# Aircraft interiors INTERNATIONAL

2019 SHOWCASE

## *Inside this issue*



**2019 DESIGN SHOWCASE**

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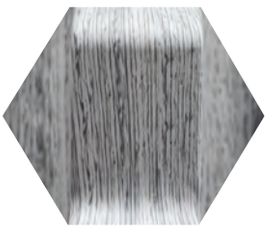

# PEAK STUFF

Welcome to the 2019 Showcase edition, a special annual publication that brings together some of the best aircraft interior design insights and projects from 2018, and ideas for the next generation of cabins. We have also collected some rather arresting statistics from the year, as you can see on page 144. For example, by the time this publication goes to print in late 2018, airline profits should have reached US$38bn, a US$4bn increase over 2017, and the global interiors market should have reached US$26bn.

That latter figure is remarkable, especially given that it is projected to grow further over the next three years, to nearly US$39bn. So where does the money go? Of course it isn't all showers, suites and fancy fittings (although for some great examples of luxury, see Acumen's work for Etihad on page 62). Indeed some design houses are responding to a perceived change in the zeitgeist, a need for more environmental responsibility in the cabin space, and perhaps a way for the environmentally minded to feel better about flying. Adam White, director of the Factorydesign studio, discusses his thoughts on this topic on p58 with what he describes as the 'vegan cabin'.

Further food for thought comes from Tangerine (p66), which explores the experience economy, with insights from the likes of McKinsey, Cornell University and even IKEA. By following the research conducted by organizations such as these, the studio has found that as consumers in the West reach 'peak stuff', they are seeking satisfaction and well-being from spending on experiences rather than tangible goods. This is clearly good news for the travel industry, and therefore the airline industry. Even within the aircraft environment, garnering customer satisfaction is not all about investment in hard product. Of course, the physical aspect is important, but it may be best considered as the 'theater of service', complementing service innovations for an all-round amazing passenger experience.

Speaking of amazing passenger experiences, you should take a look at the Airlander on page 82. This airship is an example of the journey truly being more important than the destination, especially when that journey can see passengers float above anything from the North Pole to the Serengeti, all in air-conditioned safety and luxury. Design Q, the company that created the cabin design, also believes that the sofa seating could influence future seat design in commercial first class.

There are many more examples of great cabin designs in this issue, but which is the best? Ask a cross-section of the flying public and personal tastes and bias will elicit several different opinions, for all sorts of different reasons. However, a French design studio, Style&Design (p86), has created a rather clever tool that can translate the perceived quality of various aircraft seats into hard data. A really interesting idea, I'm sure you'll agree.

Something else upon which we may agree is that the Boeing 747 is a truly special aircraft, and we celebrate the 50th anniversary of the Queen of the Skies on page 38. Put through a system such as Style&Design's qualitative engineering process, some aspects of her experience may fade in comparison to some newer models, but whatever the numbers say, for many she still holds a special place in our hearts.

*Adam Gavine, editor*


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## *Up front*



# *Design showcase*



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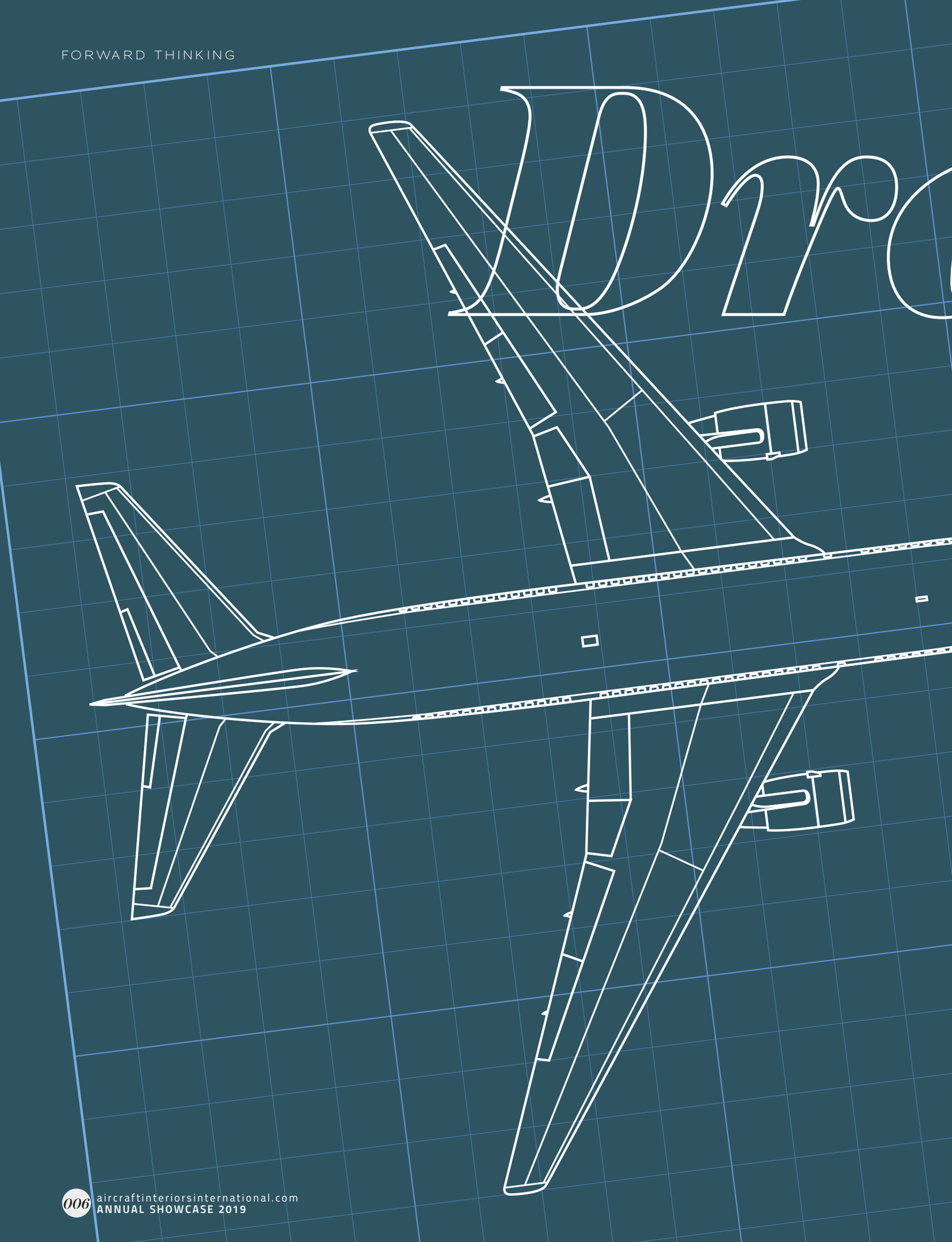
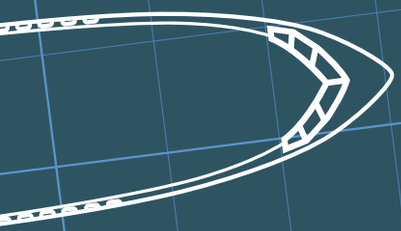


# dream machine

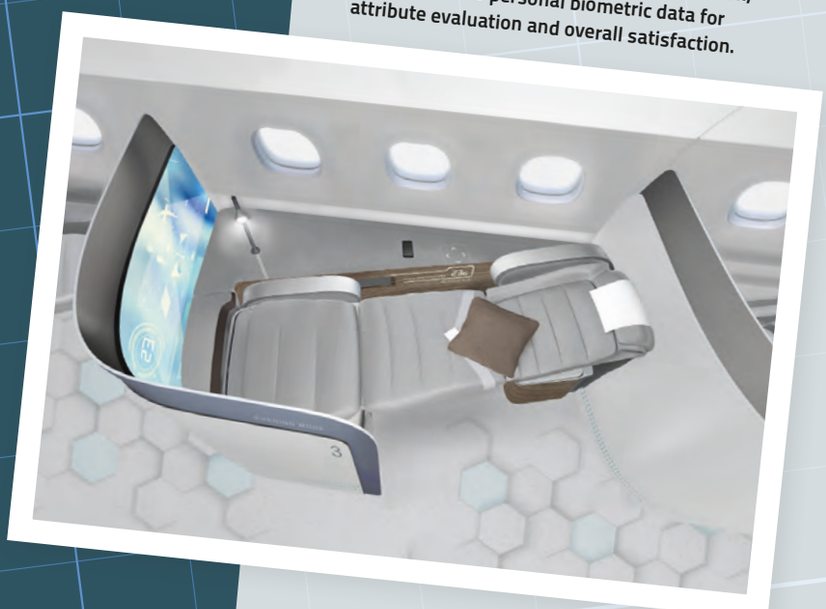
We challenged the design studios and industry suppliers within this Showcase issue to dream up ideas for the next-generation passenger experience. These are their ideas, from nose to tail



## PHONE FANS

**Sekisui SPI (p92) would like to welcome future flyers to 'custom class', which the company sees as more than a mere flight of fancy. As the passenger boards, the plane connects with their cellphone, and then as they enter custom class, a small band of light on the outer edge of the seats pulses in tandem with the vibrations of the phone, both of which quicken as they approach their seats, helping to guide them.**

**Once in the seat, snap the phone into a wireless panel, and the tray table transforms into a touchscreen keyboard. Using a 'dimmer' area on the thermoplastic panel, the passenger can manage IFE, ambient light, volume and more. The phone stores inflight preferences, including meals served, miles flown and sleep duration, and also tracks personal biometric data for attribute evaluation and overall satisfaction.**



## A MORE VARIED ECONOMY

**The vision for a dream airline at tangerine (p66) is one that brings value and outstanding experiences to each passenger. Therefore the studio imagined a concept that focuses on the area of the aircraft that is most often overlooked – the economy cabin.**

**The concept cabin is divided into zones that create targeted spaces where those who want to work can do so away from those who want to rest. Instead of having one design of seat try to encompass multiple behaviors, the concept has specialized seats that more accurately meet specific passenger needs. Creating tailored zones in this way enables the airline to introduce different pricing strategies for customer segments, attracting various audiences.**

**This concept provides passengers with a personalized experience and the ability to choose whether to dream, immerse or create.**

## SUPERFAST STREAMING

So what could the future hold for cabin connectivity? PDT, an Astronics company (p134), is working with a Scotland-based innovator pureLiFi to evaluate and test its li-fi (light fidelity) technology for use in the aerospace connectivity market. Li-fi leverages light to send information, in contrast to wi-fi, which uses radio waves.

Proved capable of transferring unprecedented data at several gigabits per second, li-fi could eventually empower passengers to download an HD video in just a few seconds. According to the company, li-fi could be an exciting future passenger experience delighter and IFE technology disruptor.

**Visit the *Aircraft Interiors International* website for more details about li-fi technology**



## ENGAGED CUSTOMERS

Every passenger wants improvements to the cabin in terms of connectivity, comfort, lighting and privacy, but for Nigel Goode, a designer and director at PriestmanGoode (p54), the dream airline is the one that looks beyond aircraft interiors.

"Air travel is not just about the flight, or the day of travel. The experience starts from the moment passengers book their ticket. The dream airline is the one that understands that and incorporates a single design vision, from ticket purchase through to arriving at the final destination. There are countless opportunities for customer engagement, but you need to have a distinct design identity that is incorporated into every element of the brand experience – from websites to apps, marketing and in the physical products so that each element of the individual passenger journey is rendered effortless."

**Visit the *Aircraft Interiors International* website for more insights from the world's top cabin design studios**

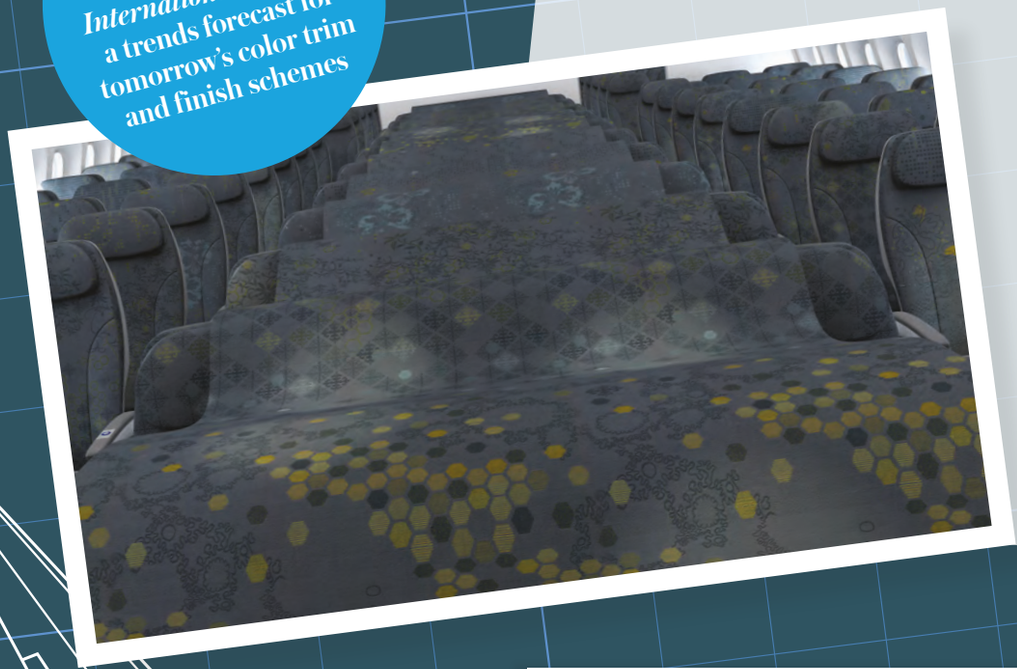
## THE BEST VIEW ON BOARD

Autonomous flight could free-up the best seat in the house. This is the view of Matthew Fiddimore, an associate at Factorydesign (p58). "Imagine a passenger cabin that extends all the way to the nose of the aircraft. With future autonomous flight, there is an opportunity to radically rethink the traditional layout of the aircraft. Pilot and cockpit can be removed, liberating the very best real-estate for passengers.

"This new in-flight destination would change constantly throughout the flight, giving passengers a new experience every time they visit – 180° views of Earth's curvature really bringing back the wonder of flight – a dramatic return to the original in-flight entertainment.

"With the flight deck removed, the opportunities are broad. We could create a fully contained first class cabin with panoramic views and even more prestige for seat 1A, a business class lounge complete with observation deck, or even an open, light-filled economy cabin with space to admire the view. The possibilities are truly exciting."

The November issue of *Aircraft Interiors International* features a trends forecast for tomorrow's color trim and finish schemes



## ECLECTIC IDEAS

**The dream airline for many people would offer a more personalized passenger experience. However, an interesting angle from Katrin Hielle-Dahm, rohi's head of design and managing director, is that the design of seat covers could add personalization (p128).**

**"Too often every seat looks the same, with identical, uniform, bland, corporate and monotonous color schemes providing little or no variation. You don't want a complete mismatch, but the ability to inject a little more customization and differentiation. This is something we have patented with our Eclectic textile concept, and we hope to develop the idea further over the next 5-10 years."**

## AN HONEST EXPERIENCE

**"Our dream airline is the first to truly break through and sell on product, showing consumers what they will actually get for their money once on board the aircraft (and accepting that they will have to be compensated in the unlikely event that the airline cannot deliver)."**

**This is the view of John Tighe, design director transport at JPA Design (p70), who continues, "The vast majority of airlines make it impossible to find what aircraft and seat type you're buying, and sell on destinations, route and price alone. These factors are all important, but someone will make the game-changing move to be proud of their onboard product and sell its virtues, and that will drive competition, which will drive the passengers' user experience up... We can't wait!"**

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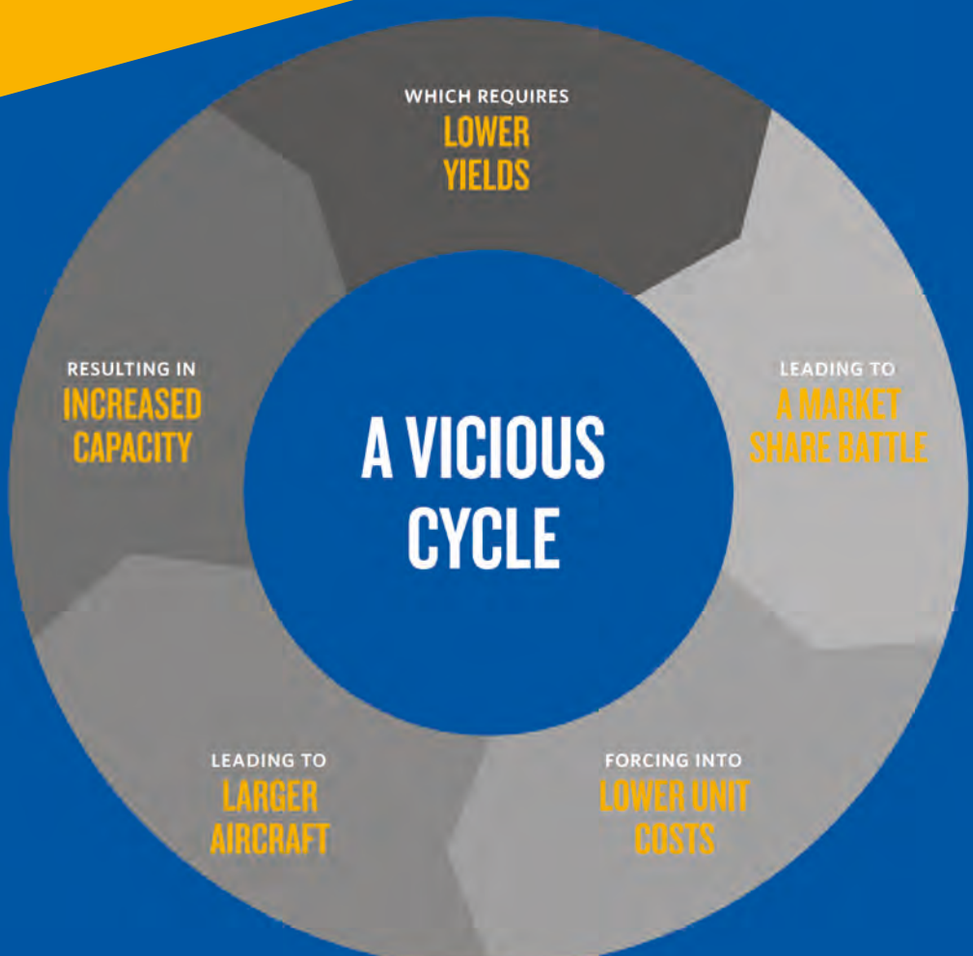
# Right-

EMBRAER'S LATEST RESEARCH HAS FOUND THAT AIRCRAFT WITH LOWER SEAT COUNTS CAN HELP ENSURE THAT AIRLINES CONTINUALLY SELL ENOUGH SEATS, AT HIGH ENOUGH FARES, TO GENERATE AN ACCEPTABLE RETURN



# -sizing aircraft capacity

There's no escaping the fact that investing in airlines has commonly resulted in disappointment for shareholders – at least partly because of challenges inherent in the business. Consider, for example, the fact that an airline seat is among the world's most perishable goods. Once that aircraft door is closed, all empty seats accumulate as waste. As anyone in the industry knows, seats are so perishable that some airlines are forced to sell them at a very low cost to avoid their being flown empty. Consequently, these seats' revenue potential is diminished even before the cabin door is closed.

In the last few decades, the industry has evolved, with changes in regulations and the introduction of more efficient aircraft. As capacity has increased, unit costs have been reduced – along with unit revenues and unit profits. All of which raises the question: how can the airline industry provide better returns for investors? Embraer believes that successful airlines are increasingly focused on the quality of revenue to boost results. From a global perspective, it is clear that the 70- to 130-seat segment can help bring sustainable profitability to the industry.

A little over a year ago the first Embraer E-Jet took to the skies, and as the family of four made its worldwide debut, the company created its 'Rule of 70 to 110' rationale for a lower seat count that would help carriers right-size their capacity to match demand. By tapping this perceived gap in equipment capacity, airlines can manage revenues with greater precision and achieve higher profits. Now, with more than 1,000 E-Jets delivered, it is clear that the rationale was right. Following the Rule has resulted in greater convenience for passengers, with more flights and better connections, and greater efficiency for airlines.

A second generation of E-Jets redefines the segment as 70- to 130-seat aircraft. But even though the essence of the original vision endures, the dynamics of the aviation industry have evolved significantly. A key example is airlines' current focus on lower unit costs as a strategic advantage in the pursuit of market share. However, Embraer believes that unit profit and return to shareholders are better measures of success. Its vision is that airlines will continue to use common measures such as unit cost, load factor and market share, but will introduce new means of assessment as investors demand a better return for their capital in a sustainable fashion.

Indeed, one such new metric is Return on Aircraft Assets (ROaA), as distinguished from conventional ROA, which Embraer believes will be an increasingly important indicator for aircraft evaluation.

## COST PER SEAT ANALYSIS

New entrants to the airline marketplace have shaken the competitive landscape with a low-fare proposition that makes air travel more accessible to the masses. Responding

**110-SEAT JET**

| CLASS | FARE | SEATS | AVG PAX | REVENUE |
|---|---|---|---|---|
| Y | $230 | 11 | 12 | $2,760 |
| B | $150 | 18 | 18 | $2,700 |
| M | $120 | 32 | 29 | $3,480 |
| Q | $90 | 49 | 46 | $4,140 |
| TOTAL | - | 110 | 105 | $13,080 |

**170-SEAT JET**

| CLASS | FARE | SEATS | AVG PAX | REVENUE |
|---|---|---|---|---|
| Y | $230 | 11 | 13 | $2,990 |
| B | $150 | 18 | 19 | $2,850 |
| M | $120 | 32 | 32 | $3,840 |
| Q | $90 | 109 | 65 | $5,850 |
| TOTAL | - | 170 | 129 | $15,530 |

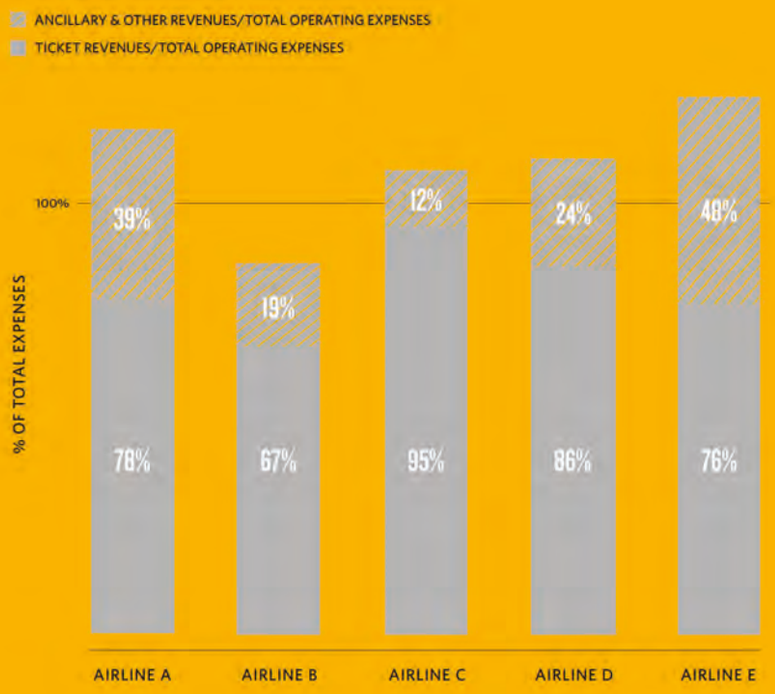
Typical 600 nm sector, North American environment

110-SEAT JET
REVENUE PER SEAT = $119

+30%

170-SEAT JET
REVENUE PER SEAT = $91

**REPRESENTATIVE AIRLINE REVENUE MODELS**
Source: Airline Financial Reports




SEE P130 FOR DETAILS ABOUT THE E-JET'S E2 CABIN DESIGN

to the challenges of this new environment, many airlines have focused on lower unit costs as a strategic goal, and this measure of cost per seat has become their main business metric. Carriers relying on cost per seat as their fundamental guiding metric have found themselves chasing the same business, with the same type of equipment, and with strategies and value propositions that allow no clear differentiation.

The result has been a partial commoditization of air travel as the industry has assumed the classic attributes of today's defined market. Airlines unable to resist the cost per seat mantra have been left with no choice other than to reduce unit cost to accommodate lower unit revenue, and ultimately see their earnings eroded.

## THE EMPOWERED PASSENGER

In parallel, dramatic changes in technology have brought new levels of transparency that also changed consumer behavior. This transformation marked the emergence of empowered passengers who are more knowledgeable and more demanding than ever in their pursuit of value. With the advent of online search engines, access to fare and seat availability has uncloaked the complexity of ticket-price categories. As the price of each component of product bundling became apparent, the lowest fares were exposed, which added to the reduced differentiation between airlines and further commoditized air travel. Consumers can compare products, read reviews and better judge value propositions offered to them, paying for the products and services they value most. Consequently, consumer bargaining power is greater than ever.

## DYNAMICS OF A VICIOUS CYCLE

The chart at the top of page 16 comparing unit cost and unit revenue tells the story clearly; the two measures are very well correlated. As markets were deregulated and liberalized, competition increased and gains the industry made by reducing unit costs were given away. Passengers were pleased; investors – not so much.

