

Aerospace

Monday July 14 2014

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Jet makers braced for slowdown in orders

The signals are increasing that airlines, on the back of the economic recovery, are expanding their fleets too quickly, writes *Andrew Parker*

Fabrice Brégier is hoping that 2014 will be remembered for Airbus delivering the A350 passenger jet – the company's first new type of aircraft in seven years – to its initial customer, Qatar Airways, by the end of the year.

The chief executive of Airbus's commercial business can reasonably claim to be the father of the A350, after supervising its progress for eight years. If it is supplied to Qatar Airways in the fourth quarter it will break with the recent record of aircraft being delivered very late.

However, 2014 will remain in the industry's memory for darker reasons. The disappearance of Malaysia Airlines' flight MH370 has cast a long shadow; a painstaking search for the jet in the Indian Ocean will resume in August.

But more pertinently for the Farnborough air show, which starts today, there have been signs that the boom in aircraft orders of recent years may be coming to an end, or at least starting to slow. Evidence is mounting that airlines, on the back of economic recovery, are expanding their fleets too fast, resulting in falling ticket prices and declining profits. This in turn suggests that Airbus and Boeing, the two giants of airliner manufacturing, plan to make too many aircraft over the next few years, and could become embroiled in price wars – or be forced to cut production.

The biggest threat to a stable duopoly between Airbus and Boeing could lie in the increasingly competitive long-range jet market, where the European manufacturer is expected to launch a new version of its popular A330 jet. The two groups risk engaging in "mutually assured destruction" towards the end of the decade after cranking up production of widebody aircraft, says Douglas Harned, analyst at Bernstein. "A glut of capacity late in the decade could lead to lower prices as wide-bodies are overproduced, ultimately weakening margins at Airbus and Boeing," he says. A lot of unwanted aircraft could end up parked in the desert.

Against this backdrop, there is no respite at the two aircraft makers'

defence businesses. Both are grappling with western governments' cuts in military spending and chasing limited deals in developing countries. There are particular problems in Europe because defence companies are struggling to unite around a single project to develop a military drone. US groups, and some Israeli companies, look well-placed to dominate this market.

In the civilian market, it was US airlines that, throughout the financial crisis and its immediate aftermath, appeared to establish a trend among western carriers of curbing fleet growth – enabling them to raise fares and profits. The bad practices of the past – deploying too much aircraft capacity, resulting in price wars – seemed to have ended.

Yet in a sign old habits may be hard to kick, Air France-KLM last week became the latest airline to warn of excessive capacity being introduced on the north Atlantic run – one of the most profitable long-haul routes in the world. This overcapacity depressed Air France-KLM's yields – a measure of the average fare paid by passengers. The company reported similar problems on long-haul routes to Asia, where it competes with fast-growing Gulf carriers led by Emirates

Airbus and Boeing risk 'mutually assured destruction' after cranking up wide-body production'

Airline. Air France-KLM issued a profit warning, as did Lufthansa last month, citing similar difficulties with overcapacity on north Atlantic routes.

Such woes are not confined to Europe. Delta Air Lines, the US carrier, this month reported lower than expected average fares on international routes.

In Asia, where airlines have been growing rapidly, as more and more people can afford to fly, there is evidence of similar problems. This



Inside view: a glut of capacity late in the decade could lead to lower prices and weaker margins

Bloomberg

is partly because some countries, notably China, are experiencing slowing economic growth and partly because of intense competition between airlines.

Casualties have resulted. Tigerair, a Singapore-based budget airline group, last month announced that Tigerair Mandala, an Indonesian carrier that it part-owned, was shutting down amid a "difficult operating environment". An order for 25 Airbus A320 narrow-body aircraft was cancelled.

Cancellations of orders – and deferrals of deliveries to a later date – are often a good indicator that demand for aircraft is waning. Airbus recorded a large number of aircraft order cancellations in the first six months of this year – 225 jets, against 116 in the whole of 2013. In June, the European group suffered its largest ever cancellation when Emirates said a contract to buy 70 A350s – worth \$16bn at list prices – had lapsed. Emirates said the cancellation was not due to the airline having to rein in expansion plans because of slowing growth in emerging markets. Rather, Emirates is understood to have been dissatisfied with the performance of the A350.

Some of Airbus's cancellations have involved financially stressed airlines. Alitalia, the Italian carrier trying to avert bankruptcy by persuading Etihad Airways to become its largest shareholder, cancelled an order for 12 A350s in March.

In spite of all this, Mr Brégier insists the market is "still extremely bullish and positive" and hints at aircraft sales announcements by Airbus at Farnborough. It will be a "good air show", he says.

It is telling, however, that he does not expect Airbus's 2014 book-to-bill ratio – calculated by dividing annual aircraft orders by deliveries to customers – to be as high as in 2013, which was a strong year for sales.

Analysts closely watch this calculation, with some seeing a declining ratio as early evidence of a deteriorating market. However, Mr Brégier stresses that Airbus's expected net aircraft orders this year should still exceed deliveries.

Like Airbus, Boeing is making several of its aircraft at record production rates which are justified by a large order backlog, according to Randy Tinseth, a senior marketing executive at the US manufacturer's commercial business. "Demand in the market is greater than supply," he adds.

Boeing has seen orders for 54 aircraft cancelled this year – a level Mr Tinseth says is below average trend.

But in research published in April, David Strauss, analyst at UBS, estimated that 20 per cent of the orders placed with Airbus and Boeing – contracts for more than 2,000 narrow- and wide-body aircraft – were vulnerable to cancellation partly because airlines

have made over-optimistic assumptions about their growth.

Nick Cunningham, analyst at Agency Partners, reckons the two rivals could have to start cutting production of their aircraft in 2016, beginning with wide-body jets.

Airbus and Boeing have enjoyed an unusually long 12 years of almost uninterrupted growth in aircraft deliveries. The boom in jet orders since the financial crisis has been made possible by a rare combination of large deals with fast-expanding airlines in emerging markets and contracts to replace old jets at longer-established carriers in western countries. This business, much of it focused on the manufacturers' new, more fuel-efficient jets, has been driven by recent high oil prices.

But analysts and consultants insist the manufacturers cannot defy gravity: the aerospace industry is inherently cyclical, because increased air travel is closely correlated to economic growth.

