 radar-guided missiles for its RAC MiG-29 fighters, with bid responses being sought by 16 November.

Referred to by NATO as the AA-10 "Alamo", the Vympel-designed, medium- to long-range R-27R1 should be sourced from a company established in the EU, the European Economic Area or in a country with which the EU and Poland have agreements covering public contracts, Warsaw says. Ukrainian companies have also been invited to participate.

Deliveries are requested as soon as 1 January 2016, or at the latest by the end of November the same year. Each weapon must have a shelf life of at least eight years in a sealed container, and not less than five years once removed.

The Polish defence ministry's armament inspectorate says it will make a selection based on two criteria: the lowest price – which carries an 80% weighting; and the offered warranty period (20%).

The service has 31 of the fighters in use, according to Flightglobal's Fleets Analyzer database. ■



SPENDING BETH STEVENSON LONDON

F-35 a focus as Norway proposes big budget boost

Norway has proposed a 9.8% real-term defence budget increase for 2016, with the boost to include a near doubling of funding for the Lockheed Martin F-35.

The recommendation was presented by the government on 7 October, less than one week after its defence ministry had published a new Strategic Defence Review covering the period to 2024. In this, the nation's chief of defence had underscored a commitment to acquiring 52 conventional take-off and landing F-35As to replace the Royal Norwegian Air Force's Lockheed F-16s.

Oslo's parliament has previously authorised the procurement of 22 F-35s – including an initial four to be used for pilot training in the USA – covering deliveries up to and including 2019. The new budget proposal for 2016 includes a request to authorise the service's next six aircraft, to be received in 2020.

"The majority of the [budget] increase comes from a near doubling of the funding related to the Norwegian acquisition of the F-35, which ensures that the procurement will proceed as planned," the government says.

"The overall priorities in the government's budget proposal are in line with the recommendations presented by the chief of defence on 1 October, and helps increase the defence budget's share of Norway's GNP [gross national product] to a projected 1.54%."

For its latest batch of F-35s, along with associated infrastructure improvements to be made at Ørland air base, an allocation of Nkr8.6 billion (\$1.05 billion) is planned. This is part of a total proposal worth Nkr49 billion – a rise of Nkr4.29 billion from 2015 in real terms – for 2016.

"While this proposal includes Nkr1.1 billion re-allocated from the 2015 budget due to planned payments that have been postponed, this constitutes a near doubling of the 2015 level [for the F-35]," the government says.

Defence minister Ine Eriksen Søreide says the funding highlights the government's commitment to protecting the nation.

The proposal also includes Nkr35 million in additional funds for the air force's Lockheed P-3C Orion maritime patrol aircraft fleet, to facilitate longer and more frequent patrols in the high north. ■



A model of the evolved design

UAV JAMES DREW WASHINGTON DC

Terminator is back in bid for US Army deal

Lockheed Martin has unveiled an evolved version of its Terminator loitering unmanned air vehicle, which it is offering for the US Army's lethal miniature air munition system competition.

Company officials declined to discuss the UAV, which was on show in model form at the Association of the United States Army conference in Washington DC on 12-14 October, saying it is still under evaluation by the army.

The new design is a significant enhancement over the high-explosive-armed Terminator revealed in 2014 as a twin-engined concept. It features a sleeker design with an electro-optical/infrared sensor installed in the nose and a single engine. Hinges on the UAV's wings and a folding tail suggest that the system will be tube-launched. ■

ROTORCRAFT STEPHEN TRIMBLE WASHINGTON DC

UAE helicopter firm widens gunship conversion scope

NorthStar Aviation is looking at several twin-engined options as it builds on Bell 407 project

United Arab Emirates-based NorthStar Aviation is evaluating twin-engined commercial helicopters for conversion to military gunships, having successfully delivered several armed Bell Helicopter 407s to its host country.

NorthStar launched operations in 2011 to deliver lightly modified 407 trainers to the UAE military, before expanding its activities to convert the commercial 407GX with a Garmin G1000 cockpit and into an armed configuration capable of surveillance and light attack missions. The last of 30 such 407MRH aircraft will be delivered in the first quarter of 2017, says NorthStar design engineer David Williams.

The company is now evaluating several twin-engined helicopters, including US- and European-built types, for similar conversion into armed aircraft, Williams says. At the same time, it also is seeking to win additional orders for the 407MRH from foreign militaries.

Although NorthStar displayed the 407MRH at the Association of the United States Army's annual



The company is on the hunt for further Bell 407MRH customers

convention in Washington DC, the company does not consider the US military a likely buyer. However, a US-based subsidiary in Melbourne, Florida is deeply involved in the conversion process. This facility takes delivery of factory-built 407GX aircraft, then modifies their avionics with an expanded instrument panel, including mission and weapons displays.

The rotorcraft are then shipped to Abu Dhabi, where workers integrate a weapons firing platform, composite fairings, plus communications and surveillance equipment, including a FLIR Systems Star Safire electro-optical/infrared sensor turret.

"We can build this faster and cheaper than what they can get going through an OEM," Williams says. ■



AltJet to launch
with TBM 900
BUSINESS AVIATION P24

DEVELOPMENT GREG WALDRON SINGAPORE

Maiden sortie for new KT-100 trainer

South Korean manufacturer says that new ab initio aircraft will form part of indigenous fleet for nation's air force academy

Korea Aerospace Industries (KAI) has conducted the first flight of its KT-100 ab initio trainer variant of the KC-100 Naraon light aircraft. Performed from the company's Sacheon production site on 5 October, the debut sortie lasted about 1h 20min, it says.

The KT-100 features a video/voice recorder, identification friend-or-foe equipment and other modifications to make it suitable for instructing military pilots.

Seoul in May 2014 committed to acquiring 23 KT-100s, with the aircraft – plus simulators and other supporting equipment – to be delivered by the end of 2016.

After undergoing initial instruction on the type at South Korea's air force academy, students will move on to fly the KT-1 basic



Korea Aerospace Industries

KAI has modified its KC-100 Naraon light aircraft to make it suitable for instructing military pilots

trainer before progressing to the T-50, both of which are also manufactured by KAI.

KAI says that using a complete system of indigenous platforms to prepare new pilots will reduce the number of training hours required by 35%, and lower costs by 26%. At present, ab initio training is

undertaken with the air force's fleet of 20 Ilyushin T-103s.

"KAI can ensure high operation rates via quick flight maintenance support. This will reduce the time needed and cost for training pilots," the company says.

In addition to meeting future domestic requirements, KAI says

the KT-100's introduction will also open export opportunities. "Via the KT-100 project, KAI can offer its training system to foreign countries as a package," it notes.

First flown in July 2011, the baseline, four-seat KC-100 is powered by a Continental Motors TSIOF-550-K piston engine. ■

UNMANNED SYSTEMS BETH STEVENSON LONDON

'Rainbow' UAV gives Iraq new spectrum of abilities

The Iraqi defence ministry has released images and video of its new China Aerospace Science and Technology Corporation (CASC) CH-4B "Rainbow" unmanned air vehicle taking part in its first combat mission against Islamic State militants.

Defence minister Khalid al-Obeidi observed the UAV taking off from Kut air base to support an operation in the nation's Anbar region on 10 October, the defence ministry says.

The move confirms Baghdad's acquisition of the type – a subject of speculation after first images appeared online early this year.

