



**ROTOR CLUB
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AND EMBRAER
TAKE ON BRAZIL
THIS WEEK P11**

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Airbus Military/Tim Bicheno-Brown

COVER IMAGE

Senior editorial artist Tim Bicheno-Brown applied Indian air force markings to this Airbus Military A330 MRTT, a type selected by New Delhi as its preferred bid for a six-aircraft requirement. See Special Report P26

PIC OF THE WEEK YOUR PHOTOGRAPH HERE

After EnoAeroPics created a "Belly Week" gallery, AirSpace peer flyvertosset paid tribute with this Boeing C-17 shot, captured at 2012's Aviation Nation show at Nellis AFB. Open a gallery in flightglobal.com's AirSpace community for a chance to feature here. And see P29 for India's first C-17



flyvertosset gallery on flightglobal.com/AirSpace



flightglobal.com/imageoftheday



US budget impasse keeps V-22 multi-year buy in hover P17.
Cirrus hopes new SR22 will be worth the weight P21

US Marine Corps, Cirrus Aircraft

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Boeing

NEXT WEEK 787 CRISIS

After the battery fire and grounding, what is the outlook for Boeing's Dreamliner? We present a full analysis of likely fallout from the airframer's unhappy new year

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flightglobal.com/ComEngDirectory



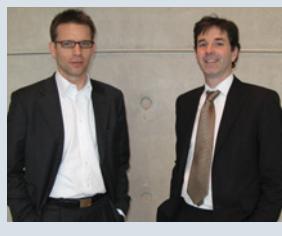
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BEHIND THE HEADLINES

In New York, **Stephen Trimble** (top, left) was interviewed by former CBS news presenter Dan Rather about the 787 grounding (P10), for the 29 January airing of the AXS show *Dan Rather Reports*. **Michael Gubisch** and **Olivier Bonnassies** (below) were in Toulouse for ATR's annual January press conference (P9).



For a full list of reader services, editorial and advertising contacts see P48

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THE WEEK ON THE WEB

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A video that the UK Royal Air Force's **4 Sqn** put together to show the **Hawk T2** advanced jet trainer in action was highlighted by **The DEW Line**. "Life doesn't get much better than doing **450kt** down on the deck," wrote Craig Hoyle. **BAE Systems** has had a good last few months with its new-generation Hawk, with 4 Sqn now training ab initio students for the RAF, and **Saudi Arabia**

and **Oman** having signed deals for 22 and eight T2-derived examples respectively. The **big prize**, however, will be chasing the **US Air Force**'s pending T-X requirement to replace a massive fleet of Northrop T-38 **Talons**. The **Image of the Day** blog carried a Eurofighter shot (above) issued with a communiqué on the use of Austrian **Typhoons** for security during the World Economic Forum.



Find all these items at flightglobal.com/wotw

QUESTION OF THE WEEK

Last week, we asked for your take on the **Boeing 787 crisis**.

You said:

Will be resolved quickly

Will drag on, and lead to lost orders

Back to drawing board for Boeing



Total votes: 4,063

This week, we ask for your thoughts on the **AgustaWestland, Embraer tie-up**: **Local tactical play** **Step to global alliance** **Eventual merger**

Vote at flightglobal.com/poll

HIGH FLIERS

The top five stories for the week just gone:

1 Japan: Over-charging preceded ANA 787 battery malfunction

2 Airbus unconvincing over further A350 stretch

3 AirAsia's Fernandes continues call for A330neo

4 Damaged ANA 787 battery sent for CT scans

5 Analysis: Grounding order moves 787 into uncharted territory

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Safran is recruiting engineers for some Very Important Missions



Safran engineers power thousands of rescue missions a year

Thanks to the Arriel helicopter engine designed by Safran engineers, holder of many international records, Eric, a search & rescue worker in the Alps, can continue helping mountain climbers in difficulty. Yet another innovation from Safran that's more than just a new technology.

safran-talents.com



The Arriel family of turboshaft engines was designed by Safran for light and medium single- or twin-engine helicopters. Over 10,000 have been produced to date, logging 35 million hours in flight for 1,300 customers in 110 countries.



KEY MISSIONS, KEY TECHNOLOGIES, KEY TALENTS

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Patience will out

Aero India's complex logistics may, like offset rules, be onerous for defence contractors seeking business from the nation, but sheer potential makes the show a must-attend

Aero India is a show to be not so much attended as survived. After navigating the torturous process of obtaining Indian visas, and paying extortionate amounts to profiteering Bengaluru hoteliers, on 6 February the world's defence aerospace sector will find itself in the dusty field outside Yelahanka air base.

Even then, security guards tend to move around the entrances to the show from day to day. Inside the halls, delegates can look forward to battles with contractors and irascible show officials. A frustrated delegate can be forgiven for wondering if it is worth it. However, after a moment of reflection, the answer will be: yes.

For the next decade India offers a unique window of opportunity for large-scale defence aerospace sales. Although the Indian air force has some reasonably modern types, such as the Sukhoi Su-30MKI and Dassault Mirage 2000H, large portions of its combat fleet are more suitable for a museum dedicated to Cold War airpower.

India offers a unique window of opportunity for large-scale defence aerospace sales

New Delhi, for example, operates more than 150 MiG-21s and 88 MiG-27s. Its fleet of 120 Sepecat Jaguars is still functional, but badly in need of upgrading. Meanwhile, New Delhi's Hindustan Aeronautics HS 748 transports is antiquated by even the most generous standards.

Progress is being made to rectify obsolescence issues. Negotiations are under way between Dassault and the Indian government for 126 Rafale fighters to replace the MiG-21s. The Rafale was the last fighter standing in the mammoth medium multi-role combat aircraft


FlightGlobal.com/Zap D

There are rewards for waiting

(MMRCA) competition that had its climax at the 2011 iteration of Aero India.

And New Delhi appears to have an insatiable appetite for other types beyond high-end combat aircraft. By the end of 2014, it will be the world's second-largest operator of the Boeing C-17 after the USAF. It has taken delivery of six Lockheed Martin C-130Js and is likely to order six more. A request for proposals to replace the HS 748s with 56 modern tactical transports is in the works.

In mid-2013, New Delhi will receive the first of eight P-8I Poseidon special-missions aircraft, which will greatly enhance its ability to project power into the vast oceans that surround the subcontinent. It has requirements for new maritime patrol aircraft and helicopters.

Aside from the sheer frustration of doing business in India, winning New Delhi's custom will come at a big price in the form of offsets. Foreign firms may baulk at supplying technology and know-how that could one day show up in competitive products, but the potential of India is too vast to ignore. ■

See India Special Report P26

Crash need not lead to new restrictions

Helicopter operations in densely populated urban environments are usually tightly regulated. They certainly are over London but the recent helicopter accident in the city's Vauxhall district has led local politicians to ask whether even more restriction is needed.

In the Vauxhall accident the aircraft was destroyed, the pilot killed, and one person on the ground died – hit by wreckage. Given that the casualty toll could have been greater if the wreckage had fallen a short distance from where it did, it is inevitable that a review of the status quo should take place, but that will happen anyway through the Air Accident Investigation Branch's inquiry.

Most helicopter operations over London are in trans-

sit, as the accident flight was until the pilot began to change his plans and head for Battersea heliport. The fact Battersea is the only permitted heliport in one of the world's great cities speaks volumes about London's cautious attitude toward rotary-wing access. Existing requirements on helicopter routeings, aircraft performance, and air traffic control clearance already constitute tight regulatory control.

This accident, whatever else emerges, was primarily the result of the marginal visibility and pilot judgement on whether it was safe to continue. It is the only fatal helicopter crash London has suffered, and no reason on its own to further restrict rotary-wing access. ■

See This Week P8



For commentary on the latest developments in Indian defence aviation programmes, consult our Asian Skies blog at flightglobal.com/asianskies



BRIEFING

REPUBLIC AIRWAYS RELOADS E175 BACKLOG

ORDER Indianapolis-based Republic Airways Holdings is purchasing 47 Embraer 175s aircraft after reaching a 12-year agreement with American Airlines to fly 53 E175s for regional carrier American Eagle. The deal, which includes 47 options, relieves Embraer of the prospect of a production break later this year by reloading the backlog. Under the agreement, Republic will fly the new aircraft and also lease a previously-owned E175. It is also adding five additional previously-owned aircraft to the fleet to satisfy the new flying agreement. The 76-seat aircraft will enter Republic's fleet at a rate of two to three aircraft per month, starting in mid-2013.

INDIAN C-17 HEADS FOR FLIGHT TESTING

AIRLIFT India's first Boeing C-17 has been delivered for flight testing at Edwards AFB in California. First flown on 11 January carrying the air force registration CB-8001, the strategic transport is the first of 10 aircraft from an almost \$1.8 billion order. Five will be delivered to India this year, with the remainder to follow in 2014.

■ See Feature P28

INDONESIA TIGHTENS RULES ON FOREIGN PILOTS

CREWING Indonesia hopes to improve air safety by tightening regulations related to the use of foreign pilots by the country's airlines. The directorate general of civil aviation has ruled that foreign pilots must have a minimum of 250h on the type being flown, says the country's transport ministry. It emphasises that carriers wishing to employ foreign pilots will have to ensure they fulfil the requirement before submitting requests for crew members to be endorsed or validated by the directorate. According to the directorate, some 600 foreign pilots work for local carriers including Lion Air, Citilink, Garuda Indonesia and Sriwijaya Air.

AIRTANKER MAKES DEBUT AS AIRLINE

OPERATIONS The UK Ministry of Defence's Future Strategic Tanker Aircraft provider, AirTanker, has performed its first flights as an approved airline. The company used civilian-registered Airbus A330 Voyager G-VYGG and an AirTanker crew to transport British military personnel to Cyprus on 5 January, having secured its air operator's certificate from the UK Civil Aviation Authority.

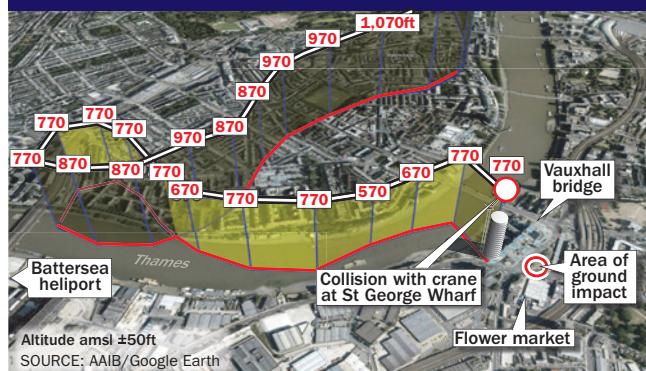
AIRMULE TO GET ADDED LIFT

COMPOSITES Urban Aeronautics has manufactured composite six-bladed propellers, which it expects to boost the payload capacity of its unmanned AirMule ducted fan vertical take-off and landing aircraft by about 200kg (440lb). The Israeli company expects to make first demonstration flights for potential customers during 2014.

FLIGHTGLOBAL ASCEND WINS APPRAISAL TITLE

AWARD Flightglobal's Ascend advisory and data service has been voted aircraft appraiser of the year in the *Airline Economics* Aviation 100 Awards. The award recognises Ascend's "consistent and professional approach, combined with thorough, measured and impartial appraisals". Les Weal, head of valuations at Ascend, will host a free webinar entitled "2013 – The Year of Snakes (and Ladders)?" on 7 February at 16:00GMT. It will interpret traffic data from 2012 and indicators from 2013 to assess whether lease rates and values are emerging from the global financial crisis. "If we do see an earnest recovery in values, by the end of 2015 market values may return to above the base value line for in-production types," Weal notes.

RADAR TRACK OF FINAL POSITIONS OF G-CRST



INVESTIGATION DAVID LEARMOUNT LONDON

AW109 hit crane in turn for heliport

Pilot had VFR clearance to return to Redhill not above 1,500ft before permission to approach Battersea

The AgustaWestland AW109E helicopter that crashed into a crane over central London on 16 January was turning right over the river Thames to reverse its easterly track and head west for Battersea heliport.

The aircraft hit the crane's jib at a recorded secondary surveillance radar altitude of 800ft (244m), a special bulletin from the UK Air Accidents Investigation Branch states.

About five seconds after the pilot acknowledged the frequency change information, the aircraft hit the crane

the aircraft hit the crane while undertaking a right-hand turn through about 180°.

The aircraft departed Redhill aerodrome at 07:35 for the flight to Elstree to pick up a client. Weather at Elstree was freezing fog, and the client, who was heading there by car, told the pilot it was unlikely he would be able to land. The pilot said he would try anyway. When he failed to "find a hole" in the fog at Elstree, the pilot was given visual flight rules clearance to return to Redhill "not above 1,500ft" via the London Eye.

En route, the pilot inquired whether Battersea was open. ATC said it would check, and advised him to hold over the river Thames while it did so. It was just after ATC advised the pilot Battersea would accept an approach and the pilot had begun a turn towards the heliport that the AW109E hit the crane's jib.

The AAIB says the crane tower and jib were lit with red lights, and the height of the jib's tip was 719ft above ground level. The aircraft was flying with the local area pressure set on its altimeter, which would have been reading height above sea level. ■

The pilot, who had previously been cleared to hold over the river Thames to await clearance to Battersea, had just been informed by air traffic control that Battersea heliport could accept an approach. He had also been provided with Battersea's frequency to enable him to return his radio and call the heliport.

However, about five seconds after the pilot acknowledged the frequency change information,

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Embraer looks to helo effect in Brazil
THIS WEEK P11

WIDEBOODIES SIVA GOVINDASAMY SINGAPORE

Fernandes renews call for 'A330neo'

AirAsia chief continues to apply pressure on Airbus for re-engined variant to make "perfect combination" with A350-900

AirAsia group chief executive Tony Fernandes is continuing to apply pressure on Airbus to re-engine its A330 widebody, even though the company appears to be ruling out the option.

Fernandes, whose AirAsia group has several franchises in countries around Asia and is one of the most valuable customers for Airbus, was in Toulouse earlier this month for "some important meetings" with the European airframer.

Both AirAsia and Fernandes have a stake in AirAsia X, the Malaysia-based long-haul, low-cost carrier that has a fleet of nine A330-300s. It has orders for another 18 A330s as well as 10 A350-900s. But Fernandes has been pushing Airbus to come up with a re-engined A330, loosely dubbed the "A330neo", for some time. This, he feels, would be a better option than the A350-800 that is slated to be a replacement for the

longer-range A330-200. Last year, AirAsia cancelled its orders for the -200 variant after determining the type was not economical enough for long-haul services to Europe. But an A330neo would interest the airline and, as Fernandes said via his social media account: "Yes, I want that [aircraft]. Honestly, [I] don't think the A350-800 is a good [aircraft]."

He went on to say that an A330neo, with the A350-900,

would be the "perfect combination" for AirAsia X.

Airbus's original design for the A350 effectively involved re-engining the A330, but the airframer subsequently abandoned this strategy in favour of the all-new A350 family. The airframer has been enhancing the A330 but has backed away from fitting new engines to the type in the fashion of its A320 revamp. ■

See Air Transport P12



Gulfstream

DELIVERIES

Gulfstream outlines plan for 2013

Gulfstream plans to deliver 139 green aircraft this year, with its large-cabin family expected to account for nearly 80% of the tally. Phebe Novakovic, chief executive of Gulfstream parent General Dynamics, says 2012 revenue was up \$800 million, and earnings \$110 million, adding: "We're seeing the largest demand coming from within the Fortune 500 companies as they replenish their fleets."

PRODUCTION MICHAEL GUBISCH TOULOUSE

ATR faces supply chain challenges to up output

Turboprop manufacturer ATR plans to increase annual production to 90 aircraft by 2014, but needs to overcome supply chain issues, especially in fabricating aerostructures.

ATR delivered 64 aircraft in 2012 but fell short of its target, having planned for 72. This year it aims to deliver 80.

Chief executive Filippo Bagnato says the manufacturer has solved 80% of the issues affecting its supply chain. Key suppliers have responded quickly and showed "good reactions", he says, but a number of challenges remain.

Aerostructure production is the main area that needs to improve and will need tighter manufacturing control, says Bagnato. However, he is confident the projected increases are feasible.

It took 74 firm orders in 2012, all but three for the ATR 72-600, and is predicting 80 for 2013. ATR's year-end backlog stood at 221 and Bagnato is confident of

maintaining this level. Air Lease has disclosed an order for two 72-600s this year, while Caribbean operator LIAT has converted one option. ATR is working to firm a 25-aircraft deal with Garuda Indonesia's Citilink arm.

ATR delivered 64 aircraft in 2012 but fell short of its target, having planned for 72. This year it aims to deliver 80

COMBAT AIRCRAFT DAVE MAJUMDAR WASHINGTON DC

Afghan LAS tender hit by delay

A US Air Force tender to purchase 20 light attack aircraft for the Afghan air force has been delayed, with the service previously having expected to award a contract for the Light Air Support (LAS) programme during January. "It's still in source selection, but we do anticipate making a decision and announcement in the next few months," the USAF says.

Intended to provide Afghanistan's nascent air force with a fixed-wing strike capability, the LAS effort has become a protracted battle between two potential contractors. Hawker Beechcraft is offering its armed AT-6 version of the Texan II turboprop trainer, while Sierra Ne-

vada and Embraer have teamed up to offer the A-29 Super Tucano.

The USAF originally chose the Super Tucano for the deal at the end of 2011, but the programme was halted after Beechcraft filed a lawsuit. The service subsequently discovered that its internal contract documents were not in order, and terminated the LAS contract in March 2012, and started afresh.

Expected to be worth about \$355 million, the programme will deliver a valuable strike capability to the Afghan air force, which must increase its inventory and skills as the USA and its NATO allies prepare to halt combat involvement in the country from 2014. ■

REGIONAL TURBOPROP DEALS

	ATR 42/72	Bom'ler Q-series
Orders in 2012	74	50
Deliveries in 2012	64	36
Backlog	221	38*

*Preliminary based on airframer data

SOURCE: ATR, Bombardier

Bagnato says the airframer was able to "give a bit more solidity" to a proposed 90-seat turboprop in 2012, submitting a business plan to shareholders Alenia Aeromacchi and EADS.

ATR has shared baseline designs with suppliers and received feedback about components such as the landing gear, flight control and air-conditioning systems.

During a presentation in Toulouse on 23 January, ATR showed a preliminary illustration of a high-wing, T-tail design with eight-blade propellers and winglets, but could not indicate whether a formal launch is likely this year. ■



787 CRISIS STEPHEN TRIMBLE WASHINGTON DC

Hopes dim for speedy return to skies

Investigators into grounding focus on wide range of possible causes from manufacturing defects to electrical architecture

Prospects for returning the Boeing 787 to flight within days or weeks dimmed as a worldwide grounding in response to battery overheating problems entered its second week.