"There are some signs that commercial aircraft order volumes are beginning to slow down in 2014 after several strong years," says John Dowdy, McKinsey's head of aerospace and defence. By the next Farnborough air show in 2016, he adds, "the industry will be forced to adjust to the return of cyclical, which will ultimately mean reductions in jet production rates by the aircraft manufacturers".

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Engine fire fuels debate over F35's capability

Defence

Lockheed Martin focuses on further development, writes *Robert Wright*

It is ironic that, ahead of this month's Farnborough air show, the key question about the F35 fighter, due to make its first European appearance at the event, has been whether it would actually turn up.

The fighter-bomber – conceived more than two decades ago – was set to make its first transatlantic flight for the show. This was scheduled to be the first chance for the UK, the biggest single export customer for the aircraft, to see the F35 in home skies.

Although the US Marine Corps was saying at the time of publication that it still planned to get the aircraft to Farnborough, a fire on June 23 in the engine of an F35 at Eglin Air Force base, Florida, raised concerns about whether it would be cleared to fly to the UK. Most F35 flights in the US were halted pending an investigation.

This has stirred long-running controversies about the suitability of the aircraft – expected to cost a total \$400bn for the US military to purchase – for its many planned roles.

Interested parties such as executives at Lockheed Martin, the aircraft's manufacturer, insist that the F35 is suffering teething problems and will, eventually, enter into service.

Marilyn Hewson, Lockheed Martin's chief executive, says the company is focused on further developing the aircraft, of which US armed forces are eventually meant to buy 2,457.

Australia, Canada, Denmark, Italy, the Netherlands, Norway and Turkey are partners in the programme, alongside the UK. Israel, Japan and South Korea also plan to buy the aircraft.

"As you look at other fighter programmes that have been at this stage of their development, I think we're working pretty well," Ms Hewson says.

For the aircraft's critics, the engine fire only confirms that the project is vastly overcomplicated and doomed to fail.

Winslow Wheeler, direc-



Doomwatch: critics of the F35 say it is bound to fail

Reuters

tor of the Straus military reform project at the Washington-based Project on Government Oversight, calls the fire "just another episode in the history of this airplane's complexity".

Despite recent cost reductions, the F35's cheapest variant is costing \$150m each, he says. "For that, we get an aircraft that in many respects is a step backward from aircraft it's replacing," Mr Wheeler says. "It's a monstrosity of complexity, which is the source of its unaffordable cost and its tremendously disappointing performance."

Many F35 problems stem from its genesis as an at

least theoretically sensible idea, namely that the US military's different air forces should ditch the wasteful habit of ordering and expensively developing entirely separate aircraft. The F35 is being manufactured in three variants: an air force version that operates from conventional runways; a Marine Corps craft capable of short takeoffs and vertical landings (Stovl); and a navy version for aircraft carriers.

The critics argue that its range of different roles makes the F35 poor at nearly all of them. Mr Wheeler says the requirement that the aircraft be

Stovl-capable dictates it having a relatively short, stubby shape and a single engine, which works against the requirement for it to reach supersonic speeds. On top of that, the aircraft has to have the stealth capabilities that will hide it from enemy radar and meet the needs of three different services.

"That's four levels of complexity," he says. "That's why we have an aircraft that's so expensive."

The US defence department's director of operational test and evaluation this year listed a series of concerns, including the tendency of the stealth coating

to come off after repeated use of the afterburners. The report criticised the F35's unpredictable handling and troublesome software.

Bruce Tanner, Lockheed Martin's chief financial officer, says the aircraft's critics are judging it by the standards of the last generation of fighters. Only Lockheed Martin's F22 fighter, introduced in 2005, offers comparable electronic capabilities. "They're ignoring the incredible sensor station that there is on those aircraft that no other aircraft in the world, with the exception of the F22, can bring to the fight," he says. "It's a different fight."

Pilots will have unprecedented amounts of information and be able to co-ordinate with other aircraft, using their weapons to launch long-range attacks, which should ensure they never face traditional close-range combat. "If an F35 gets into a dogfight, [the pilot] has done something wrong," Mr Tanner says.

Mr Wheeler accepts that there is no political will to scrap the project.

Mr Tanner, meanwhile, insists that the aircraft is on the way to transforming aerial combat forever.

Fighter jet Latest setback points to possible further delays in programme

The June engine fire, which occurred just before take-off, is the latest in a series of setbacks to the F35 Joint Strike Fighter programme. Like so many complex defence projects it is late and over budget.

When Lockheed Martin won the competition to build the JSF in 2001 it was envisaged that the first aircraft would enter service within 10 years. The programme is at least five years behind schedule, with the US Marines aiming to declare the aircraft operational with limited capabilities next year.

The technical problems (including making millions of lines of software code work) encountered during the initial production run of 100 or so aircraft, have raised concerns that this target too could be missed.

Steve O'Bryan, one of the US defence contractor's senior executives on the F35, says the programme was always designed for the testing and development phase to coincide with the early production run, a technique known as concurrent engineering.

"The theory of concurrency is it saves

money because you don't want to build 20 test aeroplanes and then shut down the assembly line and suppliers as you do the flight tests," he says.

This was an idea seen as central to lowering the cost of procuring expensive combat aircraft, but critics point to cost escalation that is only now being addressed.

The F35 was originally expected to cost about half the target price of \$75m-\$85m each, if volumes grow as hoped, depending on the variant.

Mr O'Bryan, a former US Navy fighter pilot, rejects criticism that the aircraft will never live up to its billing. He says claims that it will become vulnerable to detection much sooner than anticipated are ill-founded despite advances being pursued by China and Russia in radar technology that will defeat the F35's vaunted stealth capabilities.

"The key is you can't stand still," he says.

"So the idea behind the F35 is to build a weapons system that is made to be upgraded."

Mark Odell

Aerospace

Airbus bets on timely take-off for A350 despite past delays

Passenger jets Europe's latest is behind schedule, but with half the holdup faced by Boeing's Dreamliner, writes *Andrew Parker*

So far, so good. The Airbus A350, the European aircraft maker's first new passenger jet in seven years, and its most sophisticated aircraft yet, is on course to enter commercial service at the end of this year with Qatar Airways.

