Corporate Aviation

Tuesday May 24 2016 www.ft.com/corporate-aviation | @ftreports

Private jets ride out turbulence

Demand has stalled for now, but new technology and supersonic projects could drive growth, writes *Peggy Hollinger*

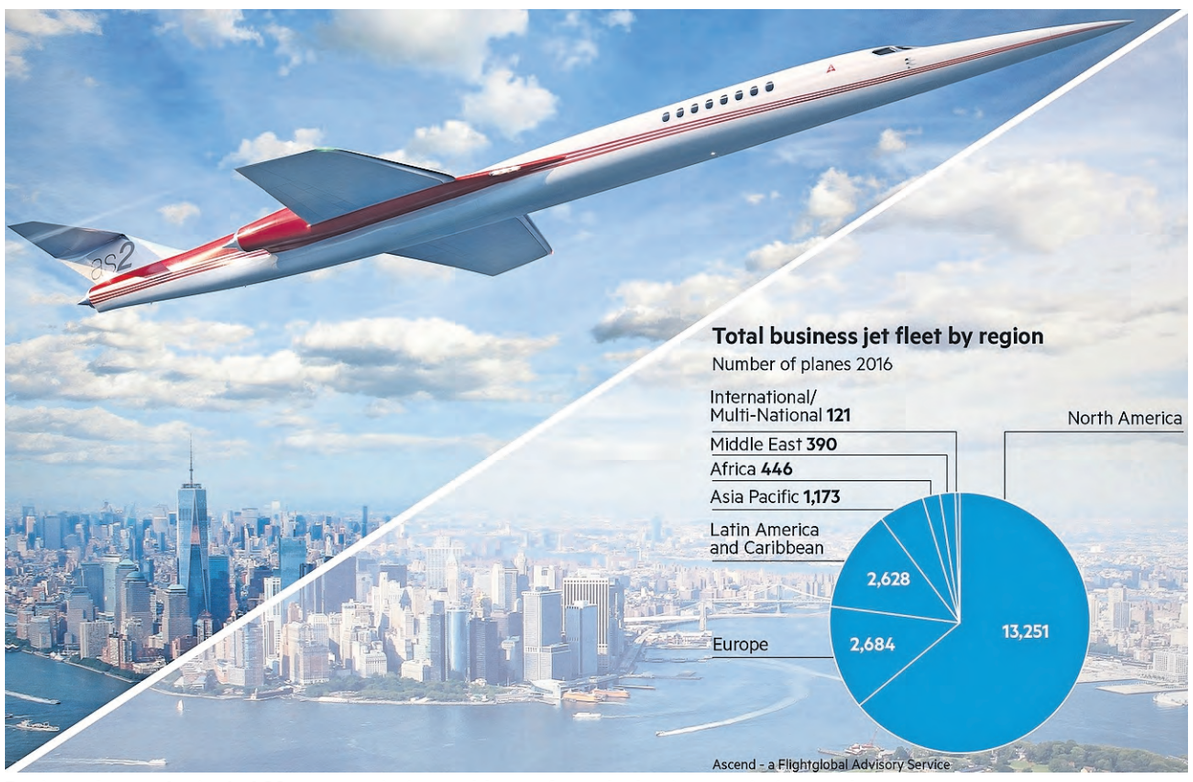
As business jets go it is hard to beat Air Force One, the airliner used by US presidents, which comes complete with a hospital and conference room.

But as usual, Donald Trump, the outsider who has stormed the Republican primaries ahead of November's US presidential election, has his own views on what makes a suitable business tool. His version comes with gold-plated safety belts, marble sinks, leather-covered toilet seats and a cinema.

Such luxury gives business jets a bad name and while the jet-loving Mr Trump may be friendlier to the industry than outgoing President Barack Obama, should he win the election, such brash exhibitionism is the last thing many industry executives want.

Corporate aviation is still struggling to recover from years of depression that have been further exacerbated by a collapse in oil prices, sluggishness in the global economy and political travails of once-booming jet markets such as Brazil and Russia. From a peak of 1,317 deliveries in 2008, manufacturers last year sent out just 718 aircraft. This year deliveries are expected to go down even further.

"There is a clear lack of confidence in the market, even with a record number of high net-worth individuals," says Marco Túlio Pellegrini, chief executive of Embraer Executive Jets.



Business boom: Aerion's AS2 supersonic jet could transform the business aviation market

Given the climate, companies are still wary of being targeted for owning private aircraft at the same time as cracking down on costs and jobs.

While there has been some revival in corporate profits in recent years, David Strauss, aerospace analyst at UBS, believes the nature of the corporate recovery means the market is likely to be depressed this year and next, with any recovery likely to be muted. The UBS business jet market index for April, which surveys manufacturers, brokers and financiers, showed the most downbeat results since 2009.

According to Mr Strauss, "companies . . . that used to have three, four, five aeroplanes have figured out how to get by with one or none."

The paralysis in the market means that private jet owners are holding on to their aircraft for longer, or buying second hand. This has hit pricing in both the new and used markets. Meanwhile, there are signs that demand for the largest category of business jets, which had remained relatively strong through the downturn, is beginning to slow.

The good news is customers are coming back to the small and medium-sized jets that are typically priced below $26m. The bad news is manufacturers such as Textron and Embraer are moving into the bigger segments of the market just as it begins to turn down, and as leaders in the heavier jet segment, Gulfstream and Bombardier, develop new aircraft. The market is ripe for consolidation, say analysts. Hawker Beechcraft has already been a casualty and as a result fell into Textron's grasp.

While the majority of commercial passenger jets sold last year were made by just two companies, Boeing and Airbus, the 718 executive aircraft delivered in 2015 were manufactured by nine companies.

Despite the difficult climate, aircraft makers believe the future for business aviation is bright. Bombardier is forecasting approximately 9,000 business aircraft will be delivered globally over the next decade.

Meanwhile, there are those who believe new technology might help to transform the market. Aerion is developing a supersonic business jet, the AS2, which has already taken a firm order for 20 aircraft at $120m each, even though there will be no jet delivered before 2023 at the earliest. Capable of flying twice as fast as a conventional jet, it will cut the travel time from London to New York from more than seven hours to four, says chief executive Doug Nichols.

