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AirTeamImages

COVER IMAGE

This shot was sourced from AirTeamImages; our cover story is an analysis of the go-around technique – and how getting it wrong has brought disaster – by our operations and safety editor David Learmount. See Cover Story P30

PIC OF THE WEEK
YOUR PHOTOGRAPH HERE

AirSpace user mrmagoo_uk shared this image of Hindustan Aeronautics Dhruv helicopters dancing in the skies at Aero India. The display was conducted by India's Sarang aerobatics team, or Peacocks. Open a gallery in flightglobal.com's AirSpace community for a chance to feature here

mrmagoo_uk gallery on flightglobal.com/AirSpace

flightglobal.com/imageoftheday

Nigerian Accident Investigation Bureau, General Atomics Aeronautical Systems

Inquiry criticises captain for failing to take control before trijet landed fast and long on wet runway P10. United Arab Emirates approves seal for unarmed Predator XPs P18

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Jean-Pierre Matanowski

NEXT WEEK A320 ANNIVERSARY
As it approaches 25 years in service, we look back at the past and ahead to the future of the best-selling narrowbody which broke Boeing's dominance

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BEHIND THE HEADLINES

It was a week of **dynamic duos** as business editor **Dan Thisdell** and air transport editor **David Kaminski-Morrow** decamped to Berlin for EADS's results briefing, while **Greg Waldron** and **Emma Kelly** were in Geelong, Australia for the **Avalon** air show (*P14*), where aircraft on display included GippsAero's GA8 Airvan.

For a full list of reader services, editorial and advertising contacts see P35

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THE WEEK ON THE WEB
flightglobal.com

On **The DEW Line**, Craig Hoyle noted the 50th anniversary of the Transall's first flight. "The phrase '**venerable**' probably doesn't do justice to the European-designed

transport, which remains in use with the air forces of **France**, Germany and Turkey, and which is most prominently supporting France's Operation Serval campaign in **Mali**," wrote Hoyle in a post that carried an image from French military Flickr feed Theatrum Belli (*above*). "Its duties there have included transporting personnel and equipment, airdropping **paratroops** and supplies, and also making tactical landings on dirt strips." In a separate DEW Line post, **Dave Majumdar** asked: "Was there ever a **YF-24**?" The US Air Force says no, but such an aircraft is listed in a bio of former test pilot **Col Joseph Lanni** – who commanded a **classified** flight-test unit from July 1995 to June 1997.

Find all these items at **flightglobal.com/wotw**

QUESTION OF THE WEEK

Last week, we asked: **Did Boeing take electrical evolution too far with 787?:** You said:

No, Dreamliner is genuine game-changer	Yes, Boeing paying price	Too early to say
45%	43%	12%

Total votes: 6,649

This week, we ask: **Which will be in the air by Paris? ❑ A350 only ❑ 787 only ❑ Both ❑ Neither**

Vote at flightglobal.com/poll

HIGH FLIERS

The top five stories for the week just gone:

1 **Picture:** First flying A350 moves to next stage of ground tests
2 JetBlue unveils first A320 with sharklets
3 **Picture:** Bombardier reveals engine-equipped CSeries
4 Details emerge about Lockheed's Cuda missile
5 USAF may not be able to afford T-X jet trainer project

Flightglobal reaches up to 1.3 million visitors from 220 countries viewing 7.1 million pages each month

Wrong assumptions

A decision by an airline several years ago to test empirically how pilots use flight instruments to monitor aircraft performance provided information that was unwelcome – and unexpected

If a pilot gets away with using an incorrect flying technique for long enough without a mishap, his training department assumes, wrongly, he must be using the correct technique. If that incorrect technique is then applied in a highly dynamic – but rare – manoeuvre such as a go-around, it is only a matter of time before that pilot's luck runs out catastrophically.

There has long been an assumption in the industry that a go-around is a simple manoeuvre. So embedded was this view that several catastrophes resulting from botched go-arounds were ignored as aberrations, and it was not until a near-catastrophic go-around occurred in southern England that the airline concerned decided to test its assumptions about how pilots monitored their instruments. They set up pilot eye-tracking tests in their training simulators, and discovered many pilots did not exercise a skill that – it was assumed – was fundamental to the skillset of any pilot who had earned an instrument rating. Many pilots were found to employ a haphazard instrument scan that ignored critical primary flight information for dangerously long intervals. But because the measurement of a pilot's instrument flying skill was previously based on whether the aircraft's trajectory and performance remained within certain parameters, if that was achieved by luck rather than judgement, the deficiency remained undiscovered. It needed an empirical approach such as eye-tracking to discover that assumptions about skills were wrong, and accidents were waiting to happen. Since that time, the all-engines go-around manoeuvre itself has been dissected.

A lurking question is whether loss of disciplined instrument scan is a result of automation

Rex Features

A lot to take in

It can be very demanding because change happens so fast as a result of the high power/weight ratio of modern aircraft, and because many airports have tight limitations in their missed approach procedure owing to terrain or conflicting traffic patterns.

But the industry is simultaneously trying to reduce the occurrence of the most common of all aviation accidents: the runway excursion. Runway excursions frequently follow unstabilised approaches, and going around from an unstabilised approach is one of the most effective ways of reducing overruns.

Behind the discovery made by Thomson Airways with its eye-tracking technique lurks the question of whether the loss of a disciplined instrument scan is a result of modern automated flying. Whatever the cause, the solution is a disciplined scan by the pilot flying, and a trained monitoring procedure for the pilot monitoring. ■

See Cover Story P30

Results mean EADS needn't be defensive

EADS chief executive Tom Enders can be excused for showing no job-security anxiety about the fact that one of his first acts as chief executive was to unveil an audacious merger proposal that failed spectacularly. By joining with weapons systems giant BAE Systems, he was going to resolve EADS's big headache – that its defence business lacks global scale – but 2012 financials show EADS to be in rude health, even without growth in the military business. Enders says that, with budgets being axed on both sides of the Atlantic, maybe it's not bad thing, as a business, to have relatively low exposure to defence spending.

He makes a point that begs a question: can the aerospace industry get along alright without defence?

As Airbus division results show, all indications point to rapid and durable demand growth for civil airliners. With budget austerity likely to last a generation on both sides of the Atlantic, military aerospace operations are starting to look like a drag on growth.

Anyway, military spending increasingly goes to electronic systems that make the difference in asymmetric conflicts. The aircraft platforms existing today are, arguably, good enough – so even another war might not boost traditional defence aerospace.

There is much talk of defence industry consolidation. Don't be surprised if the result in aerospace is a separation into civil and military specialists. ■

See This Week P9

David Learmount comments on airline operational and safety issues via his eponymous blog at **flightglobal.com/learmount**

For a round-up of our latest online news, feature and multimedia content visit flightglobal.com/wotw

BRIEFING

HEATHROW SHEDS STANSTED CONNECTION

AIRPORTS Heathrow Airport Holdings has completed its sale of London's Stansted airport to Manchester Airports Group for £1.5 billion ($2.3 billion). The company, formerly BAA, now owns London Heathrow as well as Aberdeen, Glasgow and Southampton airports.

INDIA SIGNS FOR CHEETAL HELICOPTERS

ROTORCRAFT Hindustan Aeronautics has received a contract worth RS4.18 billion ($77 million) to produce 20 Cheetal multirole helicopters for the Indian army. The company will deliver the aircraft, associated equipment and personnel training over four years.

SHAKE-UP CONTINUES AT TROUBLED FINMECCANICA

GOVERNANCE On 21 February, Finmeccanica continued its management shake-up in the wake of the arrests by Italian police of two top executives in a corruption probe. Daniele Romiti has been nominated as AgustaWestland chief executive to replace Bruno Spagnolini, who was placed under house arrest as part of the bribery investigation. Luigi Pasquali and Alessandro Franzoni become chief executives of space business Telespazio and defence systems operation WASS respectively. Giuseppe Orsi, also arrested by Italian police, was removed as the company's chief executive earlier in February.

PHANTOM EYE UAV MAKES COMEBACK

MODIFICATION Boeing's hydrogen-powered Phantom Eye testbed made a "picture-perfect landing" at the end of its second flight, the company says. The long-endurance unmanned air vehicle reached an altitude of 8,000ft (2,440m) in a 1h sortie on 25 February, having suffered a landing-gear mishap during its debut in June 2012.

LOSSES AT IBERIA DRAG ON IAG'S PERFORMANCE

AIRLINES Loss-making Iberia "must adapt to survive" if it is to have any future, parent company International Airlines Group has warned as full-year operating losses at the carrier hit €351 million ($459 million). IAG is proceeding with a 15% capacity cut and will slash 3,807 posts at Iberia as it has been unable to reach agreement with unions. The Spanish flag carrier's performance was in stark contrast to that of its sister airline British Airways, which turned in an operating profit – including operating losses of €98 million from BMI – of €347 million. Overall, IAG recorded an operating loss for the period to 31 December of €23 million before exceptional items, compared with an operating profit of €485 million in 2011.

EC REJECTS LATEST AER LINGUS TAKEOVER BID

MERGER The European Commission has rejected Ryanair's third attempted takeover of Irish flag carrier Aer Lingus, insisting that the low-cost carrier's remedy packages failed to fully address its competition concerns. An earlier "statement of objections" by the Commission had outlined a series of problems with the proposed merger. Its doubts centred on 46 crossover routes for which a combined Aer Lingus-Ryanair would command monopolies or near-monopolies. Ryanair's remedies were "simply inadequate" to allay the EU's concerns, it says.

HAMMERHEAD PAYLOAD REVISED

CLARIFICATION Following our 26 February-4 March 2013 article about the unmanned Piaggio Aero/Selex ES P.1HH HammerHead, Piaggio says the P180 Avanti II derivative has an expected maximum mission payload of 909kg (2,000lb), and not 1,810kg as reported.

Embraer

The 20 turboprops will be assembled in Jacksonville, Florida

PROCUREMENT **DAVE MAJUMDAR** WASHINGTON DC

Beechcraft loses LAS tender again

Embraer and Sierra Nevada win long-running battle to supply Afghan air force with light attack aircraft worth $427 million

The US Air Force has awarded Sierra Nevada and partner Embraer a $427 million firm fixed-price contract to supply the Afghan air force with 20 of the latter's A-29 Super Tucano light attack aircraft by 2015. Its decision brings to a close a long-running battle between the bidders and Beechcraft to secure the Light Air Support (LAS) tender.

"The A-29 Super Tucano with its proven track record is exactly what's needed for the LAS programme, where the mission is critical and time is short," says Taco Gilbert, vice-president of integrated tactical solutions for Sierra Nevada's ISR business.

Luiz Carlos Aguiar, president of Embraer Defense and Security, whose company has long been trying to secure a foothold in the lucrative US defence aerospace market, pledges to increase the company's presence in the USA.

Beechcraft, which bid an AT-6 attack version of its Texan II turboprop trainer, expressed its disappointment at the loss, and has not ruled out the possibility of once again protesting the award. The company, which also lost out to Embraer during the original LAS contract award at the end of 2011, had previously sued the US government over that selection, and forced the USAF to retender.

"We are disappointed that our proposal was not chosen. We will meet with the USAF for a full debrief of the award and determine our next steps forward at that time," Beechcraft says.

The repeat loss comes at a critical time for Wichita-based Beechcraft, which emerged from bankruptcy protection on 19 February, and cited winning the LAS deal as a critical near-term goal.

The Super Tucanos will be built at Embraer's facility at Jacksonville airport in Florida, which is already being readied to host the aircraft's assembly line.

"The LAS contract will support more than 1,400 American jobs, reflecting the large US supplier base," the winners say.

Under the terms of the contract, the partners will supply the light attack aircraft, training systems, planning and debrief stations, long-lead spare parts, flight certification to USAF military type certification standards and data rights.

The US Department of Defense values the deal as having a maximum contract value of $950 million, with the air force wanting the 20 turboprop aircraft delivered by April 2015. ■

No decision yet on second production line for A350
THIS WEEK P8

COMBAT AIRCRAFT **GREG WALDRON** MELBOURNE

USAF pours scorn on F-35 contractors

Service's programme chief decries relationship with Lockheed Martin and Pratt & Whitney over lack of long-term thinking

The Lockheed Martin F-35 Lightning II programme's key contractors need to take a longer view on the Joint Strike Fighter effort, the US military's programme head, US Air Force Maj Gen Christopher Bogdan, says in a new criticism of the relationship between industry and its customer.

"What I see Lockheed and Pratt & Whitney doing today is behaving as if they are getting ready to sell me the very last F-35 and very last engine, and are trying to squeeze every nickel out of that last engine and airplane," says Bogdan. "The behaviour I want to see is that they are knowledgeable about selling me 3,000 airplanes and 4,000 engines. I want them to take the long view."

Lockheed Martin

The air force could acquire over 1,700 Joint Strike Fighters

Bogdan made the critical comments during a media roundtable at the Avalon air show near Melbourne, Australia, on 27 February, after being asked about the relationship between Lockheed and the F-35's joint programme office (JPO). In September 2012, the official created a stir in defence aerospace circles by saying the relationship between the parties was at the lowest level he had ever seen it. "Are [Lockheed and P&W] getting better? A little bit," he says. "Are they getting better at a rate I want to see them get better? No, not yet."

Bogdan notes it took the JPO and P&W six months to negotiate the engine maker's fee for the F135s that will power the 35 aircraft within the programme's lot-five contract for low-rate initial production, which was finalised in November 2012.

"The fundamental cause of the six-month delay was the fee they would earn," says Bogdan. "You would think a company such as Pratt & Whitney that had just received the greatest Christmas gift you could ever get would act a little differently." This comment refers to a US Congress 2011 decision to stop funding an alternative F-35 powerplant, the F136, being jointly developed by General Electric and Rolls-Royce.

Despite his renewed criticism, Bogdan says progress is being made to redress several problems that have plagued the programme, including software development and the pilots' helmet.

Lockheed did not respond to *Flight International*'s request for comment. ■

INVESTIGATION **ZACH ROSENBERG** WASHINGTON DC

Fresh grounding for Lightning II over cracked turbine blade

The discovery of a cracked blade deep inside a Pratt & Whitney F135 engine on 19 February led to a temporary grounding of the entire fleet of Lockheed Martin F-35s, as an investigation into the root cause of the incident was launched.

A cracked third-stage low-pressure turbine blade was located in a conventional take-off and landing F-35A at Edwards AFB in California during a boroscope inspection. "It is too early to know the fleet-wide impact of this finding," the F-35 Joint Program Office says.

The F135's turbine module was shipped to P&W's Connecticut test facility for closer inspection. The engine involved had been run for about 700h, including 409 flying hours, the company says. Two previous incidents with third-stage low-pressure turbine blades resulted in F-35 groundings in 2007 and 2008. Both occurred in the F-35B vertical take-off and landing variant, and were traced to high-cycle fatigue.

P&W expects to test an upgraded version of the afterburning F135 turbofan in 2013, says Bennett Croswell, president of its military engines division, which "could provide another 5% thrust". ■

GROUNDING **SIVA GOVINDASAMY** SINGAPORE

Boeing briefs 787 customers on interim battery fix

The immediate future of Boeing's grounded Dreamliners was set to become a little clearer as *Flight International* went to press with the airframer due to hold a briefing with customers on a proposed interim fix for the still-undiagnosed battery issue.