The Iraqi army's aviation division has acquired the UAV in its



Iraq Defence Ministry

The CH-4's airframe bears a resemblance to the Predator family

armed B-model variant. CASC also offers a reconnaissance-only version, the CH-4A.

Like many other Chinese-made medium-altitude, long-endurance

UAVs, the CH-4 airframe bears a visual resemblance to elements of General Atomics Aeronautical Systems' family of Predator unmanned aircraft.

At last November's Airshow China event in Zhuhai, a CASC brochure described the CH-4 series as suitable for high-altitude missions over land and sea, with a claimed maximum flight endurance of up to 30h. The design has a maximum take-off weight of 1,260kg (2,770lb), including a payload capacity of up to 115kg.

The released images show Iraq's CH-4B equipped with an electro-optical/infrared sensor and under-wing hardpoints for up to four air-to-surface missiles.

CASC in August unveiled the CH-5 variant of the Rainbow, which is visually similar to the General Atomics MQ-9 Reaper, with a wingspan of 20m (65.6ft). ■

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An aerial night view of a city skyline, featuring a large, illuminated skyscraper and a parking lot filled with cars. A large, semi-transparent silhouette of a Boeing aircraft is overlaid on the image, with its wings and tail clearly visible. The text "FROM BEIJING TO FARTHER" is in white, and "A BETTER WAY TO FLY." is in yellow.

FROM BEIJING TO FARTHER
A BETTER WAY TO FLY.



Boeing builds and delivers the most complete fleet of long-range commercial airplanes, enabling airlines to offer nonstop, point-to-point service to virtually anywhere in the world. What's more, Boeing's long-range airplanes are renowned for their efficiency and comfort, and consistently ranked first by frequent flyers. Going farther to make travel easier. That's a better way to fly.





EXPANSION KATE Sarsfield LONDON

Comlux America expands ambitions

Indianapolis-based completions centre will induct its first widebody airliner in November as it targets niche VVIP market

Comlux America, the US completions and service arm of the Comlux Group, is planning to induct the first green widebody airliner into its Indianapolis facility in early November, as the construction of a new hangar extension to accommodate twin-aisle aircraft nears finalisation.

The new building will expand the footprint of the VIP maintenance, repair and overhaul facility from 11,900m² (128,000ft²) to

14,600m². This will be large enough to house aircraft up to an Airbus A340-600 or Boeing 747-8 size, says Comlux.

Its inaugural aircraft, an A330-200, was delivered to Indianapolis in July, and Comlux plans to hand the completed VVIP airliner to its unnamed customer in the fourth quarter of 2017.

"We expect this aircraft will be the first of many widebodies for

us," says chief executive Scott Meyer. "It is the beginning of the next generation of business for Comlux America."

Comlux is a relative newcomer to the VIP airliner completions market. It made its first foray into this niche sector in 2012, four years after its acquisition of Indianapolis Jet Center – an MRO facility for Bombardier Challenger-series business jets. To date, Comlux has outfitted nine VIP

narrowbodies, with two more projects under way.

Comlux is now seeking to expand its MRO presence globally, Meyer says, to take advantage of its growing international customer base. "We are pursuing several prospects beyond our current footprint," he says. "We want to be closer and more supportive to our clients in Asia, central Asia, eastern Europe and the Middle East." ■

TURBOPROPS KATE Sarsfield LONDON

Altijet to launch with TBM 900

French business aircraft start-up Altijet is preparing to launch charter services early next year with the country's first commercially-operated Daher TBM 900.

The Strasbourg-based company took delivery of the single-engined turboprop on 7 October and has applied to the French DGAC civil aviation authority for an air operator certificate (AOC).

"We hope to begin flying the TBM commercially within six months," says Altijet pilot and safety manager Julien Bottenmuller. "It will be the first French-registered [TBM] 900 to be available for passenger charter."

Fellow French company Voldirect has been offering a TBM 850 – the previous iteration of the high-speed aircraft – for charter since 2013.

Until Altijet's AOC is granted, the seven-seat single will be used by the company's private owners for corporate transportation. Its

first such flight is scheduled for 17 October.

Bottenmuller expects strong demand for its TBM from companies and private individuals in Strasbourg and the surrounding Alsace region. "The transportation links here are terrible," he says. "We will provide non-stop flights to over 3,000 destinations in Europe."

The TBM will be joined in February 2016 by a larger Pilatus PC-12NG, which will be added to Altijet's AOC in the third quarter.

France is one of a handful of European countries to permit commercial operations in instrument meteorological conditions with a single-engined turbine aircraft (SE-IMC). However, Daher hopes these operations will become more widespread, now the European Aviation Safety Agency has given the go-ahead. The final rulemaking on SE-IMC is expected next year. ■

Austrian air taxi firm has struck a deal covering its fleet of Cessna Mustangs



CHARTER KATE Sarsfield LONDON

JetSmarter's air taxi app taps GlobeAir Mustangs

The world's largest Cessna Citation Mustang operator – Austrian air taxi company GlobeAir – has sold 15,000 empty legs to mobile application-based charter provider JetSmarter in a deal valued at up to \$50 million over five years.

The agreement will help fund GlobeAir's ambitious expansion plans – which include adding up to eight more entry-level Mustangs to its 12-strong fleet by 2020 and establishing a point-to-point, low-cost, pan-European air taxi service.

The contract also broadens JetSmarter's footprint in Europe.

Earlier this year, the Fort Lauderdale, Florida-headquartered company raised \$20 million in private investment to fund its expansion across the continent. It now has offices in Zurich, Switzerland and Moscow, Russia.

JetSmarter was launched in 2014 with the aim of providing travellers with seamless, simple access to the private jet marketplace via a range of dedicated smartphone applications.

The company says the business jet empty legs it has acquired are being marketed to its customers at a cost-effective rate via its "JetDeals" feature. ■



Altijet plans to be France's first commercial operator of TBM 900



Long haul to edge of space
SPACEFLIGHT P26

TRAINING KATE SANSFIELD LONDON

FlightSafety receives Warrior trainers

Piper Aircraft has delivered the first five Warrior piston-singles to FlightSafety International from an order for 20 of the four-seat aircraft placed by the training provider's Vero Beach academy in July.

The Warriors are built to order and will replace the company's ageing Piper Cadets. The 15 remaining aircraft will be shipped throughout the fourth quarter.

The deal was signed at the AirVenture show in Oshkosh, Wisconsin, and also includes firm orders for six Arrows – to be shipped in the first quarter of next year – and options for a further 20 Warriors.



Another 15 of the four-seat type will be handed over by year-end

The Lycoming O-320-D3G-powered Warriors will be used by the 50-year-old academy for ab initio pilot training. They feature Garmin's G500 flightdeck and GTN 650 communication

and navigation system and satellite enhanced dual antenna traffic awareness technology, which Piper says enables one-second updates for traffic situational awareness. ■

PRODUCTION KATE SANSFIELD LONDON

Windecker Eagle flies again

Ground-breaking composite aircraft to be revived and updated by Chinese entrepreneur

A Chinese entrepreneur is to restart manufacture of the Windecker AC-7 Eagle 1, 40 years after its US developer shut down having produced only eight – and delivered only one – of the piston-single.