But growth could also come by opening up the private aviation industry to a wider audience. California-based Stellar Labs believes software will do for private aviation what Uber did for the taxi industry. It has developed an online marketplace where customers can buy trips from private jet operators within minutes.

"Private aviation measures success or depression based on how many new aircraft are sold . . . We will be looking at how many people are flying privately . . . Anyone with a mobile phone or computer can hire a jet," says Stellar Labs chairman, Paul Touw.

Inside

Ailing second-hand market offers buyer bargains

Used aircraft

Factors from oil prices to the UK's EU referendum are depressing pre-owned jet sales, writes *Liz Moscrop*

As if the global economic slowdown was not bad enough, more recent uncertainties over the outcome of the forthcoming US presidential election and the UK vote over whether to leave the EU have been cited as reasons for the poor market in used business aircraft.

Last year saw sales of 2,200 used jets, fewer than the annual industry average of 2,500. Some brokers think this year's total could be as low as 1,900, although the number of aircraft on the market is now as high as it has been since the start of the financial crisis.

"The large cabin marketplace is slow, to the point where even the Gulfstream G650 is difficult to sell," says Brendan Lodge, business development director for UK-based JetBrokers. Of 98 Gulfstream G650 jets sold worldwide, there are 13 for sale, or more than 13 per cent of the active fleet. "Ten per cent is generally accepted as a soft market. We are well into that territory," he says.

Five-year-old Bombardier Challenger 605s and versions of the manufacturer's Global XRS range are now priced at less than 50 per cent of their retail price. The long-range Global 6000, however, is weathering well, with just over 3 per cent of its active fleet for sale. Embraer's super midsize Legacy 650s, too, have depreciated to 56 per cent of their original price over the past five years with nearly 14 per cent of the fleet on the market. There are 28 Dassault Falcon 7Xs available, representing more than 10 per cent of the 255 in service, and prices for 2011 models have dropped by $9m since the end of 2014.

It does not help that sales of new jets are sluggish and manufacturers have reportedly been heavily discounting their products. This then pushes down the price of second-hand aircraft. It is also worth noting that there are 2,700 used aircraft brokers hungry to cut a sale even at bargain prices for clients.

Another factor hurting the market is the practice of unscrupulous brokers giving owners inflated prices in order to get an aircraft on their books. Aoife O'Sullivan, founding partner of London's Air Law Firm, said she has frequently received requests for broker recommendations from sellers when they have been unhappy with the service they have received.

Used: Challenger jets saw a price drop

"A good broker needs to have a strong sense of the market, and a good understanding of the service suppliers that surround aircraft ownership," she says.

Bad brokers are so destructive that it can take 18 months to sell a private jet.

> 'Two aircraft of the same vintage and type can have different values. It depends on quality of maintenance'

Kurosh Tehranchian, chief executive of UK-based leasing and sales specialist Axon aviation, says this is because "on day one the owner was told his jet would sell for $15m, when actually he'd be lucky to get $12m". This means a vendor is reluctant to accept offers approaching the actual market value, causing transactions to stall and likely sales prices to be forced down still further.

Other factors also affect buyer confidence. It can cost more than $100,000 to upgrade some older aircraft to be compliant with future regulatory requirements and owners are reluctant to do the modifications. However, without them, they may be unable to sell their aircraft.

As ever, in this entrepreneurial market, there are solutions. Financing has become easier with leasing firms entering the scene. Global Jet Capital's chairman Simon Davies says: "Two aircraft of the same vintage and type can have very different values. It depends on quality of maintenance, who has owned them and where they've come from."

Although many potential buyers are shy at the moment, there are real bargains to be had. For example, according to specialist researchers at Amstat, the worldwide inventory for used Gulfstream G450s stands at 30. Over the past year, the price of a five-year-old version has dropped by about $6m.

"This process has been repeated by many aircraft before and will be repeated again — inventory rises, price falls until a point when everyone wakes up and realises that the aircraft represents great value for money," says Tim Barber, Cabot Aviation's senior vice-president of private jet remarketing.

For older types of jet, while it is important to factor in the cost of future proofing their value with upgrades, an aircraft's lifespan is measured in pressurisation cycles rather than years. Business aircraft do not fly anything like the amount of hours that their commercial cousins do, so last a lot longer.

Values do not necessarily drop massively. Five-year old smaller jets have held their prices well. Embraer's Phenom 300 stands at 80 per cent of its list price, while Cessna's Citation CJ4 stands firm at 78 per cent of what it sold for. Mr Barber says: "Manufacturers are doing a very good job of keeping the momentum going by selling new aircraft. There'll always be people who can afford them."

Mr Tehranchian is positive that the market will pick up. He argues that appreciation of the US dollar against other currencies is also boosting the market by increasing the purchasing power of US buyers over foreign-built executive jets.

Corporate Aviation

Lockheed seeks commercial innovation from Sikorsky

Helicopters

The oil price slide has hit the defence company's plan to diversify into the civilian sector, says *Robert Wright*

The regular buzz of helicopters landing and taking off is one of the distinctive sounds of the airport on the outskirts of Aberdeen, the UK's most important oil city. With 36,487 take-offs and landings by rotary-wing aircraft during 2015, the windswept facility is the world's busiest heliport, handling hundreds of thousands of passenger journeys annually to and from North Sea oil platforms.

But, for Dana Fiatarone, head of commercial systems and services at Sikorsky, one of the world's biggest helicopter makers, that level of traffic is a concern. While Aberdeen's heliport remains busy, 2015 movements were 8 per cent down on the previous year, thanks to a slide that has taken the price of a barrel of North Sea crude down from a peak of $112 in June 2014 to a low of just above $26 in February this year.