US and Japanese safety investigators have ruled out over-charging as a cause for a battery failure and related fire on a Japan Airlines 787 in Boston on 7 January and an overheated battery that forced an All Nippon Airways 787 to make an emergency landing in Japan on 16 January.

Investigators are now focusing on a wide range of other possible causes, including simple defects in manufacturing to more complicated possibilities, such as an electrical architecture that may somehow demand too much discharge from the batteries.

While the investigation continues, the US Federal Aviation Administration is waiting to learn more about the root cause. The agency can then develop the corrective action plans necessary to demonstrate the safety of Boeing's solution to the problem and return the 787 to commercial service.



NTSB

Batteries on the 787 are based on lithium cobalt oxide

The question now is whether that procedure will take weeks or months to complete, and that timing depends solely on finding out why the batteries are overheating.

More is being learned about the kind of lithium-ion batteries used in the 787. Lithium-ion has become a popular power source for an enormous range of electrical devices, ranging from smartphones to electric cars.

As the grounding has raised new

questions about the safety of lithium-ion batteries, some in the electric car industry are criticising Boeing for using what they consider a risky chemistry on the 787. Boeing subcontractor Thales was selected in 2005 to provide an eight-cell, 32V lithium-ion battery made by GS Yuasa. At that time, the state-of-the-art chemistry in the battery industry was lithium cobalt oxide, says Cosmin Laslau, an electric car industry analyst for Lux Research.

Since 2005, the automotive industry has plunged dozens of electric and hybrid cars powered by lithium-ion into production, but have preferred to use safer and less powerful lithium-ion chemistries based on manganese or iron phosphate inside of cobalt, Laslau says. Cobalt-based chemistries can become flammable at much lower temperatures than other forms of lithium-ion batteries, he adds.

Boeing was understood to be considering a manganese-based chemistry in 2008 to improve the reliability of the 787's batteries, but that idea was dropped. The airframer confirms that the batteries on the 787 which start the auxiliary power unit and serve as a back-up power source are based on the lithium cobalt oxide chemistry. ■

787 CRISIS DAVID KAMINSKI-MORROW LONDON

EASA forced to rethink its policy on lithium-ion technology

Europe's safety authority has been wrangling with its own certification process for lithium-ion battery technology, after it was forced to rethink a new proposal just weeks before the 787 grounding.

The European Aviation Safety Agency put forward a revision to its electrical systems certification documentation in May 2011.

It proposed creating an entirely new section for lithium-ion and lithium polymer battery installation given the susceptibility of cells to ignition and thermal runaway.

EASA's draft demanded that safe cell temperatures and pressures be maintained during charging and discharging, and that battery design must preclude self-sustaining, uncontrolled increases in both.

It also required monitoring and warning features to alert the crew over the state of charge, and procedures for capacity measurement and maintenance.

However, EASA withdrew its proposal mid-November 2012, citing a "lack of maturity" for the revision as well as "discussions presently occurring in the frame of standardisation bodies".

"It has been concluded that the proposed amendment needs to be reviewed in the light of these developments," it stated. "The agency will make a new proposal once this item matures."

EASA had reviewed comments from various entities including the US FAA, which suggested the proposal needed revising to cover all

lithium batteries and chemistries. Airbus is intending to use lithium-ion batteries for its A350 but is confident that it will not have to amend the electrical architecture.

But the aircraft is not designed to be as broadly dependent on electrical power as the 787, with overall power requirements of 550kVA – about a third of that of its rival.

Airbus chief Fabrice Brégier says the airframer held discussions with certification agencies over its plans to use lithium-ion batteries. "They seemed happy with the selected architecture of the aircraft," he says.

He says that the airframer is "confident" that the A350's electrical design is "robust" and that there is no reason for it to be similar to the Dreamliner's. ■



The overheated ANA battery



Israeli 707 test-flies
commercial
anti-missile pod
AIR TRANSPORT P12

THIS WEEK

PARTNERSHIP DAN THISDELL LONDON

Embraer looks to helo effect in Brazil

Embraer working on rotorcraft manufacturing joint venture with AgustaWestland to exploit country's oil and gas bonanza

AgustaWestland looks set to cash in on an oil-driven Brazilian helicopter sales bonanza via a joint venture with Embraer that could lead to production of its rotorcraft in the country.

The airframers have signed a memorandum of understanding which, if a final agreement is reached, would lead to the establishment of an assembly line in Brazil constructing helicopters for both the domestic and wider Latin American markets.

Civil and military models are both being looked at by the partners – initially the AW139, AW189 and AW149 – but they have pointed principally to the offshore oil and gas market, which is set to boom with the development of massive oil fields in the Santos Basin, 250km (135nm) east of Rio de Janeiro.

MARKET SHARE

Data from Flightglobal Ascend shows AgustaWestland accounts for less than 14% of the Brazilian market for civil rotorcraft, although the airframer itself puts the figure closer to 25%.

Bruno Spagnolini, AgustaWestland chief executive, points to the importance of establishing “an industrial presence” in Brazil.

Such claims look realistic; the airframer is a significant supplier to offshore operators and is readying a new model, the AW189 medium twin, launched in 2011 and expected to be certificated in mid-2013. It has also identified a number of potential military requirements, hence the potential assembly of its 8t-class AW149 military helicopter.

Brazil is the world's largest and fastest growing helicopter market but Embraer has shown little interest in the sector



The airframer's AW189 medium twin should be certificated this year

Brazil's navy has already begun a procurement process for 20-24 new rotorcraft to replace its fleet of Eurocopter AS350/355s. Additionally, its army is defining the operational and technical requirements for its future gunship ahead of a programme due to be launched in 2015-2016. Government agencies will also have a requirement to update their ageing fleets, with estimates putting the country-wide market at about 175 units during the next 20 years.

The Brazilian market is dominated by Eurocopter and its local Helibras subsidiary, the only helicopter manufacturer in Latin America. Eurocopter controls nearly 48% of the Brazilian market – directly or via Helibras – with 700 machines in service, on order or in storage, including a major contract to supply its EC725 to all three branches of the nation's military. Second in Brazil is Bell, with 285 helicopters and a 21% market share.

Ironically, while Brazil is the world's largest and fastest-growing helicopter market, its aerospace industry champion Embraer has shown little interest in the sector. The BF-1 Beija-Flor light single-engined helicopter was developed by research institute IPD and first flew in 1959, but the project was shelved.

The company recently told Flightglobal that rotorcraft had never been a strategic priority.

However, remarking on the AgustaWestland deal, Embraer chief executive Frederico Fleury Curado describes the joint venture as “an important step as we

continue expanding our business”. The companies hope to cement their partnership in the coming months, having opened talks in the middle of 2012. Up for discussion are the location of the assembly line and the amount of indigenous content in the helicopter.

AgustaWestland already has assembly lines for the AW139 in Italy, Philadelphia and Russia, the latter through its HeliVert joint venture with Russian Helicopters. ■

Additional reporting by Dominic Perry in London, Stephen Trimble in Washington DC and Jackson Flores in Rio de Janeiro

For more news and information on the rotorcraft industry, go to flightglobal.com/helicopters



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PROGRAMMES DAVID KAMINSKI-MORROW TOULOUSE

Airbus closes on launch for A320 wing-tip retrofits

As airframer delivers its first sharklet-fitted aircraft, details emerge of proposed modification for early-build twinjets

Airbus expects to be able to launch a retrofit programme for sharklet wing-tips on the A320 by about March-April, having determined the technical requirements for the modification.

The airframer has transferred to a new wing standard for the A320, which includes reinforcement to accommodate optional sharklets. But Airbus has been evaluating demand for a possible

sharklet retrofit for the previous wing standard, although this would require more extensive reworking of the type's wing-tip.

Executive vice-president for programmes Tom Williams says Airbus has authorisation to offer the retrofit but has been "trying to see if there's enough interest". However, he believes it will have "enough numbers" to launch the retrofit by around March or April,



Conversion to match new production jets will take three weeks

and the first aircraft could be modified by the latter half of 2014. The change would take about three weeks and customers would probably schedule the retrofit to coincide with a C-check.

The process involves removing a "couple of metres" of the outer section of the wing, says Williams, and installing a replacement kit, including fitting a "bathtub" structure, which provides local me-

chanical reinforcements, and reinforced skin and stringers – a task which requires removing part of the leading edge, wing skin and aileron. "We had a lot of interest from customers," he says, without disclosing identities.

Williams says the retrofit is attractive to A320 operators wanting to maximise residual value. He says there is a "bit of a weight penalty" from the reinforced outer section but analysis indicates the retrofit would provide the same aerodynamic benefits and fuel-burn reduction as achieved with new-build sharklet-equipped A320s.

Airbus has neutralised the weight increase on the reinforced wing for new-build A320s. Fitting sharklets to this new wing is much simpler, adds Williams, requiring only a brief swap of the normal wing-fence for the sharklet tip and the uploading of new software to the flight-management system. "That's probably the longest part of the process," he says. ■

AIRFRAMES

Leahy rules out new powerplant to create 'A330neo'

Airbus has yet to completely rule out a sharklet wing-tip modification on the A330, but does not intend to pursue a re-engined version. Chief operating officer for customers John Leahy says he will "keep pushing our [Airbus] engineers" to look at adapting the sharklets – developed for the A320 – to the larger twinjet.

Airbus has been tweaking the A330's performance, unveiling a 242t maximum take-off weight ver-

sion in 2012, which it aims to deliver before mid-2015. But Leahy indicates new engines for the type – creating a theoretical A330neo – would be problematic. "If you say 're-engined', then I'd say 'no'", he says. "If the aircraft is already optimised," he adds, "[you] don't put one of these heavy engines on it."

The sharklet suggestion still faces resistance within Airbus. Executive vice-president for pro-

grammes Tom Williams says he can "understand the logic" of the suggestion but is "not so sure on the advantages". Leahy casually suggests the A330 could still remain in production in 2022, while Airbus chief executive Fabrice Brégier says it remains a lower-cost alternative to the A350. "If you don't need the full range, you can be competitive on many routes with an A330," Brégier says. ■

SAFETY

DAVID KAMINSKI-MORROW LONDON

Israeli 707 test-flies commercial anti-missile pod

Israel's air force has used a Boeing 707-300 to trial a missile-defence system intended for deployment on board commercial aircraft.

The aircraft, which carries air force designation 272, is close to 40 years old and was previously in service with operators including British Caledonian.

Israeli company Elbit Systems has used the four-engined jet to conduct a series of test flights with its C-Music infrared countermeasures system. The equipment, fitted to the aft fuselage of the aircraft, is designed to protect



Elbit Systems

C-Music is a laser-based disrupter system for protecting airliners

large jets against assault by portable shoulder-launched weapons.

Elbit has yet to detail the test regime, citing the sensitive nature

of the programme, but says the system was "proven effective, successfully performing all of the needed functions".

C-Music is a combined defence installation comprising an infrared missile-warning system and directed infrared laser, mounted in a turret, designed to disrupt heat-seeking missiles.

Elbit claims there is "considerable interest" from commercial and VIP aircraft operators, pointing out that the system has been chosen by the Israeli government for the country's entire commercial airline fleet. ■



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Iranian A300 skid probe seeks yaw control revision
AIR TRANSPORT P14

TURBOPROPS MAVIS TOH SINGAPORE

Bombardier talks 90-seater with Korea

Three potential partners involved in discussions over jointly-produced aircraft but parties appear far from any agreement

Bombardier is in talks with three potential South Korean partners to develop a joint 90-seat turboprop aircraft.

Discussions with the Canadian airframer began in early 2012, say industry sources familiar with the situation.

Negotiations, however, have not progressed entirely smoothly, resulting in a delay in the decision on whether they should launch the programme. Potential partners include state-owned Korea Aerospace Industries, Korea Aerospace Research Institute, as well as Korean Air's specialist arm KAL Aerospace.

One source who is familiar with the discussions between KAI and Bombardier says the companies are still far from an agreement. "Bombardier and KAI negotiations are not smooth, not good. So it's still unclear when a decision will be made on whether to launch a 90-seat turboprop," says the source.

KAI will only say that the programme is undergoing an "initial



Eno Aero Pics gallery on flightglobal.com/AirSpace

While the airframer has considered stretching the Q400, a formal programme has yet to materialise

technical assessment", and that a decision is due to be made "in some months".

But the sources add that the Koreans are aiming to capture markets in Europe, Africa and Asia with the proposed turboprop.

In 2010, KAI said that it was evaluating whether to launch a 90-seat programme. It also said the aircraft would probably be powered by a new engine under development by Pratt & Whitney, and be aimed at global markets.

At that time, there was no men-

tion of any intention to co-operate with Bombardier on the project.

Bombardier has not given further details of its talks, saying simply it "continuously holds exploratory discussions with entities around the world to address various business opportunities".

KAI, South Korea's largest aerospace firm, produces military training aircraft and components for commercial types.

It has worked with Lockheed Martin to manufacture the T-50 advanced jet trainer and with Eu-

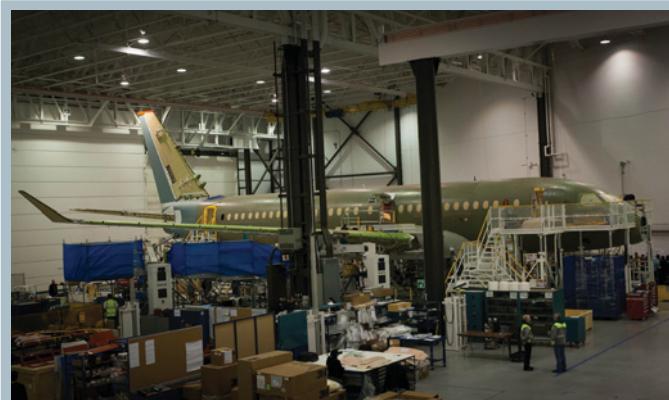
rocopter on helicopter programmes. It has also been looking to expand its civil aircraft business to include manufacturing aircraft for general aviation and commercial airline markets.

Bombardier and European airframer ATR have separately been talking about developing a 90-seat turboprop but neither has reached the stage of formally launching a programme. ■



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Bombardier Aerospace



ANALYSIS

Models to study CSeries ditching

Bombardier has recruited UK engineering consultancy Frazer-Nash to model ditching scenarios for its CSeries twinjet, while the first flight-test vehicle is nearing structural completion. Frazer-Nash says such scenarios "can be reliably predicted" through its use of computational fluid dynamics and its software capabilities. "This allows Bombardier to optimise, based on various design iterations, the number of physical tests to be conducted," adds business manager Glyn Norris. Bombardier has mated the wings of the initial flight-test aircraft, FTV-1, to the fuselage. The airframer is aiming to conduct the maiden flight of the Pratt & Whitney PW1500G-powered CSeries in the first half of this year.

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INVESTIGATION DAVID KAMINSKI-MORROW LONDON

Iranian A300 skid probe seeks yaw control revision

Inquiry highlights weaknesses in certification process for low-speed stability after powerplant failure led to run-off

Swedish investigators are recommending the introduction of new requirements on low-speed yaw stability after a departing Iran Air Airbus A300-600 veered off a Stockholm runway.

The twinjet (EP-IBB) suffered a failure in its left-hand General Electric CF6 engine shortly after commencing its take-off roll, and the crew lost directional control.

Bound for Tehran, the A300 was cleared to execute a rolling take-off from runway 19R. Its cap-

tain, ironically, warned the first officer, who was flying, to ensure the aircraft was lined up before accelerating, to avoid the risk of skidding off. About 11s after take-off thrust was applied, with the A300 some 250m (820ft) into its roll, a muffled explosion was heard and the pilots retarded the thrust levers. The aircraft, travelling at 59kt (110km/h), veered to the left and departed the runway 400m from the threshold.

"The pilots were unable to cor-



Crew and passengers disembark after the incident at Stockholm

rect the veer that had arisen," says investigation authority SHK. The jet's nose-wheel became embedded in the ground and the A300 halted 40m from the runway edge. The inquiry has focused not only on the engine failure but also on the inability of the crew to stabilise the aircraft's course. It puts the minimum ground-control

speed – the speed at which the pilots would have had sufficient rudder authority to maintain directional control after engine failure – at 113kt, far above the air-speed the A300 had attained.

SHK says there are "deficiencies" in the certification process for large aircraft with wing-mounted engines in such circumstances and recommends European and US certification authorities investigate the "prerequisites for introducing requirements" on yaw stability.

SHK found the pilots' braking was "unintentionally asymmetrical", with a higher brake pressure on the side more likely to exacerbate the problem. But it adds that the inquiry has been unable to determine, with any certainty, whether this affected the jet's movement pattern.

While braking conditions on runway 19R were listed as good on 16 January 2010, SHK points out the runway was contaminated in the icy weather conditions and its friction level probably "fell short" of reported values. ■

lugs on the high-pressure turbine diffuser aft air seal.

But SHK sought a second opinion from Volvo Aero, which found that the primary cause of the failure was fatigue damage in a different part of the seal which had undergone repair. The seal then separated from the diffuser assembly.

SHK points out that, owing to various circumstances outside its control, the damaged engine was transported from Germany to Iran before any qualified examination had been carried out. It adds that Iran Air – on its "own initiative" and without SHK authorisation – disassembled the powerplant with no third-party oversight. ■

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POLITICS DAVID KAMINSKI-MORROW LONDON

Sanctions complication stalled powerplant examination

Inquiries into the A300 engine failure and run-off incident at

Stockholm in January 2010 were held up for five months as a result of government sanctions against Iran.

Investigating authority SHK says the delay was caused by the "politically determined" restrictions and processing of applications needed to ensure compliance.

In particular, it says, a licence had to be granted before US support could be provided by General Electric, the engine manufacturer, or the National Transportation Safety Board.

Maintenance company Lufthansa Technik offered assistance to inspect the engine, but the potential transfer of technical data to Iranian

entities meant it would only participate upon approval of GE's licence.

Stricter European Union sanctions against Iran also meant that examination of specific flight-data recorder parameters could not be carried out in Sweden, and took place in Iran.

SHK is recommending to the US FAA that processes to grant licences and waivers be improved so they "do not unnecessarily delay civil aviation safety investigations" involving US-built aircraft or parts.

While Lufthansa Technik could not "completely ascertain" the cause of the engine failure, it concluded that the failure originated from fatigue cracking of attachment

AIRFRAMES MAVIS TOH SINGAPORE

C919 wing design advances after critical reviews

Chinese airframer Comac's C919 narrowbody programme has passed a critical design review of its central wing system. A team of specialists made the assessment on 17 January in Shanghai after studying the

programme's design situation report, technology summary and manufacturing solutions.