Analysts regard the wide-body A350 as the single biggest risk to the passenger jet subsidiary of Airbus. This is because new aircraft programmes by the Toulouse-based company and Boeing, its chief rival, have a track record of running up large cost overruns and delays that badly hurt the companies' profitability.

The A350 is running up to 18 months behind schedule. That, however, is half the slippage faced by the 787 Dreamliner made by Boeing of the US.

So, Fabrice Brégier, chief executive of Airbus's commercial business, may yet win the "bet" he placed in a Financial Times interview in 2012 that the A350 would not encounter delays similar to those endured by the wide-body Dreamliner.

Airbus remains haunted by the

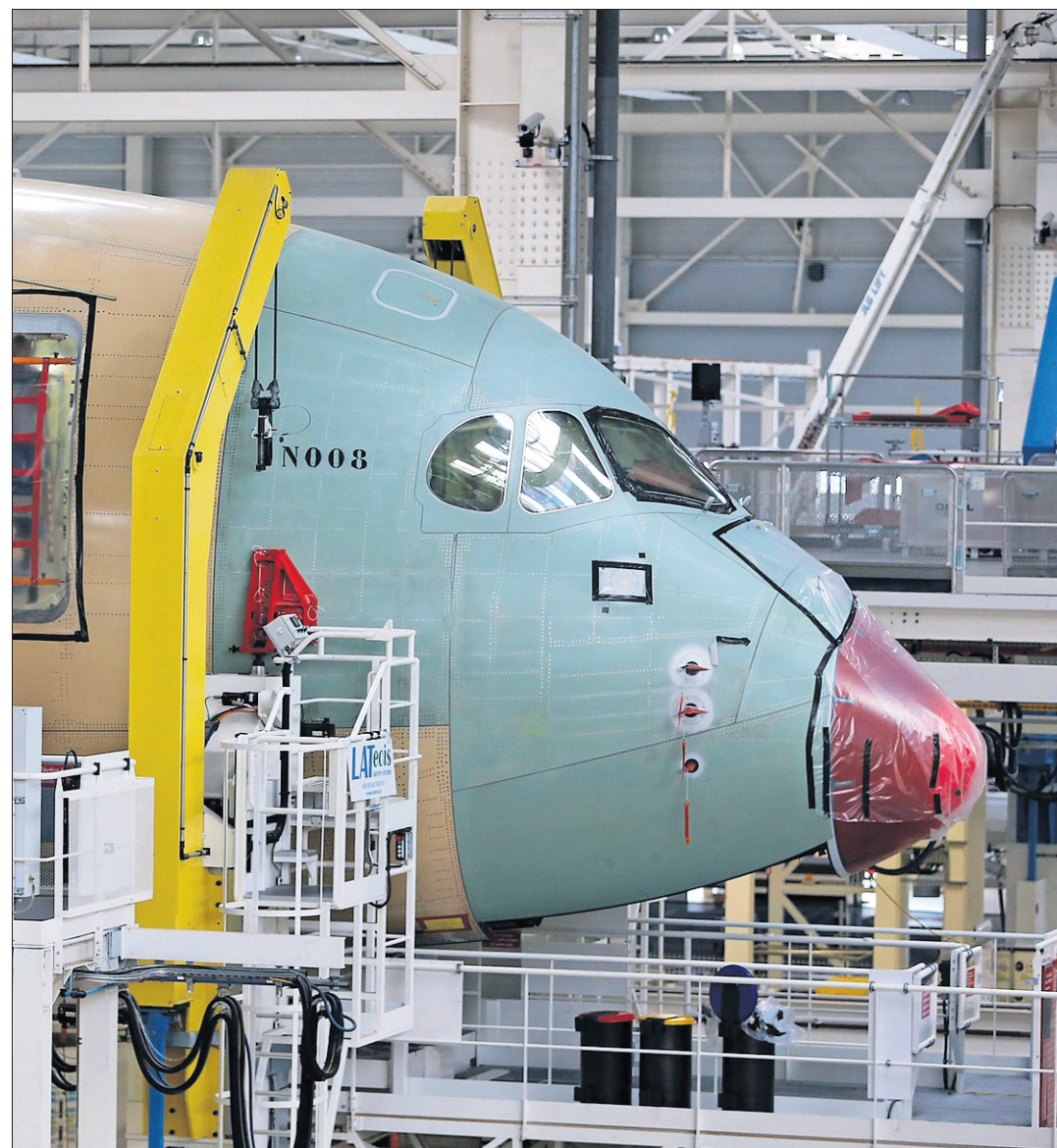
delays and production problems that accompanied the launch of its A380 superjumbo. It is determined to avoid a repetition with the A350.

The A380 entered service in 2007. Airbus had struggled with early production of the complex aircraft partly because of divisions inside the company that reflected rivalries between its French and German workers. Those divisions appear to have been resolved but the A380 programme remains loss-making. The project is due to break even only next year.

The A350's series of test flights began in June last year. Airbus has been able to stick to a challenging timetable partly because extensive reviews of the aircraft were done beforehand on the ground.

These ground tests are one key reason that Airbus is aiming for a 14-month period from first flight last year to granting by regulators of an airworthiness certificate. This compares with 20 months for the A380.

With the A350, "what has pleased me most [is that] we have initiated a lot of ground testing," says Fernando



Better late than never: the nose section of the A350 jet on the production line

Reuters

'What has pleased me most [is that] we have initiated a lot of ground testing'

Alonso, the Airbus executive in charge of flight testing. "We have made significant improvements relative to other [aircraft] programmes."

Mr Alonso adds that the test flights identified some problems, including with the doors for the landing gear and with software that controls the brakes. "All these are normal – that is why we do flight tests," he says. "We have not found anything 'Oh my God, I don't know how to handle this'."

But even though the path to A350 certification and entry into service appears open, some analysts, such as Douglas Harned at Bernstein, say there are bigger potential pitfalls after that, notably with the plans that Airbus has to increase production of the aircraft to 10 per month by 2018.

This is daunting not just for Airbus, but also for its supply chain because the A350, like Boeing's Dreamliner, represents a step-change in technology – it is mainly made from light-weight carbon fibre reinforced plastic rather than traditional aluminium, in order to reduce fuel burn.