Windecker's demise was triggered by an economic recession in the mid-1970s, which hit the light aircraft industry hard. The company had spent \$20 million developing the four-seat type – the first composite aircraft to be built and then certificated by the US Federal Aviation Administration under Part 23 standards.

Entrepreneur Wei Hang acquired two stored Eagle 1s in 2013,

along with the programme's type certificate and production rights.

He is now building manufacturing facilities in Chengdu – in southwest China's Sichuan province – and Tongliao, eastern Inner Mongolia. Production is scheduled to begin next year, although Hang has yet to decide under what name the company will trade.

"The plan is to produce refined copies of the Eagle 1 for the general aviation movement in China," says Don Atchison, chief executive of Windecker Eagle Research and Development. The Mooresville, North Carolina based-company has been commissioned by Hang to restore his pair of Eagles.

The first aircraft is scheduled to make its debut flight later this month. "We've replaced most everything from the firewall forward, and refurbished the landing gear, flight controls and mechanical, electrical, hydraulic and fuel systems," says Atchison, who is heading the restoration project.

The upgraded aircraft will eventually be shipped to China, where they will be used as marketing demonstrators.

All-new production models – which could be branded the Eagle II – will feature extra refinements, including a new interior, a Hartzell three-blade composite propeller and Garmin G3-X touchscreen flightdeck. The Eagle's original Continental IO-520-C engine will also be replaced, with the uprated 315hp (235kW) IO-550-N.

Atchison describes the upgraded model as "a fascinating blend of the oldest composite airframe in the world enhanced by the most modern technologies in avionics and subsystems".

Chinese certification is scheduled for the first half of 2016. ■



Two examples are being restored as marketing demonstrators

INFRASTRUCTURE
GREG WALDRON SINGAPORE

AVIC plans huge general aviation base in Hubei

AVIC plans to develop a CNY20 billion (\$3.2 billion) general aviation base in the country's central Hubei province.

The development will cover 30km² (11.5 miles²) in Jingmen City, says a report in state newspaper *China Daily*. The work will be completed in eight years.

"AVIC will build 50 such complexes across China to cover 90% of the country's population in order to build a national light aircraft operation network," says AVIC chairman Lin Zuoming. The base will focus on building aircraft, research, and training.

AVIC is not the first company looking to develop China's GA infrastructure. Superior Aviation Group – the Chinese firm that unsuccessfully tried to buy Hawker Beechcraft in 2012 – is awaiting approval to build a 8km² so-called aerotropolis on the outskirts of Beijing. It will house aircraft manufacturing and maintenance facilities, along with an airport, training school, completion centre, hospital and hotel.

China Aviation Investment Group is planning to build a "World Aviation City" in the Inner Mongolian town of Ordos, which will feature the largest pilot training centre in the Asia Pacific region.

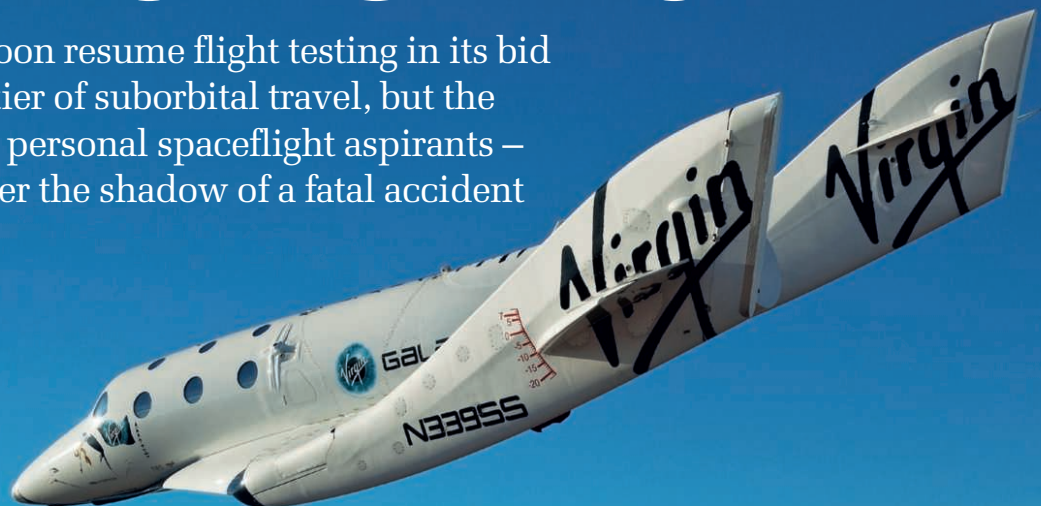
China has shown increasing interest in general aviation in recent years. In 2011 China Aviation Industry General Aircraft created a stir when it purchased US manufacturer Cirrus Design. Two years later, the Meijing Group acquired defunct light aircraft builder Mooney for \$100 million.

Other western GA companies acquired by Chinese firms include XtremeAir, Enstrom Helicopter, Epic Aircraft, and Teledyne Continental Motors.

The country's airspace, however, remains tightly controlled by the nation's military, and progress towards greater leniency in areas such as flight planning is slow. ■

LONG HAUL TO EDGE OF SPACE

Virgin Galactic will soon resume flight testing in its bid to open the new frontier of suborbital travel, but the company – and other personal spaceflight aspirants – continues to live under the shadow of a fatal accident



Virgin Galactic

Happier times: an early glide test of SpaceShipTwo promised a smooth path to space, but technical hitches and a fatal crash hang over the project

JAMES DREW LAS CRUCES, NEW MEXICO

One year ago this month, Virgin Galactic's pursuit of suborbital space tourism turned suddenly to tragedy when its SpaceShipTwo, built by Scaled Composites, broke up over the Mojave Desert, just 13sec into its fourth powered flight. The accident killed co-pilot Michael Alsbury, who had mistakenly unlocked an empennage feathering mechanism meant to reconfigure the vehicle for re-entry. In feathered mode, the vehicle – returning from apogee at 100km-plus – should drop nose-first back into the high atmosphere and slow, stably, like a badminton shuttle; the result was catastrophic airframe failure during rocket-powered acceleration in thicker air. Pilot Peter Siebold escaped by parachute, but was seriously injured.

SpaceShipTwo's destruction grounded the programme pending a National Transportation

Safety Board (NTSB) investigation and cast a long shadow over America's fledgling personal spaceflight industry, which is pioneering paths to space for ordinary travellers. But while many thought the disaster might end Virgin Galactic's drive to make suborbital journeys a matter of routine, Richard Branson's space group is bouncing back – and even expanding.

As Virgin Galactic chief executive George Whitesides told the annual International Symposium for Personal and Commercial Spaceflight (ISPCS) in Las Cruces, New Mexico on 8 October, a second SpaceShipTwo (SS2-2) is in advanced stages of construction

"The trick is to balance moving quickly with building it right and building it safely"

GEORGE WHITESIDES
Chief executive, Virgin Galactic

and will soon return the programme to flight testing. Its twin-fuselage launch aircraft, WhiteKnightTwo (WK2), is also preparing to resume operations.

PRESSURE

The company, he adds, is wary of laying "unnecessary pressure" on the production team with a timeline for return to flight testing, but progress suggests an early 2016 start. "We're working three shifts now to finish the vehicle. The trick with all these programmes is to find the right balance of moving quickly, but also building it right and building it safely."