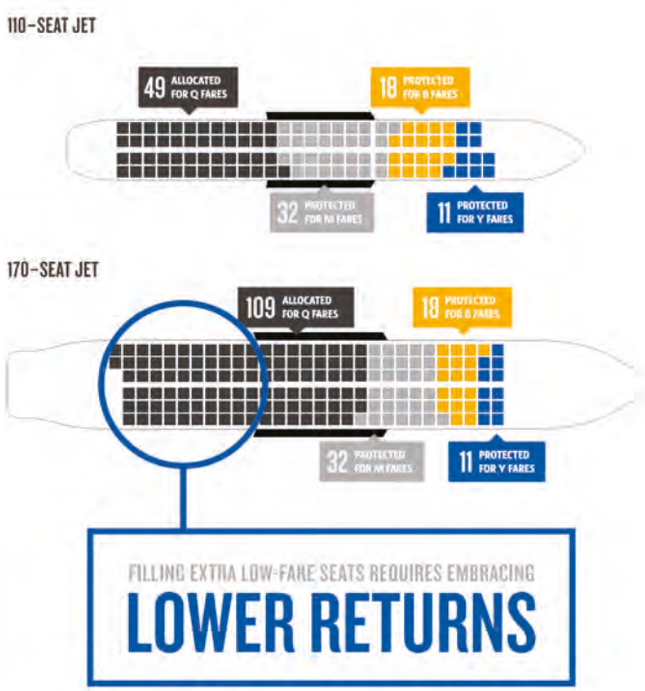
Some airlines in search of the lowest unit cost increased capacity and added seats, which had to be sold at a lower price. As competition followed suit, market share battles began, which added pressure to reduce unit costs, increase capacity, and further lower prices. Lower costs brought lower revenues and not necessarily higher earnings.

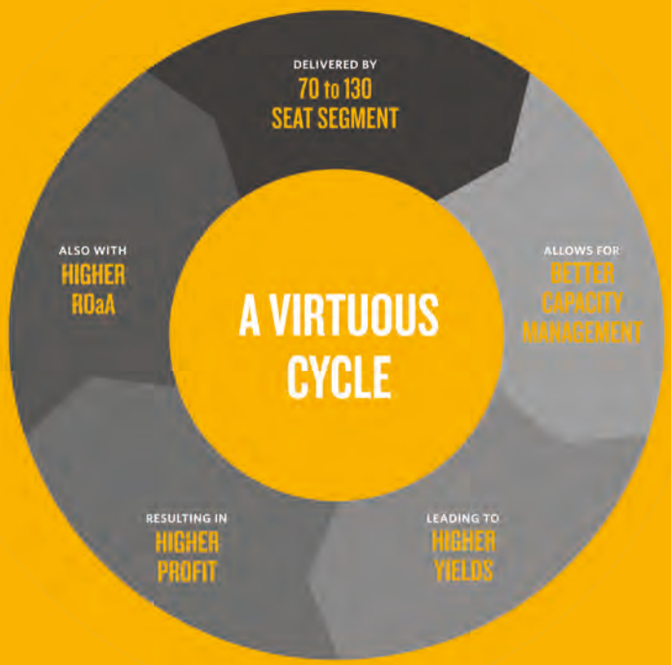
It is natural to lower costs in order to stay competitive – and sometimes even to survive. But that can lead to a vicious cycle. Ever-lower fares induce ever-lower costs. At what point do you stop? Is the marginal cost of flying an additional seat covered by the lower fare it generates? What if the additional seats remain empty? What if that surplus capacity can't be sold at a profit?

One of the most significant changes in airline pricing over the last decade has been the unbundling of services that once were included in the ticket price. The sale of ancillary products and services can boost airline profits, and also provide more value to passengers as they are able to pay only for what they want. In some cases, ancillary revenues can mean the difference between profit and loss.

Embraer believes that any business should explore every possible source of revenue, provided that these generate shareholder value. Some airlines reasoned that with the lowest cost per seat and ticket price, ancillary revenues alone would be sufficient to achieve the airline's target results. This hasn't been the case for some time.

As an airline grows and matures, costs increase. When revenue growth is outpaced by cost growth, the boost from ancillary revenues might not be enough. Revenue model





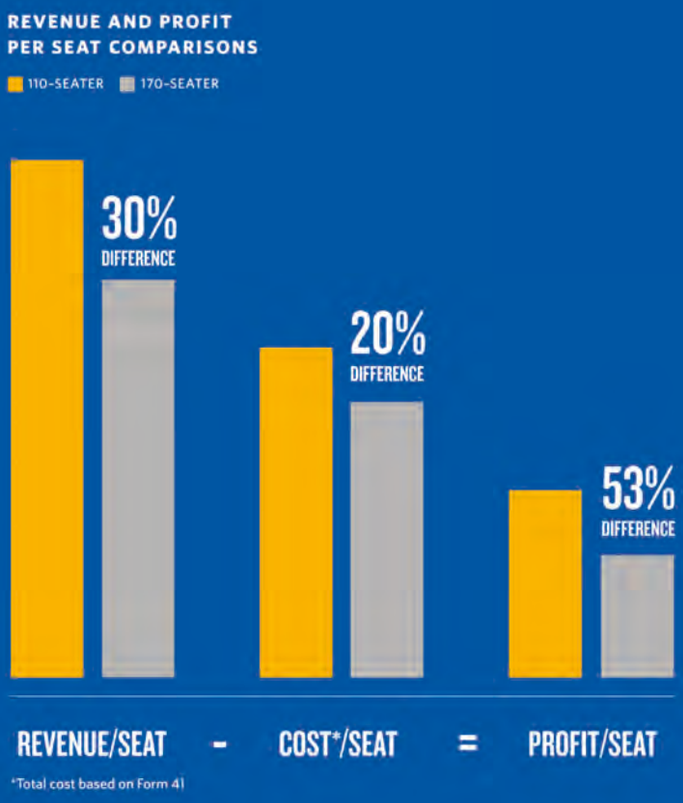

# CABIN DESIGN FOR MAXIMUM REVENUE

**Conceived as a tool to accommodate different business models, and taking advantage of revenue management and ancillary revenue opportunities, Embraer designed a modular cabin for the E-Jet E2, intended to attract premium-fare passengers and retain the budget-sensitive.**

**Key to this aim are innovations such as 30% larger overhead bins which, combined with a four-abreast cabin, allow all passengers to stow their carry-on bags above their seat. Individual PSUs emphasize the sense of personal space. A flexible 0.5in pitch adjustment in economy optimizes the use of the cabin, and a new staggered seat configuration in the premium cabin allows individual seats and vastly enhanced legroom.**

**Special attention was given to leasing company requirements for very liquid assets – for example, predefined structural and electrical provisions for the most common options, modular cabin monuments, and a staggered seating option for first class that utilizes the same bins and seat tracks as those used in economy class.**

**In 2015 the E-Jet E2 cabin interior won a Crystal Cabin Award in the 'Industrial Design and Visionary Concepts' category.**




strategies seek maximum total revenue per passenger by maximizing average fares and ancillary revenues.

## RISK DEMANDS REWARD

With few exceptions, airline equity owners are not rewarded adequately. The intensity of competition and the challenges of doing business are such that average airline returns are seldom higher than the industry's cost of capital. Some equity investors could be seeing their capital shrink. The current trend of improvement in returns is being driven by fundamental changes in management behavior rather than by desperate cost-cutting.

Adjusting load factors to a given aircraft size by simply reducing fares might not result in a sustainable business model. Engaging in fare wars leads to poor asset performance, whereas high asset performance is key to sustainable profits. When you fly an airplane optimally sized to the market, the ROaA can be impressive. It is simple math, but from a slightly different perspective. ROaA is a meaningful framework for fleet decisions.

Competitive forces notwithstanding, aircraft with fewer seats generally command higher average yield. A market-share-driven strategy would welcome additional passengers attracted by price incentives, yet overall yield would be diluted, since excess capacity would be allocated to the lowest fares. The diagram on page 12 illustrates this effect in a simple example of revenue optimization in which the additional seats on the larger jet are allocated to the lowest-fare booking class.

For a typical array of average leg values per booking class, the right-sized aircraft would have fewer seats assigned to low-yield passengers, thereby maximizing revenue per available seat. Although the larger aircraft has higher overall revenue, the disproportionate number of lowest-fare seats sold reduces the unit revenue. Strategies


***"Improving loads is easy, but improving loads along with profitability is complex"***

focused on attracting additional low-fare passengers must embrace lower returns to gain market share.

Improving loads is easy, but improving loads along with profitability is complex. The challenge is to increase load factors without simply reducing fares. Airlines flying lower-capacity aircraft are able to maximize revenue per seat and load factors. On a leg basis, a smaller airplane will have higher revenue per seat than a larger one. The magnitude of the difference will depend on market factors, but simulations run by MIT and PODS Research indicate that a 30% advantage for the smaller aircraft is widely applicable to the example of 110- versus 170-seater planes. Subtracting cost per seat from revenue per seat yields profit per seat, mostly higher for the 110-seater. The premise is that unit profit is a more comprehensive metric than unit cost.

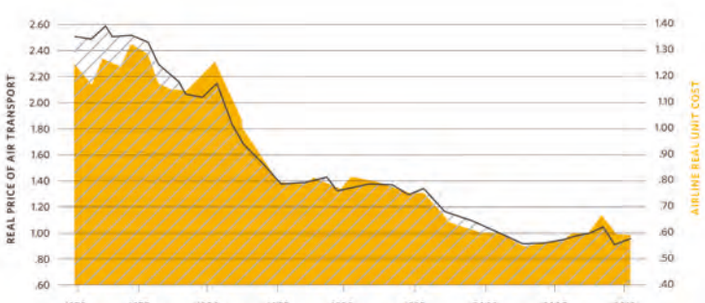
## CALCULATING TRUE ASSET PERFORMANCE

Return on Capital Employed (ROCE) has increasingly been used to drive investments and measure their performance. Some airlines set goals on ROCE, having recognized the importance of ensuring that shareholder value is being built. Simply being profitable is not enough.

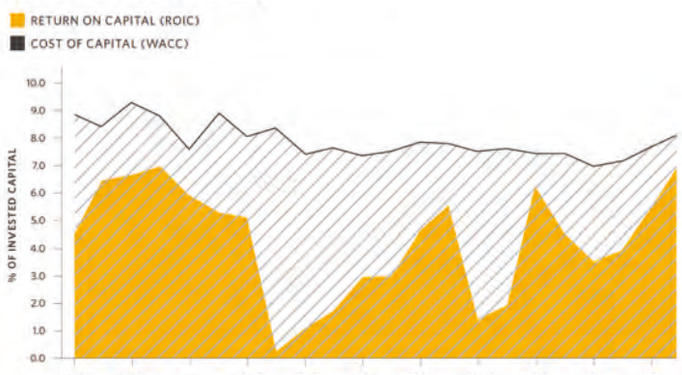
Embraer's vision is that as airlines mature, and are listed in public markets, and as shareholders expect information to compare investment alternatives, ROCE measures will be used more widely. Following this trend, ROaA is a viable way to measure asset performance and it can be useful to airlines to gauge the efficiency of aircraft asset allocation, and shareholder value. Airlines should examine the merits of switching investment criteria from a cost-per-seat perspective to profit-per-seat and ROaA maximization to bring asset performance into sharper focus.

There is only one way to increase unit revenue and load factor at the same time: by flying an airplane with appropriate capacity, through proper capacity management. A right-sized aircraft can catalyze revenue management and capacity allocation systems by better accommodating demand variations and maximizing yield. In doing so, airlines can increase unit profit and ROaA – a virtuous cycle that results in sustainable profitability.

**UNIT COST AND UNIT REVENUE CORRELATION**
Source: ICAO, IATA




**RETURN ON CAPITAL INVESTED IN AIRLINES**
Source: IATA, McKinsey & Company



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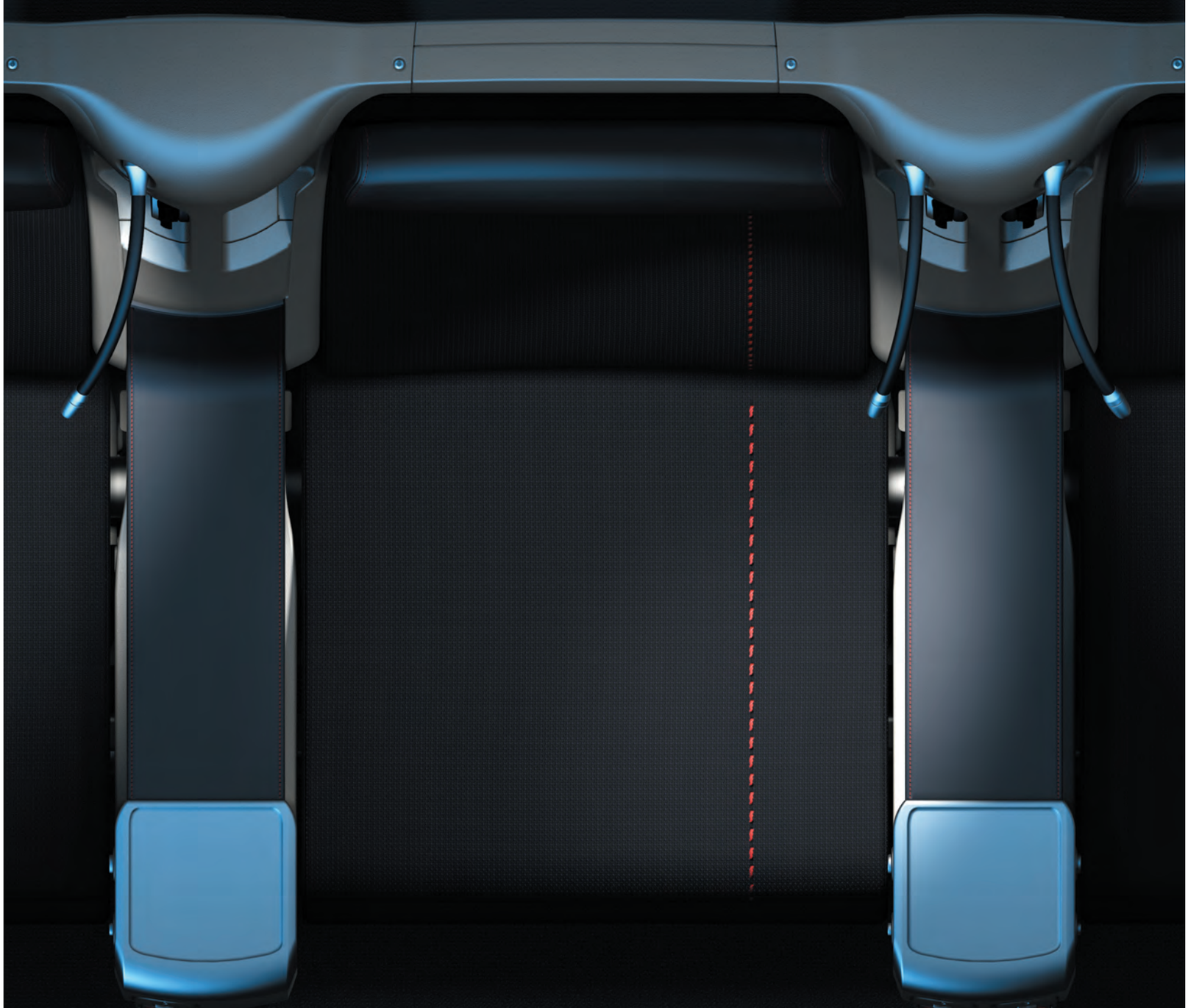

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# Quick thinking

# A COLLABORATION BETWEEN ACADEMIA AND INDUSTRY BELIEVES IT HAS CREATED AN INNOVATIVE WAY FOR AIRCRAFT INTERIOR DESIGN TO CONTRIBUTE TO FASTER BOARDING

*Words by Peter Vink and S Hiemstra-van Mastrigt, TU-Delft; André Castro, Almadesign; and Antonello Nardini, Optimares*


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FIGURE 1 (LEFT): COMFORT DURING THE FLIGHT, WITH LOW PEAKS AT LUGGAGE STOWING AND DURING CRUISE FLIGHT

FIGURE 2 (BELOW): THE SEAT PAN IS RAISED DURING THE BOARDING PROCESS (LEFT) AND LOWERED FOR TAKE-OFF (RIGHT)

**The PASSME Innovative Aircraft Seat was shortlisted for the 2018 Crystal Cabin Awards**

Research has found that passenger comfort is at its lowest during the boarding phase of flight[1] (see Figure 1). Therefore improvements to the boarding process are welcome, including ways to ease the placing of carry-on luggage into the overhead bins.

Many of us have experience of boarding and de-boarding not being optimally organized – a feeling that has been backed up by research (e.g. Nyquist and McFadden[5]). For instance, aisle blocking by passengers hinders others getting to their seats. Computer simulations indicate that there are more efficient boarding methods than those currently in use (e.g. Van Landeghem and Beuselinck[3]). However, the implementation of such optimal boarding schemes can present practical challenges (Steffen[6]).

Boarding influences the passenger experience and can also influence airline income. Boarding times have a direct relationship with aircraft turnaround times. Slow boarding can cause an airplane to lose its slot, which results in delays – reason enough to strive for faster boarding.

## THE PASSME PROJECT

Improvements to the boarding process form part of the PASSME (Personalised Airport Systems for Seamless Mobility and Experience) project. The aims of the project are to reduce door-to-door travel time by 60 minutes and enhance the travel experience.

The project focuses on four major breakthroughs: a real-time, passenger-centric monitoring and forecasting system; a passenger-independent system for managing luggage flows; radically redesigned airports, aircraft processes and interiors; and a personalized, contextually and emotionally aware device and smartphone app. The project partners included TU-Delft, Optimares, Almadesign and DLR.

***"Boarding influences the passenger experience and can influence airline income"***

As part of the redesign elements of the project, the potential for aircraft interior design to decrease boarding times and improve the passenger experience was studied. The team found 46 scientific papers that experimented with boarding processes. Most reported on simulations, while six contained observations of alternative boarding processes.

Four procedures are supported by the papers. The first is that boarding using two doors and two sets of steps is faster than using one door. Marelli *et al*[4] even reported time savings of five minutes for a B757-200 using two left doors at the front, which usually takes between 22 and 26 minutes.


The SLS Optimus hand luggage guiding system was also shortlisted for the 2018 Crystal Cabin Awards

***"Some methods ask much from the organizational efficiency of an airline"***

The second – reported by several papers – is that block boarding is slower than random boarding, as shown by Coppens *et al*[2]. It may seem logical to have the rear board first, then the middle rear, the middle front and finally the front. However, aisle blocking happens when passengers load their hand luggage in the overhead bins and results in congestion when passengers are close to each other. With random boarding, passengers are more spread around while putting their luggage in bins, which reduces the likelihood of an aisle being blocked.

Third, the Steffen method of pyramid boarding[6] is claimed to be faster than random boarding. The pyramid starts with the boarding of window seat passengers in the rear, followed by window passengers in the middle, then the middle seats in the rear and so on. The Steffen method follows this procedure, but first the even-numbered window seats are boarded, followed by uneven ones, giving more space for passengers during boarding. In practice, these methods ask much from the organizational efficiency of the airline. Positive effects have been proved in practice (Vincent[7]), but only in highly efficient organizations.

Finally, it has been found that good preparation can lead to faster boarding. Delays in boarding are often caused by passengers having difficulty finding their seats and by passengers blocking the aisle while they retrieve items from their hand luggage before placing it in the overhead lockers. Such delays can be prevented through good preparation. The PASSME tests also found that when passengers boarded a second time, they were always faster still, even when a different seat was assigned.

Three interior changes were tested in the PASSME project: a seat-locating light, a guiding luggage bin and a widening seat.

FIGURE 3 (ABOVE): A GREEN LIGHT SHOWS IN THE BIN WHEN THE HAND LUGGAGE IS PLACED CORRECTLY – AND RED WHEN IT IS NOT

FIGURE 4 (BELOW): AS THE TICKET HOLDER GETS CLOSER TO THE SEAT, THE LIGHT BECOMES BRIGHTER (DESIGN: S AKKERMAN)

## SEAT-LOCATING LIGHT

The seat-locating light, fitted above each aircraft seat, becomes brighter as the ticket holder approaches (see Figure 4). This guidance system, which uses Bluetooth technology, reduces passenger stress and helps airlines to structure the aircraft boarding process.

A prototype of this lighting system was made and tested to see how it helped people to find their seats. In a trial, 10 passengers boarded an aircraft with the light and then another 10 without the light. The boarding times were recorded and a questionnaire issued to gain insight on the experience. Boarding with the light was found to be approximately two seconds

Crystal shaped lenses in the overhead chandelier light assembly - delivered by WASP for Emirates 777. WASP also manufactured and supplied the virtual windows, seat and passenger controls.

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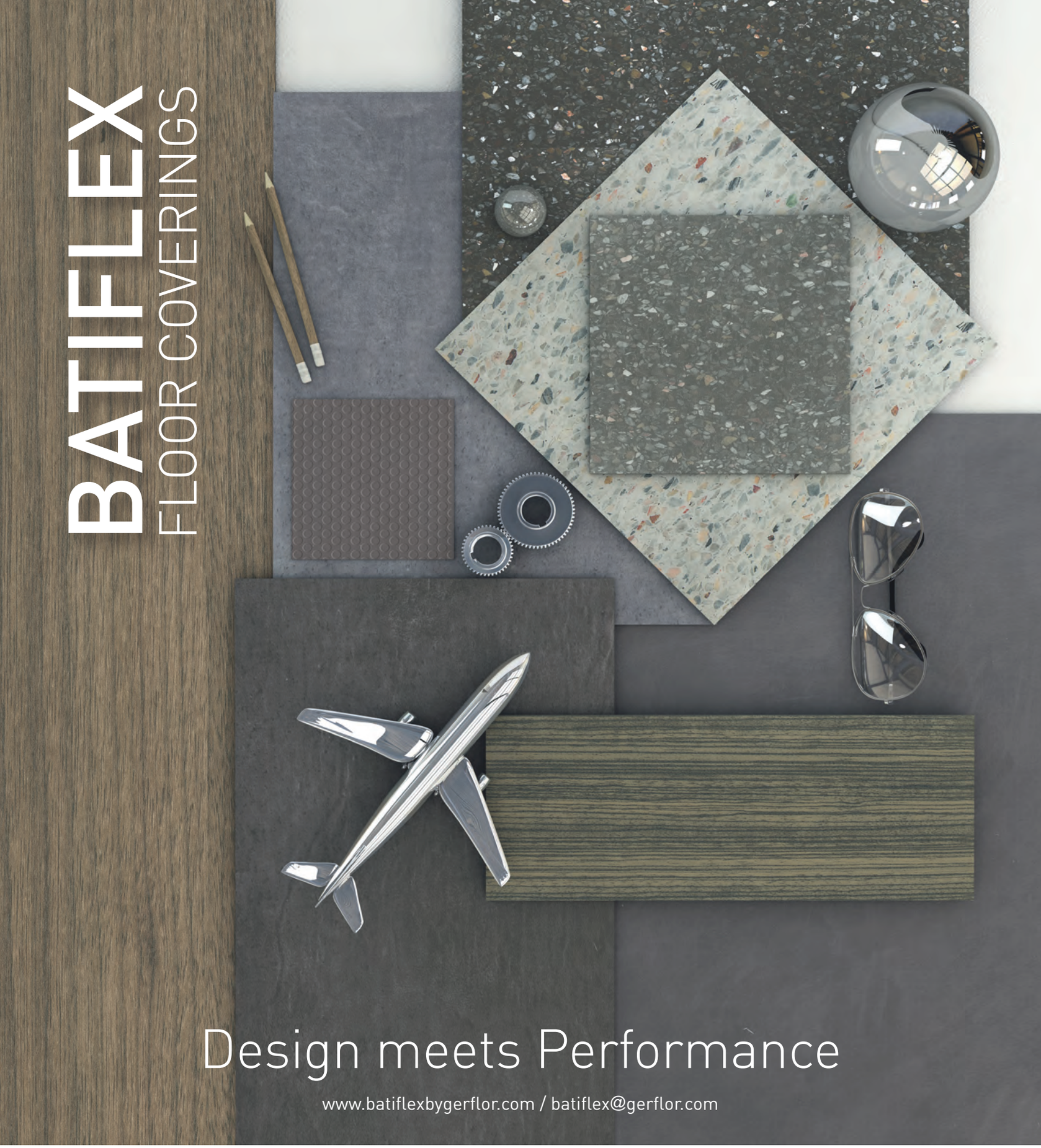

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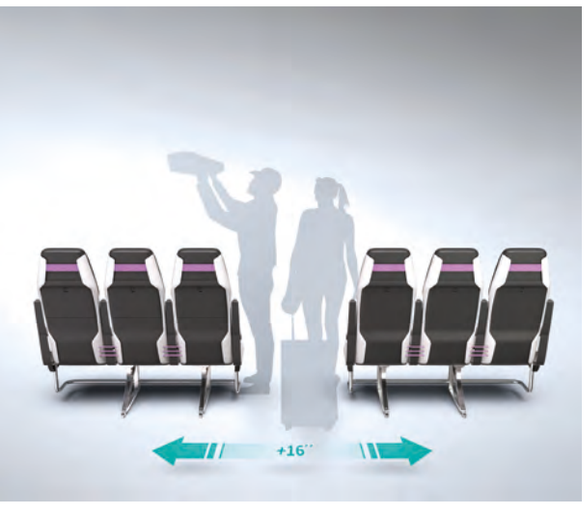


> *"It proves the ability of the system to save between three and five minutes of time"*

faster than without, but the experience data was difficult to interpret as some of the participants were not aware that there was a light. The study shows that there is potential in using the light, but further research is needed to study the effect on a flight where many passengers board at the same time, and to verify the effect on boarding time.