In May, Harald Wilhelm, Airbus

group's finance director, said the company had not accepted certain items from Spirit AeroSystems, a US aerospace company that manufactures part of the A350's fuselage. He suggested this was because the particular components in question were not of the required quality.

"We don't want to have mess in our factory," he said in response to an analyst's question. "And that I think explains what we observe on the Spirit side."

Spirit said it was "proud" to work on the A350, adding the programme was still in its development phase. "We are working through some issues that are common to all development programmes. We will continue to support [Airbus] as [production] rates increase on this programme," Airbus said Spirit's fuselage sections were now in an "increasingly better shape".

One thing is clear. Even if Airbus manages to press the A350 into service on time, the challenges are far from over and the programme is not due to become profitable until towards the end of the decade.

Budget carriers create a new map for airlines

Economy travel

Cut-price upstarts gain the advantage, writes *Jane Wild*

When two airlines started offering cut-price fares in the 1990s they fired up a process of change that is reshaping Europe's aviation industry and leaving winners and losers in its wake.

Irish carrier Ryanair took inspiration from the US, where Southwest Airlines – its flight attendants clad in orange hot pants – had in 1971 been the originator of low-cost flying with \$10 and \$20 fares.

Ryanair was quickly followed by easyJet in taking advantage of deregulation and bringing the no-frills concept to Europe. The focus on low fares and simply getting the passenger from A to B was a revolution for passengers used to higher fares and the fuller service of traditional airlines.

But the resulting competition set in place a transformation that is blurring the boundaries between low-cost carriers and their traditional rivals. The cut-price upstarts have so far gained the advantage.

"Lower-cost carriers are taking the lunch of legacy carriers," says Jonathan Wober, analyst at the Centre for Aviation, a consultancy. "Legacy airlines have had to become more efficient and lower their costs."

Low-cost carriers have about half of the market and have seized customers from the traditional airlines, many of which are seeking to slash costs or are engaged in difficult restructuring. For example, International Airlines Group – parent of British Airways – has cut 3,000 jobs at Iberia, its Spanish subsidiary.

Low-cost airlines have pounced on opportunities in

countries with struggling national carriers. In Italy, Ryanair, easyJet and Vueling are competing over the territory of Alitalia, which has not made a full-year net profit since 2002.

"Low-cost carriers have demonstrated that short-haul air travel is largely a commodity product where the lowest-cost producers win," says Oliver Sleath, airlines analyst at Barclays.

"On a two-hour flight, the vast majority of passengers simply want a safe, punctual, comfortable journey at the best-value fare. That is what the low-cost carrier business model can deliver – and highly profitably too."

Average profit margins of leading low-cost airlines are in double-digits. Traditional carriers struggle to break even. To fight back, flag carriers have launched their own low-cost brands, such as Lufthansa's Germanwings and IAG's Vueling.

But the era of travel at the very lowest cost is over, say airline executives. Ryanair, which has the lowest costs in the industry, according to Centre for Aviation data, last year announced plans to

'Short-haul is a commodity product where the lowest-cost producers win'

improve its customer service amid two profit warnings by the company. It has aped easyJet with improvements, such as a more user-friendly website, dropping punitive charges for forgotten boarding cards and allowing a second small bag to be carried free on board. Yet analysts are divided on Ryanair's ability to polish up its public image.

Already Europe's biggest airline with 82.7m passen-



Style of the 70s: Southwest originated low-cost flying Getty

gers in the past year, Ryanair is looking to take a bigger slice of the lucrative business traveller market, as easyJet has done. This amounts to another step into the territory of traditional carriers.

While the pair have built an advantage as Europe's leading budget carriers, Ryanair has been less successful than easyJet in developing a route network. EasyJet, Europe's third biggest carrier after Lufthansa – with 63.4m passengers in the past year – has steadily built slots at the bigger and popular primary airports, such as Charles de Gaulle in Paris.

The budget airlines' success has enticed new entrants into the market. Norwegian Air Shuttle, Europe's number three low-cost airline, is mounting a big challenge with its attempt to take budget flying into a new phase – long-haul, another preserve of the traditional airlines.

Behind Norwegian are Vueling, Hungary's Wizz, and Turkey's Pegasus.

"We see a push from the low-cost carriers to move upwards," said Holger Taubmann, vice-president of distribution at Amadeus, an online distributor of

tickets and other services for the industry, whose clients include easyJet and Germanwings.

It is a reflection of their success that the budget airlines have seen traditional carriers copy them. Just as Ryanair sells assigned seating and hold space for luggage as extras, British Airways has started to charge more for additional checked baggage. "Full-service carriers are emulating low-cost carriers, trying to sell additional services," says Mr Taubmann.

Average revenue from such services has risen for airlines from zero in 2007 to almost \$20 per passenger now, says the International Air Transport Association.

Competition may be toughening but it comes at a time of rising commercial airline profitability in Europe, where total net profit of all airlines, including low-cost carriers, is expected to reach \$2.8bn this year. That compares with \$500m in 2013 and is driven by the low-cost airlines, says Iata.

With airlines' business models converging and traditional airlines forced to retrench, analysts agree that the sector is set for further consolidation.

Low-cost Scandinavian operator retains hope of living the dream

Profile Norwegian Air Shuttle

Delays and lack of alliance partner have hit services, writes Richard Milne

On Saturday June 21, more than 200 passengers were looking forward to flying from Orlando to Oslo on Norwegian Air Shuttle's new Boeing Dreamliner. Their excitement soon changed to irritation. Maintenance problems led to delays that grew longer and longer. The 221 exhausted passengers eventually arrived in Oslo more than 44 hours late.

The incident was a familiar one for low-cost Norwegian. Since the airline started long-haul services last year with the Dreamliners, it has faced a barrage of negative headlines. Big delays, unhelpful staff and an inability to purchase even water on some flights have threatened the airline's hitherto good local image.

If ever an area were made for a low-cost airline, it would be Scandinavia. Dominated by SAS – part-owned by the governments of Denmark, Norway and Sweden – the regional air industry has been characterised by higher prices than in much of Europe, where the likes of Ryanair and easyJet have helped reduce fares.

Enter Norwegian and its chief executive, Bjorn Kjos. A former fighter jet pilot and author of crime novels, Mr Kjos has shaken up the Scandinavian market with much of the same chutzpah and publicity-grabbing antics as Ryanair's Michael O'Leary did in Ireland and the UK.