The team accredited the central wing system and said the next phase of work can now be carried out. "The assessment

shows that the C919 has made some achievements, but it still faces some challenges," says chief designer Wu Guanghui.

Comac's C919 is due to complete its detailed design phase this year, and the airframer in-

tends to begin a comprehensive manufacturing process.

The twinjet, powered by CFM International Leap-1C engines, is scheduled to have its first flight in 2014, with deliveries to start in 2016. ■

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INVESTIGATION MAVIS TOH SINGAPORE

Pilot miscommunication led to under-speed rotation

Australian carrier Jetstar has added a module on incorrect take-off thrust settings to its simulator regime after a low-speed rotation incident involving an Airbus A320. The aircraft – VH-JQX – had been commencing take-off from runway 16R at Sydney for a flight to Launceston in Tasmania on 6 February 2012.

Investigations by the Australian Transport Safety Bureau found the flying pilot, a captain under training, had unintentionally moved one of the thrust levers slightly forward of the required MCT/FLX setting, resulting in the aircraft switching to manual thrust.

Identifying the issue, the other pilot – a training captain – made a call, at 80kt (150km/h), indicating the thrust was not set. The fly-



Airbus

Inquiries found the Jetstar flight was exposed to a tail-strike risk

ing pilot was, however, confused by the repeated calls as his scan of the flight-mode annunciator and engine indications did not show any problems with the engine thrust.

"The [training captain], while using standard phraseology, did not effectively communicate his understanding of the thrust lever

asymmetry situation," states the inquiry. He then made another call, signalling the flight should continue and take-off/go-around thrust be selected to resolve the asymmetry. But the flying pilot mistook the command as a call to "rotate" and rotated the aircraft at 130kt, about 20kt below required speed.

The pilot noticed the error and

slowed the rate of rotation to allow the aircraft to accelerate. The A320 continued to Launceston without further incident.

The ATSB found miscommunication that was not resolved effectively by the crew. It says the pilot may have been confused because he was transitioning from Boeing 767s and manual thrust mode on the A320 is similar.

Besides the additional simulator training module, Jetstar has also since released a communication to pilots on the responsibilities of the pilot-in-command during operational events.

"The incident highlights the importance of good flightcrew communication to ensure a shared understanding of the aircraft's system status," says the ATSB. ■

PRODUCTION DAVID KAMINSKI-MORROW TOULOUSE

Stable rates to avoid A320neo clash

Airbus backs away from higher single-aisle production citing supply concerns and threat to re-engined twinjet's transition

Airbus believes it will not drop production rates during the transition to the A320neo, but appears increasingly reluctant to raise the monthly single-aisle rate beyond 42 to avoid jeopardising the switch. Deliveries of the A320neo are scheduled to begin in October 2015 and Airbus states it will have the capacity to deliver only the re-engined type from 2018.

Chief executive Fabrice Brégier

says the airframer "doesn't need to accumulate many [regular A320 variant] orders" to plug slots in the transition between 2015 and the end of 2017.

"We are confident we won't drop production rates during the transition," he says. Brégier adds that there has been "zero drift" on the A320neo programme.

Chief operating officer for customers John Leahy estimates the

manufacturer will sell 200 regular A320s in 2013. Last year it secured net orders for 261.

Airbus increased its A320 production rate to 42 in 2012, and had been exploring a possible rate rise to 44. But the airframer is concerned over the ability of the supply chain to keep up.

Although it will have additional capacity from the new assembly line in Mobile, Alabama, Brégier points out that final assembly "won't be the bottleneck" for any production increase.

Airbus chief operating officer Günter Butschek says the airframer "got hit by a couple of supplier issues" on single-aisle production, simply through the rate increase. With higher production rates, problems can start arising from the lowest tiers of the supply chain. "Very often it's not a big part which is missing," he says.

He attributes these partly to a "backlog of investment" with some companies, while some others had "put their bet on the

wrong assumptions". While the airframer has been able to cope, and stabilise the production, Butschek says: "The disadvantage is that this is still all reactive. We need to learn to move to a proactive and preventative approach."

He says he does not want Airbus to be "firefighting", adding: "The more energy we have to give to a crisis, the more difficult it is to go to the next level of excellence."

Butschek says stabilising the chain means giving suppliers a "long-term and credible forecast", and points out the timeframe for a rise in monthly rate to 44 A320s would risk conflicting with the transition to A320neo assembly.

"We would put in a lot of effort for two aircraft and compromise the [A320neo] transition," he says. "It makes more sense to stick to the rate as is, and put in place a [transition strategy]. We'll take the pressure off, and focus." ■



Butschek wants to avoid "firefighting"

Airbus



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Raptor engine line
powers down after
final deliveries
DEFENCE P18

DEFENCE

ROTORCRAFT DAVE MAJUMDAR WASHINGTON DC

US budget impasse keeps V-22 multi-year buy in hover

Order covering tiltrotor production until fiscal year 2017 awaits Congressional approvals

The US Naval Air Systems Command (NAVAIR) has approved a second multi-year production deal for the V-22 Osprey tiltrotor, but cannot award Bell Boeing a contract until a 2013 defence appropriations bill has been signed into law.

"An agreement between the programme and industry was reached for MYP II [multi-year procurement II] in 2012," NAVAIR says. "The awarding of the MYP II contract is contingent upon approval of the National Defense Authorization Act [NDAA] and the Department of Defense Appropriations Act, 2013."

The NDAA was signed by President Barack Obama on 2 January, the command says, adding: "We expect the multi-year deal to be complete when the President signs the Department of Defense Appropriations Act."

NAVAIR says an initial contract was put into place in December 2011 to purchase long-lead items to build production Lot 17 aircraft. That deal was amended on 28 December, 2012, to complete the purchase of materials and labour for those machines.

"We anticipate that this contract will be further amended to become the 'whole' MYP II and will cover all of the material and



US Marine Corps

The US Marine Corps is fielding the Osprey in greater numbers

labour for V-22 Lots 17-21, for the years 2013-2017," NAVAIR says. "We expect this to occur in the first quarter of 2013."

Despite NAVAIR's optimism, there is little indication that the US Congress will pass an appropriations bill soon. The US government is currently operating under a so-called continuing resolution until 27 March, which provides the same level of funding as the fiscal year 2012 budget.

If Congress and the Obama Administration cannot reach a budget deal by 1 March, the Congressional sequestration manoeuvre would go into effect. Originally due to have been introduced on 2 January, but averted by a last-minute temporary deal, the measure would automatically cut the

annual US defence budget by 10%, on top of the effects of the continuing resolution.

Without a FY2013 budget yet in place, many defence programmes are running into problems with contract awards, while new-start programmes are all but dead in the water. "It makes it very difficult," says Todd Harrison, a budget analyst at the Center for Strategic and Budgetary Assessments.

The uncertainty also severely impacts planning for Obama's FY2014 budget proposal, due for release in early February. Harrison says there have been indications which suggest the step could be delayed into March or April. ■

 For more news and information on the rotorcraft industry, go to flightglobal.com/helicopters

PROPELLION
GREG WALDRON SINGAPORE

India concludes engine deal for Tejas Mk II fleet

India has completed a deal for 99 General Electric F414 engines intended to power Hindustan Aeronautics-built Tejas Mk II light combat aircraft for the nation's air force.

An industry source close to the deal confirms that the sale has been concluded, but declines to provide further details about its value. Indian media reports suggest that a contract could be worth around Indian Rs30 billion (\$560 million).

In October 2010, GE Aviation defeated the Eurojet consortium's offer of the Eurofighter Typhoon's EJ200 turbofan in a contest to power the Tejas Mk II. Under the terms of that agreement, the company was expected to provide an initial batch of F414-INS6-standard engines, with the remainder to be produced in India.

The new engines will be used to power the improved Tejas Mk II for the Indian air force, with some of the powerplants to potentially be used by a planned naval variant of the aircraft.

GE's less-powerful F404 engine currently equips the Aeronautical Development Agency's original version of the Tejas, along with early development examples of a naval derivative optimised for operation from aircraft carriers. ■

AirTankerImages



OPERATIONS

UK confirms end-date for aged VC10s

Operations with the UK Royal Air Force's remaining six Vickers VC10 tankers will conclude in the third quarter of this year, minister for defence equipment, support and technology Philip Dunne has confirmed. "A decision was taken in late December 2012 to resource an extension of the VC10 fleet until September 2013," Dunn says, with the move representing a six-month run-on beyond a previously planned March retirement. Flightglobal's MiliCAS database lists the Rolls-Royce Conway-engined aircraft as having been delivered between 1966 and 1970. Along with the RAF's seven Lockheed TriStar transports and tankers, they will be replaced by a core fleet of nine Airbus A330 Voyagers provided by the AirTanker consortium.



PROGRAMME DAVE MAJUMDAR WASHINGTON DC

F-35B grounded following fueldraulic line failure

The US F-35 Joint Program Office (JPO) temporarily grounded the Lockheed Martin F-35B short take-off and vertical landing aircraft on 16 January, following a failure in a fueldraulic line used to power the actuator for its exhaust vectoring system.

Flight operations were suspended at Lockheed's production facility in Fort Worth, Texas and at military test centres at Eglin AFB in Florida, MCAS Yuma in Arizona and NAS Patuxent River, Maryland. Activities involving the US Air Force's conventional take-off and landing F-35A and

the US Navy's carrier variant F-35C were unaffected.

The JPO says its action followed an incident involving an F-35B at the USAF's Eglin site. "While initiating a conventional mode take-off roll, the aircraft experienced a propulsion system fueldraulic failure prior to take-off," it confirms. "The pilot aborted take-off without incident and cleared the active runway. There were no injuries to the pilot or ground crew. The jet was then safely towed to a maintenance hangar and secured."

"The precautionary flight sus-



Lockheed Martin

The system controls the aircraft's exhaust vectoring actuator

pension preserves safety while providing time for the programme to understand the origin of the failure," the JPO states.

Engineering teams will review

data from the incident to determine the root cause, with the JPO to then decide whether to lift the grounding order and restart F-35B flight operations. ■

ROTORCRAFT

Boeing, Sikorsky unite for US Army JMR programme

Sikorsky is teaming with Boeing on the first stage of a US Department of Defense-led programme to develop a next-generation rotorcraft. The DoD says the helicopter must offer greater performance, reliability and affordability than current machines.

The pair will submit a joint response to the US Army Aviation Applied Technology Directorate's Joint Multi-Role (JMR) technology demonstrator phase one programme.

"The Sikorsky and Boeing team brings together exceptional technical expertise," says Mick Maurer, Sikorsky's president. Chris Chadwick, president of Boeing's military aircraft division, adds: "Our combined technical strengths and our collective programme management expertise make this partnership an exciting development in meeting the army's JMR programme objectives."

Now teamed, Boeing and Sikorsky will compete to build and fly one or more medium-lift-sized demonstrator aircraft in 2017, with candidates to be evaluated by the army for possible subsequent development into the FVL system. ■

PROPELLION DAVE MAJUMDAR WASHINGTON DC

Raptor engine line powers down after final deliveries

P&W workers to preserve F119 experience via regular overhauls and possible retrofits

Pratt & Whitney delivered its last of 507 F119 engines for the US Air Force's Lockheed Martin F-22 Raptor programme on 17 January, with much of its production tooling for the afterburning turbofan now being packed for long-term storage.

Although Lockheed delivered the USAF's last of 187 production F-22s in May, the service ordered additional engines to sustain the air superiority fleet into the future, says Bennett Croswell, president of P&W's military engines division. "When they saw the end of the production line coming, the air force

ordered an additional 39 spare engines. That's what we've been delivering over the last year."

Like Lockheed's production tooling for the F-22 airframe, much of the F119 production line is being packed for storage at the Sierra Army Depot in California. "That will be the tooling we're not using in support of the engine," Croswell says. "There will be some of the tools that we will retain as we deliver spare parts to support sustainment of the engine in the field."

The F119 shut-down plan does not require preserving assembly and manufacturing knowledge to

the degree needed for the Raptor airframe because many of the same techniques and procedures are being used on P&W's F135 engine for the Lockheed F-35 Joint Strike Fighter, Croswell says.

P&W workers will also preserve their experience with the F-22's powerplant via regular overhauls, Croswell notes. "We just produced the first full depot overhaul of the F119 at Oklahoma City. As we continue to disassemble and reassemble engines, a lot of those skills will be retained."

As new technology from the F135 becomes available, more advanced components could be retrofitted to the F119 during overhaul. "We will continue to have a component improvement programme for the F119," Croswell says. "Just as we put technology back into our F100 engines, we could do the same sort of things for the F119." Restarting production of F119 is also technically feasible should the USAF need to build more engines, he adds. ■



US Air Force

Lockheed delivered the USAF's last production F-22 in May 2012



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FLEETS GREG WALDRON SINGAPORE

China lags Japanese airpower

Despite massive strides, Beijing's air force is in no position to maintain aerial supremacy in any East China Sea conflict

On 11 January, China's defence ministry confirmed that Chengdu J-10 fighters had been dispatched to keep an eye on two Boeing F-15 aircraft operated by Japan. According to its statement, the F-15s were trailing a Shaanxi Y-8 patrolling near a cluster of islands in the East China Sea that are contested by Beijing and Tokyo.

Irrespective of the merits of either party's claim to these islands, neither side appears willing to back down. Although the prospect of an all-out war over what Tokyo calls the Senkaku and Beijing the Diaoyu islands is remote, any conflict that may develop would involve air combat – possibly on a large scale. This would lead to Japan's historically strong air force being challenged by an ambitious newcomer.

ADVANCED FIGHTERS

In recent years China's air force has made significant strides. It now operates almost 500 advanced fighters, including about 200 single-engined J-10s and more than 270 Shenyang J-11s and Sukhoi Su-27s. It also operates several hundred more examples of older types, including nearly 400 J-7s: a license-built version of the Mikoyan-Gurevich MiG-21. Unsourced media reports have speculated that some J-7s can be controlled re-



Commonwealth of Australia

Tankers offer extended-range capability for Tokyo's F-15J fleet

mately, effectively transforming them into cruise missiles.

While the Japan Air Self-Defense Force boasts fewer aircraft, it operates 153 F-15J fighters, 63 Mitsubishi F-2As, and over 80 McDonnell Douglas F-4 Phantoms.

Despite China's apparent numerical equality, experts feel it is in no position to impose and maintain aerial superiority – let alone aerial supremacy – over the disputed area.

"In short, Japan has a significant edge," says Oriana Mastro, a fellow at the Center for a New American Security think tank. "But the Chinese can create chal-

lenges for Japan to maintain aerial superiority."

One challenge facing Japan, she feels, is its ability to provide constant surveillance of the disputed islands. As Chinese naval and aircraft activities become more routine, it will become harder for Tokyo to determine Beijing's intentions.

Indeed, Tokyo has identified persistent surveillance as a priority area. "The current mid-term defence programme [from March 2011 to March 2015] takes drones into consideration as part of the study on warning and surveillance posture around our country," Japan's defence ministry said in an email to Flightglobal.

"We will further study the efficiency and operational role of drones, the comparison of the cost-effectiveness with existing equipment [and] offsetability, and take into account technological trends."

Although Tokyo declines to mention specific programmes, unsourced media reports have suggested that it is interested in the Northrop Grumman RQ-4N Broad Area Maritime Surveillance variant of the Global Hawk, being developed for the US Navy.



ReX Features

China's air force operates more than 270 J-11/Su-27 strike aircraft

Another regional defence expert feels that Beijing would be at a significant disadvantage in any shooting war over the islands.

"They can fly a few J-10s out and perhaps fly alongside Japanese F-15s, but could they sustainably project power that far out from the mainland over an extended period?" he asks. "China only has limited experience using its [Xian] H-6 as tankers." Tokyo, by contrast, can call on a four-strong fleet of Boeing KC-767s.

Another area where Beijing is weak is in airborne early warning and control (AEW&C). Its new force of Y-8-based KJ-200 and adapted Ilyushin Il-76 KJ-2000 platforms are untested, while Japan has four recently upgraded E-767 AEW&C aircraft and 13 Northrop E-2C Hawkeyes.

"In a conflict Japan would have far better situational awareness," the source says. "Also, Japanese pilots are able to operate autonomously of ground control, but Chinese fighters would likely operate under GCI [ground controlled interception]."

PROCUREMENT TRENDS

Mastro feels that the current tensions will not greatly change long-term procurement trends, with both China and Japan to continue to build their air power capabilities. The key is for the USA and its Pacific ally to make the right procurement choices now, she says, so as to offer a capable deterrent to China 20 years from now.

"The trajectory is what concerns the USA," Mastro says. "China can create challenges without catching up, and they don't need to catch up to achieve political victories. With air power tipping in China's favour, [Beijing] may be more inclined to use force." ■



For commentary on the latest defence news from Asia, visit flightglobal.com/asianskies



IN BRIEF

SABENA COMPLETION

Sabena Technics has been selected by an undisclosed Asian customer to carry out VIP cabin modification to an Airbus A319. Work will be carried out at the French company's completion centre in Bordeaux, which received European approval to perform base maintenance, cabin modifications and completions work on A380s last month.

SIGNATURE LUTON FBO

Signature Flight Support has broken ground on a fixed-base operation (FBO) at London Luton airport to replace its facility at the UK's busiest business aviation hub. The FBO comprises a 1,570m² (17,000ft²) passenger terminal and 4,500m² of hangar space capable of housing two Boeing Business Jets or Airbus ACJ319-sized aircraft. Signature says Luton is one of its most important locations outside North America, handling about 12,000 flights a year. Completion of the hangar is expected in the third quarter of 2013, and the FBO and passenger terminal in late 2014.

LEA ADDS CHALLENGER

UK management and charter company London Executive Aviation has added a second Bombardier Challenger 300 to its fleet. The super-midsized business jet – registration G-LEAZ – fills a niche in LEA's 28-strong fleet between its super-light Cessna Citation Excel and its large-cabin Embraer Legacy 600/650.

BERLIN FBO

Jet Aviation has opened a fixed-base operation at Germany's Berlin Schönefeld airport to provide handling services at Schönefeld and nearby Tegel International airports.

GLOBAL APPROVAL

Bombardier has received Brazilian certification for the Global 6000, paving the way for the long-range business jet to operate commercially in the Latin American country.

OPERATIONS MURDO MORRISON LONDON

Rizon Jet accuses Qatar CAA of unfair competition

Anger hinges on flag carrier's rival charter business based at Doha International airport

Qatar-based charter operator Rizon Jet has accused the country's civil aviation authority – and, indirectly, flag carrier Qatar Airways – of "unfair competition" by creating "hindrances that make it impossible to sustain a viable business".