## GUIDING LUGGAGE BIN

If all passengers take their full hand luggage allowance on board, there will generally not be enough space in the bins. The guiding luggage bin is a system intended to help by guiding passengers toward the optimal space to stow their bags, given the available space.

This system begins with a little preparation at home before the flight, where passengers measure the size of their carry-on luggage size using an app. They simply scan their luggage with a smartphone by placing a sheet of A4 paper next to the carry-on bag and taking a picture. The app then records its size, using the sheet of paper as a reference.

If the app deems the hand luggage to be too large for the overhead bins it will warn the passenger, who will be prepared to have the bag stowed in the hold.

However, passengers with luggage sized within the applicable limits will be allowed to board first and be certain that there will be space for their luggage in the cabin. An algorithm calculates the best luggage distribution in the overhead bins, and users receive the recommended location to stow their hand luggage via the airline app, email or text message before boarding.

Key to the system is that at the gate passengers receive a boarding pass with a printed RFID tag inside, which is read by cabin systems. When each passenger enters the aircraft, they can see their seat number illuminated in the overhead bin, and the luggage stowage space is shown on electronic paper displays inside the bins. As a passenger approaches their bin, their presence is sensed via one of the RFID antenna in the aircraft and the LED starts flashing to indicate when to stop.

FIGURES 5 AND 6 (ABOVE AND ABOVE LEFT): THE PASSME SEATS CAN BE NARROWED TO WIDEN THE AISLE DURING BOARDING, AND EXPANDED AGAIN AFTER BOARDING HAS BEEN COMPLETED

LED strips mounted directly beside the screens (see Figures 3 and 7) are activated by the RFID and will give a guiding light effect until the passenger has reached the correct bin. The LEDs will flash more brightly as they get closer. When the luggage is placed correctly, a green light will confirm the correct location and the passenger can then go to their seat, which will be close by.

A user test with 24 participants was conducted in a real fuselage with a working prototype of the system, to test the boarding experience and the interaction with the lights. The results were compared with a boarding situation without a light guiding system, and if the boarding times from the test are extrapolated to reflect a Boeing 737-8 with 189 passengers, it proves the ability of the system to save between three and five minutes of time and to improve the overall experience considerably. Of the participating passengers, 63% indicated that they preferred the new way of boarding, while the other 37% said they did not mind.

The reduced boarding time can be partly explained by the fact that passengers first look for a place to put their luggage and then once stowed, look for their seat. Without such a system, passengers first look for their seat, then try

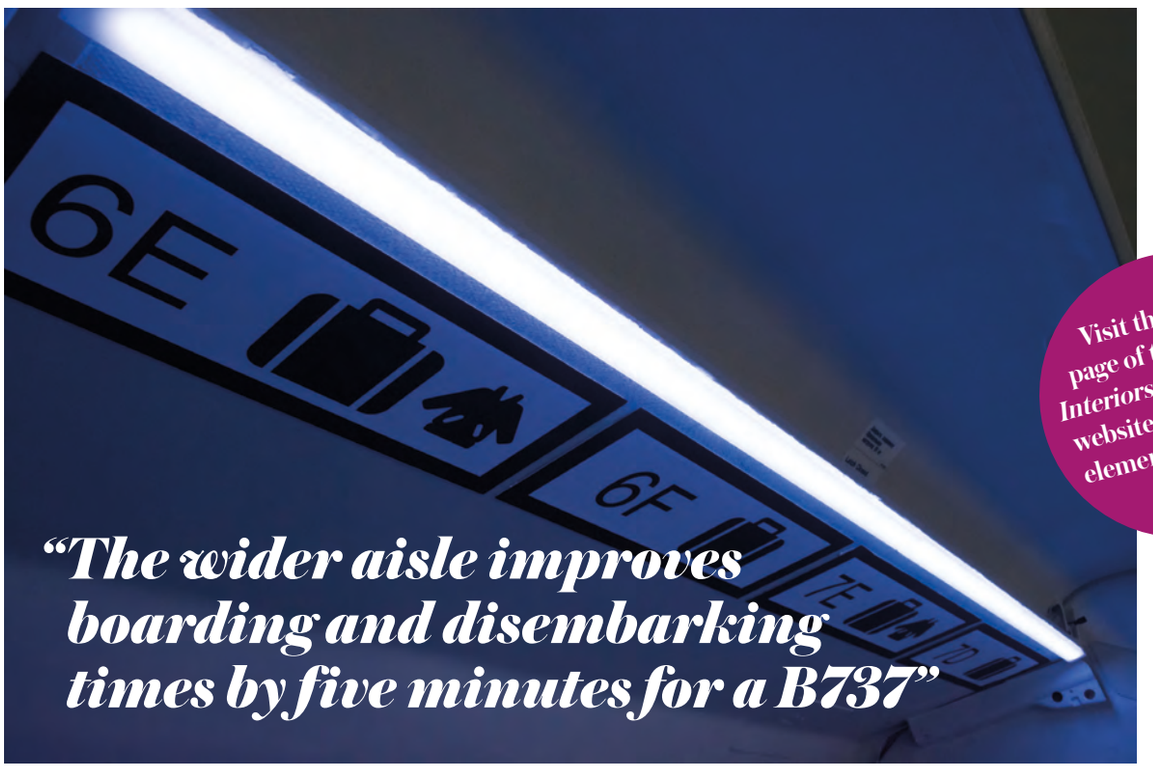


FIGURE 7 (LEFT): LIGHTS IN THE BINS INDICATE TO EACH PASSENGER WHERE THEY SHOULD STOW THEIR CARRY-ON LUGGAGE

**Visit the Videos page of the Aircraft Interiors International website to see various elements of PASSME in action**

***"The wider aisle improves boarding and disembarking times by five minutes for a B737"***

to find a place for their hand luggage, and then look for their seat again.

### THE WIDENING SEAT

The widening seat is a concept triple economy seat that is contracted during boarding, which doubles aisle width to 32in, allowing passengers to pass each other and enabling use of normal wheelchairs in the aisle. Passengers take a – briefly uncomfortable – seat, and when boarding is completed, the crew indicate that the seat triples can be expanded to normal width for take-off and cruise, by using the mechanical actuator found on each row. Tests have shown that the wider aisle improves boarding and disembarking times by five minutes for a B737-800.

A similar system is available from Molon Labe Seating in the USA, whereby when passengers get off the aircraft they slide the seat across to make the aisle wider. The aisle seat slides over the middle seat, and during flight the middle seat is larger.

The system tested in the PASSME project and considered here does not slide laterally; instead passengers are seated at a higher position while boarding to enable the seat to contract. When the seats are widened, they also lower (see Figure 2). It is a mechanical system featuring the same mechanisms used in seat recline systems, and no electronics are used. The lowering action of the seats simply uses the weight of the passengers. When passengers stand up, the system can be unlocked and moved upward.

In conclusion, boarding time can be reduced and the experience of passengers improved by using a combination of ideas such as using pyramid boarding, light guiding, preparation and a wider aisle.

## ACKNOWLEDGEMENT

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# Future values

THE PAGES OF *AIRCRAFT INTERIORS INTERNATIONAL* OFTEN FOCUS ON WHAT SHOULD GO INTO FUTURE AIRCRAFT. HOWEVER, WHAT VALUE LIES IN THE CABINS OF AIRCRAFT LEAVING SERVICE IN THAT TIMEFRAME? A TEAM AT GERMANY'S PFORZHEIM UNIVERSITY MAY HAVE THE ANSWER

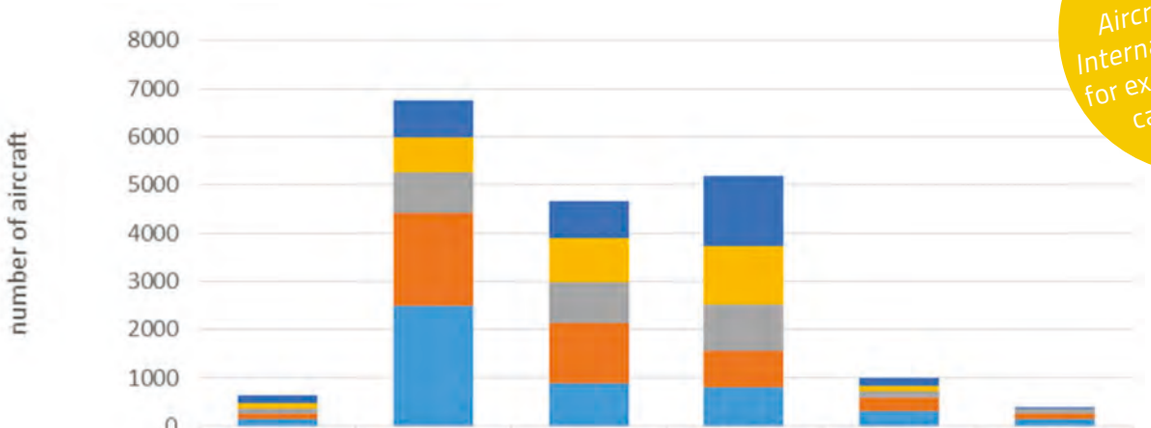
*Words by Jörg Woidasky and Christian Klinke, School of Engineering, Pforzheim University; and Sebastian Jeanvré, More Aero*

Aircraft, whether in operation or at their end of their operational life, are a potential source of valuable parts and materials. More than half of all airliners ever produced are still in use, and a dramatic increase in air traffic is expected in the coming years, which may contribute to high-value material supply.

Aircraft recycling is a field with numerous types of stakeholders. Stakeholders involved include not only aircraft (body and engine) producers and their suppliers, for example aircraft operators, dismantling and recycling companies, but also aircraft lessors, service organizations providing MRO, parts traders, airport operators and public regulatory organizations such as EASA. In an aircraft's end-of-life phase, aircraft safety regulations and waste-management rules and regulations apply, depending on the stage of aircraft decommissioning.

As long as the aircraft remains airworthy, all repair and dismantling steps, including parts harvesting (see Figure 5),

Visit the Aircraft Interiors International website for expert insight into cabin recycling




| | Africa | Asia | Europe | North-America | South-America | Australia/Oceania |
|---|---|---|---|---|---|---|
| above 20 years | 167 | 774 | 754 | 1466 | 174 | 25 |
| 16 to 20 years | 95 | 707 | 903 | 1199 | 106 | 19 |
| 11 to 15 years | 121 | 874 | 855 | 984 | 144 | 108 |
| 6 to 10 years | 122 | 1930 | 1247 | 746 | 266 | 117 |
| up to 5 years | 132 | 2476 | 895 | 797 | 320 | 132 |

require certified staff and procedures, for example under EC Commission Regulation No. 2042/2003. Once airworthiness is lost, this renders the entire aircraft and its components scrap, so the material is available to the recycling cycle, and this material has value.

## MATERIALS AND METHODS

As a basis for the calculations and forecasts, numerous sources for aircraft data were consolidated into one meta database including their quantity, regional allocation, assignment to airlines and age. This information was collected from reference sites for aircraft, including plane-spotter websites, and websites for specific aircraft data.

Based on 27,763 individual aircraft data sets, 21,056 aircraft can be classified as active and 6,707 as in storage, scrapped, written off, or to be entered into service. Aircraft empty weight is stated, as well as the date of the first flight. Furthermore the data set contains the airline and the aircraft manufacturer, plus additional model information. The forecast data was produced using the arithmetic mean composition data of aircraft engines, the mean number of engines per aircraft, and multiplying them by the total number of airliners.

Aircraft models with a known mass in their structure were selected for a material forecast using identical calculations. The total fleet mass was calculated based on a mean airliner weight and the total number of airliners.

## THE WORLDWIDE AIRCRAFT FLEET

Figure 4 gives the worldwide air fleet status, extracted from a database covering a total of 27,763 commercial aircraft (narrow- and wide-body). Currently about 25,546 aircraft are in use, but out of those, only 21,056 are actually in operation, and 4,490 are stored. Storage mainly takes place in the USA, although it can be done in Europe, for example at the Teruel site in Spain. Typically in Europe, due to a combination of unfavorable climatic conditions and high parking costs, a quick parting out and tear-down of aircraft is favorable.[1]

***"Material recovery from end-of-life aircraft is second in importance to parts reuse"***

ABOVE: FIGURE 1 – OPERATIONAL FLEET AGE OVERVIEW (IN YEARS) PER CONTINENT (A TOTAL OF 21,028 AIRCRAFT)

## MASS AND VALUE DISTRIBUTION IN AIRCRAFT

From a business perspective, material recovery from end-of-life aircraft is second in importance to parts reuse. Figure 5 provides a mass and value estimation of end-of-life aircraft. About 90% of the total end-of-life aircraft value is

## TABLE 1

***Composition of selected airliner models***

| Mass (%) | B747 | B767 | B757 | B777 | B787 | A300B4 |
|---|---|---|---|---|---|---|
| Aluminum | 81 | 80 | 78 | 70 | 20 | 77 |
| Steel | 13 | 14 | 12 | 11 | 10 | 12 |
| Titanium | 4 | 2 | 6 | 7 | 15 | 4 |
| Composites | 1 | 3 | 3 | 11 | 50 | 4 |
| Other | 1 | 1 | 1 | 1 | 5 | 3 |

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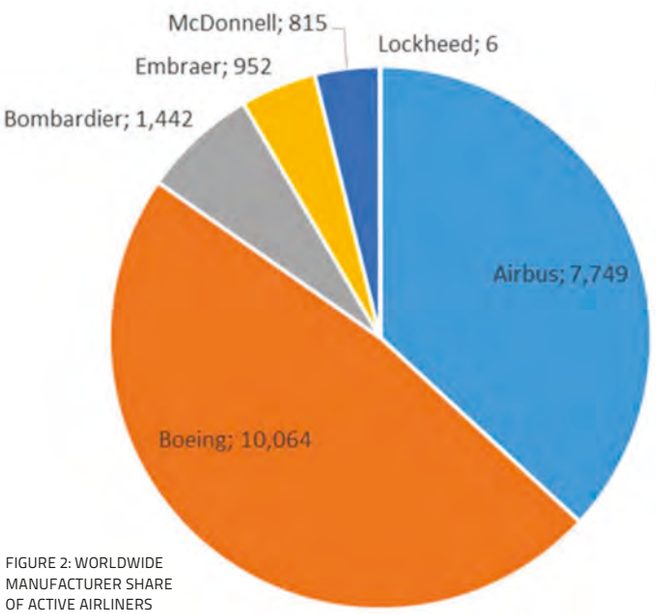



FIGURE 2: WORLDWIDE MANUFACTURER SHARE OF ACTIVE AIRLINERS

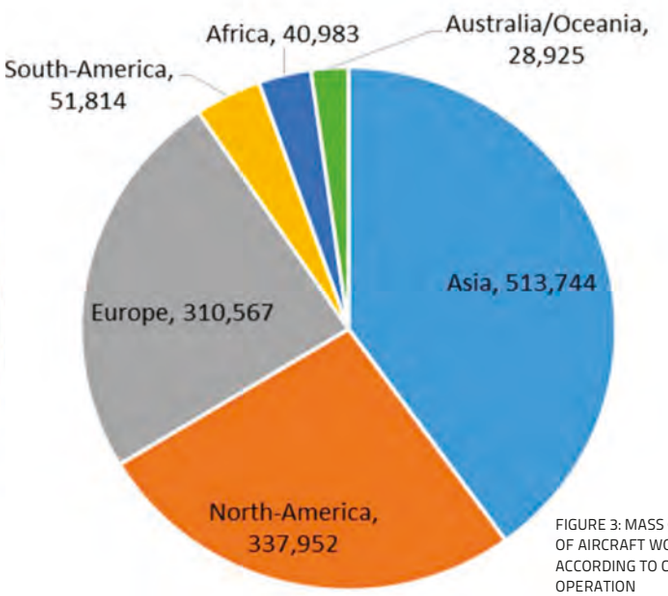


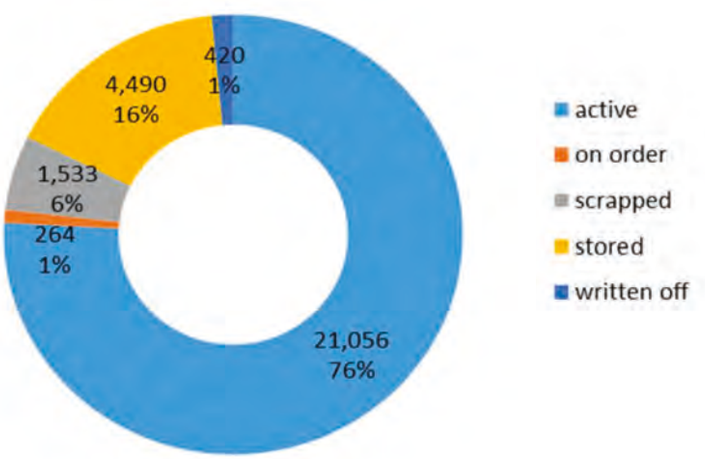

FIGURE 3: MASS (METRIC TONS) OF AIRCRAFT WORLDWIDE ACCORDING TO CONTINENT OF OPERATION

***"The use of carbon fiber reinforced plastic and other composites has grown"***

generated from parts harvesting and reuse according to air safety regulations. These operations are highly regulated, and open only to certified companies. The material's value share of the aircraft (not taking the reuse components into account) only amounts to 10% of the total, and thus is in the same range as the disposal cost for hazardous materials and components. The material value (scrap value) of the structure is in the same order of magnitude as the typical cost of a ferry flight from Europe to the USA[1] – approximately €50,000 to €100,000 (US$57,000 to US$115,000).

The composition of aircraft structures can be seen in Table 1. In recent years the use of carbon fiber reinforced plastic and other composites has grown, but the aircraft to be retired in the coming years will still mainly contain aluminum and other metals as their main components. The main aircraft elements are the structure (body with approximately 20% of the total aircraft mass, plus wings, fin and elevator covering around 28%), engines (15%), landing gear (9%) and other components[3] (28%). Table 1 gives the structure composition – without engines, auxiliary power unit (APU), landing gear and some avionics equipment.

LEFT: FIGURE 4 – WORLDWIDE AIRCRAFT FLEET STATUS AS OF 2015 (TOTAL = 27,763)




## AIRCRAFT STRUCTURE

Aluminum (7075, 6061, 6063, 2024, 5052 alloys) is the dominant material for aircraft structures – skin, wings, fin and elevators – and some electrical components.[5] Recycling trials have shown the feasibility of high-value alloy material recovery, although quality standards for material application in primary aircraft structures have not been reached.[6] Other common metals in the structure are titanium and steel.

## AIRCRAFT ENGINES

The physical and chemical stresses in the aircraft engine require the use of high-value materials such as nickel, cobalt and rhenium super alloys for their high strengths at high temperatures. Moreover titanium alloys, as well as tungsten, gold and platinum coatings, may be applied.

Of all the aircraft currently in service, 92% are equipped with two engines, 7% with four and 1% with three,[7] not including the APU. With the median mass of an engine being about 3 metric tons, based on the total fleet size of 21,056, a total engine mass of 132,651 metric tons can be calculated, mainly formed of titanium and nickel alloys, and other high-value materials.

An aircraft engine contains several metals and alloys that could be recycled not only for ecological reasons but also for economic ones. An average figure of 2.1 engines per aircraft can be derived from an investigation into the 10 airlines in Europe and Northern America with the highest turnover (2013). The population of aircraft for this investigation[1] was 7,246.

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***"Each aircraft might produce a minimum of three or four obsolete cabin interiors"***

Using the mentioned figure of 25,546 aircraft being used actively or stored as a basis, and assuming the above-mentioned average engine number of 2.1 engines per aircraft, it can be calculated that there is a potential of an overall number of 53,646 engines.

Focusing on the number of 4,490 stored aircraft currently available, it could be assumed that out of this total figure of 53,646 engines, approximately 9,429 engines might be available for recycling at short notice.

## AIRCRAFT INTERIORS AND OTHER MATERIALS

From a materials availability point of view, during the use phase, the maintenance and overhaul steps of the engines are especially relevant, but what is even more important may be the cabin interior replacement, which happens every 5 to 10 years, and with each leasing status change. Taking into account an airliner lifespan of about 26 years,[9] each aircraft might produce a minimum of about three or four obsolete cabin interiors during its use phase.

The interior mass of a typical B737 is about 5 metric tons, whereas the larger B747 carries about double this mass. The high share of composites renders the interior mainly non-recyclable as of today. The same is basically true for the glass-fiber insulation material attached to the structure, which for production before 1995 is regarded to be potentially carcinogenic.

## TOTAL AVAILABILITY OF AIRCRAFT

As Figure 2 shows, there are currently 21,028 commercial narrow- and wide-body aircraft (with a full data set) in use worldwide, with Boeing being the biggest manufacturer.

Consequently about 1,283,985 tons of aircraft (structural) material is in use. This calculation is based on an average aircraft mass of 61.06 metric tons. With an estimated aluminum share of 70% (Table 1), the total aluminum stock amounts to 898,789 metric tons. Figure 3 illustrates the share of the aircraft by continent, indicating the high importance of the Asian region and an equal share of about 25% each for Europe and North America.

Regarding the timeline of future availability, the fleet age has to be taken into account. Figure 1 shows the high number of older aircraft (20 years plus) in North America, which is about the same range as the sum of the older European and Asian aircraft. In total about 22% of today's operating aircraft will reach their end-of-life phase in 10 years or sooner. These aircraft can be expected to retire in the coming years, amounting to 3,360 aircraft or 205,162 metric tons of structural materials.

For decommissioning and recycling of retired aircraft, specific regional recycling options are available. In North America, long-term aircraft parking and aircraft recycling has been a business for decades. Starting with military aircraft, operations were soon extended to the civilian fleet, providing great experience and numerous sites, so still today, European aircraft are transferred for end-of-life operations to the USA by ferry flights.[10] In Europe, one dedicated aircraft recycling site for the civilian air fleet is operated in Tarbes, France, partnering with an international waste management company, and with parking space in Spain. Moreover, mobile solutions for dismantling are offered in Europe and worldwide, whereas it seems that on other continents mainly long-term parking for end-of-life aircraft has the highest relevance.

Based on the data available, it is possible to draw a scenario of the potential material composition of active aircraft. This leads to a model-specific forecast of the flying stock to forecast the masses divided in aluminum, steel, titanium, composites and other materials for the Boeing 747, 757, 767, 777 and 787 and the Airbus A300 family. The results for the various materials can be seen in Table 2.

To maintain the high material properties of the aircraft metal scrap, which is mainly aluminum, identification and separation of the alloys used is of primary importance. To this end, handheld x-ray fluorescence technology is currently used. Future developments may also provide laser-induced plasma breakdown spectroscopy (LIBS) for stationary or mobile (handheld) identification and sorting. These sorting processes will not only yield general-purpose cast aluminum alloys, but the recycled aluminum alloy will also qualify for aircraft use, but outside the primary and secondary structures only.[6]

Besides separation at the source, few technical options for removal of alloying elements in secondary aluminum

The interior mass of a typical B747 is about 10 metric tons. See p38 for more B747 facts

TABLE 2

***Composition of selected active aircraft related to material categories***

| Mass (metric tons) | B747 | B767 | B757 | B777 | B787 | A300 |
|---|---|---|---|---|---|---|
| Active aircraft worldwide | 639 | 802 | 755 | 1,239 | 230 | 249 |
| Aluminum | 94,462 | 56,831 | 35,209 | 132,374 | 5,447 | 16,191 |
| Steel | 15,161 | 9,946 | 5,417 | 20,802 | 2,724 | 2,523 |
| Titanium | 4,665 | 1,421 | 2,708 | 13,237 | 4,085 | 841 |
| Composites | 1,166 | 2,131 | 1,354 | 20,802 | 13,618 | 841 |
| Other | 1,166 | 710 | 451 | 1,890 | 1,362 | 631 |
| Total mass | 116,620 | 71,039 | 45,139 | 189,105 | 27,236 | 21,027 |

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***"Composites will become an end-of-life issue only from the medium-term perspective"***

processing are available, due to the chemical properties of aluminum.[11] Thus a cascade in material use can be observed,[12] which might also be caused by economic constraints such as specific alloy batches being too small to be treated economically.For current aircraft recycling, the combination of identification methods is improving for alloy sorting, and the increase in scrap availability is favorable for realizing the value of high-value materials, and associated environmental benefits.[11,12]

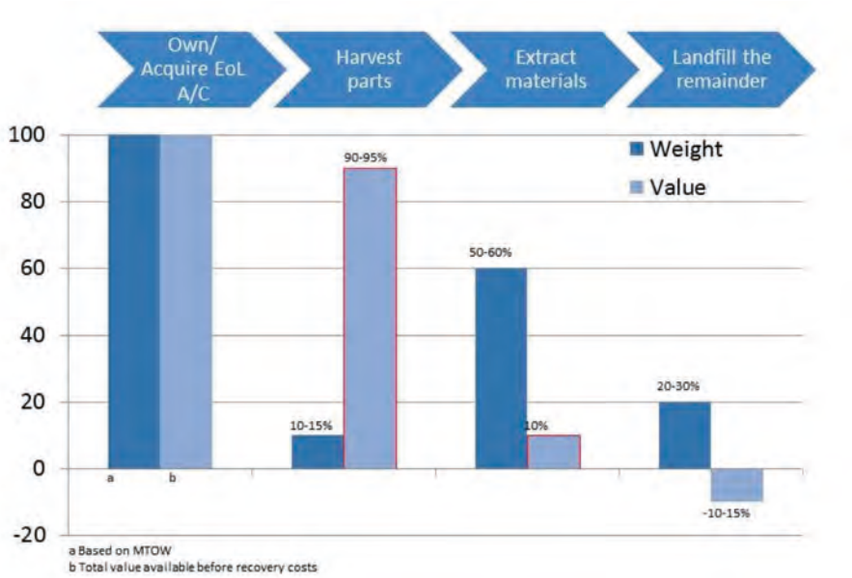
## CONCLUSIONS

Currently, about 21,000 airliners are in use worldwide, and approximately 4,500 aircraft are stored, but may return into use. Aircraft structural materials cover about 48% of the total aircraft mass, while the mass share of engines lies at 15%.