Norwegian Air Shuttle started in 1993 in modest circumstances. Mr Kjos, at the time a lawyer, took a big stake as it was proving difficult to find other investors. A decade later, the airline with which Norwegian had a contract for commuter routes was taken over by SAS. Mr Kjos pushed ahead with a focus on low cost.

Norwegian is now a clear third behind Ryanair and easyJet. Its lowest fares are not as cheap as Ryanair's but its onboard services usually match those of its Irish rival. It has become one of the first European airlines to have WiFi on most of its planes.

But as the Orlando delay shows, Norwegian is at a delicate stage in its development. It has fast expanded its short-haul network in Europe, with bases not just in its Scandinavian homeland at Oslo, Copenhagen and Stockholm but also at airports such as London Gatwick, Madrid Barajas and Tenerife.

It has become the latest low-cost airline to attempt to crack the long-haul market. Many have failed, such as trailblazer Laker

Bombardier Too early to celebrate over future of CSeries airliner

Two events in the past year at a cargo airport near Montreal could prove decisive to the success or failure of Bombardier's CSeries jet.

On September 16 last year, the aircraft – meant to challenge the Airbus and Boeing duopoly in narrow-body jets – took off for its maiden flight from Mirabel airport. Participants in the celebrations hailed the craft as "a game-changer".

Then, on May 29, after a test flight, a serious failure occurred in the engine of a CSeries aircraft on the ground at Mirabel. While the aircraft has returned to ground testing after adjustments to its engine – Pratt & Whitney's new PurePower engine – the aircraft has yet to return to flight and will not fulfil plans to be at this month's Farnborough Air Show.

The challenge for Bombardier is to return the aircraft to flight and secure new buyers. Amid a deluge of orders for the products of Bombardier's bigger rivals, orders for the CSeries are growing only slowly.

Cai von Rumohr, analyst at Cowen, the investment bank, shares the widespread scepticism about whether the project will finally succeed.

"I think they've got their work cut out for them," he says.

Bombardier continues to be optimistic that the aircraft can reach 300 firm orders by the second half of next year – when it starts carrying passengers – from the 203 at present.

Pierre Beaudoin, Bombardier's chief executive, told analysts in May, before the engine incident, that the company was pursuing "quite a few very active campaigns" to win new orders.

"People have been following the programme since the beginning and now are gaining more and more confidence with the airplane as the flight test [programme] is progressing," he said.

The problem facing the aircraft goes well beyond the current technical one.

It was designed to target a perceived gap in passenger capacity between regional jets and Boeing's 737 and Airbus's A320 family. Regional jets – of which Bombardier is the largest single producer – typically carry fewer than 100 passengers while the 737 and A320 usually carry a maximum 189 and 180 people respectively.

Because regional jets have grown in size and smaller narrow-body variants – such as Airbus's A319 – can be configured for as few as 130 passengers, the gap has turned out to be far smaller than anticipated. The budget airlines that are among the biggest buyers of narrow-body jets tend to seek to carry as many people as can safely be crammed into a single narrow-body aircraft.

Michael O'Leary, chief executive of Ryanair, Europe's largest low-cost airline, made it clear when he announced an order for 175 Boeing 737-800s in March last year that the 737's 189-passenger capacity made the aircraft more attractive than the A320, which carries only nine fewer passengers.

Mr von Rumohr points out that the larger the aircraft grows, the more it competes directly with Boeing and Airbus, which have the scale advantages of producing 40 or more of their narrow-body aircraft a month. Rivals such as Brazil's Embraer have been wary of straying too far on to the larger players' turf.

But there is the possibility, Mr Rumohr adds, that the CSeries will find such a gap in the market that customers order it in large numbers. Boeing's 727 airliner proved to be that kind of surprise success in the past.

However, he says, "I think there's a much greater risk of potentially not doing well with the CSeries."

Robert Wright

Airways, while others have struggled. Air Asia gave up its routes between Asia and London and Paris because of high fuel prices and low demand.

Norwegian does not lack ambition. It has five Dreamliners and orders in for 12 more by 2018. That is on top of the biggest aeroplane order placed in Europe: 222 short-haul Boeing and Airbus aircraft.

Mr Kjos is insistent that the timing is right for cheap long-haul flights. He argues that previous airlines struggled because

'It will be tough. The fact that Ryanair has not done low-cost long-haul speaks volumes'

they were not able to use fuel-efficient aircraft such as the Dreamliner. "First of all, I don't think they have had the possibility due to the type of aircraft they were flying," he says. "To do long haul today on a low-cost approach you need a very good aircraft. That means you have to have a low fuel burn and you have to have a possibility to keep it up in the air as long as possible." He stresses that the aircraft need to be used 17-18 hours a day rather than the 12-13 hours previously possible.

The repeated delays to its Dreamliners have hurt Norwegian. As it lacks an alliance partner, it has found renting replacement aircraft expensive and tricky. In the Orlando case, it had to wait for a part to come from London and was not able to charter a replacement aircraft as the football World Cup was soaking up capacity.

Oliver Sleath, analyst at Barclays, says fuel costs and passenger taxes are big hurdles on long-haul flights. "It will be tough to make it work," he adds. "The fact that Ryanair has not done low-cost long haul speaks volumes."

Norwegian has suffered PR problems over its attempts to avoid high Nordic labour costs by basing planes and crew in other countries, such as Spain, the UK, the US and Thailand. Its attempt to exploit the US-European "open skies" agreement by establishing a base in low-tax Ireland has run into trouble in the US from airlines and unions.

Mr Kjos professes to be unfazed. In Asia he is turning his sights beyond Thai destinations popular with Scandinavians.

Two groups of airlines will be left in Europe, he says. One is big legacy carriers such as British Airways, while smaller ones – such as SAS – will struggle. The others, naturally, will include Norwegian. "Low-cost carriers," he says, "will be stronger and stronger."

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Aerospace

Record casts doubt on 'never again' promise

MH370 Authorities failed to act on a previous disaster, writes Mark Odell

The disappearance of flight MH370 ranks as the greatest mystery of the modern jet age. Four months after the disappearance of the Malaysia Airlines Boeing 777 investigators are still no closer to solving the riddle.