This will give operators a more comprehensive indication of when they will be able to resume flights, say industry sources. "All of the 787 operators will be in Seattle. They will get a better idea of what led to the problems and get some clarification on what comes next for the aircraft," says an executive from a Dreamliner customer, who did not want to be identified.

The meeting comes after Boeing presented an interim solution to US Federal Aviation Administration head Michael Huerta and deputy transportation secretary John Porcari on 22 February. Their plan, to which the FAA is expected to respond on 4 March, could see the 787 resume service by late March. ■

See Business P24

AirTeamImages

Operators including ANA have faced disruption since January

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TESTING

Russia reveals future Embraer wing designs

A picture released by a Russian aeronautical research centre shows Embraer has completed testing of a high-aspect ratio wing for an undisclosed, turbofan-powered project.

The TSaGI Central Aerohydrodynamics Institute says data from windtunnel tests on the new wing in December and January is being analysed by a joint team of Russian and Embraer engineers.

The announcement offers new insight into the status of Embraer's long-term product development strategy. In a public presentation last August, an Embraer official listed a high-aspect ratio as among the technologies being considered for a next-generation airliner to emerge after 2025 to succeed the re-winged E-Jet scheduled for 2018.

TSaGI says the high-aspect ratio wing entered testing in Russia early in the fourth quarter of 2012 and concluded in January, with a special focus on analysing stiffness and flutter characteristics. The wingtips were not visible in the TSaGI picture but the windtunnel model used was designed to allow Embraer technicians to study several different wingtip designs, the Russian agency says. High-aspect ratios, once associated exclusively with high-altitude surveillance aircraft, are now being widely pursued for civil airliners. ■

TSaGI

Windtunnel testing is complete

Airbus

MSN001 – the first flying prototype – will shortly embark on the next stage of ground tests

DEVELOPMENT **DAVID KAMINSKI-MORROW** BERLIN

No decision on second line to support A350 assembly

EADS chief believes twinjet will be a "success" but additional capacity is not yet needed

EADS has not embarked on any decision for a possible second production line for the Airbus A350, but acknowledges that success for the type might require more capacity.

Chief executive Tom Enders says Airbus chief operating officer for customers John Leahy is "very bullish" over the prospects for the twinjet family. However, Enders plays down suggestions of a second line, stressing that there is "no decision" regarding a complement to the final assembly line in Toulouse.

"This aircraft promises to be a success," says Enders, who was speaking during the EADS annual conference in Berlin on 27 February. The A350 backlog at the end of January 2013 stood at 592 aircraft.

Boeing has established a second assembly line for the 787, located in Charleston. But Enders says that if there is a business case for a second A350 line, it will be evaluated.

Enders warns that the A350 is entering a crucial phase and the aircraft programme is "inherently risky". But he says he is "looking forward" to seeing the first prototype perform its maiden flight "in the summer".

Ahead of that crucial milestone, Airbus has moved the first flying prototype of the twinjet – MSN001 – from the Roger Béteille final assembly line in Toulouse to the next stage of ground testing.

Photographs released by the airframer show the "structurally complete" aircraft with completed wings, following the recent addition of its curved winglets, belly fairing panels and main landing gear doors.

Upcoming ground tests will include fuel tank trials, pressure testing of the fuselage and radio equipment evaluations. ■

Additional reporting by Dominic Perry in London

PERSONAL JETS **MURDO MORRISON** LONDON, ONTARIO

Diamond seeks saviour for iced D-Jet

Diamond Aircraft is confident a financial saviour can be found for the D-Jet after the Canadian company was forced to put the programme on hold and lay off 150 engineers and assembly workers on 25 February.

The London, Ontario-based airframer – a separate entity from its sister business in Austria and which owns the design rights to the all-composite, single-engined personal jet – needs $65 million, plus $12 million for assembly line set-up, to bring the D-Jet to certification and production.

Chief executive Peter Maurer says $188 million has already been sunk into D-Jet's development since its genesis in 2005, and that it is "70%" ready, with production facilities in place. "The programme is in really good shape," he says. "Customers are excited and the orderbook is solid. The thing that's missing is the cash to finish it."

Three prototype aircraft have been built, but a fourth production-conforming example would be required to achive certification, says Maurer.

Diamond announced it was halting the programme after it became clear that investment from Middle Eastern group Medrar – announced at the Dubai air show in late 2011 – was not going to materialise.

Instead, Diamond is preserving its cash to allow the legacy business to continue, says Maurer. ■

Unstable approach led 727 to overrun
AIR TRANSPORT P10

MANAGEMENT **DAN THISDELL** BERLIN

EADS defence strategy in the balance

Aerospace giant remains sanguine as chances fade of achieving Vision 2020 target to reduce reliance on Airbus revenue

For several years, EADS's corporate strategy has been guided by a vision – of reducing reliance on its dominant Airbus commercial airliners division by building up its Eurocopter, Astrium space and Cassidian defence businesses. Noting that in 2008 commercial aircraft accounted for 63% of group sales, its Vision 2020 plan calls for a 50/50 balance between Airbus and other group activities, "especially defence and institutional business".

But as EADS's 2012 accounts highlight, the numbers are going the wrong way. Revenue growth of 15% took the group top line to €56.5 billion ($74 billion), with Airbus commercial revenue gaining 19% to nearly €37 billion – or 65% of the total. Record deliveries of 588 Airbus airliners in a booming civil aviation market tell much of the EADS story. Airbus is so successful it swamps excellent growth at Astrium (up 17%) and Eurocopter (up 16%).

The focus will be on cost control and, particularly in the defence business, profit

The defence business as a whole, however, rings alarm bells. Cassidian's sales fell 1% to €5.7 billion. Adding in the defence divisions of Astrium and Eurocopter, plus Airbus Military, total defence sales were flat at €11.6 billion, barely 20% of group revenue. That is about half the level enjoyed by Boeing, which shares EADS's "problems" of having a runaway success in civil airliners and defence spending austerity in its home market.

Chief executive Tom Enders, speaking in Berlin on 27 February to detail EADS's 2012 financial performance, said that in times of military spending cuts it may be better to have less exposure to defence rather than more, a fair point but it is hard to brush aside the Vision 2020 assessment of commercial jetliners as "an extremely capital-intensive and cyclical business".

Eurocopter

Sales of the Tiger attack helicopter have been sluggish

As a former Airbus chief, Enders knows this better than anyone but, he stresses, the defence business is "not insignificant" – just shy of €12 billion – and despite Cassidian seeing profit fall 57% to €142 million owing to fourth-quarter charges, is leaner and, at root, more profitable than a year ago. Its core product range is strong and the orderbook is up without counting a December 2012 Omani order for 12 Eurofighter Typhoons.

But if there is no obvious urgency to fix the defence business, what, exactly, is EADS's strategy? Last September, the answer was clear: Enders and his opposite number at BAE Systems, Ian King, unveiled a bold merger plan to form the world's biggest aerospace and defence group, which would have tied EADS defence units to one of a major player in military hardware and services.

But that plan was knocked flat by a German government that feared the emergence of a too-strong UK-French axis. Now, Enders – who in some views was lucky to survive as chief executive after championing the failure – is keeping his cards close to his chest. Other than assuring stock market analysts there will be no major mergers or acquisitions in 2013, Enders is only saying that any plans will wait for the conclusion, probably this summer, of a strategic review. By then, EADS will have a new board of directors and be operating under a new governance charter, agreed in December and set for a shareholder vote on 27 March, which ends the days of French and German government involvement in group management.

That "dislinking" of shareholding from governance is a huge achievement, says Enders. It will clearly give management new freedom to adjust to a changing business environment. In the meantime the focus will be on cost control and, particularly in the defence business, profit. In short, the bottom line at EADS is the bottom line. ■

AIRFRAMES **TOM ZAITSEV** MOSCOW

Cuba's flag carrier continues Russian love affair

Cuba's national carrier Cubana has added passenger Ilyushin Il-96-400s and Tupolev Tu-204SMs to its future commitment for Russian-built aircraft.

Under a preliminary agreement, concluded with leasing company Ilyushin Finance, Cubana intends to acquire three converted Il-96-400s.

The lessor has yet to disclose the source of the aircraft but they could potentially be converted from three freighters which were supplied to the cargo division of Russian carrier Polet in 2009.

In addition, Cubana has placed an order for two Tu-204SMs. Both aircraft are expected to be available following the completion of type certification tests by the summer.

The two sides have also signed a follow-up agreement, under which Cubana is to receive three out of six previously ordered Antonov An-158s in March, June and August this year.

Russian prime minister Dmitry Medvedev attended the signing ceremony in Havana. Industry minister Denis Manturov estimates the value of the deal at $650 million and says it will be funded through a commercial line of credit from Russian banks under sovereign guarantees. ■

For in-depth coverage of carriers throughout the world, go to flightglobal.com/airlines

INVESTIGATION **DAVID KAMINSKI-MORROW** LONDON

Unstable approach led 727 to overrun

Nigerian inquiry criticises captain for failing to take control and abort before DHL trijet landed fast and long on wet runway

Pilots of a Boeing 727-200 freighter continued with a high-speed, unstable landing in poor weather at Lagos, resulting in the trijet being badly damaged when it overran the wet runway.

Nigerian investigators criticised the captain – who had logged more than 7,800h on type – for allowing the first officer to fly the taxing approach, in a squall with 600m (1,970ft) visibility, rather than taking control and aborting.

"The decision by the captain to go ahead and land under the severe weather conditions was unprofessional," says the Nigerian Accident Investigation Bureau, in its belatedly published report into the overrun.

Operated by DHL Aviation, the South African-registered 727 was verging on its maximum landing weight, and had still been travelling at 186kt (345km/h) while only 45ft above the ground. It touched down at 167kt, at least 30kt above its approach reference speed.

The jet landed some 1,426m beyond the threshold of runway 18L, meaning it was halfway along the 2,745m runway before it made contact – contradicting the captain's statement which said touchdown was in the normal zone.

Flight-recorder data shows the thrust-reversers were immediately deployed, but the inquiry also says the captain ordered a late go-around after the landing.

Nigerian Accident Investigation Bureau

As the freighter crossed rough ground its nose wheels sheared off

Seventeen seconds after touchdown the reversers were stowed, but redeployed 5s later. The inquiry says this indicated poor co-ordination as well as "evidence of pressure on the crew and lack of total knowledge of what to do".

Continuous reverse thrust, however, would not have averted the overrun. The aircraft collided with the localiser antenna as it exited the runway, its nose wheel sheared off and it continued travelling for 400m before coming to a halt. The 727 (ZS-DPF) also sustained damage to its main landing gear and the leading edge of its left wing.

During the instrument landing system approach, the crew did not adhere to the checklist, nor did the pilots make standard call-outs.

Investigators also highlight instability in the flightpath, citing the momentary arrest of the descent at 550ft and again at 200ft. It says this indicates control problems arising from "probable excessive weight" as well as the weather conditions.

"Operating at the maximum operating limit and with the prevailing weather, the captain should have exercised his command responsibility to take over much earlier than the last minute attempt to go-around," the inquiry states.

Cockpit-voice recordings also revealed the captain had replied to the tower controller using an "offensive word", it adds, suggesting the crew was under pressure.

None of the occupants was injured in the 7 September 2006 accident, involving flight DV110 from Accra. The final report is one of a batch newly released by Nigerian investigators. ■

See Cover Story P30

David Learmount comments on operational and safety issues at flightglobal.com/learmount

SAFETY

Multiple roles for crew risked fatigue

Investigators examining the DHL overrun at Lagos queried the carrier's policy at the time of not carrying a loadmaster and ground engineer, instead relying on the crew to perform these roles.

The Nigerian inquiry highlighted the "stressful nature" of freighter operations, and the risk of fatigue if crews were carrying out additional tasks during times which should be used for rest.

It advised the carrier to "remove the workload" on the crew by carrying appropriate personnel or stationing them at points on its network.

DHL agreed, although the division involved subsequently ended service with the 727s – which used two pilots and a flight engineer – and reduced its fleet to a handful of smaller types, with differing personnel requirements. However, the operator assured it would use loadmasters on board if it returned to flying large freighters. ■

Performance boost for MS-21 turbofan
AIR TRANSPORT P12

INVESTIGATION **DAVID KAMINSKI-MORROW** LONDON

Pitch illusion and control ambiguity led to A330 crash

Sensory confusion played role in poorly-executed go-around before Afriqiyah twinjet came down short of Tripoli runway

Libyan investigators have determined that poor co-ordination between the pilots of an Afriqiyah Airways Airbus A330-200, spurred by sensory illusion, preceded the fatal go-around crash at Tripoli.

While the first officer was the flying pilot, the inquiry found that the captain began making inputs to his sidestick control as the aircraft aborted its non-precision approach to runway 09.

The aircraft climbed to only 450ft (137m) during the go-around before it descended and crashed short of the runway threshold – striking the ground at 260kt (480km/h) with a descent rate of 4,400ft/min (22m/s) – killing all but one of the 104 occupants.

Libya's Civil Aviation Authority, in its final report into the 12 May 2010 crash of flight 8U771, says the pilots had opted to continue descending through the minimum descent altitude of 620ft.

But the inquiry determined that the crew had not acquired visual ground references before proceeding with the final approach.

The aircraft descended to 280ft above ground before a terrain-awareness warning sounded, and the captain ordered a go-around.

Immediately the autopilot was disengaged. The first officer initially made a nose-up input, and the thrust levers were set to go-around power.

"The go-around was initiated without undue haste," says the inquiry. But while the pilots initially appeared co-ordinated, it says, the captain was probably "destabilised" by the terrain warning.

Some of the go-around call-outs, such as "positive climb", were not made and the inquiry says the first officer "questioned" the captain on several occasions, indicating a need for "more active participation" from the non-flying pilot.

The aircraft pitched to 12.3° nose-up, and the crew retracted the landing-gear and flaps. However, the co-pilot started making nose-down inputs 4s after the autopilot disconnection.

"These inputs are consistent with the high pitch attitude he could have perceived, typical of a somatogravic perceptual illusion," says the inquiry.

Somatogravic illusion is the false perception of excessive pitch – caused by sensory misinterpretation in the absence of visual cues – which can prompt an instinctive nose-down response. Pitch-down inputs were applied for 21s, causing the A330's pitch attitude to reduce to 3.5° nose-down. The inquiry suggests the co-pilot was focused on the aircraft's speed, rather than its attitude, following an incident 14 days earlier when an overspeed warning activated during a go-around.

"At no time was the go-around pitch attitude controlled, nor did the [first officer] follow the instructions from the flight director," it states, adding that fatigue could have played a role in the crash by causing him to focus solely on the airspeed.

Analysis found the captain was also applying inputs to his sidestick, matching the first officer's, although insufficient to trigger a dual-input warning.

"This action appears to be intended to provide assistance, without the captain intending to fly the aircraft by himself, without showing a lack of trust in [the first officer]," says the inquiry. But it says this distracted the captain and led to "ambiguity" as to who was controlling the aircraft.

As the aircraft lost height the terrain-awareness system issued a succession of sink and ground-proximity warnings. But the captain responded with a "sharp" nose-down input, says the inquiry, adding that he might have been subject to somatogravic illusion or was similarly focused on the A330's speed.