In a public statement unprecedented in the Gulf aviation world – where such differences tend to be settled behind closed doors – Rizon chief executive Capt Hassan Al-Mousawi says the authority is "creating obstacles" to its "progress to grow and excel" as an independent company at Doha International airport.

Al-Mousawi's anger hinges on the fact that Qatar Airways owns a rival charter business, Qatar Executive, as well as being the airport operator and having a mo-

nopoly on ground handling through its subsidiary Qatar Aviation Services.

Among Al-Mousawi's claims are that – despite granting an operating certificate to Rizon in 2009 as the country's only independent aviation company – the authority has banned Rizon from permitting third parties from using its VIP terminal at Doha International. "This explicitly violates the initial approval of [the prime minister], granted in February 2009," he says.

Al-Mousawi also says the authority has turned down Rizon's applications for a travel agency licence and to offer third-party flight support services.

Al-Mousawi says Rizon has "tried to resolve the issues on an amicable basis, but now we have to

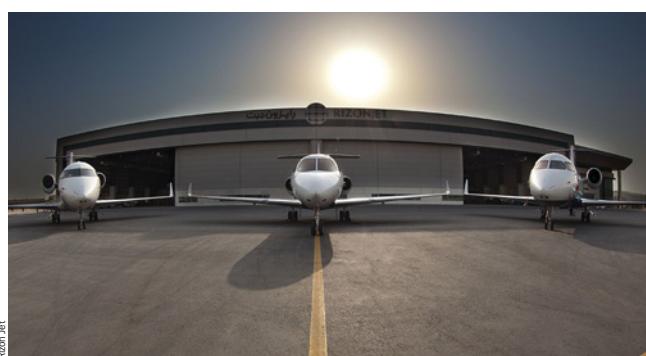
speak up", adding: "If it is a level playing field, then competition is okay, but this is uneven. We are all for clean, healthy competition... but in Qatar we have a world-class airline that also owns a private jet business, enjoys a monopoly on ground handling, as well as being the airport operator."

The ban on Rizon offering third-party services has affected "50% of our FBO [fixed-base operations] revenue", he says. "That might not be a big deal for a multibillion-dollar company like our competitor's parent company, but for us it makes a huge difference. We are a Qatari-owned company and we would like to be given the opportunity to build a viable business in Qatar."

Rizon Jet, which is owned by Qatari holding company Ghanim bin Saad Al Saad, was founded in 2006 and offers a range of business aviation services, including charter and FBOs in Doha and Biggin Hill, London.

Qatar Executive, launched in 2009, operates an all-Bombardier Global and Challenger fleet.

Qatar Airways declined to comment and the Qatar Civil Aviation Authority could not be reached for comment. ■



Rizon is banned from allowing third-party use of its VIP terminal

AVIONICS STEPHEN TRIMBLE WASHINGTON DC

Reborn Beechcraft offers free upgrade

Hawker Beechcraft will give King Air 250 or 350i buyers a free avionics display upgrade in an effort to boost sales as the company emerges from bankruptcy protection in the coming weeks.

The give-away programme for the Rockwell Collins Pro Line Fusion flightdeck is aimed at building "momentum" following a lengthy and controversial finan-

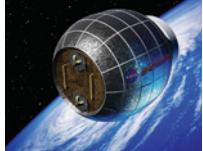
cial restructuring by Hawker Beechcraft, which filed for Chapter 11 protection in May. The offer is valid only for aircraft both purchased and delivered between 1 January and 28 February, Hawker Beechcraft says.

Hawker Beechcraft plans to emerge from its restructuring focused on the turboprop-powered King Airs and piston-powered Bo-

nanzas and Barons. The renamed Beechcraft also will seek to introduce as many as five single-engined turboprop and piston-powered aircraft. But the company will cease production of light and midsized business jets such as the Hawker 400, 900XP and 4000. ■



Read more on the reasons for Hawker's financial plight at
flightglobal.com/hbc



Bigelow expands with NASA deal
SPACEFLIGHT P23



Cirrus Aircraft

The fifth-generation piston single has been heavily redesigned

DEVELOPMENT KATE SARSFIELD LONDON

Cirrus hopes new SR22 will be worth the weight

Cirrus has introduced the latest iteration of its SR22 piston single, which it is calling "Generation 5". It gains an increase in gross weight from 1,543kg (3,400lb) to 1,633kg and a rise in seating capacity from four to five.

Cirrus hopes the improvements will boost the aircraft's appeal in the US air taxi community. "We have already sold more than 50 SR22s to Part 135 [commercial] operators," says Cirrus executive vice-president for sales and marketing Todd Simmons.

"The 'Generation 5' model... should help to increase our share of this sector as it suits companies and travellers who are seeking

low-cost, versatile private aircraft travel." The manufacturer says that with all five seats filled, the aircraft boasts a range of 700nm (1,295km) and is "capable of full fuel with four seats filled".

The SR22 has been redesigned or re-engineered to accommodate the increased airframe load. The carbonfibre wing spar, landing gear and flap system have been strengthened. Pilots can now extend flaps to the first position while flying at 150kt (278km/h).

Cirrus has increased the size of the canopy on the SR22's parachute system and fitted a new rocket extraction system that propels the parachute upon activation. ■

STUDY KATE SARSFIELD LONDON

Research reveals plunging demand in Europe's heart

Data shows persistent weakness in business jet sector in 2012 as December take-offs drop to record monthly low

European business aviation flight activity in December 2012 fell by 7% year on year to little more than 39,600 departures, marking the lowest single month of business aviation take-off across the continent since 2005, according to the latest figures from research company Wingx Advance.

"The difficult economic environment in Europe has prevented the business aviation industry from climbing out of its long recession," says Wingx managing director Richard Koe. "All the signs are that 2013 will continue to be very challenging."

Wingx data shows a year-on-year decline in departures for 11 of the 12 months of 2012, while activity for the full year was down 3.8% compared with 2011, to less than 625,000 take-offs. In December, there were more than 3,100

fewer departures across the continent – compared with the same period in 2011 – with the largest western European markets of France, Italy and Germany experiencing "particularly poor activity levels", says Wingx. Furthermore, demand for midsize, light jet and turboprop aircraft, especially on short-haul routes of up to 1.5h, continued to show a "big year-on-year decline".

Despite the gloom, there were bright spots in 2012, Wingx reveals, notably "consistent monthly increases in the use of ultra-long-range aircraft, growth in the very-light jet sector, a surge in Embraer product market share and significant increases in business aviation activity out of Turkey and the Ukraine". ■



For news from the business and general aviation sectors, go to
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Although most achievements in aviation happen because of great teamwork, sometimes involving hundreds of people, there have always been individuals who stand out as a result of their sheer talent, entrepreneurial drive, courage under pressure or leadership qualities.

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SPACECRAFT ZACH ROSENBERG WASHINGTON DC

Bigelow expands with NASA deal

Space agency awards \$17.8 million contract to extend International Space Station with inflatable structure

A revolution is occurring that could lower costs for habitation in space.

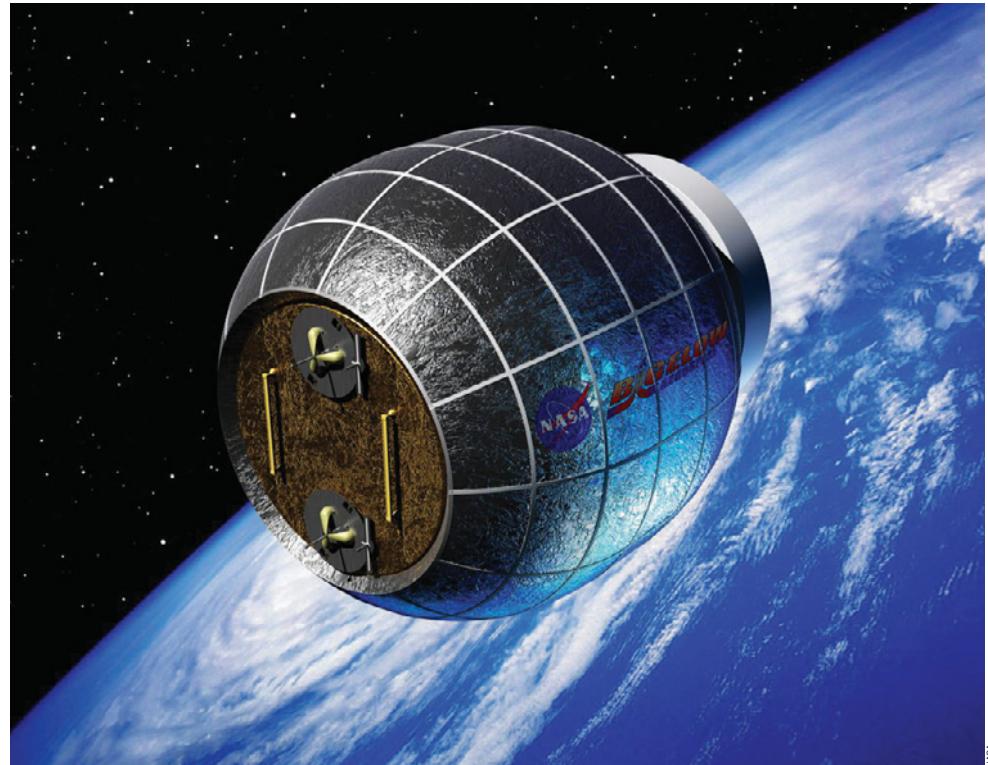
NASA has announced the addition of a new module for the International Space Station (ISS) but, in a departure from previous extensions, the latest growth is achieved through the use of an inflatable component built by Bigelow Aerospace.

The contract is a leap of faith for both NASA and Bigelow, but one that has the potential to dramatically lower the costs of maintaining a human presence in orbit.

EXPANDABLE SYSTEMS

"The purpose of this spacecraft... is to evaluate the structure over a period of time and get comfortable," says Robert Bigelow, founder and president of Bigelow Aerospace. "NASA is anxious to fly it because they want to get comfortable with expandable systems."

The new module, called the Bigelow Expandable Activity Module (BEAM), is a modest example of the company's capabilities. Although detailed layouts have yet to be finalised, BEAM is essentially a sophisticated balloon, reliant on the ISS's life-support systems for heating and cooling, air circulation and power.



The BEAM module is scheduled for launch on a SpaceX rocket in 2015

The company has been hard at work on a flagship station – the BA 330 – so named for its 330m³ (3,500ft³) of habitable volume. So far, Bigelow has flown only two payloads, Genesis I and II, both

experimental stations on proving flights, with no imminent plans to launch more until at least 2016.

Bigelow mainly markets to nations that desire, but cannot fund, their own space stations.

While Bigelow has yet to publicly discuss pricing for the BA 330 – which can be linked to others of its kind to form a super-station – it will certainly cost less than the ISS. While the ISS has absorbed about \$100 billion to date, BEAM will set back NASA a mere \$17.8 million, in addition to launch costs.

Much of Bigelow's intellectual property originates at NASA anyway. The inflatable modules began as TransHab, which NASA dropped in 1999. Las Vegas, Nevada-based real estate mogul Robert Bigelow bought the patents and resumed work.

"It's very valuable to our company to do a contract for NASA in this way," says Bigelow. "It will help to validate what we do, we're looking at NASA being a customer for larger structures." ■

MISSIONS

Countdown begins for next round of commercial launches

NASA has tentatively secured launch dates for two commercial spaceflights in early 2013 as the agency turns ever-increasing amounts of work over to private contractors to trim costs.

The year's first mission will feature the latest flight of SpaceX's Falcon 9 rocket, scheduled for a 1 March launch. It will perform a resupply of the International Space Station (ISS), the third time SpaceX will have undertaken the role.

Although its previous Falcon 9 flight on 7 October encountered problems when the vehicle lost one

of its nine main-stage engines about 80sec into the flight, SpaceX remains confident in its launcher. It has yet to publicly release the root cause of the accident, but says its investigations have led it to develop precautions to prevent a repeat of the incident.

Orbital Sciences, meanwhile, has reserved 5 April for the maiden flight of its Antares launch vehicle, after lengthy delays because of an unfinished launch pad at the Wallops Island, Virginia facility.

While the pad is now complete and turned over to Orbital, the com-

pany reports some minor problems with the pad's fuel flow systems that will require additional work.

The new rocket will carry a mass simulating Orbital's Cygnus cargo capsule, a new vehicle that will make its first flight on the subsequent Antares launch.

SpaceX and Orbital Sciences both work for NASA under its Commercial Orbital Transportation Services contract, through which the agency is guaranteeing supply flights to the ISS. A crew transportation contract is expected to be open for bids by 2015. ■





Good week

ABS JETS The Prague and Bratislava-based business jet operator handled its 7,000th aircraft since branching out as a handling agent in 2008 at Václav Havel Airport Prague, initially for its own aircraft and adding a second hangar in 2011. Noting an 18% increase in movements last year, ground operations director Jan Kralik says: "Central and Eastern Europe seems not to be hit as hard as Western Europe when it comes to a flattening of demand for flights."



ABS JETS



Re: Features

HEATHROW Snow chaos has failed to match the dark days of winter 2010, but thousands of passengers still had to camp in the terminals instead of, say, the hotels they had booked for a winter break in Spain. At one point London's two-runway premier hub had to cut 10% of flights to cope with snow, abnormal cold and low visibility, noting, with a nod to the third runway debate, that: "Because Heathrow runs at almost 100% capacity there is no slack in the system."

Bad week

DIVERSIFICATION STEPHEN TRIMBLE WASHINGTON DC

IT giant looks skyward

After a successful move into the automobile industry, India's Mahindra eyes aerospace

One of India's largest information technology companies thinks it can adapt the software sector's on-site/offshore business model for the aerospace industry and leverage that growth to transform itself into a leading aircraft design and manufacturing house within a decade.

Mahindra Satyam's aerospace practice faces the long odds of any non-established player seeking to grow rapidly and become a sophisticated designer and maker of globally competitive commercial and military aircraft.

But the group, headed by Ramalesh Satagopan, is not without certain advantages. Being part of the \$15 billion Mahindra Group is helpful. The company has grown rapidly over 15 years by becoming a builder and designer of automobiles for the Indian market.

OUTRAGEOUSLY AMBITIOUS

Now, the Mahindra Group's chairman, Anand Mahindra, has started looking for new growth opportunities – describing himself, according to India's *Business Standard* newspaper, as "outrageously ambitious to see Indian aerospace take its rightful place in the world".

Underscoring that ambition, Satagopan tells *Flight International*: "My chairman feels the next wave [of growth in India] will likely be in aerospace".

It is easy to understand why. India has to solve an infrastructure problem, but aircraft manufacturers still view the subcontinent's potential with awe.

In 2011, a total of 470 passenger aircraft were operated in South Asia. By 2031, Boeing expects airlines in the region will add 1,660 new aircraft, nearly quadrupling capacity during 20 years. Most of those new aircraft are expected to be delivered to India.

Mahindra Satyam is one of the Indian suppliers moving aggressively to prepare for what it con-



HAL

Tejas: painful development, but much gained

siders a perfect growth opportunity. Like industries in other fast-growing countries, India is not content to be merely a consumer of Western aircraft. Instead, it hopes to leverage acquisitions to fuel the capability for indigenous production.

Satagopan realises this vision is not something realised overnight. "I need to take some baby steps," he says. "I need to prove [capabilities on] some sub-assemblies and some other things – manufacturing sub-assemblies and other things."

Mahindra Satyam has already taken the first such steps. Its speciality in the aerospace industry to date has been designing interior components for Western-built business jets, such as galley monuments.

In the past two years, however, it has reformed its billing process from requesting progress payments to receiving payment only after delivering a component. That has allowed the company to seek larger and more sophisticated work packages from US and European manufacturers.

"For one of the [OEMs] we are working on the design of part of the fuselage," Satagopan says. "That gives us the opportunity for developing other skill-sets and improving those skill-sets. It's a game-changer for us."

As Mahindra Satyam develops its offshore design business, it also hopes to become one of several emerging Indian aerospace

contractors to expand via home-grown aircraft programmes. The Indian government has announced plans to develop a host of new aircraft, including fighters, unmanned aerial vehicles, trainers, transports and regional commercial aircraft.

"So you have huge programmes from the design and development side," Satagopan says. "Also there is a manufacturing capability that needs to be developed in order to produce those aircraft in this country. So I think there is a huge opportunity in the next 10 years."

In the near-term, Mahindra Satyam thinks the maintenance, repair and overhaul market in India lacks sufficient capacity, which could provide another growth opportunity, he says.

India's aerospace industry has long been dominated by only a few players, particularly Hindustan Aeronautics. However, the long and painful development of the Light Combat Aircraft programme helped to establish a small core of small and medium-sized aerospace enterprises.

Those companies are now being supplemented with deep-pocketed engineering organisations from other sectors across the nation, such as automotive and information technology in the case of Mahindra. ■

See India Special Report P26



India's own fighter is finally nearing service entry:
flightglobal.com/tejas



Assessing the
nation's prospects
ahead of Aero India
SPECIAL REPORT P26

BUSINESS

PEOPLE MOVES

Alaska Airlines, APB, Piper, Pratt & Whitney, Thales USA



Funk: Piper operations

New Jersey Republican Frank LoBiondo now chairs the **US House of Representatives** aviation subcommittee, which oversees civil aviation, including the FAA, the Transportation Security Administration and the National Transportation Safety Board. At winglets maker **Aviation Partners Boeing**, Patrick LaMoria has been promoted to executive VP and chief commercial officer. **Silver Airways** chief executive Darrell Richardson is to retire. A replacement is being sought. Former Learjet general manager operations James Funk has joined **Piper Aircraft** as VP

operations. **Alaska Airlines** has promoted Constance von Muehlen to managing director of airframe, engine and component maintenance repair and overhaul. Veteran maintenance engineer Paul Brooker has joined the **International Bureau of Aviation** as chief technical manager. At **Pratt & Whitney**, Paul Adams – a key figure in programmes ranging from the geared turbofan to the F135 – is now chief operating officer.

Thales USA chief executive Allan Cameron has retired and Los Angeles-based Thales Avionics VP Alan Pellegrini has been promoted to succeed him.



Von Muehlen: Alaska repairs

QUOTE OF THE WEEK

"American has a history of not listening to the public"



Travel industry analyst **HENRY HARTEVELDT**, of consultancy Hudson

Crossing, is unimpressed by the airline's new livery; the Twittersphere reaction has been bad, too, but he reckons nothing will change management minds short of a "no" vote by US Airways, should the two merge

BUSINESS BRIEFS

ZODIAC SIGNS UP FOR MORE POWER

EQUIPMENT Paris-headquartered equipment maker Zodiac Aerospace has enhanced its position in onboard electrical systems with the acquisition of IPS – Innovative Power Solutions – of Eatontown, New Jersey, a maker of electrical power generators and converters for regional jets, business jets and helicopters. IPS employs about 60 people. Zodiac also makes cabin equipment and galleys, seats and safety systems, and supplies the power distribution system for the Boeing 787.