Turn to p12 for more market insight, where Embraer discusses the 70- to 130-seat aircraft segment

With a mean mass of about 60 metric tons per aircraft, the total flying metal stock in aircraft structures amounts to almost 1,300,000 metric tons, plus about 132,000 metric tons of engine material. The most common single material is aluminum (about 9,000,000 metric tons) from the structure and 7,500 metric tons from the engines. The engines are much more important as a stock of super alloys, with a potential 66,000 metric tons of titanium and 35,500 metric tons of nickel alloys in the entire fleet.

In the coming decade, a minimum of more than 200,000 metric tons of structural material can be expected to become available out of this stock. For the metal alloys, current improvement of alloy identification and sorting techniques, along with the increase in scrap availability, are favorable for closing high-value material cycles. Composites will become an end-of-life issue only from the medium-term perspective, as the current fleet of older aircraft carries only a single-digit mass percentage of composites.




TOP: FIGURE 5 – END-OF-LIFE AIRCRAFT VALUE AND MASS DISTRIBUTION ESTIMATION.[2] 'A' (DARK BLUE) IS BASED ON MAXIMUM TAKE-OFF WEIGHT (MTOW); 'B' (PALE BLUE) IS TOTAL VALUE AVAILABLE BEFORE RECOVERY COSTS

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# 50 years of the

THE LAUNCH OF THE BOEING 747-100 HERALDED THE BEGINNING OF THE ERA OF MASS AFFORDABLE AIR TRAVEL. AS THE QUEEN OF THE SKIES CELEBRATES 50 YEARS OF AMAZING SERVICE THIS YEAR, LET'S LOOK INTO HER REMARKABLE HISTORY

*Words by Jennifer Coutts Clay*

# 747

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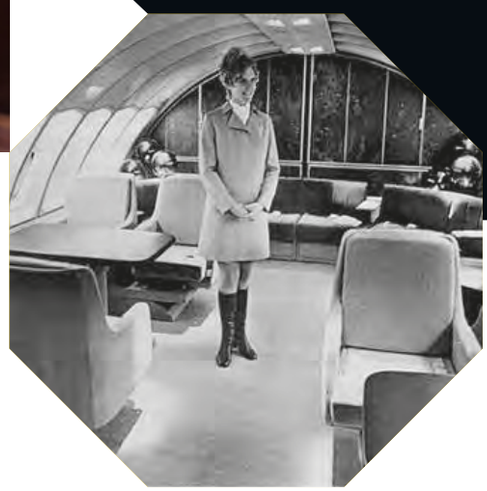
BELOW: MANY EARLY B747s FEATURED LUXURIOUS FIRST CLASS LOUNGES ON THE UPPER DECK
PHOTOS: PAN AM MUSEUM FOUNDATION



Television reports regularly show the President of the United States waving from the boarding door of a huge aircraft known as Air Force One. Do viewers realize that the President is flying on a Boeing 747? This is the same 'Jumbo' jetliner that has successfully carried billions of airline passengers over the past five decades. So how did the Jumbo's development start?

Boeing annals show that the world's first wide-body twin-aisle aircraft was built in just 29 months by hand (i.e. no robots). During the B747 feasibility process, including definition, design, development, testing, certification and introduction into service, 75,000 engineering drawings were generated – and those were pre-computer days…

The first B747-100 test flight took place at Everett, Washington, on February 9, 1969. There were two more aviation sensations that year: on March 2, André Turcat piloted the first Concorde test flight at Toulouse; and on July 20, Neil Armstrong and Buzz Aldrin walked on the moon while Michael Collins orbited in Apollo 11.

Some 50 years later, Concorde services are no more and extra-planetary missions remain the preserve of astronauts; but the B747 has revolutionized long-haul air travel.

## WHO WERE THE INNOVATORS?

Inspired by the achievements of B707 operations, for which Pan Am had been the launch customer, Juan Trippe, the airline's formidable chief executive, predicted a vast increase in intercontinental air travel during the ensuing decades. In the mid-1960s, Trippe forcefully argued the case for a completely new jetliner design that would carry two to three times as many passengers as the B707. He eventually sealed his business plans with a handshake at Boeing: according to contemporary reports, Trippe said "If you build it, I'll buy it", to which Bill Allen, then-chairman of Boeing, responded "I'll build it if you buy it".

Although reportedly verging on bankruptcy, Boeing constructed at Everett the world's biggest building by volume to house the production of the B747, – at that time the largest commercial aircraft ever built. A dedicated team of engineers was assembled – called 'The Incredibles' – led by the legendary Joe Sutter.

In his book *747: Creating the world's first Jumbo Jet and other adventures from a life in aviation* (Smithsonian Books, 2006), Sutter outlines Boeing's two-stage marketing strategy

ABOVE LEFT: AN INFLIGHT DINING EXPERIENCE MANY AIRLINES NOW DREAM OF BEING ABLE TO OFFER
PHOTO: PAN AM MUSEUM FOUNDATION

LEFT: A BRIGHT AND SPACIOUS UPPER DECK CLIPPER LOUNGE

BELOW: IN-SEAT LUXURIES IN FIRST CLASS INCLUDED SEVEN-CHANNEL AUDIO IFE

INSET BELOW: CONTRASTING SEAT COVERS VISUALLY BROKE UP THE LARGE ECONOMY CABINS
IMAGES: PAN AM MUSEUM FOUNDATION

for B747s: when no longer required for passenger service they would fly as freighters. Hence the unprecedented width of the passenger cabin: 20ft (6m), compared with 12ft 4in (3.8m) for the B707, to accommodate high-density passenger loads with twin aisles. The cabin could accommodate 20in (51cm) wide, 10-abreast economy class seating, or main-deck double pallet-loading based on the standard dimensions of 8 x 8ft (2.4 x 2.4m) containers. The 'weird hump' at the front of the fuselage was to accommodate the massive hinged nose-section, or 'mouth', for straight-in front cargo-loading. The three-crew cockpit was positioned above the main deck.

"Would the B747 have been built without Pan Am?," mused Joan M Benham, formerly system director for frequent traveler marketing at Pan Am, during a recent interview. "Probably not. Juan Trippe had a vision: to provide an aircraft capable of flying more passengers and more cargo further and faster than ever before.

"Pan Am's initial commitment of US$590m was made without even seeing a prototype of the B747. And Pan Am played a dominant role in the engineering and design aspects of the aircraft," she added. "Of prime importance was the objective to build an airplane that would prove safer, more efficient, more comfortable and easier to fly than any other previous long-range aircraft. With 16 cabin crew and much improved inflight service standards, passengers were able to enjoy the interior spaciousness, plush cabin furnishings, 10% wider seats, bigger armrests and the smooth quiet ride. Naturally, everyone loved the attractive economy class fares.

"For the four-engine program, Pratt & Whitney developed a high-bypass turbofan engine, the JT9D-3, generating more than 40,000 lb of thrust, and the B747 flew at 30% lower operating costs than its predecessors, contributing to airline profitability."

## WHY PLAN B FOR FREIGHTERS?

Sutter's memoirs describe the wave of optimism that swept through the aviation sector in the 'sizzling '60s'. In Europe, Russia and the USA, there was a firm belief that intercontinental passenger routes would soon be served purely by supersonic transport (SST). But those dreams did not materialize because of economic crises, the termination of the B2707 SST developments, the collapse of the Russian Tupolev SST program, spiking jet-fuel

## ABOUT THE AUTHOR

Jennifer Coutts Clay has worked on the refurbishment and upgrade of several Boeing 747 fleets, across all classes of service: at British Airways when she was controller of corporate identity; at Pan American World Airways (Pan Am) when she was general manager of product design and development; and when she was consultant to South African Airways.

Jennifer is the author of the e-book *Jetliner Cabins: Evolution & Innovation*, available on Amazon, Apple iTunes and Google Play (more information at www.jetlinercabins.com).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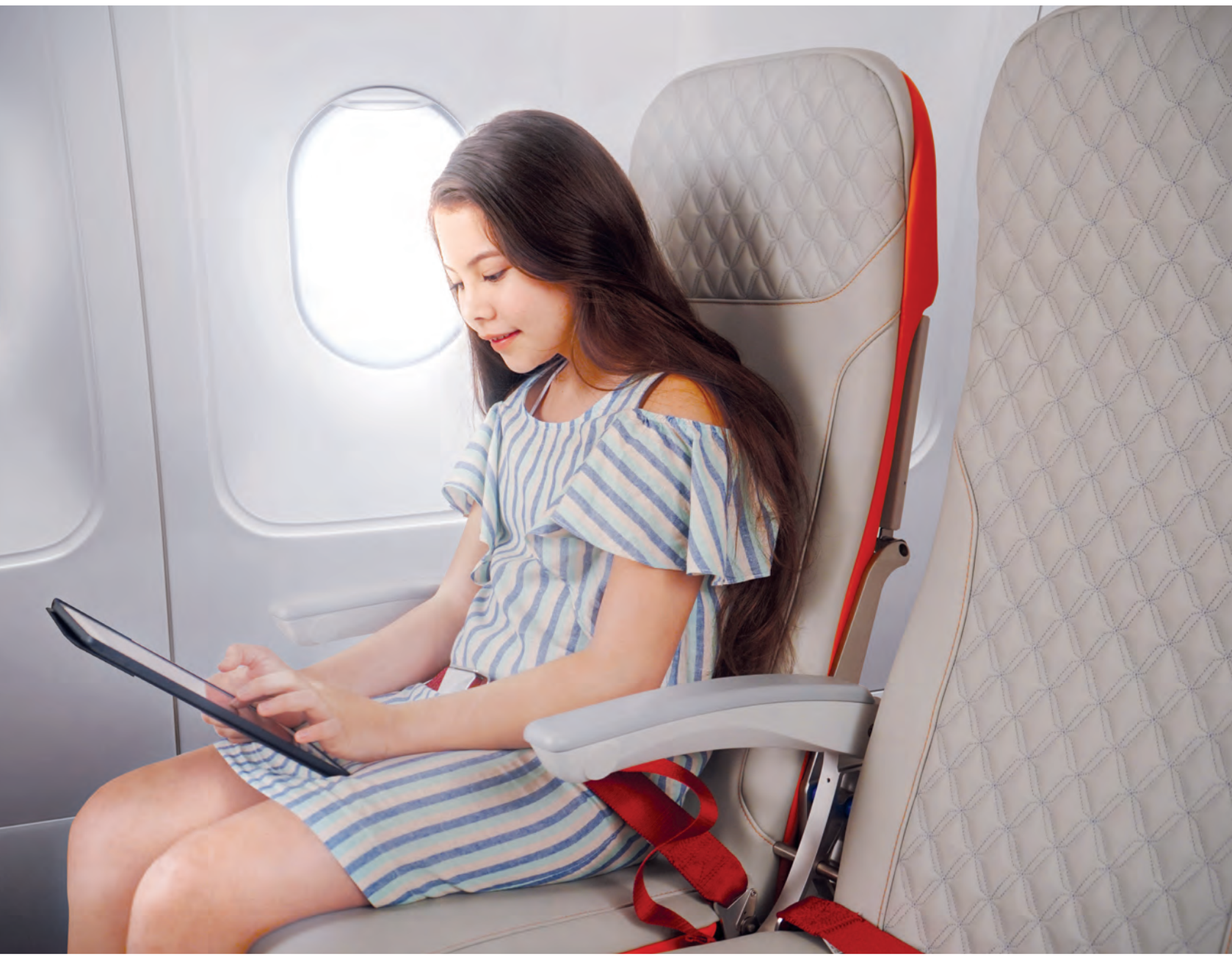

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AS AIRLINES STRUGGLED TO FILL THEIR JUMBOS IN THE EARLY DAYS, THEIR LOSS WAS THE PASSENGERS' GAIN, ENABLING GENEROUS LOUNGE SPACES

prices, and environmental concerns. And Concorde ceased operations in 2003.

Instead of SST, it was the B747 that opened up the world's long-haul routes and transformed the lives of countless numbers of airline passengers. It is only in recent years that airlines have started to retire B747s from passenger-service operations, and in several cases these units have been converted into freighters (kudos to Boeing strategists).

## REACTION TO THE B747

Critics said the outline of the B747 resembled a "flying ocean liner" or "horizontal apartment block". But the big-time gamble by Boeing and Pratt & Whitney (representing billions of dollars) quickly turned into a triumph.

At Paris Air Show in 1969, the 'Queen of the Skies' was a sensation, and Pan Am's New York to London inaugural flight on January 21, 1970 created a media frenzy.

At New York's JFK Airport, there was a vast expansion of the Pan Am hangar and workshop complex, along with a five-fold increase in passenger-handling facilities. B747 utilization averaged nine hours per day, and in September 1971 Pan Am carried its millionth B747 passenger.

Progressively, the B747 became one of the most readily recognized jetliners, operated by many dozens of airlines in even the most remote parts of the world. In 1998, the total number of B747s in service peaked at over 1,000.

ABOVE: AMAZING INFLIGHT SERVICE HELPED MAKE A LONG FLIGHT AN ENJOYABLE EVENT
PHOTOS: PAN AM MUSEUM FOUNDATION

The B747 interior program was headed by Walter Dorwin Teague Associates (Boeing's in-house design company), with input from Pan Am as launch customer.

Traditionally, galleys, lavatories and coat closets were positioned along the aircraft sidewalls. But in the B747, to free up space for more window seats, fixtures were moved to 'center islands' between the two aisles. There were six galleys and 12 lavatories: bracketed by cross-aisles, these structures created 'divider walls', sectioning the interior into separate 'rooms', designated A, B, C, D and E zones. The main and upper decks were connected by a stairway.

Other innovations included broad flat ceiling panels; flip-up armrests so that passengers could spread out when space was available; closable storage bins instead of hat-racks; PSUs located between seats because the ceilings were too high for access; stereo-sound, seven-channel plug-in audio-IFE; wide movie screens mounted on aft-facing decorative panels; and direct and indirect cabin lighting and wash-lit 'architectural reveals' on vertical sidewall panels to make windows seem larger and brighter, even though they were same size as the B707 windows.

Pan Am's publicity announcements described the décor style as "gracious living". The sidewalls were finished in 'pale eggshell', the basic shade for upholstery was 'neutral

ABOVE LEFT AND BELOW: PAN AM WAS AHEAD OF THE CURVE WITH MARKETING PREMIUM PRODUCTS TO FEMALE CUSTOMERS

ABOVE RIGHT: THE STAIRS THAT LED PASSENGERS UP TO EXTRAORDINARY LOUNGES AND EXPERIENCES

stone beige', and wall-to-wall carpet was 'charcoal brown with grey flecks'. For variety, each zone had its own color identity: blue in first class, with gold, orange and scarlet in the remaining zones.

Asked about the cabins, Kelly Cusack, director of collections and curation at The Pan Am Museum Foundation (www.ThePanAmMuseum.org) summarized: "In 1970, on the B747-100, Pan Am offered two classes of service with a total of 362 seats, compared with an average of 145 seats on the B707. There were 26 first class seats in A zone and 32 in B zone. Economy class seating was nine-abreast in C, D and E zones: 104, 86 and 114, respectively. The upper deck was furnished as an elegant cocktail lounge with 16 seats that were not sold to passengers.

"During the first oil crisis, airlines had problems with over-capacity. When Pan Am could not fill first class, the airline offered a 'convertible lounge' in B zone, with fore-and-aft seating. Depending on the competition, seats could be sold in B zone, or they could be made available free of charge as part of an economy class lounge.

"In 1972, Pan Am tested a 'dining room' concept in B zone. Following successful feedback, the airline refurbished its upper-deck lounges to accommodate the fabled 'Dining-in-the-Sky', designed by Maxim's de Paris.

"In 1974, Pan Am reduced first class seating to 30 in A zone; and B zone was converted to a quiet area for an innovative frequent traveler program: 10-abreast seating with fold-down middle-position seatbacks provided table space for newspapers, etc. Unsold seats were left empty, no movies were shown, and no children were booked in this zone."

To serve ultra-long-haul routes non-stop (e.g. New York to Tokyo, Los Angeles to Sydney, New York to Tehran), Boeing built the B747SP (Special Performance) variant (with no E zone), and Pan Am was the launch customer, in 1976. This aircraft interior was *the* real game-changer of the era: the product upgrades revolutionized the first and business class travel markets.


As Cusack explains, "Pan Am had only 10 B747SPs, so it was possible to retrofit the entire fleet relatively quickly and assess commentary from high-net-worth customers. Initially, there were two classes of service: 44 first class seats spread across A and B zones; and 136 and 86 economy class seats in C and D zones, respectively. The upper deck accommodated 14 passengers for dining services.

"The B747SP first class seats were 'sleeperette' style, with extendable footrests, similar to stretch-out seats flown by Pan Am during the piston era. This unique upgrade was instantly popular. In C zone, Pan Am subsequently launched Clipper Class, heralded as the first dedicated, branded airline business class cabin. The cabin featured luxurious service standards and competitive fares to attract long-haul business travelers at a time when corporations had restrictions on employees flying first class.

"Because the SP product developments generated excellent occupancy levels, Pan Am started to upgrade its B747-100 fleet in 1980; 21 first class Sleeperettes were installed in A zone, and 10 in the upper deck, replacing the earlier dining room usage; 42 Clipper Class seats were installed in B zone, initially eight-abreast, but later re-configured to six-abreast. So other airlines had to scramble to catch up and compete."

Since the 1980s, airlines have waged brutal wars of attrition, with every market segment up for grabs. At all times, however, the 'gentle giant' B747 has been a prestigious presence, both in the air and at airports worldwide. This aircraft has more than earned its place in history as a transformative element in global society and the enabler of mass affordable air travel.

Billions of appreciative Jumbo customers – including presidents – have enjoyed more options for onboard care and marketing ingenuity than had ever before existed in the history of aviation. In 2019, we have all these reasons to celebrate the 50th anniversary of the launch of the B747.

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# DESIGN, UNINTERRUPTED

Teague has a long history in aviation and airline design, with iconic brands of the past and present. Here, the company shares its latest collaboration with The Boeing Company and Emirates Airline

The summer of 1946 saw Boeing president William Allen place a historic call to the world's pre-eminent design consultancy, Walter Dorwin Teague Associates. After the call, a team from the New York City-based firm accepted a three-month assignment in Seattle to design and develop the interior cabin of the Boeing Stratocruiser, and never looked back.

Over the past seven decades, Teague has partnered with Boeing to design the interior of every Boeing commercial airplane produced – guaranteeing the design firm a unique vantage point in the industry.

"There is a tangible advantage that comes from the depth of knowledge and expertise we have in the aviation industry," says Teague vice president Lindsey Maxwell. "Our intimate knowledge of aircraft, combined with our expertise in technology, proficiency in regulation and certification, and decades of research in passenger experience, means that unlike any other firm, we can fast track the type of meaningful innovation that measurably improves both the passenger experience and the bottom line."

Most recently Teague has applied that expertise to the cabin design of Emirates' new B777-300ER. Teague began working with Emirates in 2008 – a partnership that resulted in an award-winning first class cabin and door 1 entry that set a new precedent for luxury air travel.

"The B777 G6 interior, designed in collaboration with Emirates, Boeing and the PierreJean Design Studio, was a watershed moment in commercial aviation," says Chris Pirie, Teague's senior director of business development, and at the time a design lead on the project. "The degree of innovation required to realize the B777 G6 architecture – featuring 3m (10ft) ceilings, a starry night sky, and dynamic lighting that replicates natural light patterns – was revolutionary."

Since the debut of Emirates' B777 G6, the industry has experienced incredible change, with competition among airlines growing increasingly fierce. Keeping up with rising passenger expectations and the pace of innovation, not to mention technological change, has made it difficult for airlines to drive passenger preference and command a price premium. However, one of the few geographies seemingly unaffected is the Middle East. Gulf carriers have expanded at double-digit rates over the last decade. Numbers suggest, however, that this level of growth may not be sustainable. In 2017, the region's aviation industry reported a return of just US$300m, down from US$1.3bn the previous year. Sluggish profits, political instability, crowded airspace and new competition are motivating a renewed interest in design and innovation as a means of differentiation.

Beyond the purchase of new airplanes, Gulf carriers, including Emirates, are investing in new cabin interiors and reimagining the passenger experience to cater to a new class of travelers who demand comfort, connectivity and a high level of service, in equal measure.


1

Teague has been involved in aircraft cabin design since 1946

1. IN EMIRATES' B777 ECONOMY CABIN, THE LENGTH OF THE SEAT FABRIC DESIGN, WHEN COUPLED WITH RANDOM INSTALLATION, GIVES EACH SEAT A DISTINCT FEEL

2. THE NEW EMIRATES B777 BUSINESS CLASS IS PARTLY INSPIRED BY THE MERCEDES-BENZ S-CLASS

## VALIDATING IDEAS

**Teague opened its first dedicated prototyping workshop in 1937. Today that facility, known as the Design Realization Center, spans nearly 130,000ft² (12,000m²). A dedicated team of industrial designers, mechanical and systems engineers, technologists, lighting designers and researchers works to bring the airplane cabins of tomorrow to life today for clients across the aerospace industry.**

**"Whether we're validating a new seat design, architecture, lighting orchestration or ceiling structural systems, prototyping allows us to move very quickly through the process with our clients," says Teague's principal designer, Franco Cagnina. "Using full-scale physical and experiential mock-ups combined with virtual reality means our clients don't have to imagine what something might look like or how it might work – they can experience it first-hand. This way of working mitigates risk, helps educate the client, and improves speed to market, so we can quickly build toward the best market solution."**

"Passengers deserve, and now expect, a sense of continuity from ground to air," says Pirie. "Our job is to deliver an experience that ensures passengers feel at home while traveling at 30,000ft."

Historically, incremental improvements in service and experience have resulted in significant value for airlines over time. To keep pace with the speed of change both in and surrounding the industry these days, however, requires investment in real and meaningful innovation.

Unveiled in late 2017, Emirates' new B777-300ER delivers a brave leap forward for commercial aviation. The second collaboration between Emirates, Boeing, PierreJean Design Studio and Teague, the all-new cabin interior reflects the airline's commitment to deliver meaningful connections and experiences to its passengers.

With a multimillion-dollar cabin refresh from nose to tail, the Emirates B777 aircraft features a modern color scheme, textured wall panels, and lighting design inspired by trends in residential interiors. The custom-designed patterns and fabrics found throughout the cabin unify the


"THROUGHOUT THE AIRCRAFT, OUR CUSTOMERS WILL SEE MODERN AND AIRY CABINS, WITH PAINSTAKING ATTENTION TO DETAIL EVIDENT IN DESIGN TOUCHES SUCH AS THE TEXTURED WALL AND CEILING PANELS, LIGHTING FEATURES, AND MORE"

***Sir Tim Clark, president, Emirates Airline***

**Teague is now collaborating with Boeing on the Emirates B777X interior design**

3. THE BACKLIT GHAF TREE MOTIF IN THE EMIRATES B777 FIRST CLASS

4. THE FULLY ENCLOSED SUITES IN FIRST CLASS BOASTS UP TO 40FT² OF PERSONAL SPACE

5. THE ZERO GRAVITY POSITION IN FIRST CLASS OFFERS A RELAXING AND HEALTHY SEATED ENVIRONMENT

brand, pulling a red thread through the cabin design of Emirates' entire fleet. To ensure a world-class experience for all passengers, special attention was given to Emirates' economy class. The ergonomically designed seats come with full leather headrests that have flexible side panels that can also be adjusted vertically for optimum support. An added touch is that the length of the seat fabric design, when coupled with random installation, gives each seat a distinct look and feel.

Throughout the airplane the UAE's national tree, *prosopis cineraria* or Ghaf tree, is used as a design feature to bring an element of the region's unique beauty into the cabin. The simplified, geometric design is backlit in first class, creating an instantly iconic and ownable symbol for the brand.

"The interior design is completely custom," notes Teague senior interior designer Kelly Earls. "We've gone to great lengths, working with suppliers across the globe to deliver an experience that captures the spirit of the UAE's geography and culture, the sophistication and elegance of the brand, in a way that is distinctively Emirates."

Inspired by a unique partnership between Emirates and Mercedes-Benz, fully enclosed suites in first class resemble the Mercedes S-Class interiors, with soft leather seating, mood lighting and high-tech control panels. Providing up to 40ft² (3.7m²) of personal space in a 1-1-1 configuration with floor-to-ceiling sliding doors, the suites offer passengers the ultimate in air luxury: absolute privacy.

What's next for Teague? The firm's collaboration with Boeing and Emirates will continue with the groundbreaking interior design of the B777X.