He then took control of the aircraft, without warning, via the sidestick priority button and maintained the nose-down input, while the first officer was simultaneously – and in vain – pulling back on his own sidestick.

Only 2s before impact, at a height of 180ft, the captain also pulled his sidestick fully back, suggesting both pilots were aware of the aircraft's impending collision with the ground, but were unable to arrest the descent. ■

Rex Features

Just one person among the 104 on board survived the accident

SAFETY **DAVID KAMINSKI-MORROW** LONDON

Cockpit audio to warn pilots of Dash 8 overspeed

Australian investigators are advising Bombardier Dash 8 pilots to familiarise themselves with the signs of propeller overspeed, following a serious QantasLink incident.

When the Dash 8-300 hit turbulence, the first officer inadvertently lifted one or both of the gates designed to prevent pilots accidentally moving the throttles into the "beta range" below flight-idle. Flight-recorder data shows the propeller speed increased uncontrollably – the left to 1,253rpm and the right to 1,067rpm – exceeding the 900rpm setting for 3s. The aircraft (VH-SBV) had been descending through 11,300ft (3,500m) to Weipa, Queensland on 6 December 2011.

To aid familiarisation, the Australian Transport Safety Bureau has released a section of the cockpit-voice recording on its website, containing the audible propeller-speed increase and a warning horn.

It found that all 57 Australian-registered Dash 8-100s, -200s and -300s were fitted with warning horns, but 48 of them had neither of two modifications – a beta lock-out system and an adapted gate – developed to avoid overspeed. While quick action averted damage to the QantasLink aircraft, the ATSB says the captain initially thought the horn was signalling the autopilot disengaging. Similar serious incidents have resulted in efforts to mandate preventative modifications. The ATSB says release of the recording is an interim measure to "increase awareness". ■

PROPULSION **TOM ZAITSEV** MOSCOW

Performance boost for MS-21 turbofan

Aviadvigatel makes major changes to configuration of powerplant including the relocation of engine's accessory drive gearbox

Russian engine specialist Aviadvigatel has made substantial changes in the configuration of its prospective PD-14 turbofan to enhance performance and variability as part of the development project aimed at creating a family of engines to power Irkut's medium-range MS-21 twinjet.

While retaining the core engine's two-shaft, two-bypass architecture, Aviadvigatel has decided to revise the location of particular engine modules.

"The key move involved the accessory drive gearbox," says Aviadvigatel PD-14 chief designer Igor Maksimov. "We opted to put it under the nacelle cowl rather than under the gas generator. This ensures a steadier thermal regime and reduces temperature-related risks for oil lines and cooling systems."

Maksimov adds that there is now more room inside the nacelle for rejigging other modules, making it easier to modify the baseline engine configuration and "meet thrust requirements of stretched and shortened MS-21 variants". Aviadvigatel has introduced innovations to enhance service life and cut down core engine components. "To reduce weight, we've thoroughly redesigned the low-pressure turbine," says Maksimov. "It has become smaller and lighter. We've also worked in improvements stemming from the latest aerodynamic research. As a result, we've bumped up the turbine's efficiency."

Irkut

The Russian engine manufacturer is aiming its PD-14 engine at Irkut's new twinjet family

Assembly has started on two low-pressure turbines for the PD-14 prototype. One will be tested at Aviadvigatel's laboratory and the other at the Central Aero-engine Institute in Moscow.

Aviadvigatel and the institute have completed tests of the combustor prototype. Maksimov says these checks, which were also conducted at a high-altitude test facility, validated all pre-test predictions in terms of emissions and performance. The partners plan to start testing the prototype this year – initially on a testbed and then within a demonstrator engine. If the prototype proves a better solution, Maksimov does not rule out that Ivchenko-Progress's affiliated manufacturer Motor-Sich could supply PD-14 combustors.

Test runs of the technology demonstrator engine are scheduled to begin in the third quarter of 2013. Maksimov says the MS-21 project envisages, for the first time in Russia, the engine developer taking charge of the nacelle. "Under our agreement with Irkut we bear an overall responsibility, from designing the engine to customer specifications and selecting suppliers to certifying and providing after-sales support," says Maksimov. "We've already defined nacelle configuration. It features sliding panels rather than hinged cowl doors."

Composites will make up some 60% of the nacelle weight. Components such as intakes and cowl panels will be made of carbonfibre-reinforced plastic. Full-scale engine nacelle tests are scheduled to begin in early 2014. ■

Track the progress of development programmes at flightglobal.com/aircraft

DEVELOPMENT

Russia begins two-year test of strength on jet's fuselage

Russia's United Aircraft says development of the medium-range Irkut MS-21 twinjet remains on track as structural tests begin on a key fuselage section.

On 25 February, a specially chartered Antonov An-124-100 freighter transported the aircraft's centre fuselage barrel from Irkut's manufacturing facility in Irkutsk to the TsAGI Central Aerohydrodynamics Institute at Zhukovsky, near Moscow.

Irkut president Oleg Demchenko says the project has entered the "stage of manufacturing airframe elements and their full-scale testing".

He indicates Irkut has introduced a number of advanced technologies into the test mid-section of the fuselage, which TsAGI will subject to a series of static trials to determine the structural fatigue and residual strength.

Boris Alyoshin, TsAGI director, says the centre fuselage evaluations could take up to two years to complete. In addition to static tests, the programme will include more than 100,000 events to simulate flight.

Demchenko says Irkut will build four MS-21 pre-production examples – one for static trials and three for flight tests. United Aircraft chief Mikhail Pogosyan says assembly of the prototype aircraft in Irkutsk will begin this year, following the transfer of blueprints to the airframer. ■

KC-30A achieves crucial milestone
SHOW REPORT P14

ANALYSIS **LAURA MUELLER** LONDON

Re-engined fleets 'do not threaten' single-aisle value

Lessor's assessment suggests A320neo and 737 Max will have no impact on predecessors' worth before mid-2020s

Analysis by lessor Avolon suggests the impact on Airbus A320s and Boeing 737s from the transition to re-engined versions will be diluted by the much-larger installed fleet, compared with earlier aircraft shifts.

In a newly-published market assessment, Avolon says the stable transition to the A320neo and 737 Max will not have an immediate effect on current-generation aircraft values.

"Our analysis confirms that the [A320neo] and [737 Max] do not pose a disruptive threat to the long-standing competitive balance between the two aircraft families and that the transition to the new aircraft will be orderly," says Avolon chief technical officer Lucas Mollan, co-author of the report *Transitioning to Neo and Max*.

The installed base provides "more than double the cushion" of the previous major fleet switch and offers "natural protection from mass premature retirements", says the lessor, adding that the change will be "smoother" than earlier cases.

"We believe that it will take eight years from entry into service for the [new jets] to build a 35% share of their respective family fleets," says Avolon head of strategy Dick Forsberg. There is still strong demand for the current types, he adds.

Boeing

Both new types will need eight years to reach 35% market share

When the 737-300s to -500s entered service, some 1,100 older 737-100s and -200s had been ordered, of which 1,000 had been delivered. But when the 737NG entered service, 13 years later, orders for the prior model stood at 2,000 with 1,800 delivered.

The lessor forecasts more than 6,000 737NGs will have been delivered when the Max enters the market, and some 6,000 baseline A320-family jets will be in service out of a likely orderbook of 6,700. "These levels are three times larger than the installed base at the start of current-generation fleet operations," says Avolon.

It says the 737-300s to -500s took five years to achieve a 35% share of the 737 market – the point at which previous-generation values start being hit – and seven years for 737NGs to do the same.

Avolon expects the A320neo will reach this threshold around 2023 and the 737 Max in 2025. There are more than 3,000 single-aisle aircraft that will be more than 22 years old by 2016, it says, and therefore at the "forefront of the replacement process". This number will exceed 4,000 by the beginning of the next decade.

As the A320neo and 737 Max are delivered in greater numbers, more than 60% will be required to meet market growth requirements. The pool of eligible retirement candidates will stay "deep enough" to absorb the remaining 30-40% of new deliveries.

As more A320s and 737NGs begin to reach 25 years of age, in the first half of the next decade, Avolon says the pipeline of "suitably-aged feedstock" will be further replenished, avoiding "cannibalisation" of younger fleets. ■

STRATEGY **DAVID KAMINSKI-MORROW** BERLIN

Airbus resists slashing prices of remaining A320 slots

Airbus will resist engaging in a price war to sell the final slots for the regular A320 before production switches to the re-engined A320neo.

The airframer's parent, EADS, says the number of outstanding slots for the type is less than 300.

"We want to sell [these] at a reasonable price and margin," said EADS chief financial officer Harald Wilhelm, speaking during the company's annual conference in Berlin on 27 February. He says the company has been "satisfied" with pricing levels and that the number of remaining A320 slots is a "pretty remote number".

Wilhelm acknowledges that, from behaviour seen in the market, holding out completely would not necessarily be "rational".

However, he says: "We definitely won't move into what some might call a price war."

Wilhelm adds that Airbus achieved "healthy" pricing on the A320neo in 2012, with customers paying a premium for the aircraft.

EADS chief executive Tom Enders similarly dismisses any suggestions of a price war, stating that Boeing's rival 737 Max is "desperately trying to catch up" with the A320neo.

"It creates some tension in the market," he says. ■

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AVALON 2013

Rain, a lack of major competitions and an election later this year made for a much-subdued 2013 Avalon air show held near Melbourne in southern Australia. Nonetheless, Avalon marked an important milestone for the Royal Australian Air Force, with its Airbus Military A330 multirole tanker transport finally gaining initial operational capability. Business jets were also out in force, with two Gulfstream types making their Avalon debut, as manufacturers target the burgeoning Asia-Pacific market. Greg Waldron and Emma Kelly report

Commonwealth of Australia

BUSINESS AVIATION

Australian debut for duo

Gulfstream's super-midsized G280 and ultra-large-cabin, ultra-long-range G650 made their debuts in Australia, appearing on the static line at the Avalon show.

The two aircraft set a series of claimed city-pair records en route to the event, with the G650 registering a world record between Honolulu and Auckland, flying 3,868nm (7,160km) in 7h 57min.

The G280, meanwhile, set three to-be-verified records on its journey to Avalon. It took off at maximum weight from Carlsbad, California, where it demonstrated its take-off capabilities from the short 1,492m (4,900ft) runway.

It then flew six people – three passengers and three crew – 2,322nm to Honolulu in 5h 31min at an average speed of Mach 0.83. The aircraft then covered the 2,292nm from Honolulu to Pago Pago in 5h 12min at an average speed of M0.83.

The flight from Pago Pago to Melbourne, a distance of 2,846nm, took 7h 16min at an average speed of M0.80. The G280 has set 22 city-pair records since it entered service in 2012. The aircraft's appearance at Avalon 2013 is part of a world demonstration tour.

Gulfstream has 208 business jets in service in the Asia-Pacific region – a fleet that has tripled in size in recent years, according to the airframer. The G450, G550 and G650 are of particular interest to customers in the region due to their large cabins and range, it says. Gulfstream claims a 46% share of the region's large-cabin aircraft market. ■

See our Gulfstream G280 flight test and cutaway drawing at flightglobal.com/g280

Airbus Military

Australia's air force has received five of the tanker transports

DEFENCE

KC-30A achieves crucial milestone

Initial operational capability attained by A330-based aircraft but service awaits modifications to boom refuelling system

Australia's Airbus Military A330 multirole tanker transport (MRTT) aircraft have achieved initial operational capability (IOC), with the type demonstrating an air-to-air refuelling mission on the sidelines of Avalon.

The aircraft, designated the KC-30A in Royal Australian Air Force service, refuelled a pair of Boeing F/A-18A Hornets from its wing-mounted hose and drogue refuelling pods. The event was witnessed by journalists travelling in the tanker's cabin.

Australia's air force has taken delivery of all five of its A330 MRTTs. The IOC milestone includes the ability to refuel F/A-18s via the hose and drogue method at day or night, as well as carrying a full load of passengers. The type's passenger cabin is identical to that of Qantas Airways' commercial A330s, although the military aircraft lack an in-flight entertainment system.

One of Australia's MRTTs is with Airbus Military in Getafe, Spain, for remedial work to resolve issues with the aircraft's aerial boom refuelling system. The service is likely to begin working with the boom at the end of 2013.

The boom will be required for the air-to-air refuelling of types such as the Boeing 737-based Wedgetail airborne early warning and control system aircraft, and Australia's Boeing C-17 strategic transports. In addition, the boom will be required for the air force's future fleet of Lockheed Martin F-35A Joint Strike Fighters. ■

PROCUREMENT

Grob covets RAAF trainer deal

Grob Aircraft made a major push for its G120TP basic trainer at Avalon, with its stand including a simulator for the type, as it eyes an upcoming requirement to replace the Royal Australian Air Force's 63 Pilatus PC-9/9As.

Andre Hiebeler, Grob Aircraft chief executive, says the G120TP can "eat into" up to 60-70% of the syllabus provided by higher-end tandem-seat turboprops such as the Pilatus PC-21, which is also likely to compete for the Australian deal. Canberra's requirement, designated AIR 5428, calls for a complete training solution including simulators. Grob envisages the RAAF using the G120TP in conjunction with a more advanced basic trainer type.

Hiebeler says only 45% of pilots trained by the Australian military end up in the air force, with only a small portion transitioning to fighters. The majority become transport aircraft or helicopter pilots, making the G120TP, with its side-by-side configuration, a suitable training platform. ■

USAF's budget warning shot
NEWS FOCUS P16

TRAFFIC MANAGEMENT

Bidders eye OneSky tender

Contract award for first ever combined civil-military ATM system possible by end of year

Airservices Australia and the country's Department of Defence are expected to release their long-awaited request for tender for OneSky – a new combined civil-military air traffic management system – in the middle of this year, with contract award possible by the fourth quarter.

If it proceeds as planned, Australia will become the first country to commission a joint civil-military ATM system.

A request for information for the project, believed to be valued at A$300-A$500 million ($306-$510 million), was issued in 2011 which resulted in considerable industry input, says Airservices, with Thales, BAE Systems, Lockheed Martin and Boeing among the respondents.

The RFI was "an early indication of how the project would come together", says Airservices. Since then, a dedicated programme office comprising Airservices and Department of Defence personnel has been established in Canberra, putting together the full information for the tender.

Thales, BAE Systems, Lockheed Martin and Boeing were among the respondents to Canberra's 2011 RFI

As a prelude to its release, some 80 industry participants attended a briefing on the project last December, when preliminary documentation was circulated. As a result, Airservices, which is leading the programme, believes that industry is "well-primed" and the tender requirements will contain few surprises.

Airservices is aiming to complete the process within six months, it says. It hopes to have the system up and running in the 2018-2020 timeframe, although industry sources suggest the latter end of that period is more achievable. The combined ATM system is expected to have a service life of 15-20 years.

Australia's present civil ATM system, The Australian Advanced Air Traffic System (TAAATS), which was supplied by Thales, entered service in 2000. ■

UNMANNED SYSTEMS

Northrop Grumman pitches Triton for Canberra's need as first flight nears

Northrop Grumman hopes to conduct the maiden flight of the first MQ-4C Triton unmanned air vehicle in the coming months.