The declining traffic poses acute questions about whether Lockheed Martin, which bought Sikorsky for $9bn late last year from United Technologies, will achieve one of its aims in the purchase — to diversify away from military business. While Sikorsky — maker of the US military's Black Hawk helicopter — is the world's biggest supplier of military helicopters by sales, Mr Fiatarone points out Sikorsky is Lockheed's first sizeable acquisition of a company with substantial civilian business.

Demand for Sikorsky's two main civilian models — the S-76D, which can lift up to 5,386kg and the S-92, which can lift 12,018kg — has traditionally depended heavily on offshore oil and gas customers.

"The oil and gas downturn is probably steeper than anyone really anticipated," Mr Fiatarone says.

Richard Aboulafia, an analyst for the Virginia-based Teal Group, says that United Technologies chose an "impossibly good time" to sell the business. "Lockheed Martin didn't really choose an optimal time to buy," he adds.

Nevertheless, Mr Fiatarone insists that Sikorsky can be competitive in the commercial market, particularly if it pushes ahead on the introduction of new, innovative models. "We have a technology and innovation group inside Sikorsky that thinks about things like clean sheet designs," Mr Fiatarone says.

The existing products undoubtedly face tough conditions, however.

The heavy-lift S-92 won a competition to provide the new Marine One helicopters, as the aircraft that carry the US president are known. The aircraft is also in use as a search-and-rescue helicopter for the UK and Irish coastguards, while a variant is being developed to offer search-and-rescue services around the coast of Canada.

The aircraft still remains best suited to undertaking heavy lifts of people and equipment to and from oil platforms. Sikorsky has 263 orders for the aircraft over the next 10 years, according to Teal Group.

The prospects of the medium-sized S-76D, however, looks more uncertain.

AgustaWestland's competing AW139 model has 684 orders over the next decade, according to Teal, while Sikorsky has only 154 for the S-76, despite the introduction of a revamped D variant of the aircraft in 2013.

"That product has been around since the 1970s," Mr Aboulafia says of the S-76. "The D appears to be getting a lukewarm reception after a whole bunch of teething problems and development delays."

The Sikorsky S-92 is set to replace the current fleet of helicopters carrying the US president

Mr Fiatarone concedes that the process of gaining "acceptance in the marketplace" for the S-76D has been "a little slower" than he would have liked. But he adds: "As customers get to know the aircraft, they seem to like it."

One solution to the problems might be to develop new models to fill the sizeable gap in capabilities between the S-76 and the S-92. AgustaWestland's AW189, Airbus's EC175 and the 525 from Textron's Bell Helicopter all fit into the so-called "super-medium" gap between Sikorsky's two models.

Mr Fiatarone concedes it is "at least interesting" that three separate competitors all concluded there was space for a helicopter in that category, even if it might not make "perfect sense" to enter the segment at this point. "It's certainly something we'll take a look at," he says.

There may also be scope for bringing to the civilian side of the business the revolutionary technology that Sikorsky has been developing with an eye to US military business. The company's S-97 Raider helicopter is able to fly twice as fast as conventional helicopters — up to 276mph — because it has two main rotor blades spinning in opposite directions. This overcomes the problem facing traditional rotor designs — that, beyond a certain speed, each rotor catches up with the vacuum created by its predecessor and runs out of air to push.

Mr Fiatarone says there are "possibilities" for the application of such superfast helicopter technology on a commercial front. "One is getting out to oil rigs that are 300 miles or more offshore — ultra-deep oil wells," he says. "Another is emergency medical services and search-and-rescue."

Yet the central problem facing Sikorsky's commercial business remains the depressed activity level at Aberdeen and other oil and gas-focused heliports. Mr Fiatarone expresses some hope that revival in the sector might be closer than it appears.

Nevertheless, he accepts that there is a considerable period of pain to come, particularly since many "capital assets" — including helicopters — are currently lying idle.

"As the oil price recovers, you'll first see those idle assets being put back to use," Mr Fiatarone says.

"But it may be 18 months after that before you start to see significant increases in orders placed."

Buzz around next-level business jets lures investors

Crowdfunding Entrepreneurs seek novel ways to finance blue-sky projects, discovers *Paul Sillers*

Dodging the constraints of airline schedules and networks, and bypassing laborious procedures at big airports is the *raison d'être* of corporate aviation.

But what if you could take the advantages of private flying further? Imagine if there were a type of plane with the speed, comfort, range and privacy of a corporate jet — but combined with the ability to take off and land vertically, just like a helicopter. You would not only avoid delays getting in and out of airports — airports themselves would become obsolete.

That is precisely the vision Denver-based XTI Aircraft Company intends to bring to market in the form of the TriFan 600, a vertical take-off and landing (VTOL) aircraft which will have flight capabilities similar to those of tilt-rotorcraft such as the Boeing V-22 Osprey. Three ducted fans lift the plane vertically and within seconds, two of those fans, mounted in the wings, rotate so that the plane switches to forward high-speed flight, reaching a cruising speed of about 340 knots within 90 seconds. Carrying one pilot and five passengers, the TriFan is designed to fly at 35,000ft, avoiding bumpy weather, with a range of 1,500 nautical miles.

XTI is using crowdfunding as a route to "test the waters" of investor interest and to generate enough buzz to bring this aircraft to the attention of potential financial backers, owners, operators and the media.

So far, XTI has garnered $20m in expressions of interest and has been registered by the US Securities and Exchange Commission. It has already converted a little more than $1m of commitments into actual investments from more than 700 individuals, with investments ranging from $350 to $50,000 each, through the crowdfunding site StartEngine.

"The TriFan will save people hundreds of hours a year by reducing total trip time because they won't have to travel on the ground to and from major airports. All you need is a helipad or other paved surface that is 60x60ft," says David Brody, founder and chairman of XTI.

Industry insiders are already embracing Mr Brody's gusto. "If we look ahead to the commercial potential for the TriFan 600, it's a tantalising concept of aviation without boundaries," says Carol Cork, co-founder and marketing director of PrivateFly, a private jet booking service whose business provides access to a global network of more than 2,700 accredited private aircraft operators. "The one thing that unifies all our customers is the desire to save time. Private jets don't fly faster than commercial airlines on the whole — the time-saving aspect is largely on the ground. Over two-thirds of our customers choose private jets to fill gaps in airline schedules, so a VTOL aircraft obviously takes that potential time saving to a new level."