The project workforce has expanded by nearly a fifth on a year ago, he says. The manufacturing arm, The Spaceship Company in Mojave, California, recently began installing the nitrous oxide tank to feed the liquid-solid hybrid rocket motor – a second-generation RocketMotorTwo engine. Whitesides says the

oxidiser tank will be bonded to the fuselage “a little bit later in the year”; the solid-fuel mix being tested for the first time when SS2 ripped apart is unchanged. At the conference, he showed video of a full 60sec test firing on a test stand in Mojave.

The air vehicle passed its weight-on-wheels milestone in May and the fuselage has been mated with WK2. Critical fatigue testing and pressure cycle testing of the main cabin has been done, and improved pilot seats – and avionics system – are being integrated into the cockpit. “We’re working to integrate all systems into the vehicle: plumbing, electrical, pneumatics and other systems,” Whitesides says.

SS2-2 reflects the findings of the NTSB, which held a public meeting outlining its preliminary conclusions in July, but has yet to issue a final report. According to the board, the probable cause of the crash was “Scaled Composites’ failure to consider and protect against the possibility a human error could result in a catastrophic hazard to the SpaceShipTwo”. The Federal Aviation Administration was also criticised for failing to recognise this shortcoming. While the new vehicle features enhancements including a device to prevent the feathering unit from deploying prematurely, Virgin Galactic is understandably keen to show little has changed – in terms of the vehicle and space-tourism concept. Tickets remain on sale.

“At a top level, the airframe is sound, the propulsion system is sound. We require very few changes to the vehicle following our accident,” says Whitesides. “WhiteKnight should be flying very soon. That will be a great moment [when] she will be waiting for the spaceship, which should be coming along soon.”

When testing resumes, the company expects to move more quickly than in the first series, with two or three flights “rather than five or 10, to gradually inch up on a particular test point”. Nobody, however, should underestimate the scale of the challenge. A programme that at one



SpaceShipTwo debris in the Mojave Desert

point expected suborbital flights in 2010 has got no higher than 71,000ft, on its third powered flight in January 2014; at 328,000ft, suborbital space is a long way away.

SAFETY, SAFETY

Other personal spaceflight ventures, such as Blue Origin’s New Shepard and XCOR’s Lynx vehicles, have yet to prove viability. Neither has suffered a Virgin Galactic-level catastrophe, but neither is progressing smoothly either.

At Blue Origin – founded and bankrolled by Amazon billionaire Jeff Bezos – the New Shepard vertical-launch vehicle is expected to resume testing this year. Its maiden launch in April was mostly successful; the capsule landed safely by parachute, but the main BE-3 propulsion stage, which should have returned to the pad for a controlled vertical landing, was lost owing to “loss of hydraulic pressure” during descent. XCOR, meanwhile, is developing a single-pilot, single-passenger runway take-off and landing rocket plane. Years behind schedule, a flight debut at one pointed slated for 2010 has yet to happen.

Hanging over them all is a debate about whether the FAA should impose stricter safety regulations on the commercial space industry. The prevailing view at the ISPCS gathering was that this is still an uncharted, experimental endeavour, and should not be held to the same uncompromising safety standards im-

posed on the air transport industry.

Wayne Hale of Special Aerospace Services, an engineering consultancy, tells Flightglobal that he hopes to see all three teams flying, but it is hard to tell if SS2, New Shepard and Lynx will all make it past the development phase.

“Virgin Galactic I would have said a year ago was in the lead. Of course, they had that awful and unfortunate accident and they’re rebuilding their programme – which takes a while, and I can speak from experience,” says Hale, who ran NASA’s Space Shuttle programme from 2005 to 2008 and supervised its return to space after the 2003 Columbia disaster.

“Blue Origin has got a neat concept which they demonstrated 90% of, and I think they’re really close to flying people into space. XCOR has a longer road ahead of them, from what I understand, because their financial situation is

“Space is not for the faint of heart. As a community, we push the boundaries”

GEORGE WHITESIDES

Chief executive, Virgin Galactic

a little different. They don’t have a billionaire backer, but they’re making great progress. They are [all] competitive at some level, but like with this conference, everybody wants the larger enterprise of human beings going into space to succeed.”

ISPCS curator and director of the New Mexico Space Grant Consortium, Patricia Hynes, is one of more than 700 SS2 ticket-holders, and says most people recognise that testing almost always runs longer than planned and failures will happen and must be overcome.

She says despite the mishap, SS2 was performing as designed. She was one of many ticket-holders to encourage Branson to continue backing the space-tourism venture immediately after the disaster.

“It has a very good partner in Mojave air and space port,” says Hynes. “It has done over 50 different types of tests on the vehicle, so it has done what the industry told it to do – be careful, be relentless, go step by step, don’t over-promise and under-deliver, do your job, do it well and let the job tell you when to launch.

“They’re changing the industry, they know it. They’re in the lead, they know that. They have to do it well for those coming behind them. They’ve been at it a long time. So they know they’re leaving a legacy even though they’re a young company.”

Whitesides, too, is pragmatic: “Space is not for the faint of heart. As a community, we push the boundaries. We’re looking forward to the future eagerly, because we think the opportunities are huge.” ■



Virgin Galactic’s SS2-2 in construction; subtle changes reflect accident report findings

CHASING A DREAM

A concept for a mini Space Shuttle seemed doomed when NASA passed it by, but Sierra Nevada is pressing ahead to develop the vehicle it believes has a bright future

JAMES DREW LAS CRUCES, NEW MEXICO

When NASA chose seven-seat capsule concepts from Boeing and SpaceX for full development funding in 2015 in its bid to restore a US manned spaceflight capability lost with the 2011 retirement of the Space Shuttle fleet, it looked like the end of the runway for the Dream Chaser, an alternative concept best described as a mini Shuttle.

The prospects for the vehicle worsened when Sierra Nevada Corporation (SNC) lost a court bid to force NASA to change its mind.

Now, Boeing and SpaceX are spending \$6.8 billion from NASA's Commercial Crew Transportation Capability (CCtCap) programme to prepare for astronaut launches to the International Space Station (ISS) from Cape Canaveral from 2017. But a determined SNC is blazing its own trail – which the company insists will end in space, with or without NASA's blessing.

SNC is first pitching an uncrewed version of its reusable, runway-landing Dream Chaser for a NASA contract to resupply the ISS from 2018 to 2024. The company also sees international opportunities, such as partnering with Europe or Japan. The Dream Chaser may, of course, turn into expensive wishful thinking, but SNC's Space Systems corporate vice-president,

Mark Sirangelo, is confident that a series of flight tests set to begin in early 2016 will prove that this concept for a follow-on to the shuttle is no idle plan.

"In the last year, we were not part of the [commercial] crew downselect, and a lot of people thought that would be the end of the programme," he told the International Symposium for Personal and Commercial Spaceflight in Las Cruces, New Mexico on 7 October. "But we're resilient. We don't like giving up."

DYNAMIC MODEL

Sirangelo emphasised that SNC will press on with the Dream Chaser, even if it doesn't secure the next NASA cargo contract.

"We have real vehicles and we're well into development. The vehicle is highly mature... so the idea of taking it and moving it to the next level should we not win the cargo programme is much more viable than it ever was," he says.