ILFC DEAL COUNT FALLS IN 2012

LEASING International Lease Finance (ILFC), the Los Angeles-headquartered aircraft lessor owned by troubled US insurance giant AIG, which has agreed a deal to sell it to a consortium of Chinese financial institutions, executed a total of 242 lease transactions in 2012, 54 fewer deals than the previous year. And, according to the company, it raised \$4.2 billion through several financing structures that incorporated secured bank financing, secured institutional term loans, and unsecured public bonds. The proposed sale of up to 90% of ILFC, which owns 960 aircraft, values the company at about \$5.3 billion and remains subject to US and Chinese regulatory clearance.

SOFTWARE MAGNATE LINKED TO ISLAND AIR SALE

AIRLINES Software billionaire Larry Ellison is understood to be the undisclosed buyer of Hawaii intra-island carrier Island Air from its parent, Gavarnie Holding, according to the *Honolulu Star-Advertiser*. Island Air has yet to confirm or deny the report, but Gavarnie expects the sale, which it believes will help Island compete with market-dominating Hawaiian Airlines, to be completed in February. Ellison, who is chief executive and co-founder of Oracle software, bought nearly 98% of the Hawaiian island of Lanai in 2012.

ROCKWELL COLLINS DOWN SLIGHTLY IN Q1

ELECTRONICS Sales and pre-tax profits both edged down 3% – to \$1.06 billion and \$188 million – at Rockwell Collins in the first quarter of its 2013 financial year. The period to end-December saw modest gains in commercial systems sales and profits, almost offsetting a year-on-year decline in government systems business for the Iowa-headquartered aviation electronics maker. For the current fiscal year, Collins expects total sales of \$4.6–4.7 billion, slightly behind the \$4.73 billion achieved in 2012 and \$4.81 billion in 2011.

SAFRAN LANDS FACTORY INVESTMENT SUPPORT

MANUFACTURING Safran is to continue a programme up to 2015 to modernise its Messier-Bugatti-Dowty landing-gear plant in Bidos, France, with the assistance of the local Aquitaine and Pyrénées Atlantiques governments. Since 2007, Safran has invested €10 million (\$13 million) annually in the project and will spend about €35 million on the second phase, including a 6,500m² (70,000ft²) facility to machine large titanium parts for Airbus A350s and Boeing 787s.

UTC REACHES NEW ACCORD TO SELL PUMPS UNIT

ACQUISITIONS United Technologies has agreed to sell the former Goodrich pump and engine control systems business to Triumph Group pending approval of competition authorities. The agreement, part of a divestment package ordered by US and European competition authorities on approval of the Pratt & Whitney, Sikorsky and Hamilton Sundstrand parent's \$18 billion acquisition of Goodrich last year, follows regulatory blocking of a similar sale agreement reached earlier this year with Cincinnati-based TransDigm.

RISING TO THE CHALLENGE

Surging growth of India's civil and military fleets has only added urgency to its need to solve problems relating to airline-sector health, airport capacity limits, offset rules, and the role of HAL. We assess the nation's aerospace prospects ahead of Aero India



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ADA/Boeing

(Clockwise from above) Delays have beset HAL's Tejas programme; Jet Airways has 10 Boeing 787s on order; and, despite financial troubles, Air India is adding widebodies



Boeing

**PROCUREMENT**

On the offensive

The MMRCA may be settled, but defence contractors will be out in force at Aero India as there are big national deals still to be won

GREG WALDRON NEW DELHI

Major air shows are never easy places to hold a conversation. Aside from the hum of a thousand voices talking in cavernous exhibition halls, there is the constant interruption of high-performance jet aircraft roaring overhead. Nowhere was this more true than the last iteration of Aero India in 2011, when the five fighters involved in the 126 aircraft medium multi-role combat aircraft (MMRCA) competition, not to mention Indian air force Sukhoi Su-30MKIs and Hindustan Aeronautics (HAL) Tejas fighters, performed constantly throughout the long, dusty week of the show.

With the Dassault Rafale's securing of "L1 Vendor" status in the MMRCA competition – marking the Rafale as the lowest-priced option, allowing Dassault to enter final negotiations for the deal with India's Contract Negotiation Committee – Aero India 2013 will not be the same for fighter aficionados. Nonetheless, India still has vast requirements. Although some have yet to be clearly defined, the world's heavyweight prime contractors

will be out in force at this year's show.

Airbus Military will come to the show in an upbeat mood. In early January, New Delhi selected the A330 MRTT (multi-role tanker transport) as the L1 vendor in a competition for six tankers. The announcement followed a competition between the A330 MRTT and the Ilyushin IL-78MK, of which the Indian air force already operates seven examples. Airbus Military hopes to complete negotiations with the Indian government and sign a production contract by the end of 2013.

New Delhi's decision was sweet vindication for Airbus Military. New Delhi had previously selected the A330 MRTT to meet its air force requirement, but cancelled the programme in 2010 before a contract could be signed. That decision followed pressure from India's finance ministry on the proposed cost of the deal. In September 2010, the defence ministry issued a fresh request for proposals that emphasised the lifecycle costs of operating the aircraft.

REFUELLED CAPABILITY

If the deal moves forward, this aircraft will enhance New Delhi's ability to carry large numbers of troops over long distances – the A330 MRTT can accommodate up to 300 troops in addition to cargo. The A330 MRTT's refuelling capability will also bolster New Delhi's ability to project airpower along its northern frontier and above the Indian Ocean, Arabian Sea and Bay of Bengal. New Delhi could eventually add six more A330 MRTTs.

Although MMRCA appears to have gone to the Rafale, industry sources in New Delhi paint conflicting pictures of how well the deal

is progressing. One source says final negotiations were delayed several months in 2012 owing to an investigation into the criteria by which the Rafale was selected. India's ministry of defence has confirmed negotiations are under way, but both itself and Dassault are tight-lipped about progress.

In early January, New Delhi selected the A330 MRTT over the IL-78MK in a competition for six tankers

Virtually all sources agree, however, that the Rafale deal needs to be completed by the middle of 2013. If it is not, there is a danger it could be delayed, possibly up to a year, by India's next general election, expected in early 2014. Were the MMRCA signing to be delayed until 2015, the first delivery of a Rafale to the Indian air force would likely occur around 2018, nearly two decades after India said it was interested in obtaining additional Mirage 2000 fighters, a requirement that eventually morphed into the \$10-20 billion MMRCA competition. What is more, Eurofighter Typhoon, the runner-up in MMRCA, relishes the idea of playing spoiler in the competition.

Meanwhile, an industry source tells *Flight International* that India is keen to obtain even more HAL-produced Sukhoi Su-30MKI fighters. This type forms the backbone of India's air force, although some experts question the readiness of the fleet owing to limitations of the aircraft's Russian engines. India has orders for 272



India's navy is due to receive its first of eight Boeing P-8I Neptune maritime patrol and anti-submarine warfare aircraft this year

Su-30MKIs, of which more than 150 have been delivered. An industry source familiar with the programme says India has plans to operate up to 350 examples of the type.

In addition to these major fighter acquisition programmes, India is participating with Russia in development of a Fifth-Generation Fighter Aircraft, a two-seat variant of Sukhoi's T-50 PAK-FA. In August last year, Air Chief Marshal NAK Browne said the first prototype will arrive in India by 2014. It will undergo trials at the Ojhar air base. A second prototype is planned for 2017 and a third for 2019. India hopes to eventually purchase some 214 of the stealthy type by 2030. The total cost of the programme is expected to cost the Indian government more than \$30 billion.

India's Aeronautical Development Agency (ADA) is also planning an Advanced Media Combat Aircraft (AMCA). While the ADA has declined to comment on the status of this programme, India's National Aerospace Laboratories (NAL) in Bengaluru has conducted

research into the aerodynamics of various configurations for the type.

According to NAL illustrations, the low-observable AMCA will have twin engines and twin canted tails. Its wings will feature a clipped delta configuration, with a long leading-edge extension similar to that of the Boeing F/A-18E/F Super Hornet.

Beyond India's plans for new tankers and fighters, it has a broad range of requirements for other types of aircraft. By far the biggest potential requirement lies with a plan to replace the Indian air force's fleet of HAL-produced HS 748 transport aircraft. Based on the 1960s-era Hawker Siddeley HS 748, the examples in Indian air force service are badly in need of replacement. Although several international airframers received a request for information (RFI) in 2010 for the Avro replacement, the two strongest contenders for the 56-aircraft deal are likely to be the Airbus Military C295 and Alenia Aeromacchi C-27J.

According to the RFI, 16 of the aircraft will be obtained in a flyaway condition, and 40 produced under licence in India. In a first for India, local production will not be undertaken by HAL, but by a private-sector company.

While India has yet to produce a major private sector airframer, a number of its large industrial conglomerates, such as Larsen & Toubro, Mahindra & Mahindra, and Tata Sons have been steadily building their aerospace units in recent years. India could require that the first aircraft be delivered within two years of a contract signing, with 15 more in the following 24 months. A one-year pause would ensue, followed by the remaining 40 aircraft being produced in India at a rate of eight per year.

STRATEGIC TRANSPORTS

In late 2012, unsourced reports in the Indian media indicated a request for proposal (RFP) for this requirement had been issued, but two companies who received the original RFI told *Flight International* no RFP has emerged.

Although India has traditionally filled the heavy transport role with the Russian-built Ilyushin Il-76, in June 2011 India took the

An industry source says India is keen to obtain even more HAL-produced Sukhoi Su-30MKI fighters

unprecedented step of ordering 10 C-17 strategic transports. In February 2012, Boeing confirmed it had been rewarded a \$1.78 billion contract for the acquisition, which was conducted under the US government's Foreign Military Sales mechanism. The C-17 deal included no formal option clause, but Boeing says India has expressed interest in an additional six C-17s. It stresses, however, that no formal dialogue or discussion has occurred related to this potential follow-on purchase.

JOINED UP

A milestone was passed in July 2012, when Boeing joined the forward, centre, aft fuselage and wing assembly of India's first C-17. On 22 January, the first Indian C-17 was delivered for flight testing at Edwards AFB, California.

India is due to receive its first C-17 by the middle of 2013, four more by year-end, and five next year. Boeing is optimistic that the nation could decide to obtain six more. It notes that the UK and Australia decided to obtain more C-17s after commencing operations with the type. And 16 C-17s would allow India to operate the type from two or more bases.

India also operates six Lockheed Martin C-130J tactical transport aircraft that it ordered in 2008. Lockheed says it is in "detailed discussions" with the Indian government for an additional six C-130Js.

Aside from its clear interest in western transport aircraft, India is also working with Russia to develop a Medium Transport Aircraft (MTA). In October, Russia's United Aircraft said it had signed a deal for the long-planned programme. The MTA will be a twin-engined transport with a maximum take-off weight of 65t, including an 18-20t payload, a 30m (98ft) wingspan, and a top speed of 434kt (800km/h). Earlier that year, United



Boeing has delivered India's first C-17 transport for flight testing at Edwards AFB

» Aircraft president Mikhail Pogosyan told Flightglobal he expected New Delhi to eventually acquire 45 of the new type, with Moscow to order 100 and export customers to take up to another 60.

NAVAL AIRPOWER

Another big focus of Aero India this year is bound to be maritime patrol and naval airpower. With its vast oceanic frontier, New Delhi has significant maritime airpower requirements. Missions range from preventing infiltration along India's coastline – terrorists involved in the 2008 attacks in Mumbai infiltrated by rubber dinghies – and monitoring India's special economic zone all the way to projecting naval power to defend the nation's sea lines of communications.

In January 2009, Boeing secured a contract for eight P-8I Neptune maritime patrol and anti-submarine warfare aircraft for the Indian navy, with options for an additional four. Boeing says the programme is progressing well, with three P-8Is undergoing flight tests in the USA. India is due to receive its first example of the type in mid-2013.

India is also working on RFPs for two other maritime patrol requirements: the navy's medium-range maritime reconnaissance (MRMR) aircraft and the coastguard's medium maritime patrol (MMP) aircraft. Both are likely to be for six aircraft initially, with options for six more, say industry sources. They note that the initial requirement for the MMP could be as high as nine aircraft.

Unlike the navy's long-range maritime patrol aircraft requirement, which was filled by the P-8I, the 2010 MRMR RFI suggested India will not require the aircraft to have anti-submarine warfare capabilities, with the aircraft instead to be focused on maritime patrol missions while being capable of carrying anti-ship missiles. It will replace India's 12 Britten-Norman BN-2 Islanders.

SELF PROTECTION

In the RFI, the navy stated that the MRMR aircraft will require a top speed of 300kt or greater and a patrol speed of 200kt. It will require a full self-protection suite, including radar and laser warning receivers, an active electronically scanned array surface-search radar and a forward-looking infrared sensor.

One contender for the requirement could include a variant of the P-8I, although Boeing representatives have said they want to see India's exact requirements before deciding how to address the campaign. A P-8I variant would make sense from a logistical and crew-training perspective given that India has already ordered eight P-8Is for long-range patrol.

Sources say the MMP requirement is less well defined. "Based on the RFI, the MMP is a really big beast," says one source from a

European airframer. The request called for a diverse range of missions, including search and rescue, anti-surface warfare, environmental monitoring and medical evacuation with three intensive care stations.

Longer term, a source familiar with New Delhi's naval plans says the navy could have a requirement for six carrier-capable airborne early warning & control (AEW&C) aircraft. This requirement is contingent on whether a future carrier known as IAC 2 (indigenous aircraft carrier 2) will be equipped with catapults. IAC 2 will follow IAC 1, which is being built in Kochi shipyard.

"Based on the RFI, [India's medium maritime patrol contract] is a really big beast"

EUROPEAN AIRFRAMER SOURCE

IAC 1 will be similar in size to the INS *Vikramaditya*, formerly the Soviet carrier the *Admiral Gorshkov*, and displace approximately 36,000t, says the source. As with the *Vikramaditya*, IAC 1 will launch aircraft using a "ski-ramp" structure.

IAC 2 is envisaged as a far larger warship – with a displacement of about 60,000t – and could enter the fleet within 10-15 years. Senior leaders within the navy are leaning towards deploying this ship with catapults, with a decision on whether to integrate steam catapults or an electromagnetic aircraft launch system to come as soon as July this year. In addition to enabling fighters to launch with heavier payloads, catapults also allow carriers to operate large AEW&C aircraft.

At the 2011 Aero India show, Northrop Grumman displayed a large model of its E-2D Hawkeye AEW&C aircraft, and at last year's DefExpo show in New Delhi, a good part of Northrop's stand was dedicated to highlighting the E-2D's capabilities.

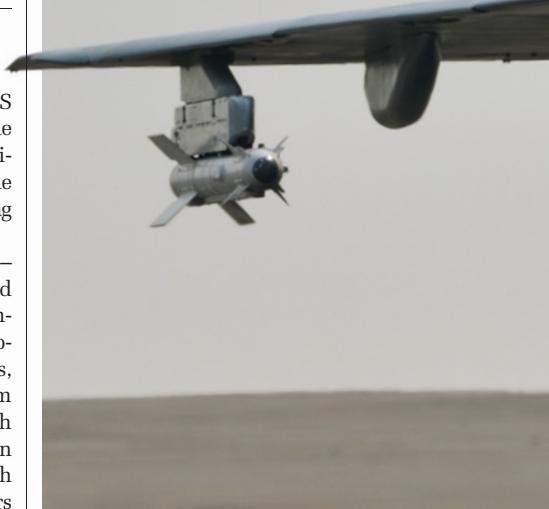
As the world's only carrier-capable fixed-wing AEW&C platform, the E-2D is in an unrivalled position to fulfil any Indian carrier-borne AEW&C requirement that emerges.

While fewer Western defence executives will be making the dusty trek to Yelahanka air base this year than at the height of the MMRCA contest in 2011, there will still be a lot of action in and around the stands and chalets of big players such as Boeing, Lockheed Martin, Saab, BAE Systems, Dassault, Northrop Grumman and Raytheon. And, although MMRCA appears to have been settled, India's vast requirements will remain one of the global defence sector's bright spots for years to come. ■



For commentary on Asian defence aviation procurement programmes, visit our Asian Skies blog at flightglobal.com/asianskies

The canopy design of HAL's Tejas light combat aircraft reportedly concerned test pilots so much they refused to fly it



MANUFACTURING

Rocky relations

There are increasing signs that the Indian government and military is growing impatient with national giant Hindustan Aeronautics

GREG WALDRON NEW DELHI

Imagine a parallel universe where Lockheed Martin is owned by the US government and rival companies such as Boeing and Northrop Grumman never existed. Tier-one suppliers such as Honeywell and Rockwell Collins do not exist either, and there is no Pratt & Whitney and General Electric to produce engines.

Instead, all these vital aerospace infrastructures exist within the confines of Lockheed itself. Furthermore, the fantasy version of Lockheed has only rarely designed aircraft, and has



ADA

spent most of its career snapping together kits of aircraft designed and largely built elsewhere. Over the decades, since the Second World War, fantasy Lockheed has not acquired major companies such as Martin Marietta simply because it has always had a government-enforced monopoly.

This prospect is absurd, but not in India, where government-owned Hindustan Aeronautics (HAL) has dominated virtually every aspect of India's aerospace sector for more than 50 years. This has hardly made the company a paragon of efficiency: the 1940s-era Bengaluru factory, where HAL produces BAE Systems Hawk advanced trainers, teems with engineers, and it is not uncommon to see two or three observing while another performs a basic task. Although men in uniform are rarely enamoured with defence contractors, there are ample anecdotes to suggest the long relationship between the Indian military and HAL has been rocky at best.

Prominent HAL aircraft such as the Tejas light combat aircraft and Dhruv light utility helicopter have suffered legions of problems.

In the latest issue to afflict the programme, Tejas test flights were reportedly delayed for three months in 2012 as a result of a design issue with the aircraft's canopy that concerned pilots so much they refused to fly it until a redesign was implemented.

DISMAL RECORD

Although the Indian government has had a dismal record of divesting government-owned companies – as exemplified by its coddling of debt-ridden Air India – there are increasing signs it is growing impatient with HAL. In

November, it proposed an initial public offering (IPO) for 10% of HAL's shares, of which half would go to retail investors. “[The] 10% would be relatively easy to float on the market, but the government would still have complete control over the company,” an equity analyst says of the proposed IPO. “In order to greatly enhance HAL's competitiveness, the government would need to cede control to an outsider player. [The] 10% is far too small an amount to make any real difference in how HAL is run.”