Speaking to *Flight International* at the Avalon air show, Greg Miller, Triton UAS business development manager, says the first aircraft, SDD-1, could fly as soon as April.

Formerly known as BAMS (Broad Area Maritime Surveillance), the MQ-4C is tasked with partial replacement of the US Navy's Lockheed P-3 Orion maritime patrol aircraft, and will operate alongside the service's fleet of Boeing P-8A Poseidons.

Northrop sees the MQ-4C as suitable for Phase 1B of Australia's AIR 7000 requirement for a multimission unmanned aerial system. It has displayed a full scale mock-up of the Triton at both the 2011 and 2013 Avalon air shows.

Both Triton test aircraft, SDD-1 and SDD-2, are in the "final stages of testing," says Miller. They have completed taxi and ground tests, he adds.

"We're very close to the first flight [of SDD-1]," says Miller. ■

Northrop Grumman

The MQ-4C will be initially operated by the US Navy

GippsAero

The GA10 first flew in May 2012

DEVELOPMENT

Enhancements delay approval for new GA10

Mahindra Aerospace-owned airframer GippsAero is aiming for certification of its new 10-seat, multi-role turboprop, the GA10, in the first quarter of 2014 following a delay to the programme.

Although it performed its maiden sortie last May, targeting certification in 2013, the manufacturer has since changed the baseline aircraft, says Elizabeth Allenbaugh, GippsAero marketing and communications manager.

The GA10 will now have additional atributes, including instrument flight rules capabilities from launch, necessitating a slight delay in the certification effort, says Allenbaugh. The changes are due to input from prospective customers, she adds.

GippsAero has yet to open a deposit programme for the 10-seater, but there is considerable interest in the Rolls-Royce M250-powered type, particularly from existing operators of the smaller GA8 Airvan, says Allenbaugh.

Once the GA10 is certificated, GippsAero plans to finalise plans for the GA18 programme – formerly the Nomad — which has now slipped from a previous entry-into-service date of 2014. Although declining to reveal a timeframe, it remains committed to the programme, says Allenbaugh.

The company will also attempt to increase in the North American market via an "aggressive" advertising campaign. ■

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SEQUESTRATION **DAVE MAJUMDAR** ORLANDO

USAF's budget warning shot

Decade-long cuts programme would reduce flying hours, threaten exercises and hurt major procurements, officials say

The US Air Force may have to take drastic actions which will severely impact the readiness of its combat forces for years to come if the threatened Congressional sequestration comes into effect, senior officials from the service warned in the final days leading up to a 1 March deadline.

Draconian measures would include cancelling major large force exercises such as Red Flag and Northern Edge, Air Force Secretary Michael Donley told the Air Force Association's (AFA) Air Warfare Symposium in Orlando, Florida on 22 February.

With the sequestration act also to fall late in the current fiscal year, the majority of the USAF's fighter and bomber wings not on combat deployment will also run out of money to keep flying by as early as mid-May, Donley says. The issue could lead to the loss of 200,000 flying hours, including cancelling some advanced training and weapons instructor courses, but the service is trying to preserve its undergraduate pilot training course.

Such training stand-downs could take six months to a year to recover, but then only to "sub-optimal levels," Donley warns.

Sequestration will automatically cut defence funding by 10% per annum for 10 years, on top of the $487 billion that has already been removed from the US Department of Defense's spending plans. Current and planned major procurements would also be affected, according to other officials also speaking at the AFA convention.

US Air Force

Donley: Draconian measures

US Air Force

Any threat to cancel the F-35 programme would prompt the Air Combat Command to seek additional Raptors

For example, the USAF could potentially be forced to change its fixed-price development deal with Boeing for the 767-based KC-46 tanker, says Gen Paul Selva, commander of its Air Mobility Command. "As currently structured, there is no danger in that contract," he says, as any cost overruns must be borne by Boeing. "If there is no flexibility in the sequester, it is possible we will have to reopen the contract," he says, as the air force would "literally have run out of money in the procurement lines".

Doing so would not only place the USAF at risk of having to bear the price of any cost overruns, but may also delay the delivery of the first four test aircraft, and "could threaten the developmental test and evaluation part of the contract", Selva says. A critical design review for the KC-46 should to be completed later this year, he adds.

Due to its many competing budgetary priorities, the air force also may not have the funds to procure its prospective T-X jet trainer; a planned replacement for its vintage Northrop T-38 Talons. Potential candidates for a contest include an Alenia Aermacchi/General Dynamics T-100 version of the former's M-346, the BAE Systems/Northrop Grumman Hawk and the Korea Aerospace Industries/Lockheed Martin T-50, plus a potential new design from Boeing.

OBSOLESCENCE

"That's been our challenge for some time now," says Gen Edward Rice, commander of the USAF's Air Education and Training Command. "I think we've been open and clear about our challenges in finding the money to pay for it, given all the other recapitalisation needs of the air force." Asked if he still expects the T-X to achieve initial operational capability in 2020, Rice says: "That's not something I'm thinking about."

While the USAF can live with the T-38 for the time being, Rice says as time goes by, it becomes less effective at preparing new pilots to fly advanced fighters like the Lockheed F-22 and F-35 Joint Strike Fighter.

The USAF is already training prospective F-22 pilots on the T-38, with an additional eight-flight "bridge course" in the Lockheed F-16. But as the number of F-35s grows, using the F-16 to train their pilots will become impractical. "I can't produce enough F-16 pilots today for the air force," Rice says. "I can't afford to get into a situation where I've got to use F-16s in large numbers to train into the F-35."

In testimony to the Senate Armed Services Committee on 12 February, US Air Force chief of staff Gen Mark Welsh warned that the entire F-35 programme may have to be restructured if the Pentagon budget undergoes the full 10-year effects of sequestration.

Speaking to the AFA's Air Force Magazine, Air Combat Command chief Gen Mike Hostage detailed a possible consequence were the F-35 programme to be in any danger of being cancelled outright.

"I would have to refurbish the [Boeing] F-15 and [Lockheed] F-16 fleets, and the legacy hardware I have today. I also have a very small fleet of tremendously capable airplanes in the F-22s," he says. "I would push to buy more of those," Hostage adds, noting that the USAF would need 225 more Raptors. ■

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UAE approves deal for unarmed Predator XPs
DEFENCE P18

PROGRAMME **ZACH ROSENBERG** WASHINGTON DC

New X-plane must combine speed with vertical lift

Experimental aircraft requires maximum airspeed capability above 300kt with hover efficiency greater than any rotorcraft

The US Defense Advanced Research Projects Agency (DARPA) is releasing a requirement for a new experimental aircraft, combining the best of vertical take-off and landing (VTOL) technology with conventional design.

To be formally designated as an X-plane, the new aircraft is meant to both hover and fly at high speeds with efficiency equal to dedicated platforms. Specifications call for a design capable of more than 300kt (555km/h) maximum airspeed; higher than conventional helicopters can achieve, and the ability to hover with greater efficiency than current rotorcraft.

So far, aircraft that have both flown at high speed and operated vertically cannot operate well in either flight profile.

"What we're trying to do here is achieve radical and transformational" technologies, says Ashish Bagai, DARPA programme manager. "We're looking to develop vastly improved technologies usable by the community, particularly by [the Department of Defense].

"We're looking at doing this in an elegant fashion, we're not looking for brute force," he adds.

The programme, budgeted at $150 million, will have three distinct phases: a first will involve maturing necessary technologies, while phases two and three will include hardware proving and flight testing. While multiple concepts will be selected, only one will be chosen for flight.

DARPA hopes for first flight three and a half years after programme launch.

"I think we have to be a little bit careful about just going back and revisiting what's been tried before," says Bagai. "There is a lot of technology now available to directly address shortcomings" of previous designs, he notes.

Further details, including whether the aircraft will be manned or unmanned, have purposely been left vague, which Bagai says is to allow bidders the most creative freedom in designing solutions.

Several companies have previously shown concepts for similar equipment, including Lockheed Martin's VTOL advanced reconnaissance insertion organic unmanned system, or VARIOUS. ■

Lockheed Martin

Lockheed has previously shown an unmanned VARIOUS concept

Airbus Military

The MRTT is one of three already contractually delivered to Riyadh

OPERATIONS **CRAIG HOYLE** LONDON

Saudi Arabia puts first A330 tanker into service

Saudi Arabia has placed its first Airbus Military A330 multi-role tanker transport (MRTT) into operational use, with the aircraft having been inducted into Royal Saudi Air Force service in Riyadh on 25 February.

Airbus Military says aircraft 2402 is one of three MRTTs "that have already been contractually delivered" to its Saudi customer. Three more being produced under a follow-on contract will be handed over from late 2014, it adds.

Powered by two General Electric CF6-80E engines, Saudi Arabia's new aircraft is equipped with an aerial refuelling boom system and under-wing hose and drogue refuelling pods, which enable it to support the air force's Boeing F-15, Eurofighter Typhoon and Panavia Tornado combat aircraft. It can also carry up to 266 passengers, in a two-class configuration.

The Royal Saudi Air Force already operates seven Boeing 707-derived KE-3A tankers delivered in 1987, says Flightglobal's MiliCAS database. ■

DEVELOPMENT **ARIE EGOZI** TEL AVIV

Urban gives AirMule extra kick

Israel's Urban Aeronautics is evaluating a high-speed version of its AirMule ducted fan vertical take-off and landing aircraft that could be used to perform tactical resupply missions.

Work began in 2009, with initial windtunnel tests of a 250kt (465km/h)-capable cargo variant. To use a 1,600shp (1,190kW)-class turbine engine, the model is 20% larger and 50% heavier than the standard AirMule, which is being designed for applications including medical evacuation.

Urban Aeronautics president Rafi Yoeli says the higher-speed version is designed to meet operational requirements for a ducted fan unmanned cargo delivery capability. Data gathered during windtunnel testing shows the design is capable of exceeding 250kt, he says. Yoeli says the new variant's performance is accomplished mainly through the use of a "stagger" built into the air vehicle's centre fuselage between its forward and rear fans, along with a horizontal stabiliser mounted at the rear of the aircraft.

The fans are kept horizontal on the ground and in the hover, using a vane control system and other patented aerodynamic and flight control provisions. To transition to cruise flight, the vehicle tilts forward and its lift fans act partly as thrusters. ■

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PROPULSION **DAVE MAJUMDAR** ORLANDO

Rivals power up for AETD engine programme bid

General Electric finishes core testing on its new ADVENT demonstrator, while Pratt & Whitney reveals adaptive fan

Two rivals for the US Air Force Research Laboratory's (AFRL) adaptive engine technology development (AETD) programme have detailed their activities in pursuit of a future variable-cycle powerplant for use in combat aircraft.

"Our AETD configuration features an adaptive fan," Pratt & Whitney military engines president Bennett Croswell said at the Air Force Association convention in Orlando, Florida in late February. "It's a three-stream fan and our initial test of that piece is coming up in about a month."

The adaptive fan rig will be tested at P&W's compressor research facility in Dayton, Ohio, with the technology to eventually be mated to an advanced core design which the company is working on, for test in 2015. A full engine test will be performed in 2016.

> **"We will integrate these proven ADVENT technologies into our AETD engine, along with advanced controls and exhaust system designs"**
>
> **DAN MCCORMICK**
> Programmes manager, General Electric

P&W's AETD core is roughly the same configuration as that used in its F135 engine for the Lockheed Martin F-35 Joint Strike Fighter, but has more stages and will use a very high pressure ratio with very high thermal efficiency, Croswell says. The company will need to use advanced metallurgy and ceramic matrix composites to achieve some of the sought-for performance, but he says it is "less bullish" on the latter than some of its competitors, and is more focused on advanced nickel alloys.

Reduced-temperature air extracted from the compressor using a third stream will be used to cool the back of the compressor and parts of the turbine, making for a more efficient cycle, Croswell says. "We have some innovative approaches as to how we use that third stream to provide a heat-sink," he adds, while it will also cool the engine's F135-derived afterburner nozzle at full test in 2016.

General Electric, meanwhile, says it finished core testing for the AFRL's Adaptive Versatile Engine Technology (ADVENT) demonstrator on 6 February, and also completed the initial design review for its candidate for the follow-on AETD programme two days later.

The company says it has already demonstrated the "highest combination of compressor and turbine temperatures ever recorded in aviation history" during the prototype ADVENT effort, which will conclude later this year with a full engine test.

"We will integrate these proven ADVENT technologies into our AETD engine, along with advanced controls and exhaust system designs," says Dan McCormick, GE's general manager for both programmes. A preliminary design review is scheduled for the latter effort during November 2014.

GE says the use of advanced lightweight, heat-resistant ceramic matrix composite materials and an adaptive low-pressure spool results in a 25% improvement in fuel efficiency, a 30% increase in operating range and a 5-10% improvement in thrust, compared with existing fixed-cycle engines. ■

General Atomics Aeronautical Systems

General Atomics' MQ-1 derivative can reach a 25,000ft altitude

SURVEILLANCE **ZACH ROSENBERG** WASHINGTON DC

UAE approves deal for unarmed Predator XPs

The United Arab Emirates has approved a $197 million deal to purchase the international version of General Atomics Aeronautical Systems' Predator A unmanned air system.

Announced during the IDEX exhibition in Abu Dhabi, the sale is being made via the International Golden Group (IGG), which had previously selected the export-standard Predator XP on behalf of the UAE's armed forces.

"Following the expected near-term completion of negotiations between IGG and General Atomics, and between General Atomics and the Abu Dhabi-based Tawazun Economic Council to establish a joint venture for long-term service and support of Predator XP in the UAE, the procurement will be complete," the US manufacturer says.

The airframer says the selection will "provide affordable, reliable and cost-effective multi-mission capabilities to the UAE armed forces for years to come", and adds that the type will "strengthen its national security and protect critical infrastructure".

Derived from the US military's MQ-1 Predator A and not capable of carrying weapons, the intelligence, surveillance and reconnaissance-roled XP offers a flight endurance of up to 35h, and can reach a maximum altitude of 25,000ft (7,620m), according to its manufacturer.

"This is the first sale of Predator XP, and the first time a non-NATO country is able to buy our technology," it notes.

General Atomics has not disclosed how many UAS are involved in the export sale, but has provided details of the air vehicle's configuration for the UAE.

To carry a high-definition electro-optical/infrared sensor payload and the company's own Lynx synthetic aperture radar with a maritime wide area surveillance mode, the type will also be equipped with automatic identification system equipment to monitor surface ships.

The UAE also is acquiring its aircraft with an automatic take-off and landing system capability, winglets and "a more efficient propulsion system", the company says. ■

For more about unmanned air vehicle operations, visit flightglobal.com/uav

First Challenger 890 set for outfitting
BUSINESS AVIATION P21

REGULATION **STEPHEN TRIMBLE** WASHINGTON DC

Bell pressure prompts FAA rule-change query

On the eve of the 2013 Heli-Expo convention, the US Federal Aviation Administration will ask manufacturers whether the basis for the airworthiness standards for part 27 and part 29 helicopters should be rewritten.

The FAA issued the request for comments on 22 February because it has received "some rotorcraft community interest" for increasing the 3,180kg (7,000lb) threshold that defines the part 27 and the more rigorous part 29 standards.

Bell Helicopter has been the most outspoken critic of the current policy after missing its weight target on its 429 light twin.