"People thought perhaps we couldn't do this when we weren't selected for the commercial crew programme, but in fact we've moved faster and developed a whole second variant to the vehicle in that time. It was never designed to be a NASA-only project."

If nothing else, SNC is putting a lot of its money where Sirangelo's mouth is. As of Oc-



A folding wing design will reduce launch costs

tober 2013, when a 1min glide from 12,500ft by a full-size aerodynamic model proved the airworthiness of the lifting-body craft (and, apparently, its autonomous flight and landing avionics), the then-nine-year-old Dream Chaser project had consumed around \$300 million of NASA money, and what Sirangelo at the time said was a similar amount from Sierra Nevada's investors.

This month, the privately-held company declined *Flight International's* request to detail programme finances, but says: "The second free-flight test [in 2016] will be conducted as part of a NASA milestone which, upon successful completion, will be funded by NASA. In addition, SNC has made significant financial contributions to the programme."

Failing to make NASA's CCtCap cut was piling insult on to literal injury. Though declared a success in terms of data gathering, that first free-flight test in October 2013 ended with a runway crash at Edwards AFB in southern California, when one leg of the landing gear failed to deploy. To get to where it could talk about resuming flight tests, SNC had to rebuild the vehicle. The Louisville, Colorado-based programme has also endured staff lay-offs.

Outside of the USA, SNC has discussed collaboration with Germany's DLR aerospace agency and the European Space Agency, which has active spaceplane development programmes as part of a medium-term plan to gain the ability to bring material home from



Reusable spaceplane could resupply the International Space Station, and act as temporary module

The craft could land on runways around the world, offering swift transition of time-sensitive cargo



space. SNC has also been courting Japan's JAXA space exploration agency.

But the most lucrative and immediate opportunity is NASA's 2018 to 2024 ISS cargo resupply contract. An award announcement for two service providers is due on 5 November, and SNC is offering a Dream Chaser-based cargo system in a four-way contest. This involves incumbents SpaceX and Orbital ATK, with improved versions of their now-flying Dragon and Cygnus systems, and Boeing – which has proposed a cargo-carrying derivative of the CST-100 spacecraft it is developing for the CCtCap crew programme.

RESUPPLY MISSION

The Dream Chaser – based on NASA's HL-20 lifting body concept from the 1980s – has evolved significantly over the course of development, but the most significant changes have come over the past year in response to NASA's resupply programme. The latest design, announced earlier in 2015, has folding wings and a solar-powered cargo attachment for the resupply mission.

The change should lower the launch cost considerably, since the spacecraft now fits inside the standard payload fairing of United Launch Alliance's Atlas V and Delta IV rockets, or its in-development Vulcan. The possibility of launch on top of ArianeSpace's Ariane 5 is also thought to have been explored: the original design would have seen the Dream Chaser attached externally on a specialised adaptor.

"We have real vehicles and we're well into development. The vehicle is highly mature"

MARK SIRANGELO

Corporate vice-president space systems, Sierra Nevada

Sirangelo says the cargo variant is capable of delivering 5,000kg (11,000lb) to and from the space station, and could also be used as an additional module or to host science experiments. As for reusability: "The turnaround of the vehicle is expected to be about 30 days. It will be refurbished in Florida and then launched back up at the same location."

Sirangelo adds that the vehicle can "stay on-station for well past the NASA minimal time of 280 days [and] return home within 8-12h to a standard 10,000ft [3,000m] runway".

He also stresses its flexibility. The absence of any toxic materials in the craft's construction means many landing places around the

world could host Dream Chaser. And, he adds: "We can offload immediately after the vehicle stops. Anything that's critical can get the shortest amount of time from the space station to wherever it needs to go."

SNC says that if the Dream Chaser secures the NASA resupply contract, it could begin ferrying cargo by late 2018 or early 2019.

The Dream Chaser is also targeting military applications, although Boeing dominates that market with its X-37B orbital test vehicle. SNC believes its spacecraft could be a viable alternative to the X-37B, which is designed for recoverable, long-duration experimentation in space. "We are not part of that programme, although we believe our vehicle can do many of those types of operations [for the US Air Force]," Sirangelo says. "It is a larger vehicle that can stay in orbit for well over a year."

Boeing's X-37B was launched for the fourth time in May 2015, having previously spent 674 days in space. The spacecraft is almost 3m high and 9m long; Boeing has proposed a scaled-up, potentially-manned version.

Patricia Hynes, curator of the Las Cruces gathering and director of the New Mexico Space Grant Consortium, tells *Flight International* that she sees SNC as pursuing a long-term set of opportunities, going even beyond the 2024 end of the space station programme. "They believe very much in what they're trying to accomplish. They believe in the vehicle and the potential markets the vehicle will open up." However, she warns: "They have to be relentless. If you give up, then it's over." ■



A full-size model was glide-tested in late 2013



Airbus plans a completions centre for its A330 in China

Airbus

BIG PLAYERS UP THE ANTE IN CHINA

Rival airframers have both moved to increase their industrial footprint in nation

STEPHEN TRIMBLE WASHINGTON DC

GREG WALDRON & ELLIS TAYLOR SINGAPORE

There can be little doubt of the importance of China to Seattle and Toulouse. On a monthly basis, a large portion of Boeing's production run makes its way to Chinese airlines. The same holds true for Airbus, which has seen its share of the China market grow rapidly over the 1990s and 2000s, making it an equal to its perennial rival. Airbus was much quicker to develop a production capability in China, with an A320 final assembly line in Tianjin and a planned completions centre for the A330. Boeing, however, held back from such commitments – until late September, when it announced its first foreign completion and delivery centre, for the 737.

Apart from the centre, Boeing will also broaden collaboration with supplier and potential rival AVIC and launch an initiative to develop biofuel from Chinese agricultural waste. All three initiatives were announced as part of Chinese president Xi Jinping's visit on 23 September to Boeing's widebody assembly complex in Everett, Washington.

Boeing's new facility in China will be operated jointly with Comac, the maker of the C919 narrowbody. Workers there will install interiors, paint liveries and deliver 737 aircraft to Chinese customers. The completion and delivery centre stops short of opening a fourth final assembly line for the 737, in addition to three active lines in Renton, Washington. But the commitment to open the facility at a location and time to be announced later should "enhance" Boeing's access to the fast-growing Chinese aviation market, the company says.

UNION CONCERNS

Boeing's two largest unions, predictably, immediately protested management was using union jobs as "bargaining chips" in sales discussions with customers. But Boeing executives say the Chinese facility will enable an increase in production rates for the 737, creating demand for labour on the three final assembly lines in Renton. Boeing is already raising 737 monthly deliveries from 42 to 52 by 2018.

China has become Boeing's largest commercial customer, taking delivery of 155 aircraft already this year. China Aviation Supplies

Holding, meanwhile, announced on 23 September a commitment to purchase up to 300 aircraft, including 190 737s and 50 unspecified widebody aircraft for Chinese airlines. Another 60 737s will be purchased for leasing companies ICBC and CDB Leasing.

"The 737 will be a cornerstone of the Chinese fleet for years to come, and we look forward to delivering 737s to Chinese customers in China," said Boeing Commercial Airplanes chief executive Ray Conner.