Vertical thinking: XTI used crowdfunding to get the TriFan 600 concept off the ground

But why did the TriFan's creators turn to crowdfunding? Mr Brody explains that XTI is "pursuing several avenues to raising the funding needed and the idea of making the investment available to unaccredited and accredited investors was part of our effort to spread the word".

For early investors, Mr Brody says there are advantages to crowdfunding, including the ability to purchase shares in the company for $1 each.

XTI is not alone in the aviation sector in recognising the potential of crowdfunding as a way to promote a brand while diversifying the shareholder base at the same time. Hybrid Air Vehicles, based at Cardington Airfield in Bedford, is the latest in a long line of companies attempting to reinvent the commercial concept of airship transport with its Airlander, a vehicle that can stay airborne for up to five days. Its owners say it "will fulfil a wide range of roles in both the military and commercial sectors, all with a significantly lower carbon footprint than other forms of air transport".

Chris Daniels, HAV's head of partnerships and communications, says crowdfunding brought non-traditional investors into the funding mix and bolstered marketing efforts. "We've been inundated with requests from retail investors who want to invest in our game-changing technology. Historically there wasn't a practicable way to allow this class of investor to purchase equity in the company, but crowdfunding changed that."

Last year, HAV raised £2.1m from 983 investors over 45 days. This year, £1.25m was raised from 1,431 crowdfunding investors over 23 days, closing out early — having reached the limit allowed under the EU prospectus directive of raising €5m over any 12 month period. "Crowdfunding has proved to be a great tool for increasing awareness in Airlander," says Mr Daniels. "The increased profile has created benefits with potential customers, partners, sponsors and government."

'The increased profile has created benefits with potential customers and partners'

Chris Daniels, HAV

But as with all opportunities in the crowdfunded sector, prospective punters may have to be patient to see a return on investment, if one is due at all. With the long design, testing, certification and manufacturing timeframes typical in the aeronautical sector, investors have to ask whether there is a balance between their propensity for risk-taking and the kudos that comes from being a part of what could be the next paradigm in corporate aviation.

As for the TriFan and the future of corporate aviation, XTI's plans a full-scale proof-of-concept aircraft for 2020 and deliveries of the could start between 2024-26. According to Mr Brody: "We expect to be able to sell between 40 and 100 aircraft a year."

Bombardier charts a return to profitability

Corporate fortunes

The aircraft maker looks set for recovery after winning new orders and investment, says *Robert Wright*

When Canada's Bombardier issued first-quarter results on April 28, observers' attention was focused mainly on good news for the commercial aircraft division.

The company was able, after 18 months with no firm new orders for its C Series commercial jet, to announce that Delta Air Lines planned to buy at least 75 of the aircraft, intended to compete with Boeing's 737 and Airbus's A320 narrow-body jets. The order was widely seen as rescuing a programme that, as recently as last year, threatened the future of the world's third-largest aircraft manufacturer by sales.

Yet the first-quarter performance of Bombardier's business aircraft division, until recently the world's biggest supplier of business jets, underlined the price this part of the company has paid for Bombardier's recent problems. Revenue for the quarter fell 15 per cent to $1.3bn, while earnings before interest and tax also fell 15 per cent to $82m.

The falls reflected Bombardier's decision last year to cut back on production of its top-of-the-range Global 5000 and 6000 business jets, which it had been producing unsustainably fast in an effort to earn cash. The cost and time overruns on the C Series consumed so many of the company's available resources that it had to postpone by two years entry into service of its Global 7000 and 8000 long-range jets, to 2018 and 2019 respectively.

The question for the company is whether Bombardier Business Aircraft can reclaim the powerful market position it has ceded during the past 18 months' upheavals. Forecasts from the Virginia-based Teal Group project that aircraft delivered by Bombardier will account for only 28 per cent of the total value of business aircraft delivered this year, against 38 per cent for Gulfstream, once a smaller competitor.

Alain Bellemare, the chief executive brought in last year to tackle the company's corporate crisis, told investors after the results were published that the division was "taking a disciplined approach" and adapting to "challenging market conditions".

However, Richard Aboulafia, an analyst for Teal Group, says the C Series' effect on Bombardier's business aircraft operation has been "devastating". He points particularly to the effect on the company of postponing work on the Global 7000 and 8000, which has left Gulfstream, part of General Dynamics, unchallenged as the leader in ultra-long-range aircraft.

The extended range version of Gulfstream's G650 can fly 7,500 nautical miles without refuelling. Such large aircraft have done disproportionately well since the last recession compared with smaller sizes. The Global 8000, when it eventually takes to the air, is due to have a 7,900 nautical mile range.

"They gave Gulfstream a six-year lead in the ultra-large market, which was arguably the only growth part of the business in the last few years, because of the delays to the Global 7000 and 8000," Mr Aboulafia says.

The core of the problem for Bombardier, according to one observer familiar with the company, is that the C Series' problems have starved development projects across many parts of the company of resources they might otherwise have received. The company last year scrapped its only outstanding development of a smaller business jet — the Learjet 85 — although some observers believe the challenges of producing that innovative aircraft might have justified its cancellation anyway. "I think it's good [Bombardier] killed it," says the observer, who asked not to be named.

'They're unlikely to get their number one position back — certainly not anytime soon'

Meanwhile, the sales performance of the Challenger 350 — which entered into service in 2014 — and many of the company's other midsize aircraft has proved disappointing. Competitors such as Gulfstream's new G500 have been taking market share. "They haven't been winning their share of that market," the observer says.

Bombardier declined to comment.

Yet the Delta C Series order is not the only reason to hope that Bombardier's business aircraft division may be past the worst. A $1.3bn investment in the company's trainmaking business, by a pension fund linked to the government of Bombardier's native province of Québec, helped to keep net debt for the group steady at $6.35bn at the end of March compared with December.