In August 2012, the FAA rejected Bell's request for a 227kg exemption to the part 27 rule to allow the 429 to carry a full payload and all the required safety equipment.

Bell filed an appeal to the FAA's ruling in December, noting its exemption request was approved by more than a dozen airworthiness agencies, including the original 429 certification authority Transport Canada.

However, other manufacturers, including AgustaWestland, have objected to Bell's request for a special exemption to existing part 27 standards, arguing that it designed its rival line-up to products assuming they would be required to meet the existing weight threshold.

The FAA, however, has long been considering a change to weight-based aircraft regulations. In recent years, the FAA has proposed changes to the part 23 general aviation standards to abolish divisions by weight, arguing new technologies, such as fly-by-wire controls, make them irrelevant.

The weight standards for part 27 and part 29 helicopters have not been changed in 18 years.

"More recently we have recognised that the evolution of the part 27 and part 29 rules has not kept pace with technology and the capability of newer rotorcraft," the FAA says. ■

Eurocopter

Oil and gas transport specialist Bristow has yet to order the type

ROTORCRAFT

EC175 shows colours ahead of US tour

Eurocopter has revealed the first EC175 in the livery of potential launch customer Bristow Helicopters, as part of the rotorcraft's US demonstration tour and debut appearance at the Heli-Expo convention.

The super-medium twin-engined helicopter was pictured in flight at American Eurocopter's headquarters in Grand Prairie, Texas.

Compared with the primer-coated EC175 that completed first flight three months ago, the EC175 was displayed in the white, red and blue livery of USA-headquartered Bristow.

The aircraft will be displayed at Eurocopter's exhibit booth at the Heli-Expo convention from 5-7 March in Las Vegas.

Eurocopter continued plans for the demonstration tour after delaying certification of the EC175 six months to mid-2013. Entry-into-service for the 7t type is scheduled for September 2013. ■

DEVELOPMENT **STEPHEN TRIMBLE** WASHINGTON DC

Airframe challenges stall Learjet 85

Unspecified manufacturing issues push back entry-into-service date of Bombardier composite jet until third quarter of 2015

Problems affecting manufacture of the all-composite airframe of the Learjet 85 have prompted Bombardier to delay entry into service to the third quarter of 2014.

The airframer's top executives are unwilling to say unspecified problems have been completely overcome, even as the first flight-test vehicle advances in final assembly in Wichita, Kansas. "I don't want to say the challenges are completely behind us," says Pierre Beaudoin, Bombardier president and chief executive. "There will be additional challenges, but I think we understand very well the work that needs to be done."

The Learjet 85's all-composite fuselage structure is a first for Bombardier in several ways – in addition to the usage of the material itself, it is also the first time Bombardier has assembled complete airframe structures in Querétaro, Mexico.

A new workforce has been hired and trained at the facility on Mexico's high central plateau, where the roughly 6,000ft (1,830m) elevation requires Bombardier to use special techniques in the curing process for the composite material.

However, progress continues on preparing FTV-1 for first flight later this year. In September, the programme had shipped the fuselage for FTV-1 from Querétaro to Wichita, but the wings were not scheduled to ship to Wichita until November.

According to a Bombardier video posted online on 22 February, the wings and landing gear have been installed on FTV-1, but the Pratt & Whitney Canada PW307B turbofan engines have yet to be mated to the aircraft, nor has Bombardier installed the doors and windows.

FTV-1 has now moved into the second assembly positions, where Bombardier is installing the first systems. FTV-1 has reached the "power on" milestone, says Ralph Acs, Learjet vice-president and general manager.

The scheduling delay for entry into service has not changed Bombardier's outlook for the mid-size business jet, which will face competition in two years from the shorter-range but larger-cabin Embraer Legacy 450.

Meanwhile, the company plans to introduce the Learjet 70/75 into service in the first half of 2013, hoping to boost sales for the struggling light jet sector as Learjet 40/45 production is phased out. ■

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Laser vision may end turbulent times
TECHNOLOGY P23

INTERIORS **MURDO MORRISON** PETERBOROUGH

First Challenger 890 moves to fit-out

Canada's Flying Colours begins work on unnamed customer's Bombardier corporate jet and eyes expansion into China

Canadian completions house Flying Colours is preparing to outfit the first Bombardier Challenger 890 – a corporate version of a green CRJ900 regional jet. The airframer has adopted the marketing name – together with the Challenger 870 for future variants of the smaller CRJ700 – to sit alongside the Challenger 850, its VIP version of the CRJ200.

The aircraft – to be outfitted for an unnamed US customer – has arrived at Flying Colours' facility in Peterborough, Ontario from the assembly line in Montreal. The work is expected to take 24 months, says Flying Colours executive vice-president Eric Gillespie.

While the out-of-production CRJ200 has proved popular as a business aircraft, neither of its larger siblings – the CRJ700 and CRJ900 – have been transformed into executive jets. Flying Colours has established a niche in converting used CRJ200s into what it calls its Execliner VIP configuration, and completing new Challenger 850s on behalf of Bombardier.

Flying Colours

The completions centre has still to gain certification for modifications to the type's fuel system

On the Execliner, it installs supplementary fuel tanks between the rear lavatory and the cargo hold to increase the range of the regional jet. On the Challenger 850 these are factory-fitted, but – other than in age of airframe – the Execliner and Challenger 850 have the same specifications. The family-run company, which also has a facility in St Louis, Missouri has delivered 12 Execliners, with seven more completions under way.

Since 2008 it has outfitted 10 Challenger 850s for Bombardier, with work on five others ongoing. Bombardier remains by far its main focus but the firm also carries out refurbishment and maintenance on other business jet types.

Flying Colours still has to get the fuel system for the Challenger 890 certificated, and is in discussions with the owner about the configuration, says Gillespie. However, he hopes the contract will open the door to further VIP completions of new and used CRJ900s and CRJ700s. International expansion is also on the cards. With 15 Challenger 850s and Execliners delivered into the country, China has become a major market for Flying Colours and it plans to open a completions facility in the country by the end of the year. "We value this market as it is where our principal growth has come from over the last three years," says Gillespie.

The business is also expanding its footprint and capabilities at Peterborough airport, with a fifth hangar due to open later this year big enough to handle two Boeing Business Jets.

The municipality-owned airport has just extended its runway to handle Boeing 737-sized aircraft, and Flying Colours is keen to move into this market. ■

REGULATION **DAVID LEARMOUNT** LONDON

Finnish firm gains single-engine breakthrough

A Helsinki-Vantaa-based Pilatus PC-12 operator has been granted the first licence in the EU to operate the single-engined type on commercial flights under instrument meteorological conditions (SE-IMC).

Hendell Aviation gained permission for the operations from the Finnish Civil Aviation Authority. SE-IMC is a commercial transport mode recognised by the ICAO but not by all EU states.

Hendell chief executive Matti Auterinen says the licence enables the company to fly its PC-12s in most parts of Russia, Belarus and Europe as a one- or two-pilot operation depending on whether the task is pure cargo or passenger/air ambulance duties.

EASA is framing rules on SE-IMC operations, and Auterinen admits these may eventually affect his carrier – positively or negatively. But he is optimistic, reasoning that arguing a case for departing from ICAO's rules, which have defined successful SE-IMC operations in North America, is difficult.

Hendell Aviation

The PC-12s have been confined to non-commercial flights

Far less reliable operations by vintage twin-piston-engined aircraft such as Piper Navajos are permitted, under grandfather rights, to fly the same trips commercially at flight levels that confine them to the worst icing conditions, he says.

As such, Auterinen believes this certification is significant in Europe. He sees the argument about operational limitations turning more on the professional skills of an SE-IMC-trained two-pilot crew than the capabilities of the airframe and engine combination: "If it's done well with a properly trained two-pilot crew drilled in well-tried procedures for single-engined aircraft, we could be looking at a new era."

With the pressurised PC-12 able to fly at flight levels close to 30,000ft (9,150m), he points out, the drift-down capabilities give a crew a huge choice of landing options, and using the UK Royal Air Force high-key/low-key glide approach technique combined with a battery system that permits the autopilot to remain engaged, SE-IMC looks a different prospect than it did some years ago. ■

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Wall Street
787 fears ease
BUSINESS P24

SAFETY **DAN THISDELL** LONDON

Laser vision may end turbulent times

In-flight validation of air pocket detection LIDAR could lead to automated flight control adjustment – and smoother flying

Airliners of the 2020s may be equipped to automatically adjust to turbulence, gusts and air pockets, thanks to laser detection technology under investigation at EADS.

The Airbus parent's Innovation Works research department has successfully tested on an A340 a LIDAR system – light detection and ranging – capable of analysing motion in air molecules up to 200m ahead of the aircraft, and the research team is envisaging connecting that data to the aircraft's flight control computer so it can adjust wing control surfaces before the aircraft meets rough air.

Nikolaus Schmitt, of Innovation Works, says: "What our LIDAR sees is at most a second ahead. That's long enough for a machine, but not for the human brain. But our measurement of the airflow at that distance in front of the aircraft is extremely accurate, so the aircraft really will be able to automatically react to a vertical or horizontal draft on the basis of our advance information."

NASA Langley Research Centre

In 1990, NASA used coloured smoke to show this wake vortex

EARLY WARNING

Schmitt's team has used a LIDAR sensor that radiates ultraviolet light at rates of about 60 pulses per second, from four sources on the aircraft; the UV light is scattered by the nitrogen and oxygen molecules that make up most of the air we breathe or fly through, and computer analysis of the reflected light can identify moving air.

With direct control of wing surfaces, Schmitt believes it will be possible to avoid the sudden loss of altitude experienced in so-called clear air turbulence, or air pockets.

With such a system, in-flight meals may be less stressful events. However, the motivation to develop a practical turbulence early warning system goes beyond passenger comfort. Such a system would also reduce mechanical stress on an aircraft's wings and fuselage.

Having validated the accuracy of the measurement, the EADS team will now work on integrating LIDAR with the flight control system; after that, much miniaturisation of laboratory-scale equipment will be needed, but Schmitt reckons a system could be ready for series production in about 10 years. EADS notes that airframers on both sides of the Atlantic are interested in this technology – though it concedes it is a "matter of conjecture" as to who will deploy it first.

UV light is critical in this application; unlike infrared LIDAR systems such as Lockheed Martin's WindTracer, which is used to monitor wind shear at a number of airports with close-spaced parallel runways, most recently including San Francisco and Newark Liberty, UV LIDAR does not need aerosols in the air to detect movement. Aerosols – such as water droplets and dust, soot or particles from vehicle emissions – are abundant in airport approach paths but relatively rare in clear air at altitude.

UV is also ideally suited to the close-range detection needed to feed a flight control computer with useful data, while an IR system would be best-suited to providing a pilot with longer-range warning, for example of the wake turbulence behind other aircraft approaching landing. Indeed, as larger aircraft create greater disturbance, Airbus and Boeing have both used IR LIDAR to build data on wake vortices during development of their ultra-large A380 and 747-8 aircraft, at low altitude and sometimes with the aid of smoke generators in preceding aircraft.

> **"What our LIDAR sees is at most a second ahead. That's long enough for a machine, but not for the human brain"**
>
> **NIKOLAUS SCHMITT**
> Innovation Works

Airbus and Boeing would obviously like that data to persuade airworthiness authorities not to demand unnecessarily large separations on approach and take-off, as large separations in part undermine the marketing argument for large aircraft, which can increase an airport's capacity even without increasing the number of movements.

Authorities understandably remain cautious, but so far the data used to determine separation distances has not been based on real-time measurement of wake vortices. UV LIDAR aboard in-service airliners could, in conjunction with commercially available ground-based IR systems, help air traffic managers understand actual conditions near runways.

Schmitt would certainly like to see airliners carrying UV detection systems; whether or not a miniaturised IR system for long-range detection would also be suitable for general use depends on the economics of adding the mass needed to accommodate both systems.

However, Schmitt adds, there is some research being carried out at EU level into long-range detection by UV LIDAR, so it remains to be seen whether or not both objectives could be achieved with a single system. In any case, he says, there is another short-range application for a UV system of the type EADS is developing.

On-board LIDAR would be an ideal way to measure data such as air speed, temperature or pressure during flight. A LIDAR system could back up the mechanical air data systems used today, providing an extra, and totally independent, layer of safety.

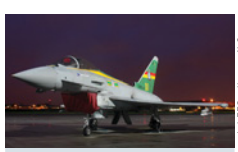
Airlines would also be keen to take advantage of LIDAR's ability to identify particles in the air, if those particles happen to be volcanic ash.

On-board LIDAR might prove capable of determining whether it is safe to operate following a volcanic explosion such as the April 2010 eruption of Iceland's Eyjafjallajökull, which grounded more than 100,000 European flights and cost airlines $1.7 billion over six days – a form of commercial turbulence which is arguably as disturbing as the sort that brings on the "fasten seat belts" signs. ■

Good week

ASTRIUM EADS's space division posted 17% revenue growth to €5.82 billion ($7.62 billion), second only to the 19% growth racked up by Airbus's commercial aircraft operation. Seven Ariane 5 rocket launches and nine satellite deliveries combined with an uptick in the order take, to €3.8 billion, to make for a stellar year, capped off by November's agreement by European Union ministers on a robust five-year budget for key customer, the European Space Agency.

Rex Features



andyh1558 gallery on AirSpace

CASSIDIAN EADS's defence unit again trailed its fast-growing sisters, with revenue trickling downward by €43 million ($56 million) to €5.74 billion. At €142 million, profit was overshadowed by one-off charges of €198 million and, in any case, was lower than expected, even though R&D costs were down on 2011. At €5 billion the order intake was up by nearly a quarter, though, and management is promising a new focus on the bottom line, so 2013 may bode well.

Bad week

FINANCE **STEPHEN TRIMBLE** WASHINGTON DC

Wall Street 787 fears ease

Alarm gives way to optimism that battery trouble will not cause Boeing shares to tumble

Market analysts are growing more confident that the Boeing 787's six-week-old battery crisis will not have a major impact on the company's bottom line. Within days of the first 787 battery fire on 7 January, analysts who cover Boeing business regularly appeared surprised but not seriously concerned about the prospect of major losses.

However, the mood became more fretful as a battery overheated on another 787 on 15 January and the fleet was grounded a day later, halting deliveries of new jets while production continued.

More than six weeks later, investigators have narrowed the problem down to the 787's unique lithium-ion power sources, but are still trying to identify the root cause of a short-circuit in one of eight cells that triggered a thermal runaway throughout the battery.

TIMING AND COST

Questions abound about the timing and cost of returning the 787 to flight, but some market analysts have seized on recent signs which indicate a potentially benign course.

On 26 February, Cai von Rumohr, senior aerospace analyst for New York-headquartered investment bank Cowen and Company, sent a research note to investors with the headline "787 battery issue resolution looks close at hand".

Wall Street seems encouraged that Boeing can weather the crisis without hurting the stock price, which closed on 27 February at $77.36 a share, only 33 cents below its peak on the last trading day before the battery crisis began. Von Rumohr has discounted Cowen's target by 5 cents for Boeing's earnings per share target in 2013 because of the battery issue alone. However, Cowen's projected price of $5.50 still exceeds Boeing's own earnings guidance for the full year by 30 to 40 cents.