At the same time, Boeing also pledged to expand its industrial partnership with AVIC. Chinese suppliers already hold major positions in Boeing's supply chain, building horizontal stabilisers, vertical fins and wing panels for the 737, rudders for the 787 and control surfaces for the 747-8. A new framework agreement commits the partners to add major component assembly work for Boeing commercial aircraft by AVIC.

Boeing will help China develop processes to convert waste, such as corn cobs and wheat stalks, into jet fuel under a memorandum of understanding signed with the National Development and Reform Commission.

Just days before Xi's visit to Washington state, however, Airbus stressed its desire to continue investing in China production.

"Our recent widebody co-operation for the A330 completion and delivery centre was quite a breakthrough," said Airbus China president Eric Chen. "The A330 completion and delivery centre is proof about how we never stop expanding co-operation with China. Our next target is to build on Tianjin based on these two projects, and make it our Asia centre."

COMPLEX RELATIONSHIP

Chen made the remarks to journalists at the China Aviation Expo event in Beijing. His comments follow news in early September that Airbus will add an A330 completion and delivery centre in Tianjin, which will eventually also do work on the A350.

In response to a journalist's question about the emergence of the indigenous C919 as a local competitor, Chen admitted that this has made the relationship with Chinese partners "a little bit complicated".

"Still, we have a lot of confidence about being open to our Chinese partners," he says. "We embrace competition and we think the market is big enough to accommodate more than two competitors."

Chen stressed Airbus's progress in China since entering the market in 1985 with an A310 operated by China General Aviation, which became China Eastern Airlines. In 1995 Airbus had 6% of the market and this has grown to 50%. The company employs around 1,300 staff in the country, and it has partnerships with local companies.

Aerostructures for various Airbus aircraft are produced by Chengdu Aircraft Corporation; Shenyang Aircraft Corporation; Xi'an Aircraft Company; Shanghai Aircraft Manufacturing; Hong Yuan Aviation Forging & Casting; and Hafei Aviation Industry.

Although China's narrowbody market will remain a key battleground for the airframers, it is abundantly clear China's widebody market

is crucial. The 2015 Flightglobal Fleet Forecast predicts the country will take 1,130 new widebody aircraft over 20 years, with the in-service fleet to swell to over 1,200 by the end of 2034.

Chris Seymour, head of market analysis at Flightglobal's Ascend consultancy, says this is being driven by a growing affinity in China for long haul travel.

"With the growing wealth of China and a more affluent middle class, the desire to travel for business and leisure is increasing," he says. "The market is also seeing an increase in links from secondary cities to points in Asia, Europe and North America, and also more of the smaller carriers adding widebody capacity."

WIDEBODY DEMAND

Presently, Boeing trails Airbus in the widebody market, with Flightglobal's Fleets Analyzer database showing that the European manufacturer has around a 65% share of the market of in-service passenger widebodies. Furthermore, the average age of the Airbus fleet is much younger than the Boeing one, with the latter likely to see a number of retirements in the coming years.

Prior to September's 300-aircraft deal, Boeing held the advantage in the firm order backlog for widebody passenger aircraft – 33 units compared to 23. The recent deal announced in Seattle includes 50 widebodies, but the types were not specified and this number could include aircraft the market was already aware of.

To maintain that advantage, Boeing needs to



The A320 final assembly line in Tianjin



Chinese premier Xi Jinping, left, meets a Boeing employee in Everett, Washington

boost sales of its 787 and 777.

Hainan Airlines and Xiamen Airlines have indicated that they plan to order additional 787s, and further 777 orders could be likely for the big three carriers: Air China, China Southern Airlines and China Eastern.

"With the growing wealth of China, the desire to travel is increasing"

CHRIS SEYMOUR

Head of market analysis, Flightglobal Ascend

More immediately, it appears that the A330 could be the short-term beneficiary of Chinese carriers' desire to further expand their international services.

"It has proved especially popular in domestic and regional operations and the A330neo is forecast to gain sales, too," says Ascend's Seymour.

Compared to the 787, A330ceos are available with shorter lead times, and it would appear that Airbus is open to offering aggressive discounts. As for the re-engined Neo variant, the type's additional range and lower operating cost could be a major positive for carriers looking to add new city pairs on longer routes, but without the range capability of a 787 or the capacity of a 777.

Nevertheless, not all has gone Toulouse's way in China. Airbus's proposed A330 Regional – a high-density and lower-weight certificated A330 that would be optimised for use on domestic flights – has yet to garner any orders despite being targeted strongly at Chinese carriers. Airbus's flagship, the A380, has also secured just five orders, from China Southern.

Given time, though, Seymour says that the focus will shift to the 787-9 and A350-900, with 75% of future deliveries in the country predicted to be in the 250-300 seat range.

Indeed, at the Beijing event Chen stressed confidence in the A350's prospects in China. For now, Air China is the only customer with an order, for 10 of the -900 variant. Chen says Chinese interest will grow after the aircraft's successful entry into service this year, and that the aircraft is well suited to long-haul sectors. He specifically mentions Guangzhou-New York as a possible routing pair for the type.

"In terms of economics and technology, the A350 is very suitable for Chinese airlines' international routes," says Chen. "My concern is not demand, but production capability. How much can we produce to satisfy the market?"

Longer-term, Boeing and Airbus may face competition from Beijing's plans to develop a widebody aircraft with Russia. However, Seymour says that this will only start taking share in the later 2020s, leaving the two western airframers to battle it out in the meantime. ■



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When the future was orange

Such is EasyJet's place in Europe's aviation firmament that it's easy to forget the one-time upstart from Luton is just 20 years old. The budget airline has come a long way from the days of hand-me-down 737s and cabin crew in trainers and shapeless orange fleeces.

Back then, its tuppence ha'penny marketing strategy was based on a larger-than-life Stelios (remember him?) popping up everywhere and – as an advance on the original giant phone number emblazoned on its aircraft – a slogan that gently mocked British Airways' boast about being “the world's favourite airline”. In the fledgling days of the internet, Squeezy was “the web's favourite airline”.

As a disruptor, the “orange squash” was ahead of even Michael O'Leary's Ryanair and has managed – arguably more smoothly than its Irish rival – that awkward brand transition from cheap and cheerful (never cheap and nasty) to hybrid carrier appealing to both business and leisure travellers across Europe.

So, to a genuine innovator in the aviation industry, we say: happy birthday.

Tel Aviv it or not

A transport industry website has the story that United Airlines is to launch non-stop Tel Aviv flights next year.

Hopefully that will be in a Boeing 787 (as the text describes), rather than the considerably less state-of-the-art United-liveried aircraft (*below*)



Now it's EasyJet profits that have lots of zeros at the end

that was chosen to illustrate the news, an early-1960s Sud Aviation SE210 Caravelle.

You might imagine the conversation: “So, Dreamliner, Mainliner? Is there a difference? They're both airplanes, right?”

Figure it out

The Airbus A380 has 350 companies in its supply chain, a tweet from UK trade body ADS informs us. Does that mean the A350 has 380?

Treat 'em gruff

Overheard at ATL service desk of a certain Georgia-based airline after several passengers missed their overnight transatlantic connection because of delays caused by severe thunderstorms on the east coast.

Exhausted passenger (very courteously): “Will [US airline] be paying for my hotel?”

Staff member (passive aggressively and avoiding eye contact): “What? You think [US airline] is God? That we control the weather now?”