"Our expertise in aviation allows us to define and deliver new features that offer quantitative value to airlines and their passengers – from defining new brand identities to designing aircraft seats from the ground up, and delivering world-class IFE experiences," adds VP Lindsey Maxwell. "What might surprise the industry is to know that a large part of Teague's business is outside of aviation. Working with clients like Amazon, Intel and Google, we're aggregating and analyzing data in ways that are meaningful to business, helping define the future of autonomous cars, and envisioning tomorrow's smart cities.

"The intersection of travel and technology is what's most exciting for us, and where we see the most opportunity for the aviation industry."

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TEAGUE

# THE BIG PICTURE

The PriestmanGoode studio can apply its skill sets across an airline's passenger experience, from industrial design innovation in aircraft cabins, to branding and marketing campaigns


1


2

The aviation industry is in constant flux. Airlines today need to be agile and flexible, able to respond quickly to meet consumer needs and stay relevant. Titles have changed. Where before there were customer service representatives and heads of product innovation, today there are heads of passenger experience, who consider the full passenger journey, from home to destination.

On a macro level, this means competition is tougher. On a micro level, it means the demands on you, the reader, are tougher than ever before. Whether you're an airline CEO, head of innovation for a manufacturer, a customer experience expert or a materials supplier, you need to be flexible and resourceful in order to navigate an increasingly complex landscape and remain at the forefront of the aviation industry.

As the aviation business has changed over the past decade, so has the way in which PriestmanGoode operates. The studio encompasses varied teams with unique skill sets – from branding to product design, visualization, CMF, innovation, digital services and marketing. More than a design consultancy, PriestmanGoode is a human-centered business that is continuously looking at industry trends and the demands placed on airline clients to ensure that it can support them effectively both from a creative and an operational point of view.

One of the studio's recent projects saw the team working with Canadian airline WestJet. Nigel Goode, co-founder and director at PriestmanGoode, explains, "WestJet saw the purchase of new Dreamliners as an opportunity to review its branding and cabin interiors. The airline wanted to position itself as the 'most Canadian of Canadian airlines' and to create an exceptional passenger experience as it entered the long-haul market."

Goode continues,"This project was a significant undertaking for WestJet. The airline was transitioning to become a full-service airline and needed to work with people who were experienced in the field, not just of design, but of the whole passenger journey."

The project from order to delivery of the aircraft will take about 18 months, and in that time, PriestmanGoode has been able to deliver a unique design across three cabin classes, leveraging relationships with suppliers to complete the project in record time.

PriestmanGoode's brand specialists and CMF experts began looking to the Canadian landscape and its visual

# "THE WAY IN WHICH AIRLINES TELL THEIR STORIES HAS CHANGED"

**Priestman-Goode's digital and visualization department is key to engaging with customers**

1. WESTJET'S DREAMLINER COLOR SCHEME REFLECTS THE CANADIAN LANDSCAPE

2. THE CUSTOMIZED SEAT FOR WESTJET'S DREAMLINER HAS SHIFTED THE AIRLINE'S MARKET POSITIONING

language in order to create a design that would accurately depict 'the most Canadian of Canadian airlines'. Specifically, the studio looked at nature to select a color palette that would be calming, elegant and mirror the breathtaking Canadian landscape. This was combined with patterns inspired by the First Nations (the country's predominant indigenous peoples), to create a contemporary look and feel.

Meanwhile, the studio's team of designers worked to customize the seat design as much as possible. This progressive project saw WestJet move from the budget market to being a serious competitor for top-tier, long-haul carriers, able to compete with some of the world's most established airline brands. The resulting design, as one journalist described it, is "a game-changer for WestJet, not just in its international push, but in market positioning".

PriestmanGoode didn't just work on the design of the cabins. The studio worked with WestJet to conceive the brand story, translate it to the onboard product, and deliver a suite of marketing materials that the airline could use in its promotional push.

The saying goes 'If you build it, they will come'. But just as important as building it, is how you tell that story to your customers, both existing and prospective. Goode continues, "Our digital and visualization department regularly creates promotional videos, digital cabin walk-throughs, augmented and virtual reality experiences and marketing materials, as well as microsites for our clients. The benefit of having all these skills under one roof is that as a client, your job is made easier. We oversee a project in its entirety, which is both time- and cost-effective. Additionally, as we work from the brand conception onward, the studio is able to ensure that the brand story is clearly articulated through every step of the journey, and never gets diluted or misinterpreted."

The way in which airlines tell their stories has changed. The wide adoption of mobile technology in particular means that airlines need to cultivate their digital presence as much as the physical passenger experience. PriestmanGoode has established itself as an expert in user experience. Luke Hawes, director at PriestmanGoode, explains: "What this means is not to have a digital strategy, but rather to have a strategy for the digital age. It's a subtle difference, but one is reactive, and the other is more holistic, long-term and considers the digital experience as part of a bigger brand experience."

PriestmanGoode is more than a design consultancy. The studio works alongside airline clients as a long-term partner that can support airlines in a vast range of

The team's evidence-based approach creates optimal designs

3. THE SCHEME CREATED FOR UNITED AIRLINES' POLARIS CLASS EXTENDS RIGHT ACROSS THE PASSENGER EXPERIENCE

## "WE'VE ADAPTED OUR BUSINESS TO WORK WITH OUR CLIENTS EVERY STEP OF THE JOURNEY"

ways, from the technical product development, engineering and innovation side, to the big picture corporate identity, strategy, communications, branding and marketing work.

At the heart of how the studio operates are people: individual clients, as well as passengers. PriestmanGoode prides itself on its human-centered approach to design. Hawes continues, "Everyone in this industry is under pressure, whether it's from management or from stakeholders, and whether it's to create a new innovative onboard product, or to deliver an airport on time and on budget. We start each project by understanding what our individual client needs and how we can support them to make their life easier."

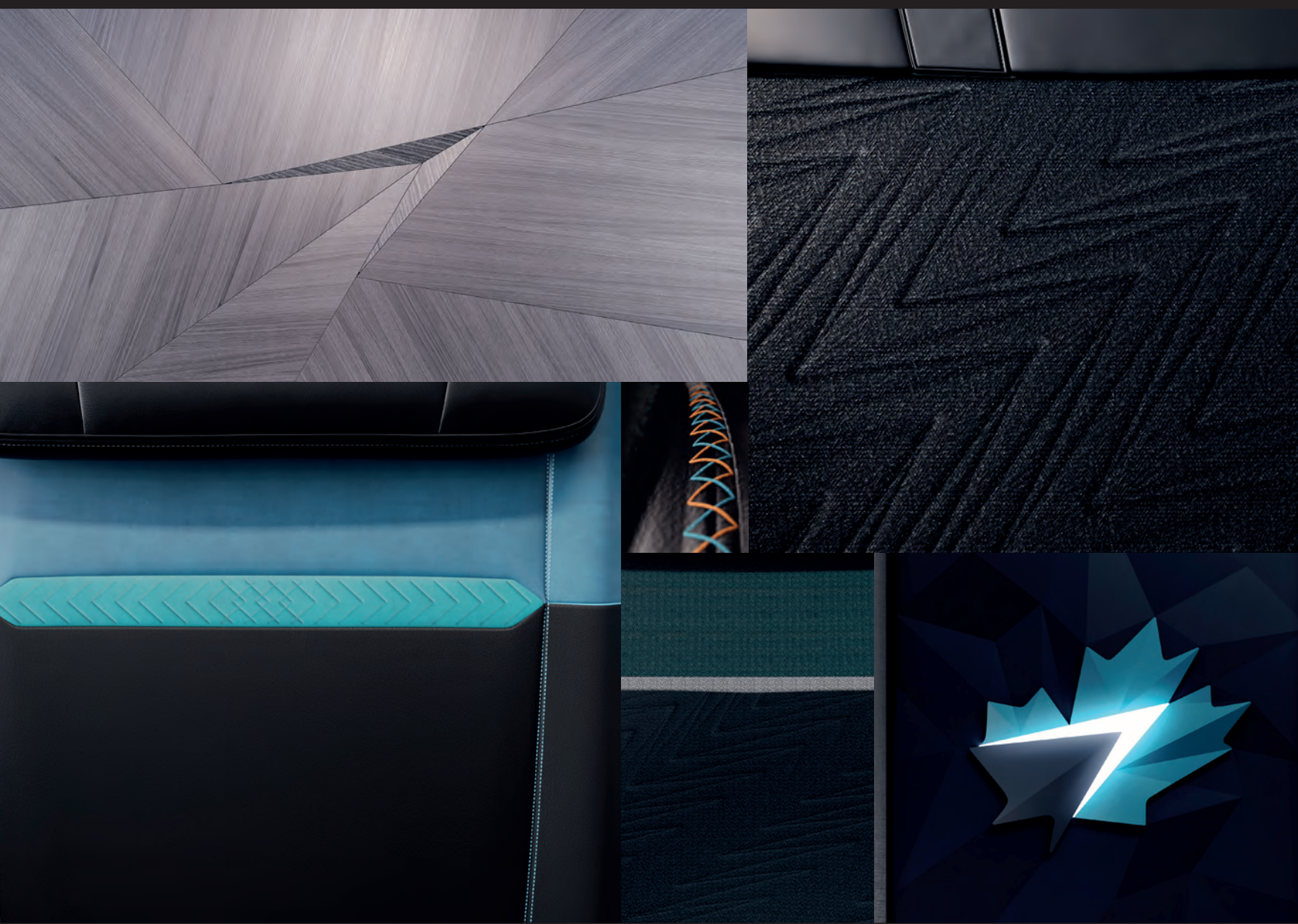
Working closely with clients during the process – from ground services staff to check-in staff, customer experience specialists, marketers, engineers and more – creates better end products and services. Goode says, "This evidence-based collaborative approach means we only bring to market solutions that actively tackle passengers' biggest issues with air travel. And for our clients, that means a better return on investment."

Clients such as Qatar Airways and United Airlines, with whom PriestmanGoode has worked for many years, are great examples of the success of collaborative partnerships. The work for both of these clients demonstrates what can be achieved when working together over a long period of time. Through trust and understanding a brand's values, PriestmanGoode has collaborated with these clients to produce award-winning passenger experiences across ground services, on board and online, breaking new ground in product design and focusing on delivering solutions in response to passenger pain points.

As the aviation industry continues to grow in complexity, PriestmanGoode has developed into a multiservice design agency, helping airline and airport clients all over the world move ahead of the competition by creating better passenger experiences, increasing brand loyalty and stakeholder engagement.

Goode continues, "Whether you're a CEO or a project manager, the reality is that you need to deliver complex, multifaceted projects on time and on budget. We've adapted our business to work with our clients through every step of the journey and deliver an improved return on investment."

PriestmanGoode.



# Great design from the big picture to the smallest detail.

WestJet's Boeing 787-9 Dreamliner

PriestmanGoode.com

# THE VEGAN CABIN

In the technology-driven aerospace arena, are animal products still a suitable option for cabin trim and finish? Factorydesign director Adam White considers a plant-based approach to cabin design

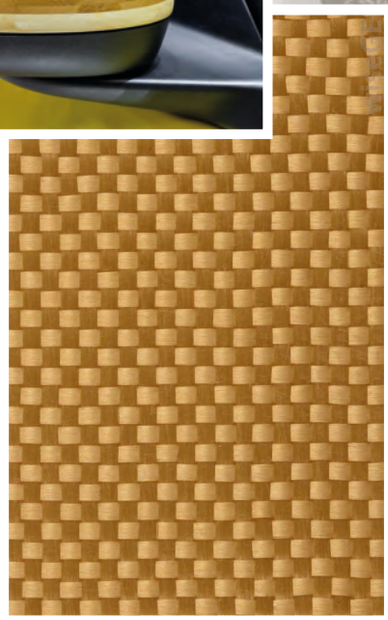
Just a few years ago, the idea would not have made sense. Some people would have loved it, but most would just have raised an eyebrow. But things, movements, can gain traction, and when technologies evolve in such a way that they can be better, rather than just being a substitute for something, traction increases.

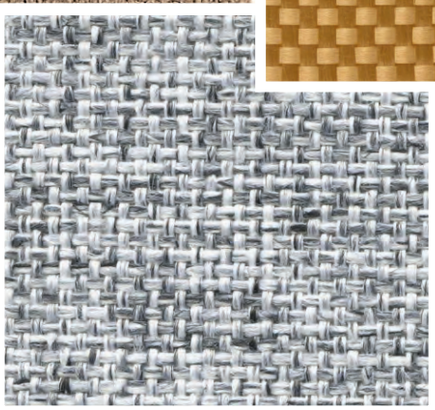
Veganism is a philosophy that essentially excludes (as far as possible) anything from an animal being used for food or manufacture, be it a sausage or a seat. Furthermore, it has a resonance now that embraces a more caring attitude to our world and everything in it; it is a part of the zeitgeist of today.

Watching, as we do, many different markets and trends, we believe the technology is available to deliver everything an airline passenger could want and expect in the cabin, without compromise, but with a manufacturing philosophy that actually has a resonance with them, rather than merely delivering a product. Being bang on trend, as in feeling the zeitgeist, has value, and I suspect that done exquisitely and with care, increasing numbers of airline passengers would more readily chose a vegan interior than an extra inch of legroom or a ticket costing a few pounds less.

Materials are the key, and as was noted by our trim and finish people at Aircraft Interiors Expo 2018, there is an even bigger uptake of the likes of Ultraleather and ELeather, year on year. Although the latter is not vegan, it has impressive environmental credentials. The weight saving of Ultraleather over cowhide is considerable, at over 50% lighter for the same dress cover, and the impact of this saving as a multiple in terms of annual fuel savings is clear. And yet it delivers something visually remarkably similar to cowhide. As Paul Wylde said during our project to design seats for British Airways' Concorde, "Leather is the language of luxury."

However, beyond faux materials there are opportunities to introduce old materials in new ways. The world's first commercial airliner, the Lawson L-2 biplane, had 26 seats made from wicker laced around a bamboo frame. Insect





"BAMBOO HAS BEEN EXAMINED AS A NATURAL ALTERNATIVE TO MANUFACTURED COMPOSITES"

The team is identifying opportunities to introduce old materials in new ways



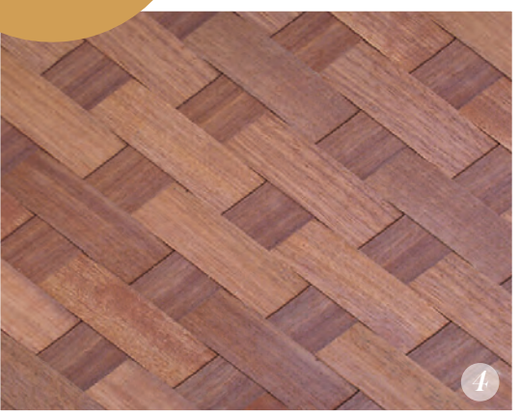
1. EVERYTHING FROM A FIAT WING MIRROR TO MOSS CAN INSPIRE A VEGAN CABIN DESIGN (2)

infestation proved an issue (among others) and aluminum had taken over as the material *du jour* by the 1930s. However, bamboo has refused to go away as it is astonishingly strong, with a tensile strength greater than steel, and it grows at a prodigious rate, meaning it costs 100 times less than the more brittle carbon fiber. So it's no surprise that over the past few years bamboo has been examined as a natural alternative to manufactured composites. Fiat produced a groovy 500 in 2014 showcasing the tan brown weave – it was more decorative than structural, but that was five years ago. A resin/bamboo composite is now in the making that would offer genuine benefits to parts of a cabin interior, either on show or tucked away.

And this raises another observation for the vegan cabin. There are elements that can be seen and enjoyed – the visible touchpoints – alongside ones that are out of sight, but deliver both the performance and the promise. You really need, and can have, both.

Sono Motors in Germany created the Sion prototype this year – an electric car covered in solar cells that gathers energy as it drives, at least during daytime. The car features a stylish but simple interior, with a glass strip on the dashboard behind which sit what appear to be small green cauliflowers. They are actually tufts of Icelandic moss that naturally filter the cabin air. Vegetarian air-con – who'd have guessed? It looks very cool and calming.

The Range Rover Velar has been designed with a vegan-friendly interior



3. ICELANDIC MOSS FILTERS CABIN AIR IN THE SONO MOTORS SION

4. THIS DECORATIVE HARDWOOD VENEER IS HAND-WOVEN

And that's a small car. Beyond the confines of the seat, an aircraft cabin has so much more to offer in terms of opportunity and there are some interesting areas to tackle. Wool is a great material for use in carpets and curtains, being naturally fire resistant and hard wearing, but it wouldn't deliver a vegan cabin, even if some would deem it acceptable.

Fortunately synthetic fabrics have been under development for many decades, so by now, materials like Trevira offer excellent properties of look and feel alongside airline essentials such as high fire resistance for curtains and endurance for carpet materials.

A vegan cabin should not echo to the familiar cry of 'chicken or beef' at the main meal service, but there are many alternatives. Vegetarian food is a straightforward change to the service offer, and many people already choose it as a safer alternative to airline meat dishes. A general review needs to be carried out to make sure other products such as soap and hand conditioner in the lavs have the correct credentials, and of course the amenity kits in the premium cabin must be similarly green. Once you start flushing out non-vegan products, there is a delight in thinking of another that needs dealing with.

"FOR AIRCRAFT, I DON'T THINK IT'S A QUESTION OF IF, BUT WHEN, DESIGN GOES VEGAN"

It should be noted that this year the Range Rover Velar won the World Car Design of the Year 2018, praised for its optional vegan interior. Within the automotive industry, there has been a lot of effort from manufacturers to acknowledge this opportunity. It is one born out of many things coming together at this point in time and it should be taken seriously.

For aircraft, I don't think it's a question of if, but when, design goes vegan. One of the reasons it works as an idea is that it just feels right. Aircraft are technical marvels, and one of the pleasures of working in the aviation industry is that you are surrounded by the best engineering and manufacturing, so it follows that everything in the aircraft should continuously evolve and further refine. This is a technology-driven arena, so it is inevitable that alternatives to serving up animals and using their by-products in aircraft manufacturing will be replaced by something just a bit more modern, a bit more engineered, or in the case of the plant-based suggestions, a little more inspired.

It will remain true that at that moment of interaction between a person and an object, that moment of touch, organic materials offer a warmth that is hard to imitate.

# DELIVERING INNOVATION

Devising great ideas is one thing, but making them commercially viable and airworthy is another. Acumen manages the progress of taking innovative ideas from a sketch to the skies

The aviation industry has created some of the most advanced and complex vehicles in the world, capable of safely transporting people from one side of the globe to the other. Yet truly groundbreaking innovation is still relatively rare. How does the industry collaborate to ensure the next generation of aircraft not only delivers the safety and security we expect, but takes the experience of flying to a whole new level? And what is the designer's role in this process?

Every few months there are headlines announcing radical aircraft innovations, from standing-only short-haul flights, to modular cabin interiors and passenger sleeping quarters in the cargo hold. Mainstream newspapers are awash with stories predicting how the future of aviation will look. However, there is a big difference between creating a headline-grabbing concept and delivering a product capable of passing certification processes while also remaining financially viable.

At Acumen Design Associates the emphasis is always on the entire picture. Since 1996 Acumen has worked on more than 40 full design programs, for many leading airlines – with numerous cabin, seat and even aircraft designs launching from Acumen's London studio.

With many of those iconic designs still flying today, Acumen has a unique heritage in creating and protecting its own intellectual property. The company has more than 20 aviation patents to its name – including the original cabin layout for Polaris, United Airlines' critically acclaimed business class product.

Any new cabin interior concept will need to fulfill several criteria: financial viability for the airline, an enhanced and superior experience for the passenger, and the ability to meet safety regulations. Creating products that fly, both literally and commercially and by taking to the air, is challenging but ultimately rewarding.

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## BACK TO THE BEGINNING

Designers are uniquely positioned to challenge the status quo and act as agents

"ACUMEN HAS A UNIQUE HERITAGE IN CREATING AND PROTECTING ITS INTELLECTUAL PROPERTY"

**Acumen Design Associates has more than 40 airline programs and 20 aviation patents to its name**

1. LOTS OF SPACE, COMPANION DINING AND LASHINGS OF STYLE: ACUMEN'S 1990s VISION FOR BRITISH AIRWAYS' FIRST CLASS

for change. For the past 20 years, Acumen has operated in a pivotal position that drives improved cabin revenues, pushes the passenger experience to new levels, and provides opportunities for suppliers, airframers and airlines to harness their collective creativity and work together.

Acumen's first foray into the world of aircraft interiors came in the mid-1990s, when the studio was commissioned by British Airways (BA) to radically rethink first class. At the time it was Acumen's experience in luxury yacht design that proved alluring. Yachts have limited space but need to deliver a sensational experience – a fact BA understood, given the limited footprint of a first class cabin.

The result was the iconic Bed in the Sky, a complete reimagining of what luxury air travel could be. The world's first fully flat bed in commercial aviation became the most in-demand experience in aviation, with the cabin selling out for months and winning a host of design awards in the process.

Beneath the fairy-tale nature of this story hides an incredible amount of work and effort to achieve the inconceivable. Acumen's vision was to deliver an experience like no other – convincing the airline to reduce the number of seats in first class to accommodate its radical design. BA did so with the firm belief that the flat-bed experience would prove so popular it would generate more revenue despite fewer seats. The results spoke for themselves: sold out flights for months.

But there were challenges along the way that saw the designers needing to be the linchpin in the entire product development cycle. Certification for a flat bed had never been achieved before, meaning that to bring the idea to life, Acumen needed to be pivotal to both the airline and the regulator from the outset.

## THE ETIHAD EXPERIENCE

When Etihad was looking to redefine its first class offering for a new generation of travelers in 2008, Acumen (as part of the Etihad Design Consortium [EDC]) thought

Acumen is working with Adient to bring a range of aircraft seating to the market

2. JETBLUE HAS PRAISED ACUMEN'S ABILITY TO MAKE CREATIVE VISIONS COME TO LIFE

3. SABIC'S JET PANEL MATERIAL ENABLES BOTH PRIVACY AND A LIGHT ENVIRONMENT

4. THE LIVING ROOM SPACE IN ETIHAD'S A380 RESIDENCE IS AMAZING BOTH IN TERMS OF LUXURY AND SPACE EFFICIENCY

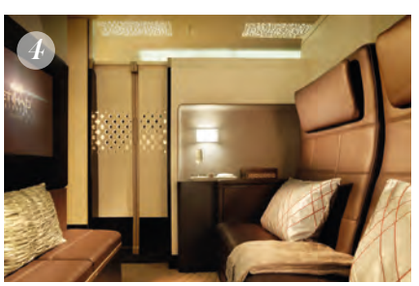
big again. This time the vision was to completely reimagine luxury air travel. The end product was The Residence – the world's first three-room apartment in the sky. Not only did the cabin showcase everything Etihad had to offer as a luxury airline, but it took a relatively unused part of the aircraft and made it profitable.

Creating this vision led to a host of certification challenges. Acumen worked closely with the airline, other organizations in the EDC and a range of high-end suppliers – coordinating the collective efforts to realize the vision.

Designers have a critical role as the central link between an airline, external manufacturers, regulators, airframers and passengers – ensuring creative ideas make it off the page and into the sky.

## THE VIRTUOUS CIRCLE

Nowhere is this truer than when it comes to introducing new materials into the industry. Twenty years ago, transparent and translucent materials capable of being used in large panels did not exist – yet now we have products like the Jet Panel from SABIC which can be used to create an improved sense of privacy without blocking light. The next generation of step changes in aircraft interior design will come from new materials and technologies.



"STEP CHANGES WILL COME FROM NEW MATERIALS AND TECHNOLOGIES"

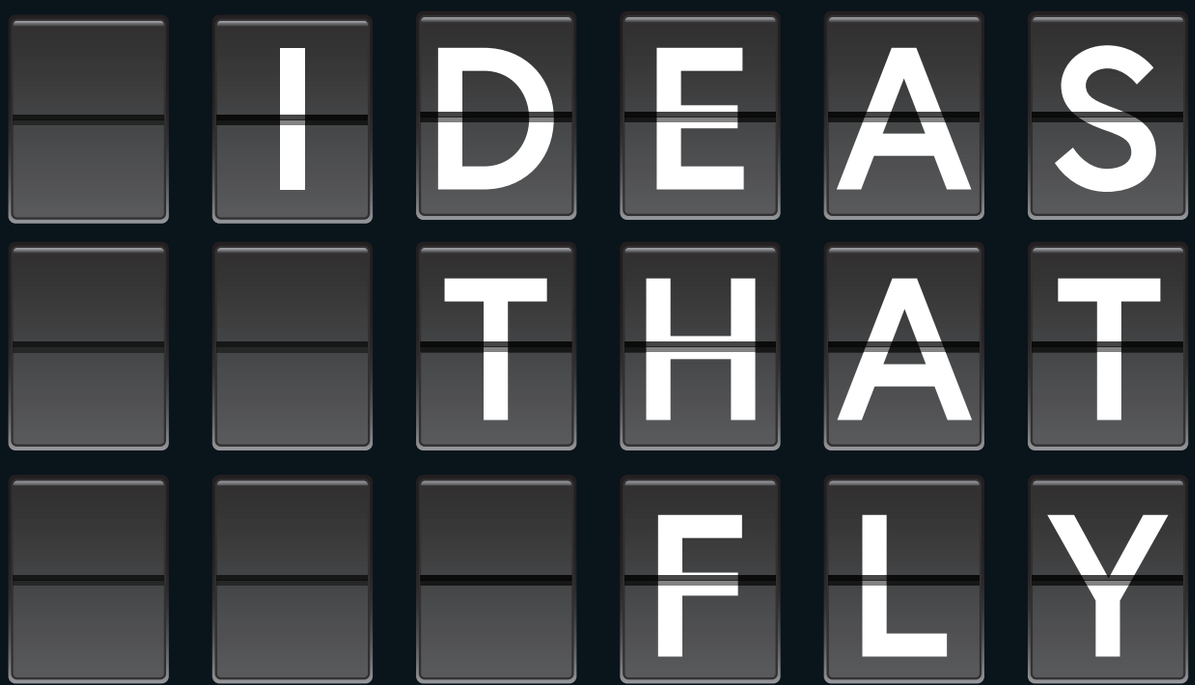
Acumen's designers are always searching for and encouraging dynamic suppliers able to adapt to the challenges and opportunities offered in the aircraft interiors industry. Quite often these companies may not realize the true potential of their products to the aviation industry. Designers can demonstrate the benefits that arise from creating something truly groundbreaking.