This is in spite of the recent methodical search for the airliner, which vanished without a trace after leaving Kuala Lumpur in the early hours of March 8 en route for Beijing with 239 passengers and crew aboard.

The favoured theory is that someone onboard, most probably one of the pilots, deliberately turned off all the transponders that would have identified the aircraft on radar and then effectively hijacked the aircraft.

But there are just too many unanswered questions to quell the unease felt behind the scenes by many in the airline industry. Despite promises to ensure that such an event never recurs, there are doubts about how effectively the authorities will implement any recommendations to track commercial airliners.

In the absence of mandatory tracking, the only evidence that enabled investigators to focus the search efforts – on a part of the ocean thousands of kilometres to the south from the last known position of MH370 – was a complex scientific analysis of an intermittent satellite signal from an automatic system on the aircraft.

This data, from an Inmarsat satellite, was combined with primary radar data supplied by the Malaysian air force, which had ignored an unknown radar contact crossing its airspace but only later concluded it must have been MH370.

Four months on from the disappearance, and that same set of data has been used to define a new 60,000 sq km search area. Specialised vessels are mapping the southern Indian Ocean floor before a new deep-sea search commences. This search, using autonomous mini-submersibles and sonar from surface ships, could take another year.

Costs are hard to determine because so many countries have taken part. The Australians, who have led the search from the early days, have allocated A\$90m (\$84.3m) to the effort.

The focus for airlines is to ensure the industry retains the trust of the public. This is paramount for a sector plagued by such thin margins that it struggles to sustain profitability. The impact of the 9/11 attacks, when many people shunned flying for months,

Flight MH370 Many questions and few answers



Sources: Malaysian government; Australian Transport Safety Bureau

All times Malaysia Standard Time

FT Graphic. Photo: Dreamstime

almost brought the sector to its knees.

It was not surprising, then, that less than a month after the Malaysian aircraft's disappearance, the airline industry vowed this must never happen again. "The loss of MH370 points us to an immediate need," said Tony Tyler, director-general of the International Air Transport Association. "A large commercial airliner going missing without a trace for so long is unprecedented in modern aviation. And it must not happen again."

He said Iata and the International Civil Aviation Organisation, the UN agency that sets global standards, were "working together to agree on the best options to improve global tracking capabilities".

Those assurances disguise the fact that ICAO failed to implement key recommendations put forward by French air accident investigators in the wake of the 2009 crash in the South Atlantic of Air France flight 447, whose black boxes took nearly two years to discover. The French recommendations would have required the tracking of all large aircraft flying over water and forced commercial airlines regularly to "transmit basic flight parameters" such as position, altitude, speed and heading.

The 219-page report by France's Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA), published in 2012, also proposed changes to the way black boxes, or

flight data recorders, work on aircraft that operate over water. One proposal, extending from 30 to 90 days the life of the battery that powers the transponder used to locate black boxes after a crash, was adopted by ICAO and will come into force in 2018.

Rémi Jouty, head of the BEA, told the FT earlier this year that all the recommendations were made to avoid a repeat of "the difficulties we had in locating AF447 in mid-ocean". While the tracking technology exists, Mr Jouty pointed to "a need for govern-

ments at the international level to reach an agreement". Although ICAO had discussed the proposals, he said "one aspect" of its failure to require tracking was lobbying by airlines concerned about cost – a view corroborated by a senior airline executive.

Iata's Mr Tyler insists "MH370 is very different from AF447". "While we knew pretty accurately where AF447 went down, the issue with MH370 is that it disappeared from tracking capabilities, which included radar surveillance." An interim report into the

disappearance of MH370 by the Malaysian authorities repeated the BEA's recommendation that commercial aircraft should be tracked at all stages.

Mr Tyler says the trade body will "have some draft recommendations to share with ICAO and our members in September. And our board will decide on it in December".

Iata cannot mandate the use of tracking equipment. That would require ICAO action – and the UN body's record on rapid implementation of any changes is poor.

'The loss of the airliner is unprecedented. And it must not happen again'

First sits below business in airline bottom lines

Class differences

Experiments protect industry golden egg, says Rose Jacobs

What is the difference between first and business class? Rather than a set-up for a joke, this is a much-debated matter in airline forums. Many come to the conclusion that first is not worth the extra money.

The question of late has been whether airlines agree. As many carriers squeeze extra cash out of perks most people once saw as core to air travel, such as reserved seats and checked luggage, and as members of "the one per cent" lie low after the global recession, it is not so crazy to think of the first-class cabin as a disposable luxury.

Yet in an industry as cyclical as aviation, it is difficult to find a trend that has not been seen before – which is perhaps why the notion elicits eye-rolling among industry veterans. "I can count 10 times in the past 45 years that first and business class have come under the cosh," says Tim Clark, president of Emirates Airline. "And the more I hear about it, the more it's music to my ears."

More first-class customers for him, in other words. Indeed, while the economic cycle does have a big impact on business travel, the people who buy first-class seats – paying twice as much, often, than the next class down – tend to be somewhat immune to economic downturns. All Emirates' first-class seats to the US are booked up to the end of August, Mr Clark says.

That means that the fate of first class has much less to do with demand and more to do with supply:



Option for 'the one per cent'

whether airlines are willing to devote cabin space to a class of seats that is generally considered lower-margin than business class (once you consider the capital investment required for the likes of in-flight showers and flying art galleries) and with a smaller audience, too. Three-quarters of the space in Emirates' premium lounges is devoted to business class rather than first. On some routes, first class is not an option at all.

Douglas McNeill, a long-time airline analyst and now investment director at stockbroker Charles Stanley, cites three reasons why airlines retain first-class seats. First, there is the money. Mr McNeill doubts that any airline that lost money on first-class seats would keep them.

Then, there is a branding benefit: "It adds a bit of pizzazz to the brand, a bit of glamour," says Mr McNeill. The very idea of the first-class cabin reminds passengers that flying need not be a chore; it might even bring you, briefly, shoulder-to-shoulder with a musician or film star – provided they haven't boarded into an upper-level cabin via a private gangplank.

Finally, there is a marketing benefit related to

products throughout the aircraft. "First-class products exude a kind of halo effect on the other classes," Mr McNeill says.

Mr Clark talks about it as a trickle-down effect: "What we do in premium cabins cascades down into economy."