The company is also due to receive a $1bn investment from Québec's provincial government in a joint venture to build the C Series. It is in negotiations about a potential investment from the Canadian federal government.

Short reprieve: Bombardier's C Series order from Delta came with a cost — EPA

Mr Bellemare told investors in April that the further investments would give the company "additional flexibility" and the ability to keep investing.

He also predicted that, in cutting back production rates last year, the company had acted more promptly than other companies during difficult market conditions.

"We were proactive. We took some tough actions last year, but they are starting to pay off this year," said Mr Bellemare.

Yet there is little doubt that events over the past few years — when Bombardier struggled to invest in new products — will have a lasting effect on the business. Mr Aboulafia reflects how the company once offered strong products across the whole size range, from its smaller Learjets up to the Global products — which were the first truly intercontinental business aircraft. "They're unlikely to get their number one position back — certainly not anytime soon," he says.

Corporate Aviation

New stretched jets bring more cabin comfort

Aircraft design As well as making planes go faster and further, leading jet makers are working to enhance the in-flight experience. By *Michael Dempsey*

Superficial similarities between most business jet designs can obscure the reality of continuous change and development. Speed and range are two obvious aspects of an aircraft where advances yield advantages to the business traveller. But going faster and further does not stop passengers wanting to make the best use of their time in the air.

Bombardier, the Canadian aerospace group, is working on the launch of stretched versions of its Global series business jet that will offer greater range and cabin comfort.

Brad Nolen, Bombardier's director of product strategies, explains how the Global 7000 and 8000 jets are being built with nonstop flights from North America to Asian locations in mind. Their numeric names refer to their approximate ranges in nautical miles.

This push towards longer-range aircraft is being accompanied by an emphasis on greater comfort and more elaborate interiors. One potential configuration for a large Global series jet consists of four different zones, the first of which is reserved for four seats. The other three rooms inside the aircraft can offer a dining room, bedroom and a stateroom.

"These aircraft are completely customisable" says Mr Nolen. "They can be set up to equal a boutique hotel that transports itself from Sydney to San Francisco." Travelling at just below the speed of sound, Mach 0.925, and at very high altitudes up to 51,000 feet, the Global 7000 will be much more than a swanky hotel with wings, according to Mr Nolen.

Those wings have been the subject of intensive research and are designed to handle high-speed flight and slow landings via slats and flaps that can configure the wing for approaches to shorter runways.

This need for advanced wing technology points to a contradiction that plagues business jet designers. More speed equals shorter journey times, and larger aircraft have the fuel reserves for long-distance flights. But business aviation is about convenience, and the airport closest to the passengers' final destination may not have the long runway required by larger jets. "We want to increase size and comfort," says Mr Nolen, "but we also want to be able to fly into the small, challenging airports with short runways."

Hotels in the skies: longer range jets can have elaborate interiors
AFP/Getty Images

Aircraft design is about compromises. A swept wing equates to speed and a straight wing allows for slow landings into limited space. With the fuel load necessary to fly 7,000 miles, a jet will need at least 6,000ft of runway to get off the ground, which in turn limits the number of available departure points.

Passengers who are airborne for long flights expect to remain in touch, and Bombardier's Global Series of jets offer satellite-based internet connectivity with enough download capacity to host online meetings or access Netflix.

The company's Challenger 650 jet allows passengers to control the cabin temperature, lighting and window shades using their smartphones. Mr Nolen says all of this convenience is about responding to the need for personal devices to be integrated into the cabin design.

"People are streaming media everywhere so we have to integrate that level of connectivity into the aircraft."

Others are competing with Bombardier in developing and enhancing their aircraft. Textron is the group that includes classic US aviation names such as Cessna and Beechcraft. It manufactures the long-established King Air twin turboprop that covers shorter distances. In its latest iterations, the King Air offers WiFi in its small cabin and incorporates touchscreen displays to lower the pilot workload.

> People are streaming media everywhere so we want that level of connectivity on board

Roomier cabin space in its mid-range jets is also on the agenda for Textron, which believes that in-flight meeting space demanding greater cabin height and width should not be restricted to longer-range aircraft.

The larger models in its Citation range reflect what Kriya Shortt, senior vice-president for sales and marketing, says is a customer demand for improved working environments that "allows people to be more effective while they are on board".

Flexjet, the fractional ownership business, has improved the odds on a supersonic business jet taking to the skies by placing a $2.4bn order for 20 Aerion AS2 aircraft.

The AS2 is yet to fly and has no shortage of critics, who point to the substantial technical challenges involved in sustained supersonic flight, the large associated development costs and apparently limited market for such an exotic machine.

Michael Silvestro, chief executive of Flexjet, is undeterred. "There is no question that building and operating a supersonic business jet will not be easy, but we've spent a lot of time with Aerion and so far we are confident they can pull this off."

He talks about taking delivery of this aircraft, which is designed to fly at speeds up to Mach 1.5, by 2024.

Mr Silvestro hopes that the relatively small size of the AS2 will prevent supersonic booms from reaching populations on the ground and hence the jet will be able to negotiate the restrictions that limited Concorde to supersonic flight over the sea.

The potential gains in time offered by boosting jet speeds beyond the sound barrier will appeal to Flexjet's customers, Mr Silvestro says, adding: "Time is much more valuable to executives than it was a generation ago."

How aircraft makers are catering for military uses

Armed services

World defence ministries' demand for business jets has surged with changes in modern warfare, writes *Angus Batey*

Special: King Airs remain in service

During the Dubai air show in November, the United Arab Emirates' defence ministry announced it was buying two surveillance aircraft from Saab of Sweden in a deal valued at $1.27bn. The news was a surprise, but one aspect attracted little comment: the aircraft selected to fly Saab's radar equipment was not military, but a Bombardier Global 6000 business jet.

"Our radars have been integrated on many platforms," Hakan Buskhe, chief executive of Saab, told reporters following the announcement. "The platform itself is extremely important for endurance, and the capability of using these types of sensors."

It is not just corporate executives who fuel demand for today's business aviation fleets. The combination of range, reliability, easy maintenance and comparative affordability has put business jets on the inventories of several of the world's defence forces. They are often used to transport VIPs, but are increasingly being deployed in air-ambulance and surveillance roles.