The process then becomes a positive experience for all parties, with suppliers getting the recognition their materials and products deserve, designers receiving the tools to bring their creative ideas to life, and the airlines and their passengers benefitting from an industry that is consistently looking to progress. Acumen has worked alongside many of the world's most illustrious airlines, including British Airways, Etihad, United Airlines, Cathay Pacific, Air France and JetBlue. But the company has also introduced innovation to the industry through the likes of Sabeti Wain, Poltrona Frau, VT Volant and Sekisui.

Manager of product development at JetBlue Andrew Litavis values the company's heritage and expertise highly: "The great thing about Acumen is that they don't just present conceptual renders that cannot be executed. Their team is uniquely positioned to assemble the right players across the industry to execute against our creative vision and bring these concepts to life. When combined with a passionate airline partner, the result is a powerful force for change in what can feel like a very obstinate industry."

For Trystan Parry, executive director at Adient, a transportation seating company looking to expand into the aviation market, the expertise that Acumen offered was critical. "Acumen helped us to create a unique and compelling product range in a crowded marketplace. Even after the concept was delivered, they stayed involved, helping to make sure that the products could be engineered, certified and delivered without compromise," he says.

Designers are the pioneers in aviation. Their ability to identify the needs of passengers, suppliers and airlines, while creating experiences that benefit each, will drive the next generation of aviation innovation. This may be through new products, materials or technologies. Designers can power the next generation of innovation by understanding the parameters of the industry and developing the experiences that truly fly for all.

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# EXPERIENCE ECONOMY

While hard product design faces many constraints, the passenger experience is an area that is open to innovation and individualization, across all classes

Two decades ago, Joseph Pine and James Gilmore defined the emergence of the experience economy as an "experience that occurs when a company intentionally uses services as the stage and the goods as props to engage individuals to behave in a way that creates a memorable event".

In recent years, the experience economy has taken off as millennials and Generation Z drive change by rebuffing the ownership of things in search of finding the ultimate experience. IKEA recently said that consumption of many goods is reaching a global limit, and in the West "we have probably hit peak stuff".

McKinsey has seen spending on experiences grow four-times faster than spending on goods; and two years after Airbnb launched its experience feature, it is now growing 10-times faster than the company's core business of home rental.

The psychology behind this shift in behavior indicates that sharing an experience with friends leads to a hedonic rush, linked to a deeper sense of well-being and happiness than that of buying products. Recent research from Cornell University shows that our levels of happiness drop quickly after purchasing a tangible object, while our sense of well-being following an experience goes up and stays up for longer.

Sir Colin Marshall adopted this mantra for customer service during his time in the car business, and then as chairman at British Airways he went further, defining the carrier's experience work as, "orchestrating service to fill customers' value-driven needs". Under Marshall's stewardship, British Airways pioneered the world's first fully lie-flat beds for commercial passengers, premiering in first class and then shortly after in business class, with tangerine's yin-yang design for Club World.

Today, premium airline seats can be angled, lie-flat and configured every which way; avoiding 'prior art' is becoming an Olympic sport for designers. With opportunities for breakthrough innovation constrained, airlines naturally have turned their attention to how other elements of their service can be optimized to enhance the customer experience. They seek a perfect progression of economic value, which, put bluntly, means that the more positive and engaging an experience, the more loyal customers are, and the more they are willing to spend.

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Airlines seeking to gain competitive advantage are quick to embrace emerging technologies and consumer trends in the hope that these will differentiate their service from competitors; offering such experiences as a wider choice of IFE, HD monitors, fast wi-fi, luxury travel items and in-seat heating/cooling systems. In first class, the word 'experience' transcends the physical and metaphysical in the pursuit of personalization and the real progression of economic value. Mini-suites and inflight chefs are just some of the ways in which 'clients' are treated to five-star service.

But what of the commodity, knees-up-around-your-earlobes, economy class?

# "AIRLINES CAN IMPROVE PERSONALIZATION AND DRIVE SALES WITHOUT COSTLY MEASURES SUCH AS RECONFIGURING AIRCRAFT"



The Digital Sky seating concept was a finalist in the 2016 Crystal Cabin Awards

1. GULF AIR'S REDEFINED BUSINESS CLASS PROPOSITION

2. WITH THE DIGITAL SKY CONCEPT, THALES, ROCKWELL COLLINS AND TANGERINE EXPLORED THE FUTURE OF INFLIGHT SERVICES

Airlines often view economy class as an area in which they cannot afford to radically innovate, and seat vendors are often reluctant to change their catalog offer because it works. Put simply, the cost of change often outweighs the benefits.

Breakthroughs do occur, as seen with Lift by Encore and Rockwell Collins' Pinnacle seat for Cathay Pacific's new A350 economy cabins, but economic constraints mean that airlines are focusing on creating economy class experiences that appeal to the widest range of customers. They are assessing how they can obtain additional value from people by tailoring their core offer to suit the specific needs of different passenger personas. The benefit of this approach is that airlines can improve personalization and drive sales without costly measures such as moving seats or reconfiguring aircraft interiors.

Virgin Atlantic is trialling a new three-tier economy class – Light, Classic and Delight – from 2019, while Air New Zealand led the way in 2012 by adopting the Skycouch. Both are great examples of innovation in economy class, but they still required substantial investment and only begin to scratch at the surface of what is possible. Sometimes, it doesn't need to be a physical or even planned experience to be truly memorable.

For example, on one flight, a mother of four boys traveling economy class to Australia could have kissed the cabin crew member who insisted that he held her newborn baby so that she could visit the bathroom during a 12-hour flight. It was a truly memorable event for her, even decades later, made possible by the emotional intelligence of the airline crew member. This memorable positive interaction drove loyalty within her extended family, who still use the airline when they travel to Australia.

How an individual perceives an event is down to their state of mind and the situational context. No two people will perceive the same event in the same way, as each person has a different expectation, appreciation and awareness of what occurred. This also means that customer experiences are inherently personal. By engaging passengers on both an emotional and physical level, airlines can create bespoke offerings that become truly memorable experiences.

Creating a truly special experience in business class is also challenging as the desire to offer a spacious, premium and personalized experience must be balanced with the commercial impetus to maintain high cabin density. It's a fiercely competitive market and few airlines can afford to reconfigure their business class space from the ground up to provide something radically different. Creating a platform in which to design and develop a new seat is therefore usually the role of the seat vendors – as evidenced by Rockwell Collins' Crystal Cabin Award-

"DESIGN IS FUNDAMENTAL TO SHAPING THE FUTURE OF AN AIRLINE"

tangerine's cabin designs for Virgin Australia were a finalist in the 2016 Crystal Cabin Awards

3. CREATING MEMORABLE BRAND EXPERIENCES FOR VIRGIN AUSTRALIA'S BUSINESS CLASS

4. TANGERINE DESIGNED A SIX-WAY HEADREST FOR CATHAY PACIFIC'S A350 PREMIUM ECONOMY

winning Valkyrie seat, created in collaboration with tangerine.

For airlines adopting mostly standard platform products, the process of differentiating their brand is not easy, as predefined elements can be constraining. Therefore, tapping into the growing experience economy is an attractive and ever more popular path to success. These airlines will look to lightly touch or highly customize existing catalog seats, create bespoke textiles and finishes to adorn the cabin interior, and design a superior theater of service. Most airlines recognize the value in such programs, but it is surprising how differently they go about procuring the means to achieve their end goal. Starting the process and engaging designers at an early stage will pay dividends, but many simply don't follow this rule.

Gulf Air is one exception. This was one of the first commercial airlines in the Middle East, taking off from Bahrain in the mid-1950s. Over the years, the pioneering airline has been the carrier of choice for many passengers, but aggressive expansion by other airlines in the Middle East led Gulf Air to reassess its entire offer. Several years ago, the carrier chose branding consultant Saffron and design consultant tangerine to work in close collaboration with Gulf Air's executive management and board of directors to create a new brand identity and customer experience for the airline.

Launched in April 2018, the rebrand includes a new identity system, livery and cabin interior that repositions the Gulf Air brand in a contemporary and sophisticated way at every touchpoint of its service. The new aircraft have a distinctive new livery and every element inside the cabin has been redesigned, including a moderate, but impactful, customization of a Rockwell Collins seat. Nothing has escaped the designers' brushstrokes.

The result of this collaborative project is an aircraft cabin that works perfectly in harmony with the airline's brand identity. The essence of Arabian hospitality and the Kingdom of Bahrain's national identity is captured in a modern way that resonates with Gulf Air's national and international customers to create a truly memorable experience. This success was achieved through the early adoption of a joined-up approach.

"Design is fundamental to shaping the future of an airline," says tangerine's chief creative officer, Matt Round. "The closer you integrate designing the right experience for your customers into your business goals, the more advantage you can achieve from it as a competitive tool. The earlier you start in the airline program, the better the outcome for the passenger."

As designers, we are affecting what the theater of service will be, finding ways to enhance the customer experience and creating economic value for an airline. Whether it is the tangible or intangible elements of an experience, as designers, we use insight and knowledge gained from creating innovation across a variety of industry sectors to explore, examine and create.

Euromonitor, the market research analyst, forecasts that global expenditure on the experience economy will reach US$8.2tn by 2028. The successful innovators will be those with the emotional intelligence to develop deep insights into the psyche of consumers and keep one step ahead of them, taking them on a voyage of discovery.


# Transforming brand and customer experience

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# MASTERING SPACES

JPA Design discusses its unique approach to design, how it makes it easier to innovate within the customer experience, and how it delivers products that resonate with brands

Steve Jobs once summarized Apple's prowess in developing personal electronics thus: "Innovation distinguishes between a leader and a follower." Apple, however – like every other technological giant – is starting to show the strains of being caught in an innovation cycle.

Like other market leaders, it is still able to bring new ideas and products to consumers – with the inevitable fanfare – but doing so means competitors can replicate these successes quickly without the risks or financial investment.

Today more than ever, there is a thirst to innovate and stay ahead of the curve. This doesn't always mean bringing a new product to the market. Apple has shown through the evolution of its iPhone that merely designing a brand-new product isn't always enough to garner attention. The company's long-term success has been through simple and clear reformation within the user experience, improving the product to benefit the consumer rather than disrupting loyal customers with a new, unfamiliar product.

This innovation cycle isn't limited to the tech industries; it resonates with the product development teams of airlines, airframers and aircraft equipment manufacturers. Product teams strive to develop and refine the passenger experience, within the most stringent safety limitations, in order to build their positions as leaders in the aviation market. This is where design agencies can help bridge the gap between an airline and its consumers, and selecting an agency with the right balance of experience and creativity is vital to a project's success.

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## A RICH HERITAGE

"We are proud of what we have achieved in over two decades in aviation," says Ben Orson, managing director of JPA Design, sitting in the studio's London office – one of the company's three key locations.

"We aren't just a seat design company or a new agency riding off the recent wave in passenger experience improvements. We've been building our capabilities for many years and have as much history in designing interiors for hotels and rail companies as we do for aviation."

It is easy to see the similar approaches to design in the Venice Simplon Orient Express train cabins and those on Singapore Airlines, for example. It's this wide-reaching yet vital background that has given JPA a unique approach to 'mastering spaces', as the company's strapline declares.

# "TODAY MORE THAN EVER, THERE IS A THIRST TO INNOVATE AND STAY AHEAD OF THE CURVE"

**JPA Design first worked with Singapore Airlines in 1996, on a lounge design**

In 1996, many years before competitors began to connect the dots between ground and aircraft passenger experiences, Singapore Airlines employed JPA Design to work on its first class check-in lounge at Changi International Airport. Following a successful launch, the airline asked JPA to bring the same design expertise to the skies for its Boeing 747 first class cabins.

Breaking the mold of the traditional aeroplane seat, JPA then gave Singapore Airlines center stage in the premium business class sector in 2006 with the launch of its revolutionary A380 cabins. Featuring the widest seat in its class, the design was developed with passenger satisfaction at its core, subsequently drawing attention for the comfort it offered and the way its arrangement enhanced the airline's legendary service.

The launch came at a time when only a handful of airlines were looking at seating in an innovative way – many simply picked a seat off the rack. At the time, fully flat beds were rare in the skies and a true differentiator. However, JPA's approach went further still, offering one of the first all-aisle-access, fully flat products that gave each passenger unprecedented space and privacy. This elevated design meant that Singapore Airlines was able to sustain a premium price point for its business class cabins for many years.

Yet despite this, launching such a game-changing product was only going to give Singapore Airlines an edge for a finite period. So, when the time was right to re-address the cabins on the flagship A380 fleet, JPA was once more called in.

Building on the unique layout of the preceding products, JPA leveraged its patented monocoque technology to redefine the way aircraft seats are constructed, unlocking benefits for airline and passenger. The new design takes full advantage of the benefits of carbon-fiber construction; it provides more seats without compromising passenger space, or the luxury and functionality expected by Singapore Airline's flyers. Crucially, it also delivers more stowage space within the seat, enabling the removal of the center overhead bins, in turn saving a great deal of weight and creating a more open cabin.

With new styling and storage details, reflecting the passengers' requirements and embodying the airline's attention to detail, the latest incarnation is evolutionary, revolutionary and built with the next decade in mind, all the while keeping the airline ahead of the competition and ensuring a familiar experience for its most valued passengers.

In featuring JPA Design's spaces within its aircraft, Singapore Airlines joins the likes of Gulf Air, Cathay Pacific, American Airlines, Air China, Brussels Airlines, Finnair, flydubai and Hawaiian Airlines.

## BUSINESS CLASS BENCHMARK

In fact, many frequent passengers who fly business class will have traveled on a JPA

1. SINGAPORE AIRLINES' A380 FEATURES POLTRONA FRAU LEATHER AND ALL THE FUNCTIONALITY REQUIRED FOR TOMORROW'S BUSINESS CLASS TRAVELER

2. IMPROVED STOWAGE REMOVES THE NEED FOR OVERHEAD BINS

3. GENEROUSLY PROPORTIONED BEDS WITH PRIVACY SCREENS

## TECHNOLOGIES SHAPING THE PASSENGER EXPERIENCE

### *Fluid dynamics*

**Within the airport experience, the dynamics of passenger flow are being studied in the same way we study fluid dynamics or large systems of interacting particles. As a result, JPA can draw on insight into how to plan for airport experiences, such as check-in zones and gate areas, improving the passenger journey and removing pain points.**

### *Algorithmic generative modeling*

**This relatively new technology is a way of creating a virtual environment. It allows artificial intelligence to compute behaviors much faster than humans can, generating complex 3D models. This can dramatically speed up the design process and bring innovative new structures to seat manufacturing.**

### *Monocoque construction*

**3D printing and composite materials mean that seat designs can be lighter, and monocoque construction enables them to be stronger, as the shell of the seat supports all of the structural loads, removing the need for a separate supporting framework. A good example of this is the latest business class seat for Singapore Airlines' A380s.**


4. INSPIRED BY LANDSCAPES AND CRAFTS OF NORDIC COUNTRIES, FINNAIR'S UPDATED BUSINESS CLASS

5. FLYDUBAI'S DAN KERRISON COLLECTING AN AWARD FOR THE B737 CABIN WITH FULLY FLAT BEDS

**JPA Design is working with vehicle brands to share approaches to challenges and processes**

product without realizing. The Cirrus seat designed by JPA and produced by Zodiac Aerospace can currently be found on around 15 carriers. Much like the Singapore Airlines business class seat, it too was a game changer when it was conceived. However, it has remained the business class benchmark due to seemingly infinite customization possibilities. Each airline can adapt this seat to suit their passenger profile while still benefiting from the fundamental benefits of the layout and the now industry-standard all-aisle-access. It is this careful balance of passenger satisfaction, adaptability and ease of manufacture that continue to make the product, and those it inspired, a success.

While the Cirrus seat is a perfect example of a successful product, in itself it doesn't guarantee carriers a memorable experience that will sway passengers' purchasing habits. A coherent engagement with the brand across the passenger journey is vital, and smart airlines are beginning to break down the silos between internal departments to deliver this. Trying to manage every detail of the passenger experience is challenging, to say the least, especially when one department is responsible for the entire product and brand proposition. However, where this structure has been implemented, it allows carriers to connect the dots and build relationships with passengers who are increasingly brand conscious and loyal.

> "WE HAVE LONG BELIEVED IN A HOLISTIC PASSENGER EXPERIENCE"

"We have long believed in a holistic passenger experience," says John Tighe, design director, transport, JPA Design. "Many of our customers ask us to help them create a series of coherent product experiences, throughout the passenger journey, to deliver their brand on the ground and in the air."

This integrated approach has won JPA awards for its product set, including Skytrax, APEX, Red Dot and D&AD.

"Our practiced methodologies focus our innovation to overturn established ways of thinking and create the designs that will define the future. We have changed the way that people fly," says Orson.


It is these award-winning products, especially those in premium cabins, that create the marketing halo effect that airlines strive for – attracting passengers to the brand and helping to build loyalty.

### SHAPING THE FUTURE

But what does the future hold? The design studio team knows that to stay ahead of the innovation curve, they need to look for new sources of inspiration.

"The automotive sector is becoming more relevant," states Tighe. "We are already working and having discussions with major vehicle brands, looking for ways to work together and learn from each other's challenges and processes."

So while the industry toys with concepts in differentiation, personalization and connectivity, innovation is still at the heart of shaping the passenger experience. New seats certainly attract attention and deliver a powerful marketing punch, but without a team of young design-hungry individuals guided by an agency with a background in travel products, such innovation can be risky. Investing in the passenger experience should be rewarding, and even fun, but it's best to partner with an agency that delivers innovation based on years of experience, knowledge and a holistic approach..


apex
Apex
Awards
Best Passenger Comfort Innovation 2018
Best Cabin Innovation 2018
JPA DESIGN
The award-winning new Business Class for flydubai by JPA Design
jpadesign.com

# WHAT PASSENGERS WANT

Designworks has studied passenger needs, desires and behaviors to create a vision for the next-generation premium regional inflight experiences

Are today's air travelers pleased with their inflight experience? Are business and first class cabins living up to their potential to impress? How do airlines and their passengers measure the value of upgrading? Opting for a premium assignment is about much more than a wider seat, a few extra inches of legroom, and 'free' drinks and meals.

Air travel connects us socially and culturally, in business endeavors and personal exploration. Travel is the link between two destinations, and during the experience strangers become neighbors, all on board and entrusting the travel corporation to transport us in safety.

If the totality of interior comforts is central to the inflight experience, then comfort (physical and psychological) is the very soul of the airline experience. Interior comfort forms the most literal customer-carrier touchpoint, and its effects are physical, psychological and emotional. For airlines, interior comfort represents a momentous opportunity to strengthen a brand's bond with travelers.

However, what customers experience often does not meet or support this opportunity. The use of cabin space might be being maximized, but this often goes hand in hand with increased passenger capacities and a reduction in individual space, leading us to question the overall impact on the user experience.

Using expertise gained across all major modes of mobility, coupled with knowledge and first-hand experience of local markets and trends across the world, Designworks' global aviation team explored this issue, investigating opportunities for cross-industry disruption, challenging airlines to move away from heritage seating options (and their many limitations) toward a more mature, bold and unique design, capable of achieving a truly differentiated passenger experience, focusing on passenger seating and its surrounding environment.

1

## PASSENGERS FIRST

The key objective of Designworks' exploration was to reimagine the holistic

"THE VISION FOR TRANSFORMING THE PREMIUM REGIONAL INFLIGHT EXPERIENCE BEGINS AND ENDS WITH PEOPLE"

**Designworks has studios in Los Angeles, Munich and Shanghai**

1. THE FOLD-DOWN TRAYS DO NOT HINDER ENJOYMENT OF THE LARGE SEATBACK IFE DISPLAYS

2. THE SEAT SHELLS OFFER IN-SEAT PRIVACY WHILE KEEPING A FEELING OF SPACE IN THE CABIN

inflight experience and to envision a comprehensive design capable of rewarding passengers' desires while surpassing industry expectations, making tomorrow's levels of inflight comfort possible today.

The vision for transforming the premium regional inflight experience begins and ends with people, in terms of their needs, desires, dreams and destinations. Drawing on its vast global network of partners and project experience, ranging across many industries, from aviation to automotive, as well as its ability to connect with consumers directly, the team extracted core insights to fuel the vision for the future of inflight comfort.

There is a clear recognition and understanding that when discussing a customer's journey in its entirety, the experience extends beyond the duration of the flight itself. However, the focus of this exploration was concentrated around the inflight experience, highlighting findings that relate to the main passenger touchpoint: the seat.

Working within the framework of regional travel (which assumes an inflight duration of two to three hours and a premium cabin that must accommodate 20 seats), key learnings emerged, which form the basis for further exploration to successfully improve, advance and disrupt the customer experience.

These key learnings are as follows: passengers may nap but do not require full sleeping options; passengers value space over privacy, with minimal intrusions; passengers desire entertainment options, both personal and airline-provided; and passengers appreciate storage and charging options for electronic devices and other carry-on items.

## EXECUTING THE VISION

A key finding that shaped the discussion and discovery was the consideration of an alternative 'use' for seats on regional flights. It is widely assumed that people need to sleep in flight and therefore the functionality and usability of a seat is based around this primary need. An alternative requirement should now be considered: seat design optimization for 'napping' as opposed to full sleeping needs.

Lie-flat configurations are often built around the premise of being beds first, seats second, leading to compromise around seat comfort, space, serviceability and monitor size.

Recent Designworks transportation projects include the Virgin Hyperloop One prototype capsule

3. VISUALIZING THE FUTURE OF TRAVEL, HYPERLOOP ONE IS A PROTOTYPE DESIGN THAT SHOWS THE POTENTIAL THAT LIES IN NEW MODES OF MOBILITY

## "AN AIRCRAFT SEAT THAT RECLINES INTO PASSENGER SPACE IS NOT PREMIUM"

Consider therefore a seat designed first and foremost as a seat, not a bed. Begin with an aesthetically pleasing seating environment with enhanced ergonomics and a multitude of functionality, all within a contained shell that offers privacy from fellow passengers, but without creating a feeling of isolation.

A seat that reclines into passenger space is not premium, and causes unnecessary frustration and discomfort. The goal is to achieve the maximum recline within the designated seat envelope. As the seatback reclines, the seat pan also rotates to increase the seat angle to prevent the occupant from sliding forward in the seat. With a fixed shell behind each seat, there is no intrusion into the passenger space behind.

In addition to the recline, the seat also moves forward and downward. The forward movement is required for reclining due to the fixed shell. The downward movement improves space efficiency for the occupant's legs and feet by lowering the passenger and optimizing the leg angle. The fixed shell and formal recline also maximizes the space in TTL position for better ingress and egress.

### ABOUT DESIGNWORKS

**Designworks is a global creative consultancy that offers a unique suite of strategic services to foster innovation and business growth for companies worldwide. Working across multiple industries drives its culture of innovation and catalyzes its passion for visionary design. Designworks leverages the power of its parent company, BMW Group, and its culture of innovation and cutting-edge design, to advance the goals of its external clients, including EVA Air, Embraer, Singapore Airlines, Virgin Hyperloop One, Corsair, Microsoft and John Deere, while bringing outside perspectives to the BMW Group through knowledge gained during client engagements.**

Passengers want maximum entertainment and a place for all their entertainment devices. With passengers' entertainment preferences equally divided between their own devices and airline-provided seatback IFE, the challenge becomes how to enable passengers to toggle between entertainment options, meal service, drinks and other activities without forcing them to choose one or the other.

Foldable meal trays would operate without hindering the seatback IFE displays. Wider armrests and new beverage placement areas would offer more storage opportunities and allow crew to serve meals and drinks without having to reach over passengers.

Inner armrests could feature larger compartments to stow devices, reading materials, cables and chargers (as well as built-in charging ports), and a newly conceived forward-facing compartment would accommodate large water bottles.

### ENHANCING SPACE

Designworks considered two fundamental design tools to answer the challenge of enhancing space. The first tool is increasing the separation between passengers without creating a feeling of isolation. Increased separation is achieved by opening up the seat angle, giving the passengers small but significant increases in personal space – a few more inches of room where it counts, such as the armrest and footwell. For flights of up to three hours, comfort and space take priority over privacy.

Airlines seeking to provide solutions and experiences that reward premium travelers with a truly distinguished inflight experience have some enticing new options and possibilities to consider.


Take a look at our design for the new EVA AIR 787-9 business class seat at
**bmwgroupdesignworks.com**

Designworks
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# THE EXTRA DIMENSION

Airlines have been commissioning AIM Altitude to create technologies that can turn the walls of onboard galleys and lounges into feature elements that will enhance the passenger experience

Airlines spend a great deal of time and money creating differentiation in the aircraft cabin. Bars and lounges have become common in first and business class sections, and airlines are now looking to provide ever more social elements to flights. Even areas that are in theory strictly functional are becoming more aesthetically pleasing too – such as galleys and stowages. With airlines' desire to make the most of all available space, AIM Altitude has been receiving an influx of requests to turn the walls themselves into features.