On some airlines, perks offered as part of a first-class package might eventually turn into something economy-class fliers can buy a la carte, playing into one of the biggest trends in the industry: an unbundling of products and services. This blurs the lines between classes, with some economy fliers buying access to the premium lounges in the airports, for example, or paying for extra legroom.

The success of these offers has led some carriers to create a new class: premium economy. At British Airways, for example, these fliers even sit on the upper deck of the A380 – a space reserved in the past for business and first class.

A fourth class presents logistics issues – and costs – but new computerised booking systems could help ease these. Does that mean that premium economy might start eating away at business class? Mr McNeill doubts it: in the same way that business class tended to pull more travellers up from economy rather than down from first, he thinks premium economy will prove margin-enhancing for airlines.

Mr Clark does not anticipate a fourth class in Emirates' immediate future but "would never say never". It is about the careful calibration – and about protecting the golden egg – of business class. "You don't want to close the gap too much," he says. "Premium economy yields bear no resemblance to business-class yields."

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Aerospace

Drones enter more sober zone

UAVs Stricter budgets and appetite for intervention may prompt reassessment, writes *Sam Jones*

Few new technologies can have so comprehensively changed the military arsenal in recent years as drones.

The use of unmanned aerial vehicles – as they are more properly known – has gone from almost total secrecy to ubiquity and is continuing to grow. The US department of defence operates more than 8,000 UAVs, roughly 40 per cent of its entire air fleet.

In Afghanistan, drones have become central to Nato's security mission. An estimated one in every four missiles used in air strikes there is fired from an unmanned system. In conflicts such as Syria, drones are in extensive use. Western powers operate an undisclosed number of surveillance missions over Syrian airspace from bases in Turkey, Jordan and Israel.

The way in which militaries think of drones is perhaps at a turning point. After a flurry of interest – and many new prototype designs from contractors – many defence ministries, constrained by both budgets and appetite for interventionism, are making more sober assessments of their future need for UAVs.

"The idea that in five years' time the whole of the air force is going to be unmanned is wrong," says Elizabeth Quintana, senior research fellow for air power and technology at the Royal United Services Institute in London. "There are limitations on what UAV systems can do. How will they perform QRA [quick reaction alert, or scrambling] to escort Russian bears out of airspace, for example."

Frequently, Ms Quintana points out, pilots, and their judgment, are needed in the air – even looking cockpit to cockpit – and not just on the ground.

As a case in point, planners in the UK are beginning to consider their options for replacing the Typhoon – the Royal Air Force's principal combat aircraft – when its service runs out in 2030.

Certainly drones are being considered. But they may not end up being the whole part of the picture, according to current thinking among MoD mandarins. Indeed, opting to make drones the mainstay of the RAF's air power in 2030 would be a peculiar move at a time when the government has committed to investing £15bn in



Homing in: drone programmes have fallen victim to runaway costs

Getty

carrier-capable F35 joint strike fighters. Drones do not come cheap. Although they are far from being the preserve of the wealthiest nations only – the Iraqi army, for example, operates a small fleet – at this cutting edge of UAV technology, there are so far only a limited number of players able to

afford the huge costs. Developing the most sophisticated drones can require investment and timescales similar to those seen for regular aircraft.

Even producing basic weaponised systems is an expensive – and so far relatively specialist – affair. Of the Pentagon's vast drone fleet, just 1 per

cent are weaponised, reflecting their cost and complexity.

"Lots of people can do cheap systems but when you want more complex ones the costs rise steeply," says RUSI's Trevor Taylor, professorial research fellow in defence industries and society.

The very earliest stage prototype costs for the BAE Systems-developed Taranis combat drone have already mounted to £185m. The Northrop Grumman X-47B, meanwhile, designed to be launched from an aircraft carrier, has so far cost \$813m in its early prototype stage.

As with other complex military systems in development, drone programmes have become victim to runaway costs that have hampered rollout of some of the newest systems. Germany, for example, cancelled its order for a European version of the Northrop Grumman Global Hawk – to be known as Eurohawk – after costs rose by more than \$780m to bring it in line with European airspace regulations.

Amid tightened budgets most militaries have increasingly reverted to existing, basic systems rather than opt for expensive new ones.

Indeed, the potential for a European-developed MALE – medium altitude long-endurance – drone system looks troubled. With a set-up cost for the facilities to manufacture such drones in Europe estimated at \$1bn by defence contractors, there is little justification not to turn to existing systems.

"Across Europe there were vanguard programmes being explored that had received government funding," says Ms Quintana. "But a lot of people began asking why they were trying to make their own systems for \$90m when you could buy a [General Atomics] Reaper off the shelf from the US for \$30m."

The clearest example of such thinking came late last year when the French military opted to replace its fleet of EADS-outfitted Harfang drones with Reapers. There was "no alternative" to the cheaper US system, said French defence minister Jean-Yves Le Drian.

Increasingly, says Ms Quintana, it is a question of: "Either you go to the Israelis for it, or you go to the US – or you don't go at all."

Online giants study unmanned option

Internet

Facebook, Google and Amazon explore prospects of drones of their own, writes *Hannah Kuchler*

What might a search engine, a social network and an online shopping site have in common? They could all want to make – and fly – drones.

Unmanned aerial vehicles once fell largely into two categories: those made ready in top-secret military hangars for attacks on foreign soil; and those assembled on the kitchen tables of enthusiastic hobbyists.

Now internet companies are beginning to experiment with the next generation of UAVs.

Facebook and Google have bought drone manufacturers this year. This is part of their effort to bring internet connectivity to remote parts of the world using drones instead of satellites as telecom relays. Amazon made headlines last Christmas by announcing that it aimed to begin delivery by drone within five years.

Christian Sanz, chief executive and founder of Skycatch, a drone operating platform, says many of the components it takes to build a drone have been commoditised, making it easier for companies outside the aerospace sector to produce their own UAVs.

Mr Sanz thinks drones will become more mainstream as they become more robust and the software it takes to fly them develops.

Yael Maguire is an engineering director for the Facebook Connectivity Lab, which he joined after founding his own company and doing a doctorate at the Massachusetts Institute of Technology. The lab is part of Internet.org, a Facebook-lead initiative to make affordable internet available to the two-thirds of the world that is not online. Mr Maguire and his team want to improve access to the internet by a range of means, from cutting the amount of data transmitted over networks, to using drones, satellites and lasers.