Tip to big three: you never know, maybe extending some basic courtesy and empathy to harassed fare-paying customers might help level that “uneven playing field” with Gulf carriers.

A wee problem

An Indian passenger has been caught by New Zealand customs trying to import a bag of cow urine in his luggage. Presumably officers told him to re-moo-ve the illegal item, beef-ore checking his udder suitcases too.

Time to kill

Maybe we've been reading too much publicity for the new Bond film, but could this BA tweet be read as a time-based challenge to a would-be assassin?



Zeppelin flop

A Zeppelin raid was made yesterday evening over the London area, when a certain number of incendiary and explosive bombs were dropped. The material damage is small. A few fires resulted, but they were quickly put out by the Fire Brigade.”

100 YEARS AGO

Paste the bullies

A flight commander in a Spitfire squadron, who has five German aircraft to his credit, recently said: “We've been at grips with the Luftwaffe in so many circumstances that we've come to know their measure. It's the measure of a bully, and everyone likes to paste a bully.”

75 YEARS AGO

A nuclear trek

The nuclear-powered aircraft carrier USS “Enterprise” (75,700 tons) has joined the US Seventh Fleet off South Vietnam.

50 YEARS AGO

She is expected to replace one of the conventional carriers operating daily air strikes against North Vietnamese targets.

\$31m settlement

In possibly aviation's biggest negotiated personal-injury settlement, some \$31 million has been paid to a Piper Malibu pilot and his family. The piston single crashed in Long Beach in late 1987 after engine failure, killing an instructor and seriously injuring pilot Dennis Paboojian, who claimed \$50 million.

25 YEARS AGO

100-YEAR ARCHIVE

Every issue of *Flight* from 1909 onwards can be viewed online at flightglobal.com/archive

France will take the spotlight as “feature country” at Singapore

Singapore Airshow 2016 will welcome France as the Feature Country in the fifth edition of the show, scheduled to take place from 16 to 21 February 2016, at the Changi Exhibition Centre.

The Feature Country series, which made its debut at the 2014 Airshow, was developed as a permanent feature to enable the companies exhibiting within the pavilion to leverage on the Singapore Airshow as a strategic platform; lending support to businesses of the Feature Country and enabling them to tap the opportunities in the Asia Pacific region and beyond.

The French Pavilion will be located at a prominent spot within the exhibition hall. Participating exhibitors will have access to a dedicated “Deminar” area – a demonstration and seminar area for research institutes and universities to showcase their latest technologies and innovations. In addition, business meetings between the French Pavilion exhibitors and VIP delegations will also be specially facilitated.

“Being a Feature Country at the Singapore Airshow 2016 gives us the unique platform to bring together our latest and best aviation technologies to meet the growing appetite for innovation in the Asia Pacific aviation sector, translating into real business deals for our French companies,” said Emeric D’Arcimoles, the Paris Air Show Chairman and Chairman of the



International Committee of Groupement des industries françaises aéronautiques et spatiales.

The French aerospace, defence and security industry is worth 47.9 billion Euros, and specifically, out of which 30.4 billion Euros is contributed by exports. This shows that France is well-placed to leverage its Feature Country platform to bring its latest innovations to the region's top decision-makers converging at Singapore Airshow 2016.

This comes at an opportune time in the Asia Pacific aviation industry, where the com-



an **experia** event

mercial aerospace sector is expected to set new records for aircraft production in 2015, off the back of the accelerated replacement cycle of obsolete aircraft and growing passenger travel demand in the Asia Pacific region. Countries in the region are also increasing defence spending to equip their militaries with modern defence platforms and technologies.

Reflecting this growth is the continued expansion of reach and impact of each new edition of Singapore Airshow. The 2016 show is already 80 per cent committed, with specialised spaces like the Aerospace Emerging Technologies Zone, the Training and Simulation Zone and the introduction of the Business Aviation Zone, to further spawn business development opportunities.

For more information about the Feature Country programme, please contact Ms Chong Kam Lin at kamlinchong@experiaevents.com or +65 6595 6124.

Hosted Buyers Programme offers new partnership opportunities

Buyers seeking specific products and solutions at Singapore Airshow 2016 can now leverage on the Hosted Buyers business matching programme to source new contacts and explore new ventures.



Accorded with a complimentary 4-day Hosted Buyer Pass and exclusive hospitality arrangements during the trade days, each eligible buyer will enjoy a hassle-free business meeting experience as pre-scheduled meetings are facilitated with exhibitors that match their requirements.

For more information about the Hosted Buyers Programme, please visit www.singaporeairshow.com/hosted-buyers-programme or contact Ms Tan Kai Li at kailitan@experiaevents.com or +65 6595 6125.

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1-2 December

Military Airlift & Rapid Reaction Ops
Seville, Spain
smi-online.co.uk/defence/europe

8-10 December

Aerospace Meetings Brazil
Sao Paulo, Brazil
bciaerospace.com/brazil

21-23 January 2016

Bahrain International Airshow
Bahrain
bahraininternationalairshow.com

3-4 February 2016

Aircraft Interiors Middle East
Dubai World Trade Centre, UAE
aime.aero/welcome-to-aime-2016

16-21 February 2016

Singapore Air Show
Changi Exhibition Centre, Singapore
singaporeairshow.com

17-19 February 2016

Routes Americas
Puerto Rico
routesonline.com/events/178/
routes-americas-2016

6-8 March 2016

Routes Asia
Manila, Philippines
routesonline.com/events/180/
routes-asia-2016

26 March - 3 April 2016

FIDAE
Santiago, Chile
fidae.cl/en

5-7 April 2016

Aircraft Interiors
Hamburg, Germany
aircraftinteriorsexpo.com

18-21 April 2016

Defence Services Asia
Putra World Trade Centre, Kuala Lumpur
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Tenders

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The operator of Bolzano Airport, ABD AIRPORT SPA, a company owned by the government of the province of South Tyrol / Alto Adige (Italy), is looking for a continuation of scheduled flights between Bolzano/Bozen Airport and Rome. Air Carriers interested in the regular operation of the above mentioned route in cooperation with ABD AIRPORT SPA under the terms of a "risk/revenue sharing" are invited to send their "Declaration of Interest" to the Airport Bolzano Dolomiti – ABD Airport SPA.

Requirements: The carrier must hold the required certificates to operate the mentioned route according to the applicable regulations, have availability of a suitable aircraft type; homebase the aircraft at BZO.

The requirements must be documented in an appropriated statement. The statement must be submitted before **30th November 2015** to the following e-mail-address:
administration@bolzanoairport.it

The only purpose of the statement is to communicate to ABD AIRPORT SPA the serious interest to participate on a tender with an adequate offer. ABD AIRPORT reserves all rights to select the companies for this tender. This notice does not produce any obligation for ABD AIRPORT SPA and does not concede any right, especially no exclusive rights, in favor to whom has presented this statement.
Signed: Dr. Otmar Michaeler / President of Board



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WORK EXPERIENCE YOSHIYUKI HIRANO

Composing supersonic materials

A long-standing interest in flight and composite structures has thrust the engineer to the forefront of Japan's next-generation supersonic civil transport project, and to also look at space-based applications for material

Where were you educated?

I attended the Tokyo Institute of Technology in Japan, where I earned my bachelor's degree from the department of mechanical-aerospace engineering.