Cowen's more optimistic assessment is driven partly by Boeing's recent move to propose a potential fix to the US Federal Aviation Administration. Boeing briefed the FAA on the package of design changes intended to prevent another battery fire, even though the root cause remains unknown.

Rex Features

Qatar Airways has all five of its Dreamliners grounded

FAA administrator Michael Huerta told lawmakers on 27 February that he expects to receive a report on Boeing's proposal from the agency's Seattle-based Transport Directorate next week.

Another concern is the impact of the battery crisis on the launch of the 787-10 double stretch, presumed to be targeted for the Paris air show

While offering no timeline for making a decision, Huerta says the recertification process could prove lengthy. "Once we approve the plan then we have to go through the process of actually implementing the plan, which will involve a great deal of testing, a great deal of further analysis and a great deal of re-engineering before we put them back in the air," he says.

However, the FAA seems impressed by the scope of Boeing's proposal. While some expected Boeing to propose an interim fix to the battery problem until the root cause had been determined, the company has actually offered a more advanced redesign. It aims to mitigate any failures which could ignite a fire and smoke on three levels, whether inside the cell, the battery box or the electrical equipment bays. "The plan that Boeing has presented is a comprehensive plan that addresses all of those areas," Huerta says.

Despite his overall optimism, von Rumohr still thinks Boeing could be forced ultimately to replace the lithium-ion batteries altogether with a safer alternative.

Moreover, the 787 battery crisis is not the only problem weighing on investors. The ramp-up of the larger 787-9 variant this year will slow the pace of Boeing's production system, allowing only 55 to 60 787 deliveries on a line with a capacity to deliver 75 of the smaller 787-8 variants.

Another concern is the impact of the battery crisis on the launch of the 787-10 double-stretch, which is widely presumed to be targeted for the Paris air show in June. The battery crisis could delay airlines from placing orders, slowing how fast Boeing can induct what is expected to be the most profitable of the three variants into the production system, von Rumohr says. ■

See our timeline showing the Dreamliner's nightmare: flightglobal.com/787woes

Airlines eye the new breed of electronic flightbags
FEATURE P26

PEOPLE MOVES

Aeronamic, Alenia Aermacchi, Moon Express, Qinetiq

Air Charter

Bowman: Charter service

Air Charter Service has promoted Justin Bowman from commercial director to deputy managing director. On the departure of Alan Calegari for other activities, Benjamin Stone has taken over as chief executive of **Alenia Aermacchi North America**. At **Qinetiq North America**, JD Crouch will take over as chief executive on the retirement of Duane Andrews on 31 March. Crouch is currently president of Qinetiq North America's Technology Solutions Group. Andrews joined as chief executive in June 2006, following a US Air Force career that included a stint as Pentagon chief information officer, followed by 13 years with Science Applications International Corporation. At Dutch aircraft subsystem designer and manufacturer **Aeronamic**, chief executive Dick Alta has retired and been replaced by VP operations Steffen de Vries. At **Moon Express**, a privately funded lunar transportation and data services company based at the NASA Ames Research Park in Silicon Valley, Tim Pickens is now chief propulsion engineer. Pickens had been propulsion designer for Burt Rutan's X prize-winning SpaceShipOne.

Alenia Aermacchi

Stone: Alenia North America

QUOTE OF THE WEEK

"There is no Europe of defence"

Flightglobal/ Dan Thisdell

EADS chief executive **TOM ENDERS** says that the failure of his 2012 bid to merge with BAE Systems taught him that national interests still prevail – and that Europe's defence industry needs further consolidation

BUSINESS BRIEFS

AUSTERITY BITES AT BAE SYSTEMS

DEFENCE BAE Systems' 2012 financial results underscored the austerity-era challenges facing arms makers, as sales dipped 7% to £17.8 billion ($27.2 billion) and pre-tax profits slipped nearly 6% to £1.41 billion. Bright spots in last year's performance and the outlook for 2013 sit mostly outside of BAE's core UK and US markets, with much expectation being placed on a 2013 resumption of Eurofighter Typhoon deliveries to Saudi Arabia. Even in its cyber and intelligence segment, sales were essentially flat in 2012 and are expected to fall this year. However, the company is clearly evolving from an equipment supply-centred model to one that "now embraces a services culture"; in 2012, half of sales were "generated in services across a wide range of activities and geographies".

VOLVO AERO BUY LIFTS GKN

TIER ONE GKN Aerospace posted 20% sales growth in 2012 to £1.78 billion ($2.69 billion), including a fourth-quarter contribution of £191 million from Volvo Aero, acquired on 1 October. Segment profit was up 4% to £170 million. Highlights of the year included establishment of a composite aerostructures manufacturing facility in Mexico, a new contract for the design, development and production of transparencies, winglets and ailerons for the Bombardier Global 7000 and Global 8000 business jets, and further work packages for the Boeing 787 relating to floor sections, wing ribs and seat tracks.

SENIOR RIDES HIGH WITH AIRBUS, BOEING

COMPONENTS Revenue growth of 50% in commercial aircraft sector sales drove Senior group aerospace division sales up 23% to £470 million ($713 million) in 2012, with operating profit gaining 21% to £72.1 million. The structures, components and fluid control systems maker gets more than half of its aerospace revenue from Airbus and Boeing sales, and during 2012 won additional work on the A350 and 787 programmes.

BOEING SECURES SECURITY CHIP MAKER

ELECTRONICS Boeing has acquired specialist microprocessor maker Acalis from CPU Technology for an undisclosed sum. Acalis, based in Pleasanton, California and employing 40 people, makes high-security chips suitable for use in mission-critical onboard systems, to protect military personnel from information-assurance attacks. The business will be brought into Boeing Military Aircraft's Global Strike division.

KAMAN GROWS STRONGLY IN MIXED YEAR

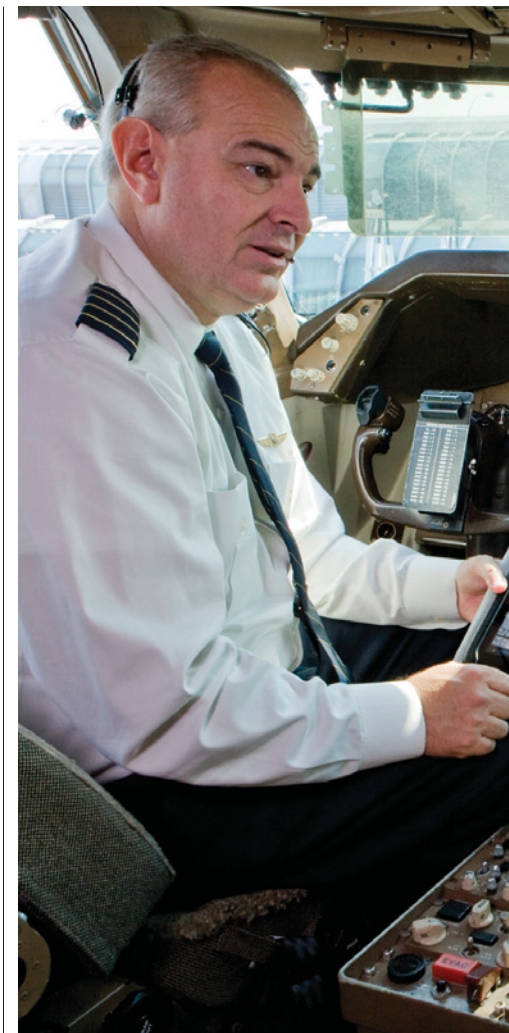
MANUFACTURING At Kaman – the components and structures maker whose business lines include support for its legacy K-MAX and SH-2G Super Seasprite helicopters, and which is developing an unmanned version of K-MAX with Lockheed Martin – aerospace segment full-year sales for 2012 were up 6.1% to almost $581 million, lifting operating profit 10.8% to $89.1 million. For 2013, Kaman expects segment sales to rise between 6.7% and 9.3% to $620-635 million.

THALES CLOSES US DISPLAYS ACQUISITION

DEFENCE Thales has completed its acquisition of the Visionix helmet-mounted display and InterSense motion tracking businesses formerly owned by Gentex. The new company, Thales Visionix, complements Thales' portfolio of helmet-mounted sight and display systems for rotary and fixed-wing platforms and is maintaining both of its existing locations, in Aurora, Illinois and Billerica, Massachusetts. The current management team remains in place.

APPLE SKY

With crews having access to devices such as the iPad during all phases of flight, airlines are targeting fresh functionalities from a new breed of electronic flight bags



KRISTIN MAJCHER WASHINGTON DC

Soon after Apple's iPad was released in 2010, aeronautical chart manufacturers and operators recognised the advantages of using lightweight, portable tablets to replace paper manuals in the cockpit. However, it was not until June 2012 that the US Federal Aviation Administration gave airlines the green light to start using tablets during all critical phases of flight as "class 1" devices, rather than having to stow them during take-off and landing.

The new rules allow tablets to be mounted in the cockpit, accessible to the pilot throughout all phases of flight without the need for a special supplemental type certificate (STC) for the mount or the device itself. Airlines are looking at future functionality of tablet-based electronic flight bags (EFBs) such as the iPad. Several plan to use the devices not only to store aeronautical charts and manuals but to provide additional features such as maintenance logs and extra situational awareness on the ground. Aerospace-built class 2 and class 3 EFBs have traditionally provided this type of information, but these functions are now being integrated into class 1 portable consumer devices as well.

Lufthansa Systems

Lufthansa: developing iPad airport moving map

EVOLVING REGULATIONS

The June revisions to the use of EFBs (FAA Advisory Circular 120-76B) introduced the idea of "viewable stowage". Under a previous advisory circular released in 2003, class 1 EFBs were treated in a similar way to the personal electronic devices passengers bring on board, having to be stowed during take-off and landing. Now, under the viewable stowage provision, class 1 EFBs must be tested for rapid decompression, non-interference and inspections related to lithium-ion batteries.

Class 1 EFBs do not connect to aircraft power or systems and are not considered a permanent installation but, following the viewable stowage definition, the tablet can be mounted for the duration of the flight, yet at the same time is considered a portable device.

The viewable stowage concept blurs the lines between the defining characteristics of EFB classes, says Rick Ellerbrock, chief strategist at Boeing subsidiary Jeppesen Aviation, which creates electronic aeronautical charts for commercial airlines under the name Jeppesen Mobile FliteDeck Pro. This distinction allows airlines to use the iPad as an EFB cheaper than other classes of EFBs, which require further integration with the aircraft. "The whole viewable stowage concept was really a game changer, helping to lead the current explosion in tablet EFB growth," says Ellerbrock.

American Airlines is one operator harnessing the shift to viewable stowage. The carrier made its first test flight with the iPad in 2011 on the 777, and it is introducing the devices throughout the fleet as a class 1 portable EFB. The carrier says it expects to save $1.2 million per year in fuel by eliminating the weight of onboard paper manuals.

The FAA has extended American's approval to use iPad EFBs on its Boeing 737 and MD-80 fleets in addition to the 777s, says Capt David Clark, manager, flight operations efficiency and quality assurance. American is also in the middle of a line test process to approve iPad use on its 106 Boeing 757-200s, 15 767-200ERs and 58 767-300ERs, says Clark. He says the goal is for American's fleet to be a paperless operation by 1 April.

For aircraft types added after the 777s, Clark says the airline can typically start a 30-day line test of the technology a day or two after submitting formal approval to the FAA. If that test goes well, the airline can receive formal "op spec" approval to operate the iPads within three to four days.

American has equipped more than 70% of its fleet with iPads across the three aircraft types. The 757 and 767 approvals are the last aircraft types in the fleet to be equipped with the tablets. Flightglobal's Ascend Online database shows that the airline's fleet includes 200 Boeing 737-800s, 186 MD-80s, 47 777-200s and four 777-300ERs.

United and Continental pilots were issued with iPads in 2011

United Continental Holdings

All of American's pilots have been issued with an iPad, says Clark. The airline co-ordinates with its parent AMR's certificate management office in Fort Worth, Texas to gain approval to use the devices on each aircraft type. American saw the ability to integrate the iPad without an STC as an important part of the rationale for choosing the device. "We specifically avoided the STC process for time and cost," says Clark.

> **"The next thing the industry is craving is own-ship position en route"**
>
> **WILL WARE**
> EFB team leader, Southwest Airlines

United Airlines also deployed the iPad with savings in mind. In August 2011, the Chicago-based airline began distributing 11,000 iPads to Continental and United pilots. Weighing less than 0.7kg (1.5lb), each saves 17.2kg (38lb) of paper from the traditional manuals. The carrier has estimated it will save 1.23 million litres (326,000gal) of fuel per year and 16 million sheets of paper from transitioning to the iPad EFBs.

Now that class 1 EFBs can be within the view of pilots throughout an entire flight, new opportunities have arisen to enhance the functionality of class 1 EFBs on the ground.

The most recent update to FAA regulations addresses additional functionality for class 1 EFBs. In a proposed update entitled "change 1", the FAA outlined guidance for using class 1 and class 2 EFBs to support own-ship position at airports. This feature acts as an additional situational awareness tool for pilots, as it allows them to see their aircraft taxi along ground routes on a map display. However, the proposed rule change does not permit operators to use own-ship position at speeds of 40kt (74km/h) or faster.

"The next thing the industry is craving is own-ship position en route," says Will Ware, EFB team leader at Southwest Airlines and US chair of the Airlines Electronic Engineering Committee/IATA users forum.

Ware says such a function would allow pilots to see weather beyond the range of its airborne radar, while noting that airlines would not use the feature for navigational purposes.

Lufthansa Systems, which also produces aeronautical charts, says it is adding functionality to its Lido/iRouteManual Pro apps for the iPad. "We are currently developing an airport moving map for the iPad," says Stefan Auerbach, senior vice-president airline solutions at Lufthansa Systems, which is looking to introduce the feature in the next few months.

FIVE PHASES

Electronic charts made by companies such as Jeppesen, Lufthansa Systems and Canada's Navtech have been the primary documents used by pilots on tablet-based EFBs. However, some operators have long-term goals to find more ways to utilise the tablets in flight, such as using them to interact with aircraft systems or cabin and maintenance crews.

Southwest is in the first of five phases to gain approval to use iPads as EFBs, which requires submitting a letter of intent. It hopes to gain interim authorisation to start testing an initial deployment in the second quarter of 2013. Southwest has been using an onboard performance computer since 1997, which functions as a class 1 EFB, but is looking to save weight by using an iPad rather than heavy documents and manuals.

The airline is creating a business case to deploy iPads to replace its airside bag system, which includes navigation charts as well as company manuals and weather applications. Unlike the onboard performance computer, which stores take-off and landing data and does not have any manuals, the tablet would allow the airline to eliminate paper and the need to send paper revisions to thousands of pilots.

Ware says a long-term desire would be to use the iPad to integrate data between airline departments. For example, cabin crew sending electronic logs to the maintenance department in the event of an onboard issue.

Southwest expects an early second-quarter deployment of iPads for at least 150 pilots, rising by increments of 150 until all its roughly 7,000 pilots are all using the device by the second quarter of 2014, creating a paperless environment throughout its fleet.

The Dallas-based low-cost carrier plans to adopt a strategy where each pilot furnishes their own iPad, accessing secure corporate content in addition to other applications for day-to-day use. Southwest has chosen the iPad for the first deployment of tablets during the first few years of the programme, but it is open to evaluating other types in the future when the technology needs refreshing.