Facebook turned to drones because they are a "very pragmatic choice" with the benefits of satellites at a cheaper price, Mr Maguire says. "The tantalising aspect of drones is they may be able to offer the same capabilities of satellites" for much less cost.

Drones are not without their problems. Facebook wants to keep them airborne for as long as possible, to give consistent internet access and to make them easier to operate, by using solar power as fuel. To do this, it must make the battery that stores the power at night very light.

"We're trying to design a system effectively the same size as a traditional aircraft but which weighs 10 to 100 times less," Mr Maguire says.

To do this, the social network has bought the small engineering company of Ascenta in Somerset, England. Ascenta helped British defence technology company Qinetiq start its Zephyr drone programme a year ago.

Google has also built its drone team by acquisition, buying Titan Aerospace, a New Mexico-based start-up with about 20 employees. Its primary aim is, like that of Facebook, to bring the internet to far-flung corners of the world. It is also experimenting with high-altitude balloons as relays.

Jonathan Downey, chief executive of Airware, another drone platform,

"We want a system that is effectively the same size as an aircraft but that weighs 10 to 100 times less"

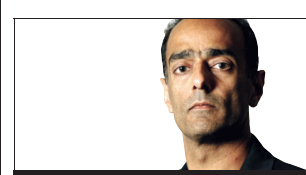
says he welcomes more companies such as Facebook coming from outside the aerospace sector into the drone market.

He dismisses Amazon's plans to make deliveries of products by drones as a "gimmick", noting that it was announced on the eve of the biggest online shopping day of the year. Even if such a delivery scheme were technically possible, regulators could still object for fear of the unmanned aircraft dropping its precious load on passersby, or colliding with aircraft and power lines.

In the US, the Federal Aviation Administration ruled in June that it would not allow such drones to deliver packages.

A US government watchdog recently warned that the FAA would not meet its deadline of September 2015 to provide drones with regular access to US air space, rather than someone flying a drone of their own over their land, which is allowed at present.

The 21st century promises era of radical change, but no rocket belts



FLIGHT LINES
ROHIT JAGGI

It is the 21st century. We should all be going to work by rocket belt, have a flying car in the garage for family outings, and be able to go halfway around the world on a hypersonic airliner in two or three hours.

One hundred years on from the first commercial airline flight, which was a short hop in Florida with just one paying customer, it is easy to feel the pace of development in aviation has slowed. That 23-minute journey came just a decade after the Wright brothers' pioneering flight in a powered, heavier-than-air machine.

Much of the progress that followed ran ahead of the infrastructure – flying boats could operate without runways so were used to link continents in the 1930s by the likes of Pan American World Airways and Imperial Airways. But the airfields that mushroomed in the 1940s meant land planes led another era of rapid expansion as jet engines fuelled the growth of commercial aviation.

Since then, however, with the exception of the supersonic and now extinct Concorde, airliner cruise speed has been stuck at about Mach 0.85, while airport infrastructure is once again a brake on growth. Many existing airports lack capacity, while noise and environmental concerns are pushing planned airports further away from the cities that are passengers' final destinations.

Technological change is still happening, though. Turbofan engines have become, on average, 1 per cent more efficient every year for the past two decades. The Pratt & Whitney geared turbofan,



Future vision: the Jetsons TV cartoon family's favoured transport remains a fantasy

or PurePower engine, that has been chosen for the Bombardier C-Series airliner promises to be 10-15 per cent more efficient than current aero engines.

Yet the pace still needs to step up. The aviation industry has set itself a target of a 50 per cent reduction in carbon emissions by 2050 compared with the levels of 2005. And while packing more passengers on to each aircraft can yield greater efficiency, we have probably already seen in the Airbus A380 superjumbo a limit to the size of aircraft that existing airports can handle.

Encouragingly, aircraft powered by electric motors are rapidly moving from being pie in the sky to a real possibility. Airbus Group Innovations is putting into production two- and then four-seat electric light planes, based on the E-Fan prototype that it will have on display at the Farnborough show.

The all-electric E-Fan 2.0, with a flight time per single charge of about an hour, is slated for the end of 2017, and the four-seater that follows will be a hybrid, using an engine to charge the batteries – meaning that range is only as much of an issue as for conventional aircraft.

Battery technology is moving forward rapidly, propelled by the consumer

electronics and automotive markets, and there is huge potential for aircraft as that technology improves. As Sébastien Remy, head of innovation at Airbus, tells me, the goal is clearly hybrid airliners.

As far as the speed of air travel is concerned, supersonic will return. Lockheed Martin's successor to its SR-71 spyplane of the 1960s is planned for about 2030, and should be capable of Mach 6, or 4,500mph. The technology is there to be repackaged into passenger-

Aircraft powered by electric motors are moving from being pie in the sky to a real possibility

carrying planes. And engineers, at Nasa among other places, are working on ways to quiet the sonic boom. Put those two together, add the potential that US company Aeron sees for the latest version of its planned supersonic business jet, and speedy airline travel seems likely.

In the longer term, the trajectory of transcontinental travel could be steep. Spacecraft of the type developed by Elon Musk's SpaceX are reusable and can land vertically. That is a boon

for his Mars plans, but could revolutionise travel around the globe too. A flight from London to Sydney, say, could describe a parabolic arc to the edge of space or beyond, cutting the journey to four hours or less.

Meanwhile hybrid power for helicopters could serve to minimise the most oft-quoted irritant when they fly into city centres – noise. Switching to electric-only mode for approaches and departures could open up new city-centre sites for heliports and thus revolutionise travel.

One can discount any return of radical ideas such as the 1931 plan for a rooftop set of runways at King's Cross in London. Safety fears over what would happen if an aircraft fell off the edge are just one reason for this proposal's demise. But a heliport needs only a small footprint and neighbours who are not outraged by a noise nuisance.

And the timescale for all of this? One hundred years ago flying was all about wood and canvas aircraft, and frequent crashes. Aviation today is almost unrecognisably changed: another century from now, the picture will certainly look as different again, though rocket belts are still, regrettably, not likely to be an everyday item. One can only hope that airport security screening makes as much progress.

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