1

## FEATURE TIMELINE

Initially requirements were fairly low-key, with airlines asking for their logos to be incorporated into existing cabin features.

In 2010 AIM Altitude used intense 3D-textured surfaces incorporated with theatrical lighting techniques to create a set of stunning feature panels for British Airways. The brief was to allow the airline to reinforce brand identity in a practical way that would not require use of precious space, but would transform the aircraft interior. The resulting panels did not require fully customized monuments, but used wall space to provide refined and understated branding.

Then in 2012 South African Airways asked AIM Altitude to build its logo into a set of feature items, including magazine racks. They were used to enhance areas of the standard cabin, providing an easy opportunity for the airline to reinforce its brand to passengers. AIM Altitude used appealing metallic-finish techniques to accentuate attention to detail and this, along with the playful color pallet, perfectly represents South African Airways' reputation for an exuberant zest for life.


2

In 2015 AIM Altitude turned the instantly recognizable stylized swooping bird logo of Kuwait Airways into the main focus of several highly complex 3D panels. The panels were injection-molded and pressure-formed to create the bespoke centerpieces. Custom-color thermoformable sheet was used to provide durability. AIM Altitude's own Autonomous Lighting Dimmer (ALD) was used to enable the distinctive lighting effects to respond to the cabin environment.

## LEADING LIGHT

AIM Altitude designed and developed the very first mood lighting to be used on passenger aircraft. Mood lighting has now

"CLEVERLY DESIGNED AND ENGINEERED FEATURE PANELS CAN CREATE A BEAUTIFUL ADDITION TO ANY CABIN SPACE"


*AIM Altitude designed and developed the first mood lighting to be used on a passenger aircraft*

become central to many key features in aircraft and is an important way in which airlines can provide brand differentiation and set the cabin atmosphere.

The pioneering autonomous lighting control device was officially made public by AIM Altitude in 2015. The main application of the ALD is for use in first and business class areas, where it can enable feature lighting to be automatically dimmed to match the cabin environment, without any connection to either the aircraft IFE system or the aircraft cabin lighting system.

Being autonomous, AIM Altitude's ALD system provides airlines with great flexibility to add ambience to specific areas of the aircraft and to manage the cabin environment as required.

## FRONT ROW MONUMENTS

The next stage in the evolution of the feature panels was to begin their integration with the front row monuments. For example, for EL AL, AIM Altitude produced clean, calming and sophisticated new front row monuments for its B787-9 Dreamliner fleet. The airline required continued style lines for a smooth and cohesive look. The feature panels were integrated with the front row monuments, with their distinctive, curved diamond profiles and subtle two-tone finish, reflecting the EL AL business class brand though the forward cabin. The design brief was for the panels to provide an expression of the airline's values of excellence and professionalism.

## MAKING AN ENTRANCE

Cleverly designed and engineered feature panels can create a beautiful addition to any cabin space and can be used to deliver branding, atmosphere and enhanced customer experience in a variety of effective ways.

For example, the welcoming entrance to the new SWISS B777-300 ER became an instantly recognizable feature on one of the airline's flagship aircraft.

The two panels, engineered and manufactured by AIM Altitude, are installed at the Door 2 galleys, facing the passengers during boarding. They feature an illuminated welcome message and world map, as also found in the reception area of the SWISS lounges at Zurich airport.

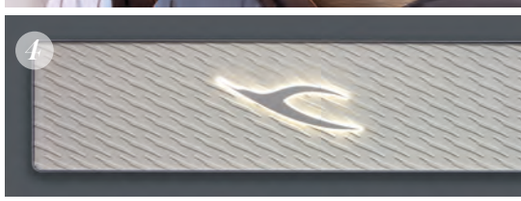
The composite backlit panels are controlled by AIM Altitude's ALD and were among the first airline applications of a new transparent polycarbonate sheet material.

1. THE FRONT PANEL ON OMAN AIR'S B787 FIRST CLASS EVOKES OMANI ARCHITECTURE AND HISTORY

2. FEATURE PANELS CREATED FOR BRITISH AIRWAYS BUSINESS CLASS

3. A MAGAZINE RACK CREATED FOR SOUTH AFRICAN AIRWAYS

4. A CABIN BRANDING PANEL DESIGNED FOR KUWAIT AIRWAYS


AIM Altitude developed the ALD with precisely this sort of innovative use in mind. SWISS has used the opportunity to great effect, creating differentiation and setting the cabin atmosphere from the minute passengers board the aircraft.

For the Emirates B777-300ER fleet, AIM Altitude manufactured the Ghaf Tree welcome panel, a truly stunning realization of what is possible in terms of branding, welcome and feature panels.

Showcased at the Dubai Airshow in 2017, the intricate pattern represents the UAE national tree, the ghaf. Created from a complex textured and layered configuration, the panels enhance the Door 1 area and provide a distinctive welcome to first class passengers.

The design intent presented new and unique challenges for AIM Altitude. The scale of the backlighting required considerable development, with meticulous selection and arrangement of hidden lights to achieve an even illumination of the ghaf tree image. LED lights are controlled by the cabin mood-lighting system, to allow the operator to customize lighting-scene color.

Incorporating the tree image into a woodgrain finish and allowing light to shine through provided design and manufacturing challenges of their own. AIM Altitude worked with Isovolta Group

**AIM Altitude has been selected as an Airbus A320 SFE galley supplier**

"THERE ARE INFINITE POSSIBILITIES FOR ENHANCING OTHERWISE OVERLOOKED AREAS"


5. THE GHAF TREE IS A PROMINENT FEATURE OF EMIRATES' B777 WELCOME AREA

6. THE ENTRANCE TO SWISS AIRLINES' FLAGSHIP B777-300ER

to develop a solution whereby the artwork was cut into the decorative laminate before it was applied to the panel. Careful selection and assembly of materials allowed AIM Altitude to meet the requirements of the panels for weight, manufacturability, structural performance and flammability.

The specification also called for a 'fasten seatbelt' sign that was concealed when the sign was not activated. Intelligent choice of lens materials allowed AIM Altitude to design a passenger information sign with a discreet 'dead front' appearance.

The initial design intent was created by Boeing and design consultancy Teague, but it was then AIM Altitude's role to make it work as a technical design. In daylight, the ghaf tree image is incorporated into the custom woodgrain finish; at night, however, it is set against a bright starry sky, representing a desert scene.

## LATEST DEVELOPMENT

With this successful track record in producing striking and unique features for airlines on otherwise widely unused space, it is not surprising that AIM Altitude is in demand to create ever more innovative solutions.

The latest feature panel created by AIM Altitude is showcased in the first class cabins of Oman Air's B787-9 aircraft, recently launched on its Muscat to London route. The front-textured panel encompasses the airline's sleek, modern logo and a shaped arch, reminiscent of Oman's culture and history. The concept design was originated by Teague, in collaboration with Oman Air's guest experience and branding teams, before going through the industrial design and manufacturing process at AIM Altitude.

The eye-catching yet sophisticated panel includes AIM Altitude-engineered lighting, with LEDs from the pelmet washing out onto the textured panel. The translucent center logo has colored opaque inserts, allowing a further LED light to project through only the main features of the logo. All the LED lighting is controlled via a sensor, which the ALD harmonizes with the aircraft cabin lighting. The LED lighting is extremely effective, adding an extra dimension to the panel.

Painted thermoplastic was used for the front-textured panel, and the polyurethane logo was produced using a silicon casting.

The result of the creation of such feature panels is the tangible and dramatic effect they have on the cabin interior.

Taking the maiden flight on Oman Air's B787-9 and experiencing the first class cabin for herself, senior interior designer at Teague, Tamae Satsu, was overwhelmed by the quality of work and the feeling expressed by the centerpiece panel.

"We had the opportunity to design Oman Air's B787-9 including the first class suites, cabin interior decor, monument panel and lighting design," Satsu says. "The monument panel's geometric pattern was influenced by Omani culture, with rich color contrast and a subtle pattern that brings drama to the cabin experience. The monument's color, texture, reflection and diffusion of light work together to create an understated luxury first class cabin."

## NO END IN SIGHT

AIM Altitude believes there are infinite possibilities for enhancing otherwise overlooked areas, using clever lighting to make a feature really 'pop', turning plain walls and dividing panels into memorable branding opportunities. The only constraint is the imagination. With expertise in engineering and certification of increasingly complex design solutions, coupled with the innovative use of new materials, the sky really is the limit.

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# FLIGHT OF FANCY

Join Howard Guy, CEO of Design Q, as he reclines in his seat and muses on modern commercial flying and what really constitutes modern luxury

I'm 27 minutes into a nine-hour flight to NBAA Orlando and I know I have to get something back to the editor of *Aircraft Interiors International*. I want to use the flight as productively as possible.

Oddly enough, I am traveling with one of Design Q's customers and sitting in a cabin for which we had design input, but not with the airline's knowledge. This makes me feel like a secret customer, but with no special privileges attached – just objective observations and interesting conclusions.

Running a design consultancy is a high-intensity job, but I thrive on the challenge. This week has been stressful, due to trying to juggle a few days in Orlando with the pressures of critical design deliverables due only six days after my return. Having said that, my job is the best in the world and the description of what I do for a living is exactly what every rising star of design degree courses around the world thinks is a possibility. Demand for good design has never been higher, as businesses recognize it is a key differentiator for their products and services. However, the journey is hard and unrelenting, though it is very rewarding.

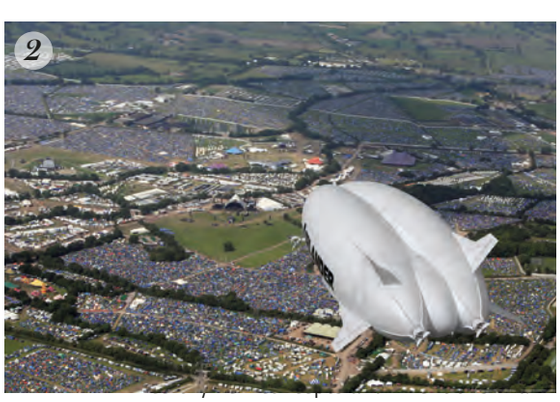
It's not about the money, if you want to get rich quick (as many of the younger generation seem to crave) you won't as a designer, but the rewards are far richer – the satisfaction of working with a talented team who create great solutions and make customers happy, who then come back for more. That is pure job satisfaction – knowing that you have created a clever solution rewards you in a way that money simply doesn't.

## THE ART OF GOOD DESIGN

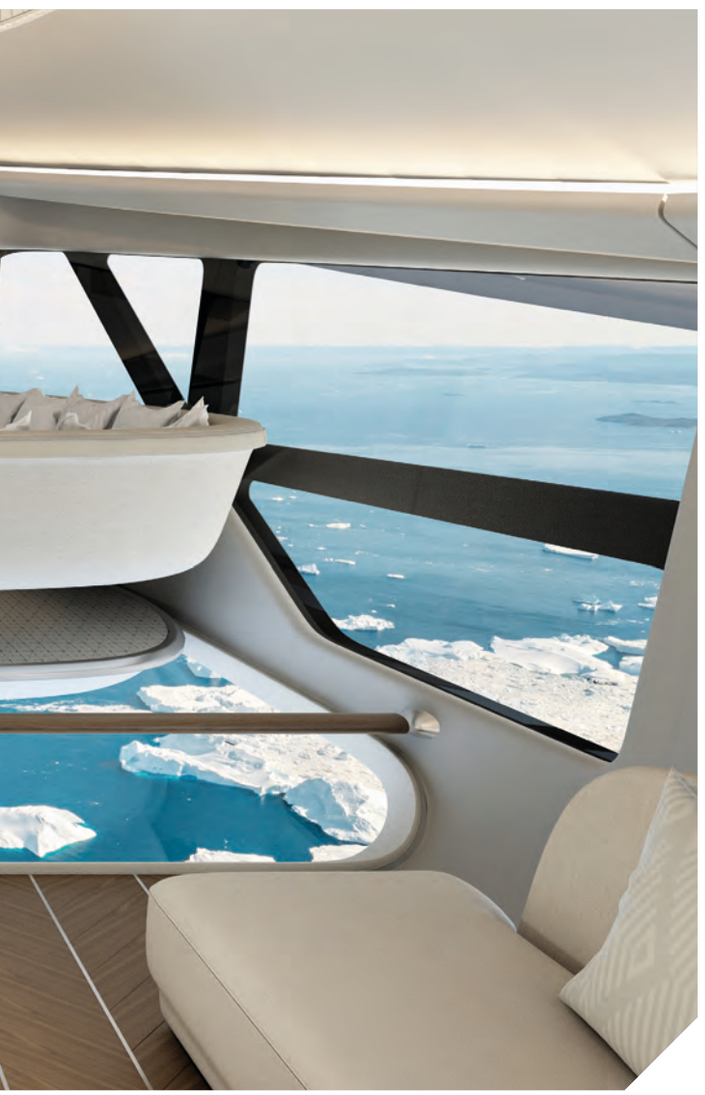
My job is to listen to my customers, look at what they currently provide and think of a way to improve their experience as much as possible to make their customers as happy and as content as possible. For aircraft interiors, the starting point for the magic is usually a standard airframe.


So what makes Design Q different? Well, when I graduated from the Royal College of Art in London, my ambition was to be a world-class car designer. And that is exactly what I became, latterly with Jaguar Cars in Coventry, before setting up Design Q in 1998 with a fellow Jaguar designer, Gary Doy.

However, it wasn't long before our customer portfolio was dominated by aerospace companies, anxious to tap into luxury automotive expertise to help them make a step-change in all aspects of the



"DEMAND FOR GOOD DESIGN HAS NEVER BEEN HIGHER, AS BUSINESSES RECOGNIZE IT AS A KEY DIFFERENTIATOR"





1+2. AIRLANDER GUESTS CAN ENJOY HOVERING ABOVE INCREDIBLE SCENERY OR EVEN A MUSIC FESTIVAL, IN SUPREME COMFORT

3+4. THE ENTRANCE AREA SETS THE MOOD FOR THE VOYAGE, AND ALSO SERVES AS A FOCAL SOCIAL AREA

incredibly restrictive and sometimes hostile environment.

## FLYING IN THE 21ST CENTURY

In the early days of post-war flying, and by that I mean the 1950s and 1960s, the experience of flying was definitely special and, until the onset of the package holiday, was the reserve of a wealthy few. Flying was on most people's bucket lists, but it was a rare and expensive way to travel. Flying in those days was exclusive and airlines spoiled their customers with quality cuisine and champagne, with barely a nod to the financial implications.

Today, budget airlines (which I use very regularly and approve of) have pressurized the established airlines into competing on cost and, as such, inflight service for the average economy flight focuses on convenience rather than service. Giving nothing away, they concentrate on the bottom line, knowing that their customers are more content to save £10 on their fare than have a 'complimentary' cup of coffee. It is a stripped down experience that is almost not a service as it was previously understood. Budget airlines have, however, transformed the industry.

In my view there are two areas in an aircraft that designers have control over that influence the perception of the service the airline provides. The first is the experience of entering the aircraft. The second is the feeling when you look for your seat number, reach your seat, then look down at what you have signed up to for the remaining half of your day.

## THE JOURNEY STARTS

Following the stress of traveling to the airport, parking and the bus ride to the terminal, the check-in process simply adds more. Then there's the passage through security and duty free (both a form of torture). But once you are at the gate (usually three to four hours after leaving home) the journey is about to begin.

The experience starts going downhill when you leave the departure lounge to walk to the aircraft – a feeling that is emphasized by the physical gradient of the bridge takes you down to the aircraft door – Door A or, if you are long haul, Door 2. If you are Door 2 then you have my commiserations; there is little hope.

That gradient in the bridge, of course, means that when you leave the aircraft at

5. THE FONDACO DEI TEDESCHI IN VENICE BLENDS HISTORY AND ARCHITECTURE WITH AN INDULGENT RETAIL EXPERIENCE

the end of your journey everything is uphill, and if the airline has skimped on paying for a boarding gantry, it usually means a convoluted mixture of bus rides and flights of stairs – the last thing you need after a long flight. I wonder how many heart attacks occur within five minutes of leaving an aircraft. I have witnessed two!

Once through the aircraft door, the entrance area is where you are greeted and the final security check of your ticket takes place. And this is the point where you either get buyer's remorse or feel pleased about the choice you have made.

The entrance area sets up your expectations and colors your judgment on what you are about to experience. I'm not sure if the process is intentional, but to bring guests past your bins and industrial equipment is not the best way to make a customer feel great. Perhaps the relief of getting to somewhere that looks a little more comfortable and soft makes you think that the 6.5ft³ you are about to occupy for the next nine hours is better than the goods inwards entrance you've just come through. I'm not sure who thought that was a great start to the experience.

**Design Q developed the PF2000 fixed recline economy seat for Pitch Aircraft Seating**

Entrances are so important. In fact the best restaurants, the best hotels, even the best houses know that first impressions are important. Remember that even the cheapest budget aircraft costs somewhere in the region of US$40-60m, which is around the same as a premium private jet, and yet you are always filed through the kitchen to get to your seat. There is clearly a disconnect between engineering and experience evaluation. But the door is where it is, so now the best we can do is make the best of it. Design Q has thought about that too – rather a lot!

## FUTURE LUXURY AIR TRAVEL

Design Q was approached by Airlander to help reinvent the luxury flying experience. The Airlander 10 is a unique aircraft and rewards clients with that most precious of commodities – time. The Airlander airship is as much about the journey as the destination; in fact often the journey is more important. It offers the great luxury of slow travel.

Airlander's engineers have worked with the Design Q team to think hard about the door and the entrance experience. What should confront a passenger on boarding the aircraft? The list was long, but the experience on this aircraft has left nothing to chance or compromise. I am confident that our team has capitalized on making the voyage as interesting and impressive as possible, giving the visual rush that makes you glad that you've chosen this flight on what is the new ultimate bucket list item.

There are many welcoming features: the high reception bar, the chandeliers, the champagne welcome, the smiles from the waiter and the chef, and the subtle smell of freshly ground coffee from a machine that seemingly has more gauges than the aircraft's cockpit. You notice the 50-year-old malt whisky; the fine wines are revealed throughout the journey.

To the left of the entrance is an elevated dining room seating 18 guests, with a full dining table for a Michelin-starred service and totally unique in the sky. To the right, unlike any galley anywhere else, a rich collection of the world's nicest things can be found in a zone that resembles the finest department store.

I recently visited Fondaco Dei Tedeschi, Venice's first-ever department store, an amazing building found next to the Rialto Bridge. On entering I did not know that it was a department store because its façade and interior form part of one of the most famous buildings in Venice. It was the wristwatch in the window that interested me, but I couldn't understand why there was a handbag nestled beneath it. Thus my wife and I were independently lured into the entrance of what proved to be a cornucopia box of indulgence.

Indulgence is what this is all about, so Italian and so Venetian, an array of the loveliest things within arm's reach, shown off in such stunning architecture. You are first drawn into a café entrance that makes you feel you would like to stay for the day, pulling you in like a kid in a toy shop, from the window to the till. The truth is, we all love to be kids in toy shops, even if the toys become a lot more expensive as you get older. The aircraft interior should give that feel.

## IT'S ALL ABOUT THE SEATS

Going back to the aircraft, the second priority area is the seat. It's the space you spend all your time in, trying to lose that time you have spare until you get to your destination. But time is the most precious thing we have. Once it's gone, it's gone, so why can't it be spent in comfort, fun and luxury? How many aircraft seats are fun? Indeed how many aircraft seats are comfortable and how few could be described as luxurious?

The Airlander Q curl seat is our solution to comfort, fun and luxury. It breaks with tradition, challenges the norm and is focused on physiological and physical comfort with the added twist that it's big on fun. Looking like no other aviation seat, this design is another ingredient in Design Q's vision of how commercial and business jet interiors will be in the next decade. Remember, you saw it here first, and we hope you like what you see.

Meanwhile I now must make the most of the rest of my flight to Orlando. Let me enjoy the in-flight entertainment and select my favorite drink, a Rusty Nail – two-thirds fine malt whisky, one-third Drambuie, the peel of a fresh orange and the largest ice sphere – which remains still, I notice, as I move. That's just given me an idea… I wonder what we will be designing tomorrow?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# DESIGN Q

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DESIGN
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MATERIALS
PROTOTYPES

# PERCEIVED QUALITY

Perceived quality is a difficult factor to address when trying to create the best business class. However, Style&Design may have a solution with BenchmarQ , a unique decision-making tool

A strength of the Style&Design studio is its complementary core skills of prototyping and industrial design, combined with strong expertise in perceived quality. The results of these combined talents have been recognized in the automotive industry, and will also become visible in aviation in 2019 when a – presently confidential – five-star airline launches a business class seat designed by the studio.

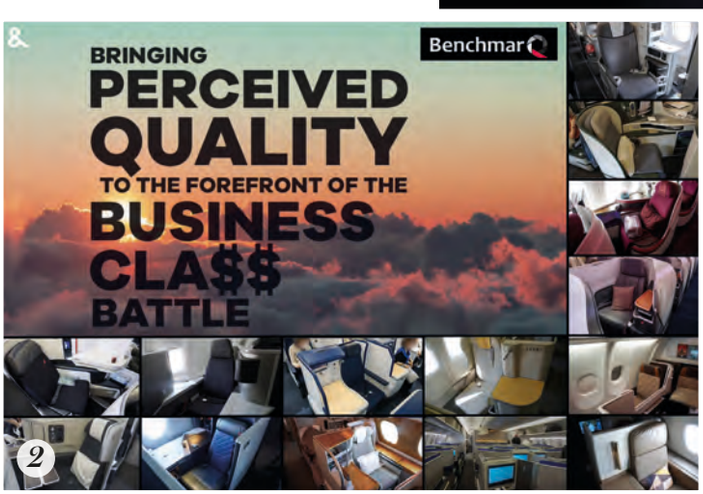
Before getting into the details of the seat, it might be worth considering the following definition of perceived quality: "The user's opinion about the overall image of a product related to its purpose of use and against its alternatives."

Interestingly, quality is subjective from a customer point of view, while from the point of view of Style&Design, it is an objective understanding of customer feel.

Let's consider the strategic importance of seats to airlines. Many business class seat designs are recognized as being iconic products, as well as being one of the greatest vectors for airline branding and one of the highest contributors to profits. These seats are installed in an aircraft cabin – the highest cost per square meter on the planet – and as they will be in service for 5 to 10 years, their design had better be perfect, right from the inception.

The need for higher quality products is reinforced by the societal shift we can see, with consumers looking for experiences rather than products.

So, acknowledging that seats cannot get flatter that flat, what is the next big thing in the business class cabin? The answer, most probably, is perceived quality, which is why Style&Design, with its efficient tools and processes inspired by automotive developments, is a unique organization able to support the migration from use value to experiential value.


2. BUSINESS CLASS SEATS FROM 15 INTERNATIONAL AIRLINES HAVE BEEN ASSESSED TO DATE, WITH THEIR SCORES AVAILABLE ON AN ONLINE BENCHMARKING TOOL

"A COMPLEX PROTOCOL THAT IS ABLE TO SCORE ANY BUSINESS CLASS SEAT"

**Style&Design projects include the HD31 seating concept for Zodiac Aerospace**


1. STYLE&DESIGN HAS DEVISED THIS BUSINESS CLASS SEAT FOR THE A350

Indeed at a time when the aviation industry is just starting to recognize the importance of perceived quality, Style&Design can demonstrate a great level of maturity in this field. This expertise is embodied by the launch of BenchmarQ, an innovative system that can translate the perceived quality of business class seats into data.

For Style&Design, perceived quality engages any organization developing and manufacturing complex products into a virtuous circle that is favorable to mastering the fragile balance between styling and engineering.

This balance is only possible if one has an objective view of perceived quality in the cabin. Thus even an exciting, ambitious and large project to launch a business class seat can be assessed dispassionately following a calculation of perceived quality.

BenchmarQ can engage the various stakeholders in a project and ensure that they begin work with a sound foundation: a clear vision of the primary perceived quality goals (from the low-hanging fruit, to the more strategic and complex topics).

Capitalizing on its experience of perceived quality in the automotive sector, Style&Design has developed a complex protocol that is able to score – from a pure perceived quality prospective – any business class seat during any commercial flight of longer than six hours (it takes five or six hours to perform a full assessment).

This cold, mechanical process, performed by a handful of trained Style&Design experts, does not take into account styling or color and trim choices, but rather how the ambitions of a project have been executed – qualitative engineering, if you will.

Many criteria are considered during the assessment of each seat subassembly, related to the form of a design concept (gaps, flushness, assembly, interface, etc), its appearance (covers, stitching, padding, brightness, color matching, etc) and usage factors (marks, premature wear, sound, noise, ergonomics, etc) that contribute to the passenger experience.

Examples of factors under assessment include seats, seat shells, lighting, ottomans, HMI, stowages, tables and privacy dividers. Also all the key dimensions characterizing comfort and

# "INSTRUMENTAL TO UNDERSTANDING THE COMPETITIVE LANDSCAPE"


3. AN AIRCRAFT SEAT UNDERGOING PERCEIVED QUALITY EVALUATION BY THE STYLE&DESIGN TEAM

4. A WIDE RANGE OF COMFORT CRITERIA AND DIMENSIONS ARE MEASURED FOR EACH SEAT


accessibility are measured to allow an 'apples with apples' comparison.