American Airlines is also interested in »

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using iPad EFBs in other sectors of the company. Clark says the "next phase of pursuit" after going paperless would be to connect the EFBs via a satellite link. "We are very close to some solutions with regard to connectivity," Clark says. Some of that information would include real-time weather data, connecting information, gate information and schedule changes, he adds.

"We're finding that traditional EFBs, or derivatives, are still our best fit for the cockpit"

DAN PENDERGAST
Senior director, international division, Arinc

As the number of connected aircraft increases, so will the ability for airlines to transfer more data, Auerbach says. "Once the satellite and also the earth-to-ground to aircraft communication infrastructure is being established, you'll see a lot more exchange of information from ground to cockpit," he says.

Avionics & Systems Integration Group (ASIG) is one provider already integrating real-time flight data into iPads, expanding the use of the EFB beyond a tool simply for storing manuals and documents. For airlines interested in adding more data, the flyTab class 2 EFB provides more functionality than a traditional class I device because it is certificated to connect to aircraft systems.

STREAMED INFORMATION

When connected to the aircraft, flyTab can load streamed information from aircraft systems and sensors. Data that can be streamed to apps on the EFB include that from ARINC 429, RS-232, RS-422 and RS-485 buses. Discrete data is also supported.

Managing director Luke Ribich says ASIG is on track to achieve an STC for the Boeing 767 and Bombardier's CRJ and Dash 8 by the end of the first quarter of 2013.

The flyTab system is designed to provide operators with a customised platform of features, says Ribich. For example, flyTab could allow an operator to send systems and sensor data from a bus to flight operations quality assurance or flight data monitoring managers easily via an interface module that provides the data for the iOS apps on the iPad.

The flyTab product includes the certification, mounts, software developer kit and data in one package. It is powered by a conditioning module, with data streamed through an interface module. Wi-fi in the cabin would allow more functionality but is limited by current regulations, says Ribich. "We hope to see the regulatory environment relax at some point in the future," he adds.

Additional flyTab applications could include other real-time data such as own-ship position and GPS data such as position, altitude, ground speed and destination tailored to each operator. ASIG says installing the EFB system on each aircraft can cost $5,000 to $20,000, depending on selected features.

Beyond saving paper, airlines could also find improvements via operational initiatives such as reducing pilot workloads through electronically sending flightplans and analysing safety data to reduce hard landings and unstable approaches.

While the uptake of iPads is strong, some airlines are still going down the route of non-tablet EFBs in the cockpit. Cathay Pacific is using tablets as part of Arinc's "e-enabled" cabin solution, but not in the cockpit. Instead, cabin crew are using the tablets for tech logs and real-time in-flight credit card authorisation. Along with charts from Navtech, the enabled system includes a feature called GateFusion, which transfers large documents and manuals while the aircraft is parked at the gate.

The airline has also integrated its communications systems. "If you look at technology for the cockpit, we're finding that traditional EFBs, or derivatives of them, are still our best fit for the cockpit," says Dan Pendergast, senior director of Arinc's international division. He explains that because of the EFB's connectivity with aircraft systems, Arinc has found that aerospace-built EFBs provide a way to more easily integrate applications "without having to go through consumer channels".

However, Pendergast adds, that "doesn't mean a tablet at some point in the near future won't be a really good fit". ■

Electronic flightplans can reduce pilot workloads

United Continental Holdings, Jeppesen

Rex Features

High approach speed was cited after a Gulf Air A320 crashed off Bahrain on a flight from Cairo in 2000, killing all 143 on board

DODGING DISASTER

The go-around manoeuvre offers an escape from unstable approaches, but all too often its mishandling has led to a crash. Could eye-scanning technology present a solution?

DAVID LEARMOUNT LONDON

Go-arounds are supposed to be the safe route out of an approach that is not going as smoothly as it should. Accident statistics, however, reveal this ostensibly simple manoeuvre has often gone catastrophically wrong, whereas an unstable approach continued to landing frequently causes damage to the aircraft, but no fatalities.

When – some five years ago – the Flight Safety Foundation initiated an industry campaign to reduce the causes of runway excursions and overruns, one of the facts established was that they frequently followed an unstable approach – usually too high or too fast, or both. An inescapable conclusion was that, if crews took note of the advice regarding unstable approaches, one of the potential effects would be more go-arounds. European airport statistics show that one or two go-arounds occur for every 1,000 approaches, which works out at about one go-around per year for short-haul pilots and one every five to 10 years for long-range crews.

Until recently, it had always been assumed that go-arounds were easy, and since a regular recurrent training exercise in the simulator has always been – and still is – an approach with a single-engine failure followed by a late decision to go around, it was also assumed that such a practice manoeuvre should ensure individual pilot competency in the event of a go-around. However, the evidence shows it is not as simple as that. First of all, crews in the simulator actually anticipate a late go-around because it is a statutory exercise, whereas in the real event the need for a late go-around will be a surprise or, at best, a late decision. The ultimate in late go-arounds is carried out just above the runway, or can even follow a bounced landing. Such late go-around decisions, Flightglobal's Ascend Online accident/incident database reveals, have resulted in multiple severe tail-scrapes in the past few years.

Besides which, an all-engines go-around generates its own problems, such as the sudden high rate of climb and forward acceleration combined with a powerful nose-up pitch moment generated by the below-wing thrust line, and – especially at night or in instrument meteorological conditions – that giddying sensation known as a somatogravic illusion, which can lead to disorientation and loss of control.

There are many examples of the failure of crews to cope with go-arounds (*see box*). Some of these were catastrophic, while others came close to catastrophe but the crews recovered control in time to save the aircraft. One of the common factors in all go-arounds, especially those following a decision made on short final approach, is the lack of height – and therefore time – in which to recognise a destabilising mistake and correct it.

There is a dichotomy here: runway excursions and overruns are aviation's most common accident type by far, but most are not

fatal; whereas the risk associated with a go-around may be relatively low but mishandling could lead to catastrophe. A recently published report by Dutch research agency NLR confirms that, despite all recent efforts to increase awareness of the risk, global numbers of runway excursions are not reducing, and that close to 90% of them are associated with landing.

As Capt Bertrand de Courville, of Air France's corporate safety department, observes, a successful campaign to encourage go-arounds from imperfect approaches tantalisingly promises a potential reduction of about 25% in overrun/excursion landing accidents. "No other single defence could have that impact," he says. But, on the other hand, a badly executed go-around could lead to a catastrophe. So what does an airline tell its crews to do?

De Courville describes this shifting of risk from one manoeuvre to an alternative as being a systemic issue, whereas crews operate in the immediate operational environment.

He explains: "We are not giving guidance to our pilots on the basis of go-around-related risks. Go-around decision-making is already difficult. We should keep it as simple as possible and be very cautious before adding more complexity."

"The best strategy at this stage is to encourage and train – in real time – a TEM [threat and error management] approach to the go-around. We still have good potential to make the go-around more robust by doing this."

But what training is appropriate? What skills does a go-around manoeuvre demand to ensure it can be accurately and safely flown under all circumstances? One way to find out is to examine the strategy adopted by Thomson Airways – then Thomsonfly – after one of its crews almost lost control of a Boeing 737-300 while attempting a go-around from an approach to Bournemouth airport on England's south coast (*see box*).

Rex Features

Nearly 200 died in this 1998 crash in Taiwan

The aircraft was on an autopilot/autothrottle-linked instrument landing system approach, when the autothrottle silently disengaged and the airspeed started to drop until the stall warning sounded.

By that time the autopilot had trimmed the horizontal stabiliser to a nose-high setting commensurate with the low airspeed, so when the crew applied full power to go around, the aircraft pitched up dramatically to a dangerously nose-high attitude. Control was ultimately regained and the crew returned to land safely.

Following an investigation, Thomson arranged for pilot eye-tracking to be carried out in its training simulators and discovered that many pilots had a disorganised instrument scan which frequently left out vital displays – such as the airspeed indicator – for critically long periods. Such a fundamental failure in the exercise of a skill which, it has always been assumed, was basic to all licensed professional pilots was a shock, raising the question as to how widespread this failure is in the industry as a whole.

As a result, since 2009 Thomson has added eye-scanning technology to its training repertoire, as Capt Colin Budenberg, manager of training standards, explains: "We expect it to be used for the retraining of pilots who have been identified with performance issues."

It will also be useful in pilot selection and recruitment, he hints, adding: "I expect the most significant outcome will be to develop the skills of the pilot not flying – the pilot monitoring [PM]. Currently, we only know when someone isn't good at this [the PM role] when the pilot flying makes mistakes that are not spotted."

Airbus, NASA, the UK Civil Aviation Authority, French accident investigator BEA and Air France have also, in the past two years, been using eye-tracking to assess PM activity and produce a best-practice guide for the PM role.

De Courville has presented on the subject of go-around risks and flying technique at numerous aviation safety seminars in the past few years. He maintains a disciplined primary flight display (PFD) instrument scan is crucial to establishing a safe go-around trajectory – particularly in instrument meteorological conditions (IMC) or at night.

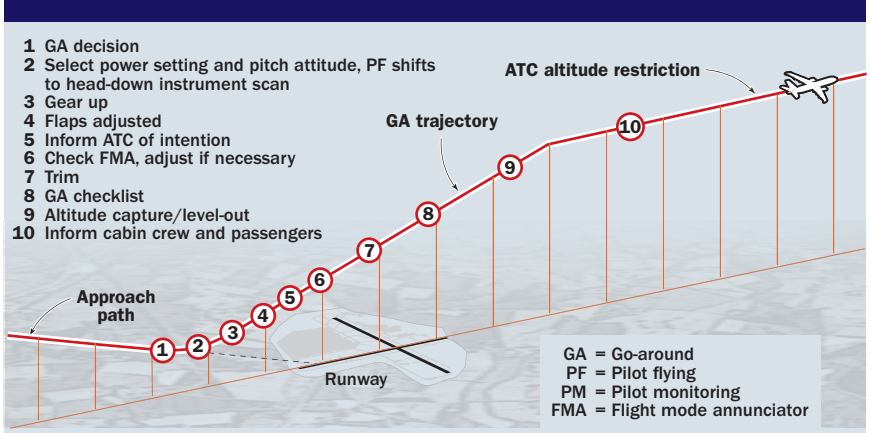
"We expect [eye-scanning technology] to be used for retraining pilots identified with performance issues"

CAPT COLIN BUDENBERG
Manager of training standards, Thomson Airways

On a modern, single-screen PFD the technique for an effective instrument scan entails using the same traditional "T-shaped" eye-movement pattern associated with classic round-dial instruments, with the artificial horizon (AH) at the intersection of the T-shaped pattern. For go-around, the pilot flying's eye scan pattern centres on the AH where they initially select the go-around attitude, then radiates outward in turn to the air speed indicator, back to the AH, then right to the altimeter, back to the AH, then down to the compass strip for heading, and so on repetitively, with an occasional glance at the power setting to ensure it is what the pilot flying intended.

The pilot flying's scan must contain some of the same, but naturally has to range a little more widely to take in system performance, flightpath monitoring and any necessary intercepts of height or heading dictated by the missed approach procedure. There is a lot to take in, and if ATC has set a low level-out height, things happen quickly. This is the same whether the pilot is flying the aircraft »

GO-AROUND WORKLOAD AT NIGHT OR IN INSTRUMENT METEOROLOGICAL CONDITIONS



*Applies whether manually flown or on autopilot/autothrottle

Tim Bicheno-Brown/Flightglobal

» manually or monitoring what the autopilot/autothrottle is delivering, with the additional complication in the latter case of a possible need to alter the flight-management system mode or its preset parameters.

On a night or IMC approach just before the go-around decision, if the pilot flying was beginning to divide his attention between instruments and emerging external visual cues, once go-around has begun there has to be a transfer of attention completely to the instruments, because when the nose rises to a go-around attitude, any surface lighting that was becoming visible just before go-around can suddenly become partially or completely obscured, robbing the crew of external visual cues or leaving them with only a few fatally misleading ones.

De Courville cites two unidentified – but non-fatal – events as examples of what can happen. The first involved a Boeing 757 crew in 2002. After initiating a go around in IMC, the pilot flying, when reaching the 2,500ft (760m) altitude intercept, applied and held a prolonged pitch-down input, resulting in a dive until the aircraft was in an extreme negative attitude (minus 40˚) from which recovery was made. The pilot reported: "When we suddenly got the altitude capture commands from our flight director, when both of us were in the mindset for a go-around, we became confused. And then, with the unbelievable nose-down pitch attitude, we became even more confused." Fortunately, they recognised the situation in time. The second event he cites involved an Airbus A330 in 2007. After initiating a go around at night over the sea, the altitude capture mode activated, the pilot flying pitched down to level off. The IAS increased towards VFE (flap exceedance speed) with the red strip becoming visible on the speed tape. Instead of maintaining a level flightpath at altitude capture, the pilot flying again maintained a prolonged pitch down input. Pitch attitude reached minus 9˚, vertical speed 4000ft/min (20m/s). The GPWS activated and the climb was resumed. The minimum altitude was 600ft over the sea, the total duration about 15s.

> **"The robustness of the pilot eye-scan pattern in a dynamic phase is where the safety efforts should be placed"**
>
> **CAPT BERTRAND DE COURVILLE**
> Corporate safety department, Air France

De Courville comments: "Degraded instrument scanning leaves an open door to somatogravic illusion and spatial disorientation. The effect of somatogravic illusion should not be considered the initial cause of this type of LOC [loss of control] incident/accident, but the robustness of the pilot eye-scan pattern in a dynamic phase is where the safety efforts should be placed."

He quotes two other training captains who have studied the causes of disorientation and loss of situational awareness: "Considering how critical an effective scan is, it is surprising that the development of a good set of scan patterns is not given high priority during training; especially since one of the most commonly cited forms of visual problems associated with mishaps is the breakdown in cockpit scan."

The US Federal Aviation Administration has this observation to make about the importance of the PM role in dynamic situations such as go-around: "Studies of crew performance, accident data, and pilots' own experiences all point to the vital role of the non-flying pilot as a monitor. Hence, the term 'pilot monitoring' is now widely viewed as a better term to describe that pilot." ■

David Learmount comments on operational and safety issues via his eponymous blog at **flightglobal.com/learmount**

SAFETY

HOW BOTCHED GO-AROUNDS HAVE BROUGHT TRAGEDY

■ **23 September 2007:** a Thomsonfly Boeing 737-300 was on a night instrument landing system approach to runway 26 at Bournemouth airport, with a crew of five and 132 passengers on board. Autopilot/autothrottle was engaged but the autothrottle silently tripped out with the power set at idle. There is no audible warning in the 737-300 for autothrottle disconnect and the crew did not notice the disconnect warning light. The airspeed started to drop until the captain, who was pilot monitoring, noticed it passing 125kt (230km/h) and took control. By that time, the autopilot had trimmed the horizontal stabiliser to a nose-high setting commensurate with the low airspeed, so when the captain applied full power to go around, the aircraft pitched up dramatically to a 44˚ nose-high attitude despite full nose-down elevator input by the captain, and the airspeed bottomed at 82kt. Control was ultimately regained and the crew returned to land safely with no injuries.