There I joined a club developing human-powered aircraft, in the role of chief designer.

Flying only with human power requires the ultimate in weight-saving design.

We decided to adopt carbonfibre-reinforced polymer. The longest flying distance it covered was over 18km.

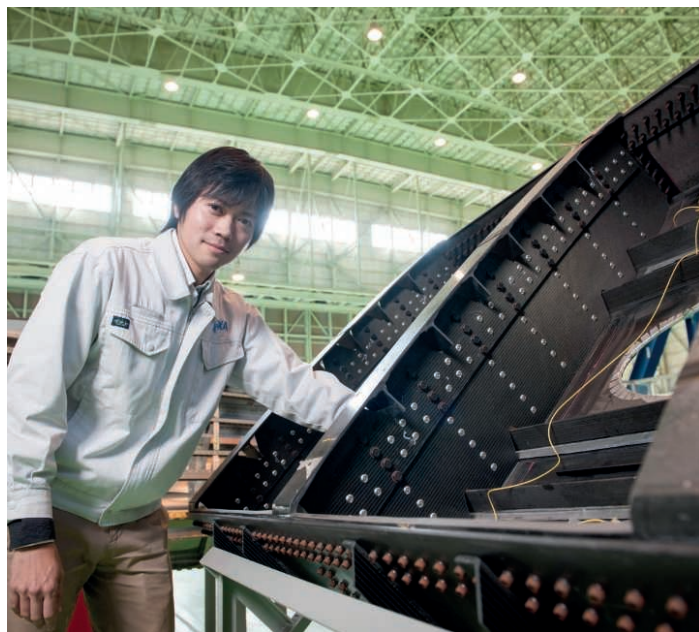
In graduate school I researched the optimisation design of composite aerospace structure. Three years later I earned my Ph.D. in engineering.

What was your first aviation job?

I took up a fixed-term post-doctoral position at JAXA's Advanced Composite Research Center just after finishing my doctorate.

My first research project was to design and develop a low-cost composite wing demonstrator with a VaRTM [vacuum-assisted resin transfer molding] process. I was in charge of the material design and manufacturing process development, conceptual and detailed structural design and structural verification with full scale demonstrator test.

The research project finished successfully, and it provided me with a valuable experience of developing composite aerospace structure. After completion of



Dr Hirano is working on JAXA's S3CM Silent SuperSonic Concept Model

the project, I signed with JAXA for mid-career employment.

What are you working on?

I'm a researcher in composite material and structure, involved in both the fundamental research on composite material and the development of flight experimental vehicles.

My recent research interests include the optimisation design of composite structures and the lightning damage behaviour of composite materials.

I'm also involved in the conceptual design of the next generation supersonic civil transport, as well as the structural design of the experimental flight demonstrator of the D-SEND2 and

ture was not a priority for the project.

My current challenge is to develop composite materials concepts for JAXA's next generation supersonic civil transport.

Do you work with JAXA's space programmes?

In the past, I have had few opportunities to contribute directly towards the development of a space exploration project. However, since composite materials have been drawing greater attention as a space structure, I am now getting involved.

What's most difficult about your job?

There is a large gap between fundamental research and practical application. Since structural integrity is directly related to safety, aircraft development is often based on conservative approaches and it usually takes a long time when applying new material or a structural concept into aircraft development.

Although there are frequent pressures that request short-term outcomes from fundamental research activity, it is always necessary to ensure I have a long-term perspective. ■

"There is a large gap between fundamental research and practical application"

FEATHER projects.

My role in the D-SEND project was to develop structural design for an unmanned experimental aircraft which demonstrates JAXA's low-sonic boom aerodynamic design concept, called the S3CM: Silent SuperSonic Concept Model.

No composite materials were applied for the experimental aircraft, since a lightweight struc-

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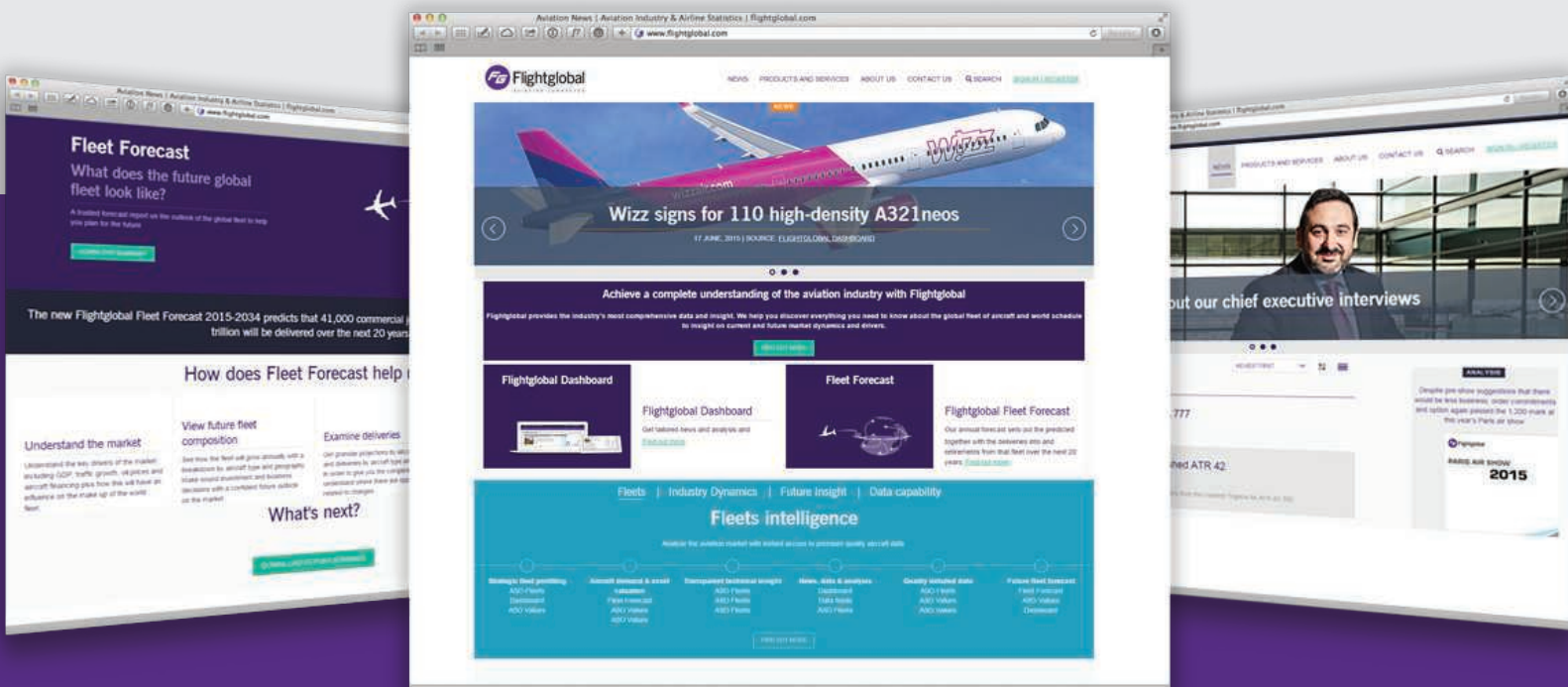
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