Civilian platforms have long been the backbone of military fleets. The venerable and distinctive Awacs surveillance aircraft — a jet with a large rotating radar antenna attached to the top of the fuselage, operated by the US, the UK, France, and Saudi Arabia among others — is a modified Boeing 707. The Awacs was itself a successor to a similar system installed on a piston-engined Lockheed Constellation airliner. The RAF's Nimrod R1 and MR2 fleets — which gathered electronic intelligence and maritime data respectively — were both built around modified de Haviland Comet jets.

The move to fielding reconnaissance equipment on smaller aircraft began in the middle of the 20th century. Since then, the market has surged after the increasing use of unmanned aircraft in the Iraq and Afghanistan conflicts fuelled a growing appetite for high-resolution streamed video.

Beechcraft's King Air range of utility turboprop aircraft, developed in the 1960s, were popular with military users. Today the type remains in service with dozens of military forces, with different antennas, camera turrets, bubble windows and other modifications.

Although it is third-party suppliers of surveillance or other equipment who usually carry out the modifications, aircraft manufacturers are not just providing an off-the-shelf product. Modification and maintenance work adds considerably to sales and profits. Several manufacturers have established business divisions to cater for the surveillance, inspection, air ambulance and utility markets, usually known collectively as "special missions".

Textron Aviation's special mission division employs more than 70 people. Tom Hammoor, president of the defence side of Textron, which owns aircraft brands including Cessna and Beechcraft, says significant work is done on these niche modifications, so that customers will not have to wait or pay for safety certifications for a particular pod, camera turret or internal equipment configuration.

Business jets are also increasingly popular for military reconnaissance roles. Pressurised cabins permit operating at altitude limits for normal airliners, which means greater range for optical or radar sensors; the fuel efficiencies and long flight durations expected by the business user are also prized by the military.

The RAF's Sentinel R1 is a Bombardier Global Express aircraft with a bespoke radar sensor and three computer workstations on board: it is able to monitor the movement of vehicles on land and to take radar imagery through cloud. Since entering service in 2008, the Sentinel was used during Nato's air campaign over Libya and also deployed over Afghanistan.

The fleet of five aircraft were modified by contractor and radar manufacturer Raytheon. The aircraft's success in such a wide variety of operations has piqued interest abroad, and Raytheon is in discussion with international customers to sell similar systems installed on business jet platforms. Enhancements to the UK's configuration make adding more analyst workstations and new sensors possible.

Contributors

Angus Batey
Freelance aviation journalist

Paul Betts
Former FT aerospace correspondent

Michael Dempsey
Freelance aviation journalist

Peggy Hollinger
Industry editor

Liz Moscrop
Freelance aviation journalist

Paul Sillers
Freelance aviation journalist

Robert Wright
US industry correspondent

George Kyriakos
Commissioning editor

Steven Bird
Designer

Michael Crabtree
Picture editor

For advertising details, contact: **Liam Sweeney,** +44 (0)20 7873 4148, liam.sweeney@ft.com or your usual FT representative.

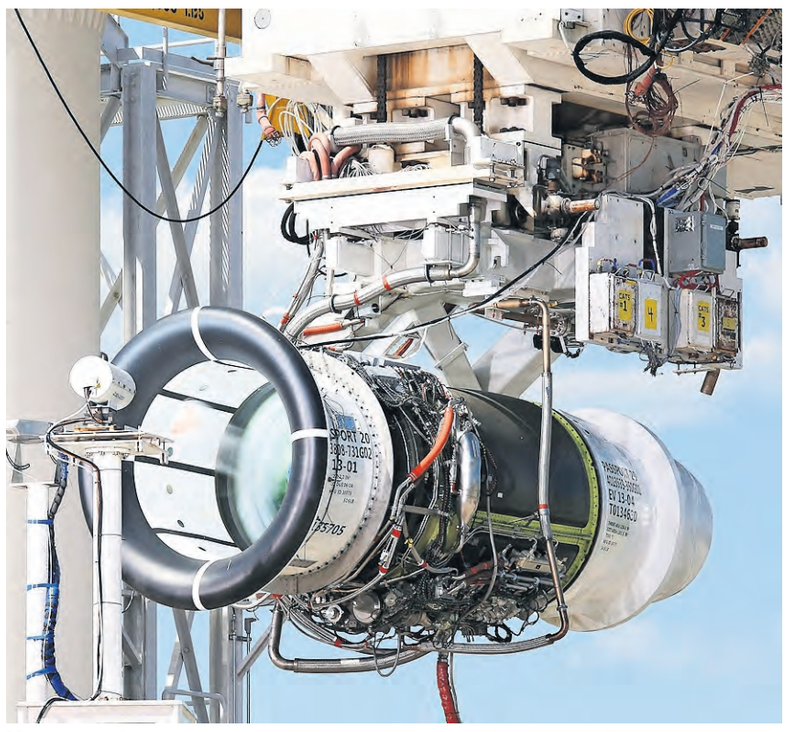
All editorial content in this report is produced by the FT. Our advertisers have no influence over or prior sight of the articles.

All FT Reports are available at: ft.com/reports

Follow us on Twitter @ftreports

GE Aviation's engine is passport to the skies

Innovations New engine marks a turning point in energy efficiency, reports *Robert Wright*



Hitting the fan: latest engines are expected to achieve bigger fuel savings

When Bombardier's Global 7000 long-range business jet takes its maiden flight, scheduled for some time in the next two years, attention will focus on the impact of the aircraft's commercial appeal on the Canadian manufacturer.

But the flight will be a landmark for another company. The take-off will be the first powered by the new Passport engine developed by the aviation division of General Electric for business jets.

The Passport is the first of a series of new engines nearing introduction to service that draw on the latest innovations in commercial jet power. The Passport features some of the innovative materials that GE has developed for the Leap engine manufactured by CFM International, its joint venture with France's Snecma. The Leap — one of the two engine types available for Airbus's new A320neo narrow-body jet — uses newly-developed materials that allow the engine to run at higher — and hence more efficient — temperatures and greater pressures.