Nonetheless, the government appears to recognise that this sprawling and vertically

HAL BY NUMBERS

Employees	32,659
2011-2012 sales:	Rs142 billion (\$2.6 billion)
Pre-tax profit:	Rs33 billion
Key production programmes:	Tejas light combat aircraft, Su-30MKI, Hawk advanced jet trainer, Dhruv light utility helicopter
Key development programmes:	Fifth-Generation Fighter Aircraft (joint development with Sukhoi), Multi-role Transport Aircraft (joint venture with Russia's United Aircraft), Light Combat Helicopter, Intermediate Jet Trainer

SOURCE: HAL

» integrated brontosaurus of a company is not the solution to India's ambitions of becoming a global aerospace power.

"The word that comes to mind when looking at HAL is 'reprehensible,'" says Teal Group analyst Richard Aboulafia. "India is not a wealthy society, yet it has strong defensive needs. HAL is effectively a tax on this society, providing almost nothing in return. As a company, it basically serves three functions, or rather dysfunctions. These include adding costs through co-production, reducing the number of platforms [such as Dassault Rafales] a given amount of money can buy, creating useless and near-useless indigenous platforms at great expense, and demanding offset contracts that increase the costs to companies that export to India. These costs are then passed on to the Indian taxpayer."

Aboulafia's views are shared by many in the Indian aerospace and defence sector, but few are willing to comment on the record, given HAL's all-pervasive role. HAL, for its part, declined repeated requests to comment.

STRANGLEHOLD

There are signs HAL's stranglehold over major programmes is no longer a given. In a request for information document in 2010 to replace the Indian air force fleet of HAL-produced Hawker Siddeley 748 aircraft with 56 tactical transports, the Indian government said 16 of the aircraft would be produced by the OEM, and the remaining 40 by a private sector market player in India. "The production plan for the Avro replacement deal is a great breakthrough," says one former Indian officer. "The air force was adamant that this aircraft be produced by

the private sector. This was the first time that HAL was really put in its place."

Behind the scenes, there are also questions about HAL's future role in producing the medium multi-role combat aircraft (MMRCA). France's Dassault is in contract discussions with the Indian government for the 126 aircraft requirement, which calls for 18 aircraft to be delivered in a flyaway condition and 108 to be produced in India. According to the initial requirement, HAL was to have a major

The word that comes to mind when looking at HAL is 'reprehensible'

RICHARD ABOULAFIA

Analyst, Teal Group

production role. Indeed, on 11 June 2012, it announced it would invest Rs6 billion (\$110 million) in two Bengaluru factories, with one factory earmarked to produce the MMRCA and the other, MMRCA engines.

In February 2012, shortly after the Rafale achieved L1 vendor status in the MMRCA deal – clearing the way for exclusive contract negotiations with the Indian government – Dassault and Indian conglomerate Reliance Industries entered a memorandum of understanding to work together on defence projects.

The head of Reliance's nascent aviation and aerospace unit is Vivek Lall, former head of Boeing Defence in India. While at Boeing, Lall played a major role in securing billion-dollar deals, including contracts for eight P-8I Neptune maritime patrol anti-submarine

warfare aircraft and 10 C-17 strategic transports. Reliance dominates India's petrochemical sector and generated revenue of \$75 billion in 2012. It is India's largest private-sector company and appears eager to have a significant presence in aerospace.

Lall turned down *Flight International*'s requests for an interview, but his LinkedIn page indicates he works in the office of Reliance's chairman, suggesting aerospace could be a future major focus area for this giant company. A Reliance-Dassault joint venture would be eager to secure a substantial degree of work on the MMRCA programme.

"With the Reliance-Dassault joint venture coming in, there are all sorts of question marks," says one industry source. "HAL might get a part of the aircraft, but there is very active debate on who will do what. With the Reliance JV in place, there will be some dilution of work at HAL."

HAL does have defenders – although they are careful to temper their praise. A former civil servant with in-depth knowledge of Indian defence acquisition policy stresses that cost overruns and quality issues occur at all the Indian government's defence public sector units.

TECHNOLOGY DENIAL

"Unfortunately, this is a problem with us," he says. "At the same time, all facts considered, such as that we are not as wealthy as the USA, and periodically suffer from technology denial, we have done pretty well. Today, only HAL has the capacity to make aircraft in India – but the Avro replacement programme will create an additional capability in the country."

He estimates that HAL presently outsources up to 40% of the work on a given aircraft, but the government would like to see this percentage rise to 60%. This would inevitably mean a cornucopia of work for private-sector players such as Reliance, Mahindra & Mahindra, Tata Sons, Larsen & Toubro, and Samtel Avionics & Defence Systems, and job cuts at HAL, which employs nearly 33,000.

"HAL has problems, all sorts of problems," says one industry source. "When you see this private-sector scene coming up at the end of the day, HAL will have competition – very tough competition."

This competition, and increasing impatience in New Delhi, will force HAL to change. Some see the company evolving into a true systems integrator along the lines of Boeing or Lockheed. This overlooks the company's weakness in original design, and programmes such as the Tejas and Dhruv suggest programme management is not one of HAL's core competencies. The coming years are bound to be painful for HAL. Not all fantasy tales have happy endings. ■



Hindustan Aeronautics

HAL's Dhruv light utility helicopter programme has also been hit by design problems

INDUSTRIAL POLICY

Closed door

India has adopted a more flexible regime governing offsets, but limits on foreign investment continue to draw criticism

GREG WALDRON NEW DELHI

Foreign defence executives working in India love to talk about capabilities. They have no lack of enthusiasm for detailing how their products and services can fill both defined and perceived Indian requirements. When asked about New Delhi's offset regime they are still enthusiastic enough, but one gets the sense this area is probably not the favourite part of their daily routine.

The consensus about offsets is markedly more upbeat since India's new offset guidelines – as outlined in India's Defence Procurement Procedure (DPP) – took effect in August last year. The new regime is widely seen as being more flexible owing to the increased use of multipliers and improved offset banking. But there are still issues New Delhi will need to address in future DPPs if it is to get the maximum benefit from offset arrangements – the ultimate goal of which is to build a self-sufficient and modern defence industrial capability.

At present, contractors are required to invest 30% of a deal's value back into India through offsets, although in the case of the medium multi-role combat aircraft competition, the offset value is 50%. Dassault and India are in commercial discussions for this deal, which could end up being worth \$10-20 billion.

Other high-profile deals in recent years have generated major offsets. These include a \$1.2 billion deal in 2008 for six Lockheed Martin C-130Js – with India likely to buy six more – a \$2.1 billion deal in 2009 for eight Boeing P-8I maritime patrol aircraft, and a \$1.78 billion deal in 2011 for 10 C-17s.

SPECIFIC OBLIGATIONS

In line with Boeing's increased sales to New Delhi, it has grown the amount of work share it conducts in India – although it stops short of publicly linking specific work packages to specific offset obligations. Hindustan Aeronautics produces gun-bay doors and wire harnesses for the F/A-18 Super Hornet fighter. It also produces the weapons-bay doors, tail cones, and identification friend-or-foe transponders for the P-8I Neptune.

Bharat Electronics produces F/A-18 cockpit panels. In addition, Boeing has a range of other contracts with Indian companies in



HAL produces weapons-bay doors, tail cones and transponders for the P-8I Neptune

areas such as software and research and development. "Within our offset programme, we're still at the beginning," says Dennis Swanson, vice-president – India at Boeing Defense, Space & Security. "We anticipate there will be much more work placed in country."

On 13 August, India's defence ministry told parliament it had signed 19 offset agreements so far, 14 of which are in the aerospace sector. "The general belief is that 70% of what our military uses is imported," says a former Indian defence ministry official who helped

Within our offset programme [in India], we're still at the beginning

DENNIS SWANSON

Vice-president, Boeing Defense, Space & Security

draft India's offset guidelines. "We want to reverse this. You can't eliminate reliance on foreign suppliers in today's globalised world, but having 70% of your military systems coming from overseas is not a healthy state to be in. You never know when a denial regime will suddenly come into being. It is better to be self-reliant. Reversing the 70/30 ratio would put us in a happier situation."

Although offsets can be applied to a range of technologies, New Delhi's new guidelines lists 15 "critical defence technology areas" that were laid down by the Defence Research Development Organisation (DRDO). Some of the aerospace-specific priority areas include low-observable technologies, hypersonic flight technology, advanced composite materials, and miniature sensors.

The former official feels the two most important changes in the seven years since the offset regime's establishment in 2005 were the allowance of indirect offsets for civilian aerospace

and internal security, and the introduction of offset banking, which allows credits to be "banked" against future offset obligations.

CREDIT MULTIPLIERS

The 2012 DPP included critical changes such as the allowance of technology of transfer as offsets, credit multipliers of up to 300% for specific technologies transferred to the DRDO, more products and services eligible for offsets, and providing incentives – namely a 150% offset credit for the value of work contractors farm out to Indian small- and medium-sized enterprises.

Perhaps most important, a new agency was established to manage offsets, the Defence Offset Management Wing (DOMW), which replaces the Defence Offset Facility Organisation (DOFA). According to Laxman Kumar Behera, research fellow at the Institute for Strategic Studies and Analyses, the DOMW has far broader remit than DOFA.

"The most critical aspect of [DOMW's] power lies in its being one of the repositories of the signed offset contracts, which the DOFA did not have access to," says Behera. "The DOMW is tasked to formulate offset guidelines, participate in technical and commercial offset negotiations; monitor/audit offset programmes, administer offset penalties in case of default by vendors, and implement offset banking and assist vendors in all offset-related matters."

Despite the improvements, industry sources still see some significant issues with India's current stance on offsets. One issue that inevitably comes up in any discussion about offsets is the foreign direct investment (FDI) limit. Although India is taking steps to increase foreign involvement in its economy – in September, for example, the ministry of commerce and industry said foreign airlines can buy up to 49% of domestic carriers – the defence ministry remains firmly behind its FDI cap of **»**



Dassault is negotiating terms with India

Greg Waldron/Flightglobal

» 26% ownership of defence manufacturing firms in the defence sector. Foreign companies are wary of injecting intellectual property into a joint venture where they have such limited control.

LOBBYING EFFORTS

"Foreign contractors would like to own at least 49% or more of an Indian subsidiary, but I don't see the FDI limit rising before the next government in 2014," says one industry source. "There has been a lot of lobbying by various countries including the USA on this issue, and a lot of lobbying in India as well, but for whatever reason, the [defence ministry] wants to stay with 74%."

There is also an issue with the definition of "defence products", says consultancy KPMG. It calls for clearly defined list of products that are considered eligible for offsets: "The introduction of dual-use items being made eligible for undertaking offsets, it becomes ever more important for the Indian industry to have a clear understanding of whether their products, components or services need to be compliant with the conditions stipulated in the government of India's FDI policy."

Another gripe among contractors appears to be that the terms of the latest rounds of offset guidelines are not retroactive. This means companies such as Boeing, Lockheed Martin, Dassault and BAE Systems, which closed major deals in India under previous iterations of the DPP, are restricted to the offset rules which prevailed at the time the contract was concluded. This restricts their options in areas such as offset banking and using commercial programmes to gain offset credits.

And, despite the advent of the DOMW, there are still issues around execution. The ministry of defence in New Delhi comprises a vast warren of bureaucracy. It is not uncommon for the left hand out to be out of sync with what the right hand is doing.

"The bureaucracy is very difficult to get through," says one western aerospace executive. "Just to put together a concept for a venture that would generate offset credits, along with all the FDI restrictions, you have to go around to all these Indian government

departments. Everyone has a small piece of the policy pie and you have to make it all fit."

"You go to one guy and ask him to how to do something under a certain policy. He'll say yes, but for this part you need to talk to ministry X. You go to ministry X and they'll point the finger straight back to the other guy. It's hard to come up with an integrated concept that meets all the regulatory requirements. There is nobody who can say definitely that something will work or that something will not work. It's all 'maybe' and 'possibly' – just submit your proposal and we'll have a look."

The Indian government, for its part, is still not satisfied with the level of technology it is receiving. Of course, anyone with an even passing acquaintance with executives from the big US and European defence players will know how tight-lipped they can be about sensitive technologies such as stealth, sensors, and hypersonic flight.

"There is a feeling in the government that OEMs are not coming forward to transfer technology, although the regime is becoming very liberal and there are a lot of incentives," says the former civil servant.

"The OEMs could have problems with offset policies, but these should be articulated to the government and this is not happening. OEMs need to specifically outline their issues. Offsets are a deadly serious business, but they can only be serious if specifics are conveyed. It's not enough to condemn things. You have to be constructive." ■

CRITICAL TECHNOLOGY AREAS UNDER INDIA'S OFFSET POLICIES

- Microelectromechanical sensors, actuators, focal plane arrays*
- Nano technology-based sensors and displays*
- Miniature synthetic aperture radar (SAR), and inverse SAR*
- Fibre-laser technology
- Electromagnetic rail-gun technology
- Shared and conformal apertures*
- High-efficiency flexible solar cells technology*
- Super cavitation technology
- Molecularly imprinted polymers*
- Technologies for hypersonic flight (propulsion, aerodynamics and structures)*
- Low observable technologies*
- Technologies for generating high-power lasers
- Carbonfibre technologies*
- Terahertz radiation technologies

NOTE: *Items without defence aerospace applications
SOURCE: Indian defence ministry



Tata Sons unit TASL makes C-130J parts

PRIVATE ENTERPRISE

Piece of the action

Household names from across Indian industry have designs on the aerospace sector, challenging HAL's grip on the supply chain

GREG WALDRON NEW DELHI

Samtel Avionics & Defence Systems executive director Puneet Kaura personifies India's nascent private aerospace sector. He is young, ambitious and determined to carve a niche in the global aerospace supply chain. At only 34, he has guided his small firm through substantial growth since its founding in 2001. Today, its cockpit displays are found in the Indian air force's Sukhoi Su-30MKI fighters, and Samtel has forged relationships with key international players such as Honeywell, Curtiss-Wright, BAE Systems, Saab and Thales.

"We want to be part of the global supply chain," says Kaura. "When you look at the global supply chain, the volumes are on the civilian side, and the competencies we are developing on the military side are applicable to the civilian side as well," he says. "In India, military offsets can now be applied to commercial deals as well. This is another driver pushing us to look at the commercial space seriously."

Kaura's company is a unit of the Samtel Group, which was founded by his father 40 years ago. A major business for the group was producing tubes for televisions, which led to a certain expertise in displays. The overall group employs about 6,000 workers.

Samtel Avionics & Defence Systems employs about 200-250 people, with staff

INFRASTRUCTURE

Connecting the dots

India is pouring money into its airports, particularly those serving smaller cities, in a bid to foster further economic growth

GREG WALDRON NEW DELHI

Terminal 3 of New Delhi's Indira Gandhi International airport is a potent symbol of India's airport infrastructure ambitions. Opened in July 2010, Terminal 3 has the capacity to handle 34 million passengers annually and is equipped with 78 air bridges, three of which can handle the Airbus A380. Clearing customs is relatively straightforward – the real hassle in going to India is obtaining a visa – and the baggage claim area is bright and tastefully decorated.

New Delhi is not alone. The Bengaluru terminal that will greet visitors to this year's Aero India show is modern, with renovations under way to boost capacity. The airport handled 12.6 million passengers and more than 240,000t of cargo in 2012. The facility's operator, GVK Airport Holdings, plans to build another runway and another terminal that can handle 20 million passengers.

While impressive, airports such as New Delhi and Bengaluru are the exception, and the government believes that to foster further economic growth, the country needs to focus on the development of airports, particularly those serving small- and medium-sized cities.

INADEQUATE FACILITIES

"There is an urgent need to upgrade and modernise India's airports by addressing the problems of outdated infrastructure, inadequate ground handling and night landing facilities, and poor passenger amenities," said a report issued in 2012 by a high-level task force formed to look at funding issues involved in developing airport infrastructure. "At the same time it is also necessary to operationalise non-functional airports and develop new airports to open up the hinterland."

The challenge is daunting, says Airports Authority of India (AAI) chairman VP Agrawal. Speaking to *Flight International* at his office at New Delhi's Safdarjung airport – a largely decrepit facility where few aircraft movements occur – Agrawal estimates India has about 456 airports, of which AAI is responsible for about 125. The rest are overseen by state governments, and many are unsuitable for commercial air traffic. Agrawal says India aims to have 250 operational airports by 2030.



Lockheed Martin

numbers growing by 40% annually. Samtel is but one example of a major Indian industrial firm building its presence in the aerospace sector, which for decades, has been monopolised by government-owned Hindustan Aeronautics Ltd (HAL). Indian household names such as Tata Sons, Mahindra & Mahindra, Reliance and Larsen & Toubro are steadily building their aerospace businesses.

Tata Sons' aerospace unit, Tata Advanced Systems Ltd (TASL), was established in 2009. "A prime area of focus for TASL has been in partnering with global OEMs in developing and delivering strategic aerostructures and aerospace programmes, including design, engineering, manufacturing, assembly and final assembly operations," says TASL.

Only three years after its birth, TASL has 600,000ft² (55,700m²) of production space in Hyderabad and employs over 1,000 aerospace workers. The two main programmes that it participates in are the Sikorsky S-92 civilian helicopter and the Lockheed Martin C-130J tactical transport.

ADVANCED COMPONENTS

The company assembles the fuselage for the S-92. The factory commenced production in March 2010 and produces two cabins monthly. It has delivered 17 cabins, with the first installed in a helicopter that is now in operation with a customer. In March 2012, another Tata facility was opened to manufacture advanced components for Sikorsky helicopters. TASL produces the empennage and centre wing box for C-130J aircraft destined for export customers. The Indian air force operates six C-130Js and is likely to obtain six more.

Founded in 2007, the aerospace unit of conglomerate Mahindra & Mahindra produces components that make their way into several aircraft types including the Boeing 737, Gulfstream G150, and even the F-35 Lightning

II. Mahindra's most high profile foray into aerospace, however, was its acquisition of a majority stake in Australian company GippsAero (formerly Gippsland Aeronautics) in 2009. The GippsAero deal gave Mahindra instant access to the general aviation market through aircraft such as the GA8 Airvan light

In India, military offsets can now be applied to commercial deals as well"

PUNEET KAURA

Executive director, Samtel Avionics & Defence Systems

transport and GA200 Fatman agricultural aircraft. The company is in the process of developing the GA10, a variant of the GA8 that made its first flight in May 2012, and is planning a large, twin-turboprop GA18, which it hopes to bring to market in 2015.

In 2012, Reliance formed an aerospace joint venture with France's Dassault. Although Reliance's aerospace presence is negligible now, industry sources say it is eager to win work on the medium multi-role combat aircraft programme, which has New Delhi in consultations for Dassault's Rafale fighter. Larsen & Toubro, for its part, is focusing primarily on manufacturing components and subassemblies for rockets and satellites.