Rex Features

Somatogravic illusion was a factor in the Gulf Air crash in 2000

■ **3 May 2006:** an Armavia Airbus A320 was approaching runway 06 at Sochi, Russia at about 02:00 local time over the sea in limited visibility. Deteriorating weather caused approach control to instruct the crew to abandon the approach with about 3.5nm (6.5km) to go, which entailed carrying out a climbing turn to the right to avoid terrain. During the turn, the captain made nose-down inputs on the sidestick when nose-up would have been appropriate, and the aircraft hit the sea. The report does not mention the possibility of somatogravic illusion but does cite the time of night, possible fatigue and poor monitoring by the co-pilot, as factors. All eight crew and 105 passengers were killed.

■ **23 August 2000:** a Gulf Air Airbus A320 was carrying out effectively a non-standard night-visual approach to runway 12 at Bahrain when the captain made the decision to abandon the approach because the aircraft was too fast and too high. ATC cleared the aircraft to climb to 2,500ft (760m) and turn left on to a downwind heading of 300˚ to reposition for approach. During the intended climbing turn the captain, the pilot flying, made nose-down inputs on the sidestick and the aircraft hit the sea with a nose-down attitude of 6.5˚ and an airspeed of 280kt. All eight crew and 135 passengers were killed. The report's verdict was that there were multiple causes starting with incomplete training and a poorly executed approach, but that somatogravic illusion was the reason for the pilot's nose-down stick inputs.

■ **16 February 1998:** a China Airlines Airbus A300-600 was on approach to runway 05L at Taipei, Taiwan, when the crew abandoned the approach because the aircraft was too high. The crew applied go-around power but for a long time failed to counteract the nose-up pitch moment generated by the increase in power. Pitch-up reached 35˚ nose high. The aircraft stalled and did not recover. All 14 crew and 182 passengers were killed. ■

Peter Clignett

A stint as chief engineer for the Fokker 100 deepened his expertise as an aerodynamicist, leading him to a pivotal role at Bombardier and, later, service as a consultant to Embraer

Once the world's largest aircraft manufacturer, Fokker was five decades past its prime in 1987 and the Fokker 100 was sinking rapidly in red ink when 48-year-old aerodynamicist Peter Clignett decided it was time to leave. It turned out to be a great career move: Fokker ceased aircraft production permanently 10 years later, while Clignett moved on to help former rivals in Canada and Brazil succeed where his first employer had failed.

As chief engineer for the Fokker 100 starting in 1984, Clignett undoubtedly objected when the aircraft was sometimes paid the backhanded compliment of being slightly ahead of its time. In fact, the 100-seat twinjet initially sold well but the airframer was simply unable to sell the aircraft for more than it cost to build, yielding lessons Clignett would apply at his next job in Montreal. Clignett's idiosyncratic style left lasting impressions on colleagues – he just saw things a bit differently to everybody else. "He had his idiosyncrasies, let's put it that way," says Rudi den Hertog, a former colleague and now chief engineer of start-up Fokker NG. "In retrospect, that's why I liked him a lot. He always had something to say that you may not agree with, but you liked to listen to."

> **"He always had something to say that you may not agree with, but you liked to listen to"**
>
> **RUDI DEN HERTOG**
> Former colleague and chief engineer, Fokker NG

One example is the Fokker 100's cabin noise signature. Clignett slipped a lower decibel level into the Fokker 100's application for type specification.

"It stayed in and everybody forgot to take it out," Hertog says. Suddenly, Clignett's personal decibel preference became part of the Fokker 100's type certification, and something Fokker had to guarantee to customers.

In 1987, a headhunter asked Clignett if he was interested in a job with Bombardier. It was an easy choice, despite him being the son of a Fokker administrator. Clignett, born in Indonesia, moved several times within the Netherlands and was never fixed in a specific location. "He was used to travelling all across the world," says his son Maurice.

At Bombardier, Clignett was tasked with the advanced design of the 50-seat CRJ200. He also played a leading role in the design of one of Bombardier's most successful and enduring products – the Global Express. It was a pivotal period for the Canadian manufacturer as it was shifting to 3D digital design tools and adopting a risk-sharing model with a complex, global network of suppliers.

The Dutchman – nicknamed "Cliggers" by his new colleagues at Bombardier – seemed to be the right man at the right time. Aerodynamics is about balancing compromises, and Clignett was a master. Kevin Hoffman, chief executive of Aerospace Concepts, worked with Clignett at Bombardier in the mid-1990s. He remembers a debate over the tail cone of the Global Express. Clignett, ever the aerodynamicist, sided with the aesthetics argument.

Clignett: helped steer design of the Global Express

In 2002, Clignett retired but the industry would not leave him alone. He received offers from Boeing, Dornier and, finally, Embraer, leading to a job in Brazil for four years. He worked as a consultant for then-chief engineer Satoshi Yokota, while the airframer was in advanced design of several new aircraft, including the E-170 and E-190 regional jets, the Phenom light business jets and the Legacy midsize business jets. He retired permanently in 2006, shortly after the 94-seat E-190's entry into service.

The CRJ and E-Jet families triumphed where the Fokker 100 failed, partly thanks to Clignett's influence. "He was always proud of the technical [achievements] he made with his team," Maurice recalls. "It was a pure hobby. He would say, 'They want to pay me a salary, but it's not necessary. I like the job anyway.'" ■

Peter Clignett, born 15 June 1937, died 15 January 2013

Read a 1989 *Flight International* feature in which Clignett is quoted at **flightglobal.com/50seatjets**

From yuckspeak to tales of yore, send your offcuts to murdo.morrison@flightglobal.com

Messerschmitt at 10 o'clock!

Wolf Czaia shares an update on "White 3", a restored Messerschmitt Me262, which he recently ferried from its hangar at Paine Field, Washington to Suffolk County Airport in Virginia. Converted into a two-seat configuration, Czaia, with lead mechanic Mike Anderson, took the pioneering jet on its 4,000km cross-country trip.

"As our FAA operating limitations mandated 'Day VFR only' and maximum altitude 18,000ft, not exactly optimal for range, it took us four days and six refuelling stops across the continent to reach our destination," he says.

The sight of a feared Luftwaffe fighter in the "rear view mirror" took some of their fellow aviators by surprise though. Czaia continues: "ATC doesn't have a computer code yet for the Me262, and controllers frequently asked me for the type of airplane. They usually couldn't wait then to pass the information on to their airliners on the same frequency: 'Delta 241, you have a MESSERSCHMITT in your 10 o'clock, five miles.' One of the many funny replies: 'Are we being invaded?'."

You can watch a video of White 3 in flight on YouTube http://tinyurl.com/bausx75

That's rich

We loved this typo on the Independent's website. Maybe getting a few more Indian tycoons to splash their cash would be the solution to the UK's economic problems.


news > UK > UK Politics

David Cameron pushes Tycoon contract as Indian PM airs concerns over Anglo-Italian helicopter firm AgustaWestland 'corruption'

Allegations threaten £500m deal for AgustaWestland to transport VIPs


Rex Features

Y oh why?

Pots and kettles. Chris Barnes writes to point out a rather silly typo on our archive column from 5 February, in which we refer to the Vickers Yalentia. As Chris points out: "The only Vickers aircraft that did not start with a V was the Vickers Gunbus. The correct name is Valentia. He adds, rather generously: "This may be the first *Flight* magazine misspelling of an aircraft I have ever seen."

As a bit of background, Chris notes: "The Valentia was basically a Vimy with a passenger cabin. I know this as, in a minor way, I helped build the first replica Vimy at Weybridge in the 1960s where I was a Vickers apprentice."

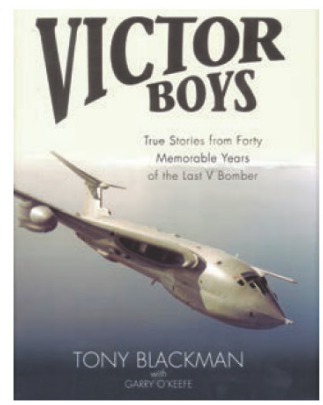
Victor victorious

The Handley Page Victor (*top*) spent much of its RAF career in the shadow of its more illustrious sibling, the Avro Vulcan. But the menacing-looking V-bomber-cum-tanker probably contributed more to UK interests than its elegant, delta-winged sister – giving sterling service in both the Falklands and the first Gulf War.

By then, of course, the Vulcan fleet had been consigned to museums. Victor force pilots are also quick to point out that it could fly faster (it was supersonic in a dive) and climb higher than its Avro rival, and carry a lot more fuel.

In his new book *Victor Boys*, former test pilot Tony Blackman lifts the lid on the aircraft's four decades in RAF service, recounting fascinating tales from the type's career. Blackman is probably better known for his association with the Vulcan from his Avro test pilot days, but was involved in the Victor tanker conversion programme.

Well illustrated and with a detailed index, the book is right up-to-date as it includes an account of the dramatic unplanned take-off of a Victor during what was supposed to be a fast-taxi demonstration at Bruntingthorpe in 2009.



Out of the Vulcan's shadow

Principles of war

100 YEARS AGO

It is sometimes said that aviation will revolutionise warfare, or even stop it altogether. This, of course, is absurd. The main principles of war have been the same for centuries, and will probably remain so for several more. It is their instruments (of which aviation is the latest, and to me the most wonderful) which vary.

Record recruits

75 YEARS AGO

Although the number of pilots required by the Royal Air Force during the year, ending on March 31, was a record 1,750, the whole number had been obtained by the end of January. About 30% are candidates from civil life and the balance are volunteer airmen serving in the RAF.

Cessna milestone

50 YEARS AGO

Cessna Aircraft Co recently delivered its 50,000th aircraft – a red and white Skyhawk, N50000, purchased by Edenwood Developers of Columbia, South Carolina. A commemorative metal plaque was designed for each side of the fuselage with a replica mounted on the instrument panel.

Celtic flavour

25 YEARS AGO

Celt Air is being formed to fill the gap left by Airways International Cymru, the Welsh charter airline that went into liquidation at the beginning of the year. Primarily funded by a Middle East consortium, the airline has lined up two McDonnell Douglas DC-9-61s.

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

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6-7 March
Arab Air Transport Economics Summit
Armani Hotel, Dubai
Israe Abbas
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26-30 March
Langkawi International Maritime & Aerospace Exhibition
Langkawi, Malaysia
hw5@hwlima.org
Tel : +603 4142 1699
lima.com.my

9-10 April
SpeedNews Aerospace Manufacturing Conference
Charleston Place Hotel, South Carolina
speednews.com/conferences

9-12 April
LAAD Defence & Security
Riocentro, Rio de Janeiro, Brazil
laadexpo.com

16-18 April
MRO Americas
Georgia World Congress Center, Atlanta
events.aviationweek.com

17-18 April
Government Enterprise Mobility Symposium
Washington DC
Ken Hood
hoodk@ttcus.com
Tel: +1 310 320 8128
governmententerprise.net

24-25 April
Big Data for Defense and Intelligence Symposium
Washington DC
hoodk@ttcus.com
bigdataevent.net

29 April to 1 May
African Aviation Training Conference & Exhibition
Cairo, Egypt
africanaviation.com

30 April to 1 May
Government and Military Smart Grids & Microgrids Symposium
Washington DC
hoodk@ttcus.com
militarysmartgrids.com

7-8 May
Safety in Aviation Asia
Singapore
hannah.bonnett@rbi.co.uk
flightglobalevents.com/safety2013

21-23 May
EBACE: European Business Aviation Convention & Exhibition
Palexpo, Geneva, Switzerland
Ana Baptista
abaptista@ebaa.org
ebace.aero

27-29 May
African Business Aviation Conference & Exhibition
Nairobi, Kenya
africanaviation.com

30-31 May
2Gether 4Safety seminar & expo
Lusaka, Zambia
aviassist.org

17-23 June
Paris Air Show
Le Bourget exhibition centre, France
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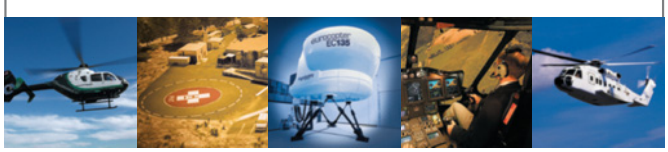

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Contact: Mr Frank McMeiken, Manager, Air Traffic Control, Guernsey Airport on 01481 234950 or email frank.mcmeiken@gov.gg **for further details.**

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Building a way to success at RSS

Irakli Litanishvili is chief executive of UK-based RSS Enterprises, which acquired the fixed-base operations of Ocean Sky Jet Centre. Among his priorities is finishing the company's terminal at London Luton airport

How did you get started?
My plan was to go into investment banking but I changed my mind. In 2007, a headhunter made me an offer to lead the charter brokerage department for the Russian and CIS market for a small company, Avolus in London. In 2008, I attended my first EBACE in Geneva and a couple of operators asked me to join them and set up their offices in Moscow. Ocean Sky then asked me to become commercial director but 2008 was not an easy year because of the recession and I started working between Moscow and London. We grew the fleet from one aircraft up to 20 in two years. At that time I had a team of 15 in the Moscow office.

What changed?
In June 2012, Ocean Sky's owner and investor put the company into voluntary liquidation. At the time I was managing director for the Russia and CIS operation. RSS Enterprises took over all Ocean Sky's fixed-base operations (FBOs) in Europe, and asked me to be the chief executive of this group. We operate the Bombardier maintenance centre in Manchester, with another UK-focused FBO in Prestwick, Scotland. We closed some FBOs in Spain because business was so seasonal.

What is your day like?
My day starts at Luton airport or one of our offices in London. I check on sales activities. I also check on construction, meet with people who might be interested in partnerships and co-operation, and spend a good deal of time with the finance team to manage our business in the right way. Right now, RSS employs 130 staff. On a monthly basis, I prepare reports for the shareholders and investors, trying to find new opportunities to expand the business.


RSS Enterprises

Litanishvili: also runs his own sales and acquisition and charter brokerage

What is your biggest project?
The main target right now is to finish construction of the terminal at Luton airport, 40min from London. It is the second-largest airport operating private jets in Europe. Our new FBO should open at the end of March. RSS has invested £7 million ($11 million) in this project. Ocean Sky had a small area for aircraft parking and with this construction we should triple that capacity, increasing our market share in the airport. I can directly approach aircraft owners and offer them our services. We hope to be gaining clients from our competitors within the first year after construction is completed.

You have another job?
My own business is LL Jets, offering sales and acquisition and charter brokerage. It mainly provides services in Russia. LL Jets has seven employees but one day I would like to open a company with at least 20 aircraft under management. Most clients will probably be Russians or from former Soviet Union countries. I am originally from Georgia and the time I spent in Moscow, between 2008 and 2012, was really interesting and challenging. I built a big network of high-net-worth individuals and aircraft owners. That is where I would like to go, maybe later this year.

What is your least favourite part of the job?
When you face a problem collecting funds. You don't want to lose the client but you have responsibilities to the group. This is what takes a lot of time. It is linked to the owners of the aircraft. When the aircraft is with the operator, the operator, of course, pays the owner. But when they don't pay it becomes a bit of a conference job. To control costs is not so difficult, but to achieve collection of the funds, you need to balance things somehow. ■

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