Brad Mottier, GE Aviation's manager of business and general aviation, says the Passport represents a significant efficiency breakthrough and will use an average 18 per cent less fuel than GE's existing comparable products. While using many of the elements of the Leap's core — the compressors, combustors and turbines that lie at the centre of the engine — the Passport uses a different, smaller intake fan.

"For a business jet, which flies faster and higher than a commercial airliner, you want to generate power efficiently, with as small a fan diameter as you can, to reduce drag," Mr Mottier says.

However, Philip Toy, co-head of the aerospace and defence practice at consultancy AlixPartners, points out the small size of the business jet market — and the relatively slim pickings to be made from maintaining the lightly-used engines — mean revolutionary products in the market are rare and innovation is normally a byproduct of developments in commercial jets.

"The business jet technology is a trickle-down from the commercial aircraft," Mr Toy says.

The best illustration of the challenges of transferring technology from commercial jet engines is the development of Pratt & Whitney's PW800, the engine due to power Gulfstream's new G500 and G600 medium-range jets.

The engine is based on P&W's revolutionary Geared Turbofan (GTF) engine, which uses far less fuel than conventional jet engines. The GTF has prompted a scramble of innovation in the industry as other manufacturers seek to catch up with its performance.

Pratt & Whitney had to decide how to adapt the GTF for the very different demands of powering a business jet, according to Michael Perodeau, head of marketing for Pratt & Whitney Canada, the division working on the new engine.

"There are different design choices that are made as a function of the aircraft that you're trying to power," Mr Perodeau says.

The company decided that a scaled-down recreation of the GTF would face unacceptable disadvantages. The GTF saves fuel because a gearbox allows its large intake fan and its turbine to run at two different speeds, each optimal for their functions.

A geared engine's likely weight, width and the drag it would create all had to be factored into the design's "overall optimisation", Mr Perodeau says. The company instead opted for a conventional design where the engine core turns the intake fan directly.

Business jet customers care far less than airlines about achieving fuel savings to cut costs but value new engines' capacity to carry the aircraft further between each refuelling.

The Global 7000 is due to have a maximum range of 7,300 nautical miles, close to the 7,500 nautical mile range of Gulfstream's G650ER, the longest-range business jet currently on the market. The still-larger Global 8000, likely to enter service a year after the 7000, will fly up to 7,900 nautical miles in one go.

Mr Toy of AlixPartners calls the PW800 and other new engines a "worthwhile optimisation exercise".

"Extending range is the main benefit," he says, adding that engine improvements were the main factor in allowing Gulfstream to introduce the G650ER — which can fly 500 nautical miles further than the original G650 — in 2014.

Yet the proof of the development process's complexity is that not every company manages it smoothly.

While GE and Pratt & Whitney have largely stuck to their development timetables, Snecma is set finally to win safety certification for its new Silvercrest engine — the company's first business jet engine — in 2018. The company had originally expected to reach that milestone as early as 2010 or 2011.

The problems have led to a two-year delay in the development schedule for Dassault's Falcon 5X, which had been due to make its maiden flight powered by the Silvercrest last year. The aircraft is now unlikely to fly until next year.

"We are deploying all the resources needed to meet our commitments and ensure that Silvercrest will be a success," the company says.

The ultimate perk

COLUMN

Paul Betts

The other day I asked a retired businessman, now living in the pretty and fragrant Italian hills of Chianti, what was his top luxury. A corporate jet, he replied without hesitation. "It gives you complete freedom. You can go wherever you want, whenever you need or feel like. You avoid all those ghastly queues and delays at congested airports. It is super convenient and comfortable, and flying in a corporate jet makes you feel a bit special," he rambled on.

Rather than a corporate jet, would you not regard one of those super yachts complete with helicopter, Riva speed boats, swimming pool, sauna, gym and grand state rooms as the ultimate luxury, I suggested meekly. A Monaco broker recently told me that a super yacht is probably the least necessary and most extravagant luxury that money can buy. After all, a corporate jet can pass as a business tool and expense.

The yacht broker was making, indirectly, a telling point. Even if a super yacht and a large sophisticated long-range corporate jet probably end up costing about the same, the big difference is that you own and pay for a yacht while in most cases you do not personally own a corporate jet. Far more conveniently, your company owns or leases a jet or a fleet of jets, your shareholders and investors pay for them, and you have extensive — if not exclusive — use of them. In other words, it is the ultimate perk.

Recipients of this largesse, mainly chief executives of Fortune 500 companies and other corporate tycoons, and their friendly and compliant boards, argue that corporate jets are necessary to fly top managers to business meetings and that it does not make economic sense for highly paid chief executives to waste time at airports. Security is also cited by boards as a reason for operating corporate jets as well as privacy to conduct business far from indiscreet ears.

During my days as an FT foreign correspondent and, at one stage, aerospace correspondent, I was invited from time to time to fly with a chief executive, a group of company managers or a politician for an interview in the sheltered and gilded confines of a Gulfstream or Embraer or Falcon cabin. But for all the practical arguments of the advantages of flying in this way, it still felt like a luxurious perk.

Not surprisingly, since the 2008 financial crash, this benefit has been one of the most closely examined and widely criticised. Although some chief executives are now reimbursing their companies for any private use of the company jet, the Institutional Shareholder Service has pointedly asked why should such highly paid individuals be given such perks that they could well afford to pay for themselves? If they can buy a super yacht with their own money, they could clearly buy their own jet.

The reason they probably do not, explained a yacht broker, is that buying a yacht is a very emotional and personal affair. Not so with a corporate jet which is widely seen as a business expense as its name implies. This may also explain why the market for very large super yachts is a rarefied world of some 150-200 yachts at most, compared with the 675-725 corporate jet deliveries expected this year according to the annual forecast by Honeywell International. The US avionics manufacturer, which has published a corporate jet market survey for the past 24 years, predicts a global market of 9,000 business jets worth $270bn over the next decade.