"Generally, India wants to get the private sector more involved in aerospace," says an industry executive. "India lacks the structure you find in the West, where there are well-established integrators at the top of the chain, and below them an established group of tier-one and -two suppliers to feed that integration. You don't have this in India in all, because HAL has dominated this space for so long. Therefore, the potential for growth in India's aerospace sector is very high." ■



AIRLINES

Flying circus

Kingfisher's near-farcical travails are indicative of the hard times that have brought suffering to a host of Indian start-up carriers

ELLIS TAYLOR SINGAPORE

India's Kingfisher Airlines could be compared to another famous bird – the Norwegian Blue in Monty Python's parrot sketch. The airline's chairman, liquor baron Vijay Mallya, says the airline has been merely resting since it was grounded in October last year. Mallya insists the carrier has a plan to be recapitalised and return to the air soon, albeit at a much smaller scale. This is not an ex-parrot, he insists.

Playing the role of unhappy customer John Cleese are the airline's staff – many have not been paid for nearly eight months and face an uncertain future at best. Most recently, they have threatened court action to force the company to be wound down unless Mallya can show Kingfisher has a plan to revive the airline. Caught in the middle are a number of lessors and financiers, who are having trouble repossessing Kingfisher's fleet, and Airbus, which still holds orders for 92 aircraft from the airline.

Kingfisher is the latest in a number of Indian carriers to run into trouble by expanding too fast, leading to a bloodbath on the major trunk routes and the closure or merger of a number of airlines since the 2000s.

Harsh Vardhan, chairman of Starair Consulting, says those days were the "enthusiasts' introduction to the aviation market".

INITIAL FLOOD

Airbus India president Dr Kiran Rao agrees: "What we had in the mid-2000s, where we had a flood of start-ups, I don't think we will see those again."

However, the loss of a number of start-ups and the grounding of Kingfisher has helped the remaining carriers – notably Jet Airways, SpiceJet, IndiGo and GoAir – to become more sustainable. As Kingfisher wound down its capacity prior to its grounding, other carriers have been able to raise their fares to a more sustainable level.

Low-cost carrier IndiGo's chief financial officer Riyaz Peermohamed says the absence of Kingfisher and subsequent air-fare rises helped some carriers towards record operating profits during the second quarter of 2012, while others reduced their losses, a positive

Indira Gandhi International airport has been a focus of the investment drive

» During India's 12th economic period – 2012 to 2017 – the task force projects domestic passenger throughput will grow by 12% a year to 209 million in 2017, compared with 122 million in 2011. International traffic will also continue to boom, rising 8% a year to 60 million in 2017, compared with 41 million in 2012. Domestic cargo will grow by 12% a year to reach 1.7 million metric tonnes per annum (MMTPA) in 2017, while international cargo will grow by 10% a year to 2.7 MMTPA in 2017.

Although New Delhi's main focus will be on the hinterland, it will still invest substantial sums in four key "metro" airports: New Delhi, Mumbai, Bengaluru and Hyderabad. Between 2006 and 2011, a total of Rs232 billion (\$4.3 billion) was invested in these four airports. From 2012 to 2017, the task force projects Rs180 billion will be invested in these four, with Rs111 billion going to the new Navi Mumbai airport alone. Investment will

come from the government and private-sector players, through "public private partnerships". PPPs are also likely to play a major role in the development of greenfield airports such as Goa, Kannur, Chandigarh, Kota and Agra. The total projected investment in these projects from 2012 to 2017 is Rs225 billion.

"It is necessary to operationalise non-functional airports and develop new airports to open up the hinterland"

HIGH-LEVEL TASK FORCE 2012 REPORT

The government has set aside substantial funds for its share of airport development. In October, Indian civil aviation minister Ajit Singh said the government had allocated Rs241 billion to its 12th five-year plan – which began on 1 April last year – for the development of airports in the country.

In a country where major highways are rare and rickety trains still form the backbone of the domestic transport sector, efficient new airports will be key to unlocking the economic potential of India's vast hinterland. New Delhi is increasingly adept at developing and managing airports through PPPs, and this is bound to transform air travel in the subcontinent. ■

FORECAST PPP INVESTMENT IN SIX PLANNED AIRPORTS

City	Investment (Rs)
Navi Mumbai	150 billion
Goa	40 billion
Kannur	10 billion
Chandigarh	15 billion
Kota	5 billion
Agra	5 billion

SOURCE: Indian government

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» sign for an industry that has been awash in red ink for many years.

Increasingly, there is a sense that India's airlines are becoming more intelligent and are growing into their markets rather than trying hard to stimulate them.

Vardhan says the market is "more mature" than it was five years ago, "so any growth that takes place now is organic growth".

A major light on the hill is a recent change in government policy on foreign direct investment (FDI), which will allow foreign carriers to buy up to a 49% stake in domestic airlines.

SIGNIFICANT STAKE

Vardhan says this will take two to three years to make an impact but there has already been movement, with Etihad Airways tipped to take a significant stake in Jet Airways. In January, Jet confirmed it had been having discussions with Etihad, with an announcement expected soon.

There is also a strong belief among aircraft manufacturers and some analysts that the new policy on FDI will lead to the emergence of new carriers backed by foreign airlines.

The exception to the recent good news is state-owned Air India, which remains in the red. The government recently said it expects the flag carrier's losses to reach Rs4 billion

(\$74 million) per month. A previous bailout plan from the government had called for the airline to show positive earnings by the end of 2012.

"Any growth [in the Indian airlines market] now is organic growth"

HARSH VARDHAN

Chairman, Starair Consulting

The carrier has been trying to sell five Boeing 777-200LRs for some time, but to no avail. Sales of other assets, such as properties, have also been held up, while plans to spin off its ground handling and maintenance units have so far failed to bear fruit. Nevertheless, the Indian government has committed to supporting the flag carrier and looks likely to continue to bail it out, something which riles privately owned airlines.

As with airlines elsewhere around the globe, the high price of fuel has been another challenge, alongside the high level of taxes placed on it.

Antiquated regulations, such as those which limit international flying to those airlines with five years' experience and a mini-

mum fleet of 20 aircraft, have also proven to be a challenge for some carriers.

Airbus and Boeing both believe India will become the second-largest aircraft market by 2031, driven by strong GDP growth and an upwardly mobile population demanding more air travel.

Vardhan believes the market will be able to sustain a 10-15% growth rate during the next 10 years, with Airbus and Boeing projections following a similar trend.

Most of that growth will be catered for by the existing carriers which, collectively, have more than 500 aircraft on order. The majority of those are A320s and 737s, highlighting how the domestic market continues to be dominated by narrowbodies. However, Air India and Jet Airways are also set to take delivery of a number of widebody aircraft to grow their international services.

Boeing and Airbus both expect the vast majority of sales during the next 20 years to continue to be narrowbodies for the domestic market. Significantly, IndiGo and GoAir will be among the earliest operators of the A320neo, with orders for 150 and 72 respectively.

Rao thinks Air India may choose the Neo to replace its sizable fleet of A320-family aircraft in the future, and also says the manufacturer will pitch the aircraft to Boeing operators »



Alamy Images

Financially troubled, state-owned Air India has been trying to sell off various assets amid eye-watering losses

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Boeing

Jet Airways will take delivery of its 10 787-8s in 2014 and 2015

» Jet Airways and SpiceJet. "It's quite understandable that with the high fuel prices and the Indian taxes, the Neo really works in India," he says.

Not surprisingly, Boeing is confident Jet Airways and SpiceJet will look to order the 737 Max to replace their 737NGs, possibly later this year. It also expects Air India Express to order the Max to replace its 737-800s.

CSERIES OPPORTUNITIES

Although the market has focused on the 150-200 seat segment, Bombardier believes the smaller CSeries could present new opportunities for Indian carriers in the medium term. It is keen to secure an Indian customer for the CSeries. While the CSeries is smaller than the current mainstays of the Indian fleet, Torbjorn Karlsson, Bombardier vice-president Asia-Pacific sales, believes it could present new opportunities for Indian carriers: "We're always having conversations with customers in India, but we really need to see a number of strategic things play out first."

He adds that the changes to FDI regulations will reshape the current landscape in India, creating new roles for the 110- to 140-seat aircraft that have not been exploited before.

On the other end of the scale, Rao believes more carriers will look to upgrade to larger narrowbodies to take advantage of the lower operating costs and deal with increasingly slot-constrained airports.

IndiGo has already indicated it may convert some of its outstanding A320 orders to the A321 to meet higher demand on certain

routes. "Airports like Mumbai, Pune and Goa are some of those where we could deploy these larger aircraft. There is a lot of demand on these routes and we should be able to fill up an A321 if we use them on these services," says Peermohamed.

But few believe the growth will require airlines to deploy more widebodies on domestic services. With most flights being less than three hours, Rao and Vardhan say widebodies are not viable on most services.

"There isn't enough traffic to use a widebody permanently on domestic [routes]"

DR KIRAN RAO

President, Airbus India

"The difficulty today is that there isn't enough traffic to use a widebody permanently on domestic – but on a mix of domestic and regional there probably is," says Rao.

Both Airbus and Boeing are confident about their prospects for selling new widebodies to Indian carriers in the future. Air India has taken delivery of six 787-8s and has a further 21 on order as well as three more 777-300ERs, while Jet Airways will take delivery of its 10 787-8s in 2014 and 2015. Air India has started to deploy its 787s on services to Frankfurt, Dubai and Paris, as well as some domestic services.

Jet Airways is also taking delivery of new A330-300s, which are replacing its smaller -200s on services to Europe. Kingfisher also

operated the A330 and is the only carrier in the country to have ordered the A350, although few believe it will ultimately take delivery of the aircraft.

In December, Boeing's then senior vice-president of Asia-Pacific and India sales Dinesh Keskar said the 787 had "barely scratched the surface" in India. Keskar believes widebodies will become the main choice as the international market grows, and fragmentation of these routes will mean no market for larger aircraft, such as the 747-8 Intercontinental and A380. "Smaller aircraft like the 777 and 787 make more sense in such a market," he says, while admitting that with so many aircraft still to be delivered, he does not expect to see a widebody order this year.

SUSPENDED FINANCING

Across the board, new orders may have to wait until the airlines can show that their finances are in order, particularly as lessors and financiers have been burned by the Kingfisher experience. DVB Bank, in particular, has suspended financing aircraft for Indian carriers after India's Directorate General of Civil Aviation refused to de-register two A320s it had repossessed from the carrier in 2012.

Nevertheless, Rao says that from Airbus's perspective, the established carriers have generally been able to finance their existing orders without much trouble.

Although much of the boom in India's air travel market has been along trunk routes between major cities, many believe there will be a greater push into regional markets in the coming years. The government has been encouraging growth of the regional market. Some airports, particularly in the north of the country, have cut landing fees for turboprops, and there are also concessions on fuel taxes for the aircraft, which have encouraged larger carriers to add turboprops to their fleets.

ATR has been a major beneficiary of the growth of regional routes. Jet Airways operates a large number of ATR 72s and Kingfisher also operated a large fleet of the type prior to its grounding. Air India subsidiary Alliance Air also operates seven ATR 42s.

TURBOPROP PROSPECTS

Bombardier has also had some success with the Dash 8-Q400, although SpiceJet is the only operator so far with 15, plus options on a further 15. Karlsson believes the Q400 has good prospects: "The market has stagnated a bit recently, but as more carriers look to differentiate themselves they will find the speed and cabin comfort of the Q400 will be attractive."

He predicts another wave of turboprop orders in the near future, as carriers look to expand their networks to the smaller cities and towns which are incapable of sustaining narrowbody operations.

Vardhan agrees the market can support many more regional aircraft: "If you look at it, the regional market alone requires at least 100 aircraft today. Imagine what it will be tomorrow."

As turboprop operations have grown significantly, regional jets are almost non-existent in India. Alliance Air is the only

"The regional market alone requires at least 100 aircraft today. Imagine what it will be tomorrow"

HARSH VARDHAN

Chairman, Starair Consulting

carrier to fly smaller jets, operating three CRJ700s. In 2009, Embraer received an order for five Embraer 170s from proposed start-up Star Aviation, and while the order still stands it is unclear when the airline is likely to take delivery of the aircraft, if ever.

Even as the industry matures and carriers look for new opportunities, Rao believes there will be no demand for regional jets as long,

thin routes do not exist. "There is no value in connecting a very small city in the south of India to a very small city in the north of India, there simply wouldn't be the traffic," he says. "If you are just flying an hour, the speed of a jet makes no difference."

Boeing supports that view, and only sees demand for 15 regional jets in the country during the next 20 years.

Vardhan, however, is more optimistic and predicts a market for about 50 regional jets. He believes that as the main trunk routes reach saturation point in the coming years, new regional carriers will emerge to open up new city pairs.

Karlsson also sees a role for regional jets to open up thinner international services to the wider subcontinent and western China: "There is an opportunity for the CRJ from a broader perspective, particularly on routes around the subcontinent. If you are flying 600-700nm [1,110-1,300km], you are going to need a regional jet."

With the potential to develop new regional routes, India's National Aerospace Laboratories (NAL) has been working for a number of years to develop a 70-90 seat regional aircraft



AT Team Images

Kingfisher's woes have led to fare rises

under the regional transport aircraft (RTA) programme. However, NAL has yet to formally launch the RTA programme and is grappling with difficulties in funding the aircraft's development.

It also lacks definition, as NAL has yet to decide whether to use jet or turboprop power for the aircraft, although it recently said it was leaning towards a turboprop.

INDIGENOUS OPTIONS

There are also doubts the aircraft will actually gain any sales, although Air India could be pressured to take it, particularly if the government remains its dominant shareholder. No other carriers have expressed an interest in an indigenous regional aircraft.

However, after years of turbulence, there is growing confidence that India's aviation industry is now well placed to sustainably manage market growth.

In the short term, most of that is expected to be absorbed by the deliveries of new aircraft, but longer term it is expected that new carriers will emerge, including some backed by foreign carriers. "Any new entrants will be well funded and well established by the FDI route," says Rao.

That is likely to drive the major airlines to open up new services internationally and also to regional destinations, creating new opportunities for regional aircraft manufacturers.

"Indian aviation is now coming of age," says Vardhan. "I think we are going into a more stable growth environment in the next six months or a year from now." ■

INDIAN AIRLINE FLEETS

Carrier	Type	In service	Stored	On order	Next five years' deliveries (est)
Air India	A319	23	1		
	A320	24			
	A321	20			
	A330	2			
	747	5			
	777	23		3	3
	787	6		21	21
Alliance Air	737 (NG)*	21			
	ATR 42	7			
GoAir	CRJ700	3	1		
	A320	13		79	23
IndiGo	A320	61		208	87
Jet Airways	737 (NG)**	74		44	44
	777	5			
	787			10	10
	A330	13		7	7
	ATR 72	17	1	4	4
	A319		1		
	A320		9	67	37
Kingfisher Airlines	A321		6		
	A330			15	
	A350			5	
	A380			5	
	ATR 42		2		
	ATR 72		14		
	Total	368	35	506	262
SpiceJet	737 (NG)	36		33	26
Star Aviation	Dash 8	15			
	170			5	

NOTES: *Operated by Air India Express **Includes JetKonnect. Table excludes airlines operating sub-30-seaters. SOURCE: Ascend

SPACEFLIGHT

Mission to Mars

Intent on sending a probe to the red planet, India's space agency will pursue partnerships with industry to sharpen capabilities

RADHAKRISHNA RAO BENGALURU

In the aftermath of the successful accomplishment of India's 100th space mission on 9 September 2012 – the four-stage Indian space workhorse Polar Satellite Launch Vehicle (PSLV) orbiting the 712kg (1,560lb) French remote sensing satellite Spot-6 along with a 15kg Japanese Proteres probe as a piggyback payload on commercial terms – Indian Space Research Organisation (ISRO) chairman K Radhakrishnan stated that India was not in a race with China. Perhaps he was reacting to the perception that India was trying to score a point over China by announcing the launch of the Indian Mars mission in November 2013, after the Chinese Mars probe Yinghuo-1 formed a part of the doomed Russian Phobos-Grunt mission launched in November 2011.

India's prime minister Manmohan Singh, during his independence day address to the nation on 15 August 2012, made a formal announcement on the Mars probe, which would make India the sixth country in the world to send a mission to the red planet. The Mars mission will focus on life, climate, geology, origin, evolution and the sustainability of life forms.

According to Professor UR Rao, a former ISRO chief, Mangalyaan – as the Indian Mars probe would be known – is the next logical step after India's first lunar mission, Chandrayaan-1, was launched in 2008. ISRO considers the Rs4.5 billion (\$82 million) Indian Mars probe a major technology build-up exercise for accelerating India's forays into deep space. After the Mars mission, ISRO plans to send probes to Venus and the asteroid belt.

Chandrayaan-2 – a follow up to Chandrayaan-1 – is another high profile probe that ISRO is lining up for launch by the middle of this decade. Featuring an Indian orbiter and rover along with a Russian lander, Chandrayaan-2 is designed to collect samples of lunar soil and conduct in-situ studies of chemical and mineralogical contents of the lunar soil.

However, India's proposed human spaceflight programme – in focus for more than five years now – has failed to gather momentum in the context of New Delhi dithering on giving a final nod to this "challenging space project". Of course, a sum of Rs1.5 billion has been



India launched its 100th space mission in September

sanctioned for the pre-project studies aimed at identifying the critical technologies for the manned spaceflight. "A human spaceflight is a complex mission requiring a host of things such as a heavy rocket, re-entry vehicle, space capsule, space suit, environmental control, life-support system and an escape system for the crew... As of now, we don't have a programme to launch a human spaceflight over the next five years," says Radhakrishnan.

Incidentally, the original philosophy with which the Indian space programme took off way back in 1963 stressed the societal applications of space exploration to the exclusion of planetary probes and human missions. Clearly, the emphasis was on self-reliance. Fighting against heavy odds, India had to initiate its space programme virtually from scratch.

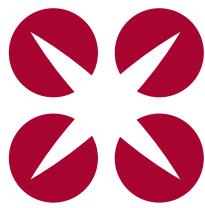
INDUSTRIAL PARTICIPATION

To give a push to the Indian space programme, ISRO plans to throw open more areas for industrial participation. This would enable ISRO to focus more on research and development in cutting-edge, futuristic technologies. In partic-

ular, ISRO is exploring the possibility of Indian industry supplying a range of satellites and launch vehicles in a ready-to-use condition. "There are 20 big companies in the EADS consortium and in the USA, NASA has a number of large private companies connected to space research, working along with it. This has led them to achieve big-time success. We can also achieve this in India with active participation of the industry, at least to a smaller extent," says Radhakrishnan.