In a period of economic stress, one of the first luxuries to go is the yacht. As the old saying goes, the happiest day in a man's life is when he buys a yacht and the second happiest day is when he sells it. This certainly does not appear to apply to the corporate jet. My old business friend in Chianti would say quite the opposite. Once you have tasted the pleasure and convenience of travelling by private jet, it is extremely difficult to get used to flying again in a commercial airliner, even in first class.

Paul Betts is a former FT aerospace and foreign correspondent

Smartphones 'cannot replace the human touch'

Online booking

Technology makes contact with customers easier but it is not a complete solution, writes *Michael Dempsey*

Corporate aviation is experiencing a wave of newcomers, all eager to show their technological mettle. But while online booking has opened up the use of private aircraft, not everyone in the business thinks that this popular approach should deflect from the serious task of operating aircraft.

Adam Twidell, who founded PrivateFly in 2008, aims to bring the ease of online bookings to the private aircraft sector. His company, which offers a mobile app to customers, has grown rapidly: in the first quarter of 2016, it dealt with customers flying out of 237 airports worldwide.

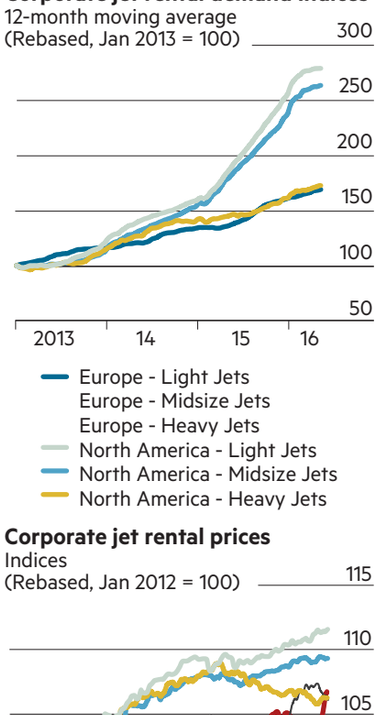
He agrees his client base wants the convenience of quick access to flights and nearly one in three bookings is made within 48 hours of take-off. But Mr Twidell does not attribute PrivateFly's success solely to the adoption of digital technology. "We have never pretended to be an Uber; that is a lazy generalisation," he says. Business aviation requires both high-tech and a focus on customer contact, he insists. "It is not about being a one-dimensional online business. Technology can make it easier for corporate customers, but it cannot replace the human touch."

PrivateFly's quickest time between a customer logging on and taking off is 43 minutes. This was recorded by a lawyer whose flight on a budget carrier to a business meeting was delayed by four hours and who used the service to book a jet from the airport in which he was stranded. Mobile booking was the key to the lawyer's rapid change of plan, but it is worth noting that 63 per cent of PrivateFly customers still book from a desktop computer.

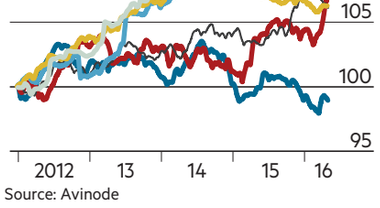
PrivateFly has 30 staff based in the UK and US providing round-the-clock support. "You can use a computer program for a lot of things, but you still need people for specifics," Mr Twidell says. "We just use technology to take the frustration out of booking a flight."

His company experienced what he calls "an intense period" while an accreditation team from Argus International, an aviation rating agency, assessed its procedures and protocols. Such accreditation of flight brokers is a relatively new development, and Mr Twidell's motivation in wanting Argus to scrutinise his business indicates a broader change in the way business aviation clients choose their operators.

Corporate jet rental demand Indices
12-month moving average
(Rebased, Jan 2013 = 100)



Corporate jet rental prices
Indices
(Rebased, Jan 2012 = 100)



Source: Avinode

Mr Twidell says there has been an emergence of savvier European business aviation customers in recent years,

> 'We just use technology to take the frustration out of booking a flight'
>
> **Adam Twidell, PrivateFly founder**

all asking far more pertinent questions of their flight operator. For example, rather than just querying how many flying hours a pilot has, they have learnt to ask how many hours the pilot has on a specific type of aircraft. Others ask whether air crew have access to simulator training which allows them to prepare for every possible emergency.

Patrick Hansen is chief executive of Luxaviation, an aircraft operator that manages 250 aircraft. Mr Hansen argues that safety has moved up the agenda while cost and online access to booking can be overrated. "For the end-client, price is just one element in the equation. There is a lot more involved and safety is very important. So apps might introduce a new group of clients but corporates are doing more and more vetting of operators for safety. You want your CEO to fly on a safe jet."

Simon Talling-Smith was in charge of ecommerce at British Airways from 2001 to 2004 and is now European chief executive of Surf Air, a model based around charging an upfront monthly subscription rather than taking bookings for individual fares from business travellers. Mr Talling-Smith says he learnt a lot from BA's move into online booking. "If you make it easy and take the friction away they [customers] will use it," he says.

Launched in 2013, Surf Air has 90 flights a day on the West Coast of the US and plans to announce a European service during 2016. It targets a new class of passenger: frequent travellers who have defected from conventional airlines to avoid the normal time penalties of queueing in airports.

Operating eight seater Pilatus PC-12 turboprops, Surf Air allows customers to pay a $1,950 monthly subscription on top of a $1,000 joining fee and then make their booking via an app. Mr Talling-Smith claims that the subscription model also removes the rigmarole of payment that makes online booking a lengthier process than necessary.

With 3,000 members, Mr Talling-Smith reckons Surf Air's private terminal saves customers two hours on every round-trip journey. One member uses the service 26 times a month between Santa Barbara and San Francisco. The key to the Surf Air model is the high utilisation rate of its aircraft which make several flights daily.

Mr Talling-Smith says an approach aimed at easing of customer access is what distinguishes its service, rather than the use of an app. Mr Hansen at Luxaviation agrees. He says operators must understand what their passengers are searching for. This means looking beyond smartphones. "The problems of corporate aviation are not going to be solved by a nice button on a phone."