Currently, about 500 Indian industrial units are contributing to the Indian space programme, with about 60% of the Indian space budget flowing to Indian industry. Sometime back, ISRO had proposed a 250 acre (101ha) space park near the national launch complex in Sriharikota island on India's eastern coast. This park was meant to enable industries to build and deliver satellites and launch vehicles directly to the spaceport.

ISRO plans to ramp up its infrastructure, in support of its plan to launch about 58 satellites designed for communications, remote sensing and scientific research during the next



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» five years. A new, ultra-modern space research complex is being set up as part of the upcoming Science City near Chitradurga in the state of Karnataka and will be geared to handle some of the futuristic Indian space projects. This complex is expected to take care of areas such as planetary exploration, space habitat and astrobiology.

To meet the growing demand for satellite transponder capability, ISRO is building higher power and higher frequency communications satellites. In conformity with this approach, a 5,000kg multi-beam GSAT-11 satellite with 40 transponders – in both Ka and Ku bands – is scheduled to be launched in 2014. The Indian National Satellite (INSAT) constellation, of which the GSAT series constitutes an integral part, is today the largest domestic communications spacecraft system in the Asia-Pacific region.

Similarly, India's Earth observation programme will focus on developing a hyperspectral imaging system and providing high-resolution data to the user community. The advanced high-resolution satellite, Cartosat-3 – now under development, with its spatial resolution of 0.25m (10in) in panchromatic mode and 1m in multispectral mode – will enhance India's high-resolution mapping capabilities.

India is also developing a high-performance geo-imaging satellite, GISAT. This 1t-class satellite will provide images of areas of interest on a real-time basis and, as such, would be

While looking heavenwards, ISRO is very clear about being down to Earth"

K RADHAKRISHNAN

Chairman, Indian Space Research Organisation

ideal for surveillance. According to ISRO, the Indian Remote Sensing (IRS) spacecraft system is one of the largest constellations of Earth observation satellites in the world.

In a move aimed at freeing India from its dependence on the USA's GPS system, ISRO is planning an independent regional navigation satellite constellation, IRNSS, designed to provide a position accuracy of better than 10m over India and the region extending up to 1,500km around India. The first of the seven satellites constituting the space segment of IRNSS will be launched during 2013.

Meanwhile, India's GPS augmented satellite-based civilian air traffic navigation system, GPS Aided Geo Augmented Navigation (GAGAN), will become operational by mid-2013. According to the Airports Authority of India, which is developing GAGAN in association with ISRO, a GAGAN-supported GPS device will allow far more accurate air traffic figures. AAI says GAGAN will be interoperable



India and Pakistan, as seen by NASA

with other global air traffic control systems. ISRO's continued dependence on PSLV – the only Indian operational launch vehicle that can put a satellite of up to 1,850kg into polar orbit – and the solitary launch complex in the Sriharikota island could be a handicap in terms of realising some of the futuristic space missions and expanding India's footprint in the global market for launching satellites. Of course, ISRO is looking for a suitable location to develop India's second launch complex.

Indeed, the failure of ISRO to master the complexities of cryogenic propulsion implies there will be impediments ahead in making operational the GSLV MkII – capable of placing a 2.5t-class satellite into a geosynchronous transfer orbit – and GSLV MkIII (4t). The failure of two GSLV missions in 2010 – one with an Indian-made upper cryogenic engine stage and the other with a Russian one – was a setback for ISRO. Meanwhile, ISRO sources say the flight of GSLV MkII, with a cryogenic engine stage modified in light of the 2010 mission failure, will take place in 2013.

ISRO is also working on the development of a 2,000kN (450,000lb-thrust) semi-cryogenic engine for the future heavy-lift Unified Launch Vehicle and Reusable Launch Vehicle (RLV). ISRO has also initiated work on developing a reusable space transportation system that would reduce the cost of access to space.

To this end, a series of technology-demonstration missions have been planned. And for this purpose, a winged Reusable Launch Vehicle-Technology Demonstrator (RLV-TD) has been configured. The RLV-TD will act as a flying testbed to evaluate various technological elements including hypersonic flight, autonomous landing, powered cruise flight and hypersonic flight using air-breathing propulsion.

By falling back on the capabilities of PSLV, India has been able to make modest forays

into the global market for launching satellites. The PSLV flight, slated for the first quarter of 2013, will launch five small satellites of foreign customers as piggyback payloads. The primary payload of this mission would be the Indo-French research satellite SARAL, designed to study ocean parameters. Among the piggyback payloads of the overseas customers is the 148kg Canadian surveillance satellite Sapphire. The other paid-for probes to be flown on this PSLV launch are: NEOSSAT, another Canadian surveillance satellite, weighing 82kg; BRITE and UniBRITE, each weighing 14kg, from Austria; and the 3kg AAUSAT, from Denmark's Aalborg University.

Antrix, the commercial arm of the Indian space programme, expects its revenue to surge by 20% annually over the next five years on the back of the expanding launch services. It points out that the high reliability and multiple launch capability of PSLV has made it an ideal platform for launching small satellite payloads. PSLV has so far launched 29 satellites of international customers on commercial terms. In the area of satellite technology, Antrix, through its tie-up with EADS Astrium, has delivered to customers the high-performance W2M and Hylas satellites.

TELEMEDICINE NETWORK

Application of space technology for socio-economic development continues to be the hallmark of the Indian space programme. Today, the telemedicine network of ISRO, which is based on the INSAT system capability, connects 382 hospitals. In this network, 60 super-specialised hospitals are linked to 306 rural and remote hospitals and 16 mobile telemedicine units to provide high-quality healthcare to a segment of the Indian rural population.

Similarly, about 500 Village Resources Centres have been set up, forming an agency that makes available the services offered by INSAT and IRS constellations – providing information on natural resources, land and water resources management, telemedicine, tele-education, adult education, vocational training, health and family welfare programmes.

ISRO is also working on two high-profile scientific missions for a launch before the middle of this decade. Astrosat – the first dedicated Indian astronomy satellite for multi-wavelength observation of celestial bodies, cosmic sources in X-ray, visible and UV spectral bands simultaneously – is expected to be orbited in 2013. Meanwhile, Indian solar research satellite Aditya, which is meant to study the outermost coronal region of the Sun, is scheduled to be launched before the middle of this decade.

Summing up the spirit of the Indian space programme, Radhakrishnan observes that "while looking heavenwards, ISRO is very clear about being down to Earth". ■

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Choose carefully

There seems to be surprise regarding the overheating battery problem on 787s. Lithium-polymer and lithium-ion units have a history of overheating when confronted by discharge rates which are excessive and charging regimes which may differ only slightly from normal through very minor electrical faults in their management systems.

I am surprised Boeing risked using Li-Po or Li-Ion cells in such a precarious location because of their inherent instability if faults occur. When aeromodellers first started using lithium, the cell quirks did not go unreported.

One pundit advised that when charging overnight, do not leave them in your workshop but place them on a concrete floor and on a large sheet of metal to dissipate heat if they caught fire. Specialised charging units must be used which monitor status throughout.

These cells are also used in phones and laptops but have only a relatively small current capacity. Even so, a great amount of heat can still be generated by them and this is why aviation authorities apply strict rules about the type of batteries and how many can be brought on to an aircraft by passengers.

A couple of cargo aircraft have already met their demise through battery fires, undoubtedly lithium, which started in crated products. This points to another problem with lithium cells: if one cell in a crate overheats it will create a chain reac-

AIRPORTS

Bring back Sheffield City

David Goodwin's frustration at the imminent closure of Filton (*Flight International*, 15-21 January) is understandable. Compared with Bristol's "main" airport, Filton is closer to the city centre and has much better access to the M5. Filton's runway is also longer.

Perhaps Mr Goodwin might be encouraged to learn that Sheffield business groups are now showing new interest in Sheffield City airport. Regional airline traffic has grown enormously since Sheffield City closed, but no business services have been available from Doncaster's Robin Hood airport for some time. A rejuvenated Sheffield City airport is now being seen by many as the ideal way to improve transport links between this large city and important centres in the UK and on the continent.

Mr Goodwin might like to consider starting an online petition to gather support. Sheffield City airport's petition could offer a starting point. I am sure he will find plenty of support.

Michael Wood

Seaford, UK



Not-so-distant dreams

tion with its companions and an extremely hot meltdown ensues.

The battery-powered light aircraft under development at the moment are required to have a very substantial metal enclosure for the power supply, but I would predict that a full-on meltdown with batteries of the capacity being used would make short work of most metals.

The battery unit in the 787 is not physically large, but the designers' thinking is that the lithium pack is much lighter than other rechargeable packs. Well, I do not think that saving a few kilos in weight by not using other, well-tried and reliable high-current capacity units was worth all of the problems which Boeing are now confronted with.

As they say, "other battery types are available"!

Dave Hayfield

Via email

Finding the middle ground

From the many reports and comments since the AF447 tragedy we know that we will be safer. But who will be first to offer an autopilot system that acts like a responsible adult and rejects the temptation to instantly cut out when it can't make total sense of its sensor inputs while in established cruise?

Such a device should put out an immediate crew alert while doing its best to maintain straight and level flight for a few minutes, using derived and secondary sensor information, including GPS readings. As soon as the crew are back ready to take over, having briefly seen what the autopilot says it is having trouble with, gathered their thoughts and agreed between themselves what to do, the autopilot can be re-

lieved of its duties until such time as all is in order.

There are parallels in other electronic control systems where a safe "get to a service" mode is reverted to in circumstances when sensor inputs are lost, albeit at reduced performance. Flight is more challenging, but a safe interim mode is needed in cruise and should be feasible.

Chris Price
Leicestershire, UK

Optional inclusion

A question about the World Air Forces directory (*Flight International*, 11-17 December): why are unmanned aircraft not included in the various national inventories of aircraft? They are steadily growing in prominence in operational and regulatory decision-making, and they are inarguably "aircraft".

Tom Farrier
Chair, International Society of Air Safety Investigators (ISASI)
Unmanned Aircraft Systems (UAS) Working Group

Atlas at last

I rather doubt if Boeing's X-37B was launched on a Saturn V (*Flight International*, 18 December-7 January) but I would have loved to have watched if it was.

Toby Gursansky
Sydney, Australia

Editor's note: Apologies. The X-37B was, of course, carried into orbit on board a United Launch Alliance Atlas V (below).



For more on the Atlas V rocket, see our dedicated news page at flightglobal.com/atlasv

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

Citywings it over lookalike logo

While American Airlines is deflecting brickbats over its new stars and stripes colour scheme, the lesser-known Isle of Man regional carrier Citywing has been sidestepping its own livery quagmire.

Citywing emerged after management bought out Manx2. But its new bird logo, based on the Manx shearwater (Puffinus puffinus), bore an uncanny resemblance to that of Ecuadorian carrier TAME, whose chief was not best pleased when we mentioned it to him.



New, previous and TAME logos

Faced with the possibility of being engulfed by, er, "Shearwatergate", Citywing hastily acknowledged the similarities and said it would make a few adjustments to distinguish its insignia.

The result is that there's a markedly different bird flying on Citywing's Let L-410s.

Can't be certain which species inspired TAME but any ornithologist will tell you that Ecuador has its own shearwater (Puffinus subalaris) on the Galapagos Islands.

Dream one-liners

It's no laughing matter for Boeing or its customers, but the Dreamliner's grounding because of dodgy electrics is... er... sparking its share of humour.

Such as the news presenter, who might have wished he



Giving a new meaning to Gulf capitals

could do a second take, after declaring the "787 programme is up in the air right now".

Or, what do you call passengers scared to fly in the Dreamliner? Battery chickens.

One colleague remarked of the revolutionary transport: "Just be grateful they didn't call it the Firebird."

And there is speculation the NTSB may compel Boeing to replace the battery's aircraft

Big name in Gulf

Qatar's new hub at Doha is the latest project to bear the name of Hamad bin Khalifa al-Thani, emir of the Gulf state, but even this \$15 billion bit of Arabian aggrandisement falls short of the egomania demonstrated by another local Hamad.

Because over the water from Hamad International airport, 300km east, lies the island of Al Futaisi, an unremarkable feature of Abu Dhabi geography were it

not for the eccentric Hamad bin Hamdan al-Nahyan. Hamad has contributed to the beautification of the desert landscape by carving his name in block capitals (*above*), 2km long and 500m tall, in a sort of Arial Narrow font version of the Nazca lines.

It's possible, of course, he'll dig a colossal arrow pointing west towards the new airport, in a supersized version of the one painted on a London gasometer to stop Heathrow-bound pilots landing at Northolt.

But given that the car-crazy Hamad also built a Jeep the size of a house, don't hold out for any intervention by logic.

Chop the pilot

Lennart Rooth sends in this snap from Stockholm Arlanda airport. "For a long time people in the industry have said that one day we will have pilotless aircraft," he writes. "Has that day arrived?"



Great idea. But will it fly?

Catchy 'pigeon'

The word "taube", which in German literally means

"pigeon" and was originally used to indicate the Rumpler, or

German-built Etrich machine, has come into general use in Germany to indicate a war aeroplane in the same way that the word "avion" has been adopted in France.

Rate of descent

The utility of a rate-of-descent indicator is obvious. There is a

limit to the blow which even the

very best undercarriage will

take without damage. A rate-of-descent metre will give the necessary information with a reasonable degree of accuracy and may thus save expensive damage.

Gemini contract

Fairchild Stratos has been awarded sub-contracts by

McDonnell Aircraft for the design and manufacture of specialised

ground refrigeration equipment for the Gemini two-man spacecraft to cool its electronic equipment and environmental system coolant loop during pre-launch tests.

FedEx Caravan buy

Federal Express has confirmed orders for the 90 stretched

Cessna Caravan I aircraft on which it holds options.

Deliveries will begin in May at a rate of four per month. The purchase makes FedEx's Caravan I fleet the world's largest operation of a non-Soviet type.



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loyalty-conference.com

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4 March

SpeedNews 3rd Annual Aerospace Raw Materials & Manufacturers Supply Chain Conference
Beverly Wilshire, California
speednews.com/conferences

4-6 March

SpeedNews 27th Annual Commercial Aviation Industry Suppliers Conference
Beverly Wilshire, California

26-30 March

Langkawi International Maritime & Aerospace Exhibition
Langkawi, Malaysia
hw5@hwlima.org
lima.com.my

9-10 April

SpeedNews Aerospace Manufacturing Conference
Charleston Place Hotel, South Carolina

29 April to 1 May

African Aviation Training Conference & Exhibition
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africanaviation.com

21-23 May

EBACE: European Business Aviation Convention & Exhibition
Palexpo, Geneva, Switzerland
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ebace.aero

27-29 May

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26-28 June

Air Finance for Africa Conference & Exhibition
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africanaviation.com



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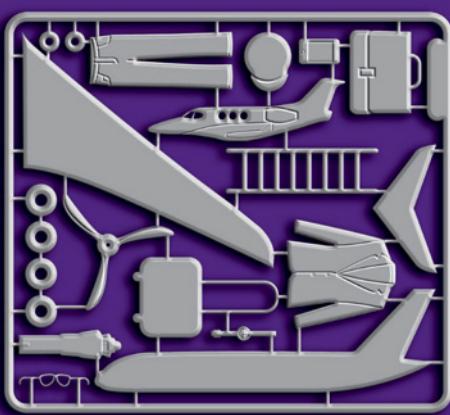
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Business Development Executive FlightGlobal Ascend – Japan

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- Effective presentation and communication in English and Japanese is essential
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- Experience selling business information to banks and financial institutions, and/or with aviation knowledge preferred
- Demonstrated record of building extremely strong client relationships
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WORK EXPERIENCE JOEL HIRST

Fuelling the success of FBOs

After beginning his aviation career washing aircraft for his university's flight school, Avfuel vice-president of sales Joel Hirst now sells his firm's fuelling solutions to FBOs throughout the eastern half of North America

Did you always want a career in aviation?

I was always curious about aircraft but only became interested in aviation as a career in my first year of college. I attended Western Michigan University, the only public university in Michigan offering a comprehensive aviation programme. I chose to go into aviation technology and management and was awarded a bachelor's degree. The university is in Kalamazoo and I did all my flight training at Kalamazoo/Battle Creek International airport (AZO). The fixed-base operation (FBO) at the airport at the time was Kal-Aero, but today it is owned and operated by Duncan Aviation – an Avfuel-branded FBO.

What was your first aviation job?

My first aviation-related job was washing, fuelling and hangaring Western's flight-school aircraft at AZO. I went on to become a line service technician at AZO and Muskegon County airport. These positions introduced me to the concept of FBO and how it operates on a daily basis – experience I draw on when working with FBOs and assisting with the development of new products and services to assist Avfuel's FBO customers.

Where else have you worked?

Rather than continuing to work on the field at airports, I became an aviation insurance agent for National Aviation Underwriters/AVEMCO Insurance, and eventually for Avsurance, which at the time was a newly-formed Avfuel subsidiary. I transferred from Avsurance to Avfuel's aviation



Hirst enjoys working with people who share his passion for aviation

fuel sales team in 2000.

What is your role with Avfuel?

I work with FBOs throughout the eastern half of the USA as well as in Canada and Europe. I build and maintain relationships with FBOs and determine Avfuel solutions to help them potentially increase sales and operate more safely and efficiently. Avfuel's product lines go beyond Jet-A and Avgas. Our involvement at every level of fuel supply – from refinery to wingtip – and our extensive knowledge of supply infrastructure and logistics

allows us to virtually guarantee every Avfuel FBO will have the fuel they need, when they need it. Our goal is to help the FBO grow its business and reduce expenses. We lease and maintain trucks and equipment, extend credit and provide back-end solutions such as card-processing systems and contract fuel programmes, pilot loyalty and marketing assistance to drive traffic to the FBO.

What is the most interesting project you have worked on?

I enjoy my involvement with in-

dustry organisations. I've been a member of the NATA Airports Committee and serve on the NBAA Associate Member Advisory Council, allowing me to connect with numerous industry peers, learn more about the challenges that impact aviation from a business and political standpoint, and exchange information and ideas with equally interested and committed individuals.

What is your favourite part of the job?

Favourite by far is meeting and working with people who share my passion for aviation. I love travelling to airports and FBOs, meeting aircraft operators and learning about all areas of their business. It is immensely satisfying to provide an FBO with products and services that can contribute not only to the FBO's overall success but to the success and enjoyment of its customers. The bottom line is: no matter what you do in this industry – whether a corporate or commercial pilot, insurance agent, flight-planner or linesman – aviation is an exciting and fulfilling business to be in.

Least favourite?

Paperwork! ■

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