The system allows multiple filters and viewpoints of the data and is designed to enable the simultaneous comparison of three different seats.

As of today, 15 seats from Air France, American Airlines, All Nippon Airways, Asiana, Cathay Pacific, Delta, Emirates, Etihad, Eva Air, Iberia, Qatar Airways, Saudia, Singapore Airlines and United have been assessed, and their data is available on the online benchmarking tool, with scores ranging from 47-83%.

This groundbreaking approach gives subscribers access (with a yearly fee and unlimited access) to a perceived quality scoring database (Shape+Look+Feel+Usage), complemented with key dimensions, panoramic interactive tours and other details instrumental to marketers and engineers from airlines, seat manufacturers and aircraft manufacturers.

With so much at stake with the development of a new business class product, the whole industry would benefit from an objective and contextualized understanding of today's products from a perceived quality standpoint.

Such an approach will be instrumental to understanding the competitive landscape and what matters to passengers, and to specifying a product that has powerful and ambitious requirements.

This approach would also help give buyers a clear vision of the strengths and weaknesses of a product, which is crucial when the selected design may fly for 10 years. It can also help designers and engineers develop products, anticipating the perceived quality issues, which removes risk and reduces costs and delays related to non-quality factors.

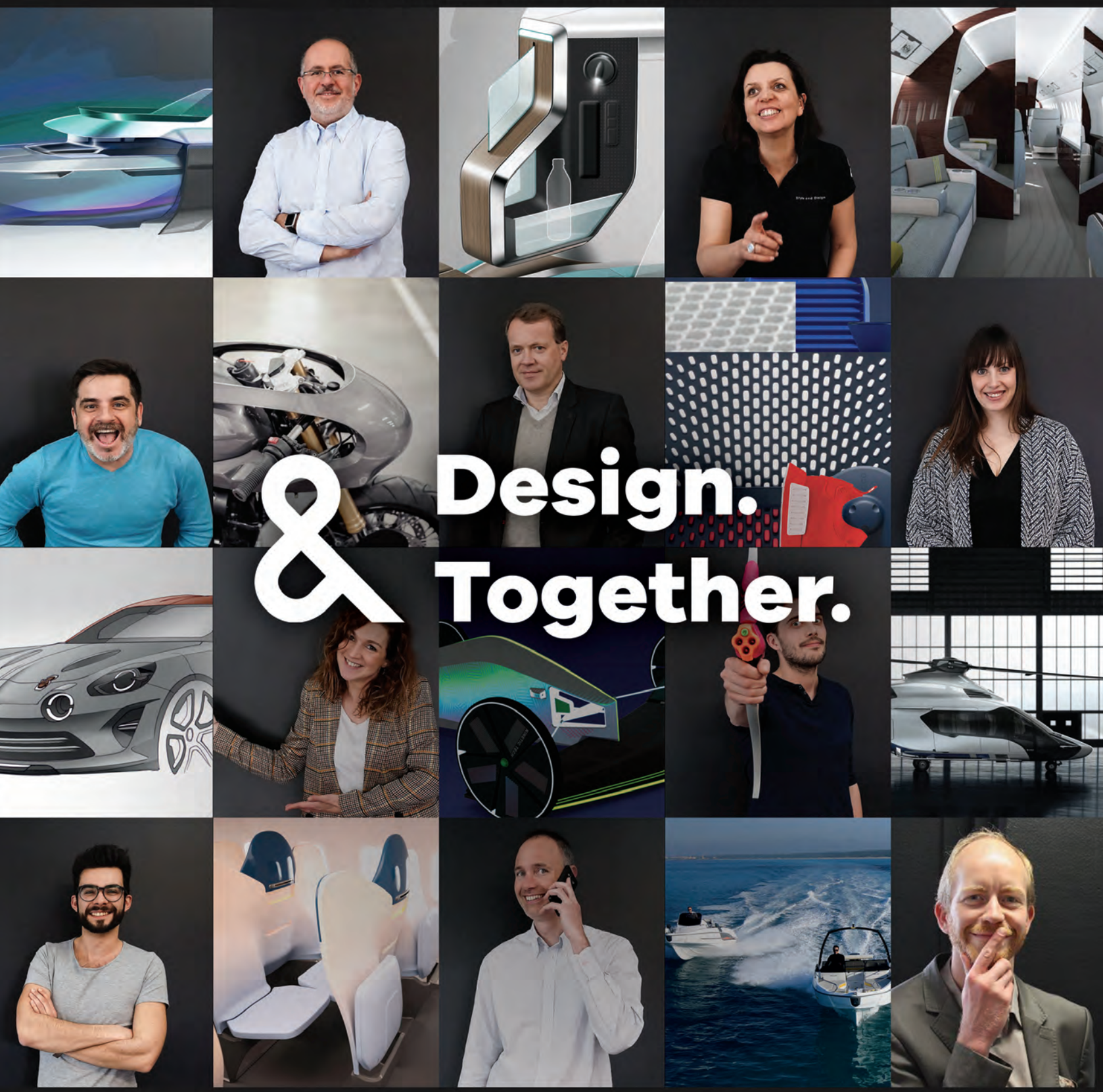
Airlines and seat manufacturers now have a tool available to increase customer satisfaction and loyalty by paying attention to all the details that contribute to a memorable passenger experience.

**Style&Design's client list spans airlines, airframers, maritime, automotive and retail companies**

The first business class seats in the world to be designed using automotive perceived quality best practise data will enter service in 2019, with premium economy and economy seats to follow by year-end.

'Design. Together' is the simple yet powerful motto of Style&Design, a motto that expresses the studio's approach to working closely with customers, not just on styling, but on developing the best-quality industrial product as a team.

Automotive, boats and now Aerospace ...




# STYLE&DESIGN

Perceived Quality, our design philosophy

www.styleanddesign.fr

# Supplier showcase

# ONWARD AND UPWARD

Design thinking and manufacturing breakthroughs are sending cabin innovation soaring, say Sekisui SPI and two of its design clients

Today in the aviation industry, growth is fast and competition is heating up. New markets are emerging in Asia, the Middle East and Africa, new players are entering the field and we're seeing healthy rivalry among airlines.

Lately, however, a contender that travels under the radar – high-speed rail – has been nipping at the airlines' heels. How, then, can the airline industry keep flying high and stay one step ahead?

Ben Smalley, aviation market business manager at Sekisui SPI, explains, "Economy seating design in aircraft has been stagnant. And if you factor in flight delays, cancellations, security lines and traffic to and from the airport, it's no wonder some passengers are opting for rail when it's available."

To address the competition and maintain growth, it's time for visionary thinking, and for executing that vision. Sekisui SPI asked aviation design experts about the state of the industry and for their insights into the future.


## WHAT ARE WE DOING WRONG? WHAT ARE WE DOING RIGHT?

Daniel Baron is CEO of Tokyo-based LIFT Strategic Design, which specializes in cabin and brand design along with passenger experience development. In Japan, high-speed rail has been around for decades, and Baron believes that good design is a basic requirement if airlines want to keep up.

"The last thing we want is business travelers saying 'I can't stand it anymore,' so they take the train or jump on a conference call instead of flying," he says.

Baron believes the focus should be on well-being and comfort, regardless of the class of service. "A comfortable seat may not get vocal praise, but an uncomfortable one will result in negative word of mouth."

Cabin design and seat hardware can influence airline choice, especially for the business traveler who prizes comfort over cost-effectiveness.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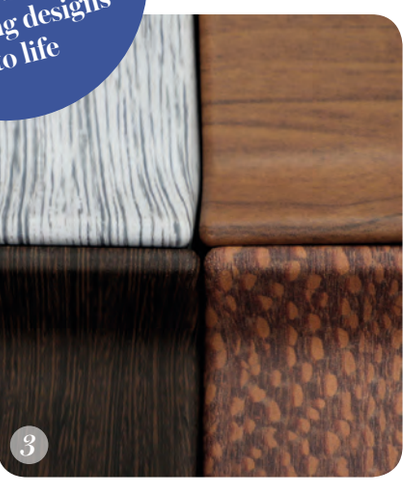
"TO ADDRESS COMPETITION AND MAINTAIN GROWTH, IT'S TIME FOR VISIONARY THINKING, AND FOR EXECUTING THAT VISION"

Sekisui's designLab™ can develop colors, textures, and effects to bring designs to life



3

"The real deal is repeat business," Baron explains. "When the experience is so good that the customer is hooked; when passengers are willing to pay a bit more or accept less optimal routing, the airline knows its investment was worth it."

In Baron's view, airlines are beginning to step up. "I'm super excited to see more and more airlines investing in cabin design, in terms of both industrial design and CMF [color, material and finish]. There are novel seating configurations now and better hardware integration, which translates to higher passenger satisfaction, greater loyalty, and higher yields for the airline."

## THE DESIRABLE IS POSSIBLE

Laurent Stritter is an aerospace engineer and designer who spent more than two decades at Zodiac Aerospace. He recently took on a role with Style & Design, a France-based transportation design studio, where he heads business development for aerospace.

Stritter sees a disconnect between the original design intention and the final product in the airline design process. "Designers usually do a good job of understanding airlines' branding and needs. But too often an attractive concept is transferred from designers to engineers without the proper convergence process."

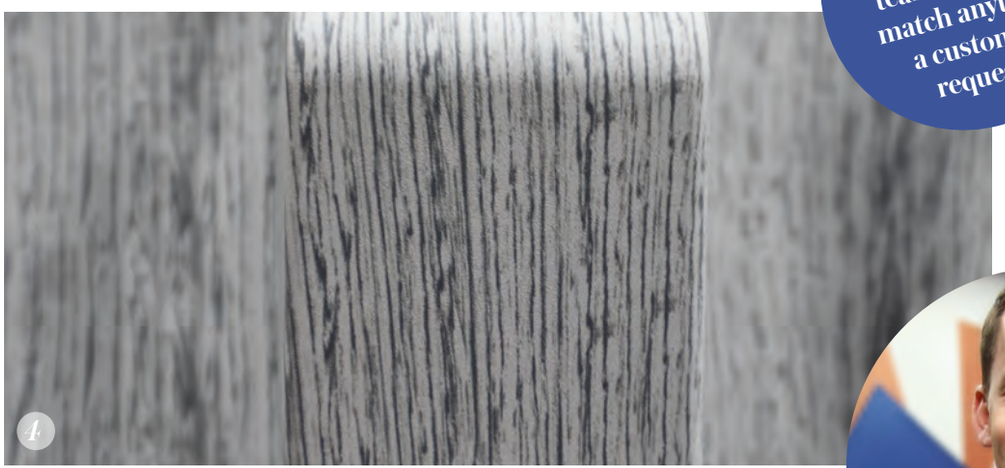
He describes the typical outcome: "Engineers often dilute the original design because of technical or certification issues. They may try to be true to the design intent, but the 'sizzle' is lost. Since it's usually the last stage before delivery, and redesigning is costly and time-consuming, airlines are stuck with a less than ideal design."

To avoid this divide, Stritter gets engineers and designers working together from the start, crafting creative designs with technological restraints already in mind. "That way," says Stritter, "designers understand the challenges, innovate around them, and present a plan that's both creative and achievable."

## SO WHERE DO WE GO FROM HERE?

Daniel Baron sees new materials and stronger branding as the future of airline interiors. "Ninety per cent of a passenger's time with an airline is spent inside the

Sekisui SPI's Design Lab team can color match anything a customer requests



4. A WOODGRAIN EFFECT ACHIEVED ON THERMOPLASTICS THROUGH THE INFUSED IMAGING PROCESS

5. BEN SMALLEY, AVIATION BUSINESS MANAGER AT SEKISUI SPI

"TEXTURE, COLOR AND OVERALL EFFECT CREATE SOMETHING SPECIAL FOR AN AIRLINE"

cabin," he notes, "and that's where their perception is built."

According to Baron, the evolution in materials has led to futuristic seat designs that deliver privacy, functionality and the critically important ability to differentiate a brand. In the cabin, an airline can nurture an emotional bond with passengers. "Frequent business travelers want to think 'This is my airline,'" Baron says. "A fantastic cabin that touches their hearts creates loyal brand ambassadors."

## PERCEIVED QUALITY BRINGS A LUXURY EXPERIENCE

As he analyzes the future of aircraft, Laurent Stritter stresses that perceived quality is an essential element of luxury car design. "It's that feeling of privilege and appreciation of details, from the way the door closes to the ergonomic design of the armrest," he says.

When perceived quality is built in, everything fits perfectly and feels good. People are willing to pay for that feeling in premium cars. "Aviation has never invested in perceived quality like the automotive industry has. But the time has come, and that translates for us into projects with airlines and seat vendors that are accelerating the implementation of perceived quality," Stritter says.

## TECHNOLOGY COULD BE THE NEXT BIG THING

Stritter also envisions technological innovations such as smart seats as a likely next step in aircraft design. "Now that we've moved to fully flat beds, we can't take up any more room. We can't get flatter than flat. So what's next?

"We do have the ability to embed tech into the seat," he explains. "Imagine a seat that remembers you and automatically adjusts to your proportions and preferred positions, even knows your drink, meal and movie preferences." Stritter believes that kind of design thinking is on the horizon.

## MATERIALS MAKE A DIFFERENCE

The two designers agree that innovative materials drive sophisticated design. Daniel Baron points to thermoplastics as products that are making a difference. "Thermoplastics go far in delivering a target ambience for the entire cabin and the personal environment of the passenger."

Laurent Stritter describes just how crucial material selection can be. "When a designer chooses a material, it shows an understanding of an airline's values and helps build the brand. The texture, the color and the overall effect create something special for an airline."

Both designers mention positive experiences working with Sekisui SPI's thermoplastic sheet. Stritter says, "Sekisui SPI understands design. The company knows trends and uses that knowledge to create its products."

Baron describes a recent collaboration: "We worked with Sekisui SPI on developing a color and finish for the seat shell of the Thompson Vantage XL that would embody 'premium.' The reaction has been phenomenal. Visitors instantly notice the richness, depth and soft glow of the seat shell. I've heard the 'wows' myself."

## COLLABORATION LEADS TO INNOVATION

No designer creates in isolation, and no project gets off the ground without collaboration between designers, OEMs, suppliers and airlines. A strong partnership is key, the kind these design experts have built with Sekisui SPI, a trusted supplier to the aviation industry.

Sekisui SPI is now developing processes for bonding materials such as leather and carbon fiber to thermoplastic sheets, injection molding metallics, and more.

"We're even adding LED lighting for drama and functionality," says Sekisui SPI's Ben Smalley. "And our proprietary Infused Imaging technology is a breakthrough in customization, enabling unique designs to be integrated into a lightweight thermoplastic sheet."

Without question, it's a stimulating time for aviation as forward-thinking designers embrace the opportunities provided by product innovations to reimagine airline interiors.

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# LIGHTWEIGHT CHAMPION

The innovative BL3710 aircraft seat from Recaro is setting new standards in economy class, with a combination of lightweight, ergonomic design and exceptional comfort

The current trend in aircraft interiors is pointing in a clear direction: achieving more efficiency by reducing weight, while also increasing passenger comfort. With its new BL3710 economy class seat, Recaro has launched an innovation for short- and medium-haul flights that meets this challenge by combining weight minimization, ergonomic design and comfort.

"Our passion for flying is what drives us to pursue even more advanced designs and developments for our economy class seats," says Dr Mark Hiller, chief executive officer and shareholder of Recaro Aircraft Seating.

"With the BL3710 we are offering our customers an exceptionally lightweight, reliable product for short- and medium-haul flights that incorporates several innovative features. The seat embodies Recaro's high quality standards and design principles, while setting a new benchmark in this class."

The BL3710 epitomises the further development of the successful BL3530 economy class seat, which has been delivered to no fewer than 70 customers worldwide. In the design, Recaro transferred the wealth of experience it acquired with the CL3710 economy class long-distance seat – which has racked up more than 260,000 sales – to short and medium-haul routes.

## FUNCTION, ERGONOMICS AND AESTHETICS IN BALANCE

Weighing less than 22 lb (10kg), thanks to the use of innovative lightweight materials, the BL3710 brings to life the ingenuity of Recaro's design and engineering teams. Many years of experience, as well as the most recent research carried out by the company's ergonomics team, were incorporated into the development of the BL3710 seat. The product and its functions were tested with people of all physical statures to ensure it ideally meets all individual requirements for comfort.

"When looking at enhancing space use in the aircraft cabin, our designers consider all the elements of a seat, from the frame to the armrests and backrests, all the way through to storage options," says Hiller.

The newly designed high literature pocket, which is positioned above the tray table instead of in the passenger's knee area, increases leg space for passengers at the same seat pitch. The high literature pocket, patented by Recaro, can be supplemented with a mesh pocket that can hold important personal items such as a cell phone or passport.

The seat design brings together all the benefits required for passengers to enjoy a pleasant sitting and inflight experience, and its modularity affords flexibility in seating configurations. The BL3710 therefore enables airlines to offer comfort


1. THE SIX-WAY ADJUSTABLE HEADREST WITH INTEGRATED NECK SUPPORT IS JUST ONE OF THE MANY INNOVATIONS THAT ENHANCE PASSENGER COMFORT

"OUR DESIGNERS CONSIDER ALL THE ELEMENTS OF A SEAT, FROM THE FRAME TO THE ARMRESTS AND BACKRESTS, ALL THE WAY THROUGH TO STORAGE OPTIONS"

**Lightweight materials have brought the weight of the BL3710 to less than 22 lb (10kg)**


2. THE BYOD SOLUTION FEATURES AN IN-SEAT POWER CONNECTION AND AN ERGONOMICALLY POSITIONED TABLET HOLDER FOR PASSENGERS WHO WISH TO USE THEIR PERSONAL TABLET ON BOARD


First deliveries of the BL3710 seat took place in Q1 2018 and feedback has been positive

3. THE LIGHTWEIGHT RECARO BL3710 DELIVERS ADDED VALUE TO BOTH AIRLINES AND PASSENGERS

"THIS VERSATILE SEAT OPENS UP UNPARALLELED FREEDOM IN ECONOMY CLASS SEATING CONFIGURATIONS"

to their customers while benefiting from economic efficiency. In addition to requiring minimal maintenance, the economy class seat distinguishes itself by offering efficient adaptation to all cabins and every application.

## DESIGNED FOR ADAPTABILITY AND CUSTOMIZATION

Thanks to its modularity, this versatile seat opens up unparalleled freedom in economy class seating configurations while offering an extensive range of features. This means the seat can be adapted to an airline's individual needs.

One innovative feature is the neck support, which is part of the six-way adjustable headrest and can be adjusted to suit passengers of different heights. This feature, which originated with the best-selling CL3710, helps passengers relax during the flight, delivering the same comfort level as a long-range seat.

Another important equipment option is the BYOD (bring your own device) feature. A specially designed tablet holder and USB power supply can be conveniently positioned and angled for ideal viewing – irrespective of the tray table position. The passenger can also make full use of an open living space. A cup holder can be integrated into the seat.

The armrest and upholstery are available in several comfort levels, ensuring that the seat can be deployed for both short- and medium-haul routes. No matter which application the BL3710 is configured for, it always stands out with its exceptional ergonomics and design.

## FULFILLING THE PROMISE

The first delivery of the BL3710 took place in the first quarter of 2018, and so far customers have been very impressed.

Norwegian Air has been flying transatlantic flights with the BL3710 seats on its newest Boeing 737 MAX fleet since May 2018. The 189 leather seats were designed to give customers additional comfort by enhancing space at knee-level. Each seat weighs 2.2 lb (1kg) less than the previous model, which reduces the overall weight of the aircraft by more than 415 lb (189kg). Reduced weight, fuel consumption and operating costs enable Norwegian to continue delivering affordable fares and an environmentally friendly service to its passengers. The airline will be retrofitting its existing fleet of six Boeing 737 MAX aircraft, which were delivered last year, with the new BL3710 seats from Recaro.

Two more well-known airlines will soon be taking off with the BL3710 economy class seat.

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# INTEGRATED CABINS

Diehl Aviation is working to make the aircraft cabin a cohesive and efficient environment, in terms of appearance, branding and technology

German aerospace supplier Diehl Aviation is making waves in the industry with its new and integrated cabin solutions. True to Diehl's company motto, 'We are one', which the company announced at Aircraft Interiors Expo in Hamburg earlier this year, customers can obtain a complete package of tailor-made cabin solutions from under one roof. This ability makes overall project planning considerably easier, saves time (and not just in assembly), and helps lead to detailed, coordinated results.

It is possible to construct almost an entire cabin from customized components, especially when it comes to coordinated linings and lighting. The result is an entirely unique cabin, with all components representing the customer's specific design language, with a consistent design throughout. The result is a visual USP, with the cabin clearly reflecting the individual brand of the airline, enabling clear distinction from the competition.

"The passenger can see the coherence of the design," says Jörg Mäder, vice president of product innovation at Diehl Aviation. "This harmonious cabin design exudes quality and excellence, which in turn creates a sense of security."

By having development, production and marketing all under one roof, modular cabin solutions can easily be adapted to the needs of passengers and airlines. Individualization and branding also play a major role.

"It is important for airlines to be able to brand their cabins. After all, customers need to be able to connect their passenger experience to the right brand," says Mäder. "Branding can be conservative, stylish, or prominent and powerful, depending on the customer's wishes and brand identity."

As a cabin and electronics specialist, Diehl Aviation uses its repertoire of cabin outfitting to benefit airlines. Four cabin areas are the focus of this attention.


1

## WELCOME AREA

The entryway of an aircraft is a crucial branding opportunity as it creates the passengers' first impression of the airline as they climb on board. This is where the customer experience begins, which is why it is so important. It's about giving passengers the impression of being welcomed personally on board, experiencing the pleasant atmosphere, being guided to the seating, and generally feeling safe. It therefore makes sense for manufacturers and operators to dedicate considerable effort to entryways.

Diehl Aviation has turned the aircraft entrance into a welcome area, which precisely reflects these concepts. The


3

**Digital printing of cabin linings can create a little extra 'wow' factor in the experience**

1. INTEGRATED CABIN SOLUTIONS CREATE A HARMONIC, FUNCTIONAL AND CUSTOMIZABLE CABIN

2. DISPLAYS CAN BE USED AS VIRTUAL WINDOWS, MEANING THAT ADDITIONAL SEATING CAN BE PLACED BY WINDOWLESS FRAMES

3. THE NEWLY CONCEPTUALIZED OVERHEAD STOWAGES OFFER PASSENGERS MORE COMFORT

## CABIN AREA NETWORK AND SERVICES

**Engineers at Diehl Aviation combine the worlds of cabin, electronics and avionics. This approach brings many advantages to the customer, one of which is the integrated cabin management system.**

**The Cabin Area Network System and Services (CANSAS) is a high-speed cabin network with an open platform. It runs a vast variety of applications and functions, including third-party applications, on an open Linux ecosystem. In addition to non-essential functions, it covers all the traditional cabin management system functions. Characterized by high computing performance and storage capacity, CANSAS is fully configurable and adaptable to customer needs.**

**The system controls and monitors several functions, including:**

- **Smart boarding with welcome displays, projection, audio and PSUs;**
- **Cabin lighting with extensive lighting and projection scenarios;**
- **Predictive health management with integrated sensors;**
- **Integrated video monitoring functions;**
- **High-quality audio management, from handset to speaker;**
- **Use of mobile devices (PEDs) for crew and passengers.**


company's newly developed integrated door- and wall-linings – combined with state-of-the-art projection techniques – ensure a unique atmosphere.

It's the details that make the difference. For example, a display integrated into the partition on the right-hand side of the entrance greets each passenger personally. Further displays in the overhead stowage compartments guide passengers to their seats, and potentially also their reserved luggage storage.

Aircraft manufacturers benefit from reduced installation time for the linings because of their component parts and pre-assembled design. During operation, the reduced weight pays for itself, creating an attractive cost of ownership. The streamlining of the boarding process is also beneficial to the operator.

"We can give passengers a truly warm greeting in the welcome area, an impression that stays with them for a long time," says Mäder. "Projections, digitally printed lining components, special accents, ambient lighting and the welcome display are just a few ways in which we can create the 'wow' effect."

These unique welcome areas don't just look attractive and create a feeling of space. Integrating the electrics and equipment saves time and money, and the components are optimized for final assembly. Each component can be tailor-made in line with the airline's branding. It also saves weight as the main lighting is no longer needed in the entryway.

### LININGS AND OVERHEAD STOWAGE COMPARTMENTS

Diehl Aviation has also been working on its floor-to-floor linings, with the aim of realizing a greater feeling of space with more headroom, more space for hand luggage, and more easily accessible storage compartments. In addition to these improvements, clearer announcements and safe guidance to seating have also been achieved. With these innovative cabin solutions, passengers can now have a more enjoyable experience overall.

The newly developed overhead stowage compartments have space for up to eight 55 x 40 x 25cm roll-on bags. At the same time, the lower loading edge affords passengers easier access to the bins.

"Finding seats and putting hand luggage away safely often create a certain


**Virtual windows offer a high-tech and attractive solution for installing more cabin seating**

4. THE COMPLETELY REDESIGNED AFT AREA IS PARTICULARLY EFFICIENT THANKS TO THE HIGH-DENSITY SOLUTION

5. THE WELCOME AREA AS FIGUREHEAD: AS SOON AS THEY STEP ON BOARD, PASSENGERS EXPERIENCE THE COMFORT THE AIRLINE OFFERS – WITH AN ADDED WOW FACTOR

6. DISPLAYS UNDERNEATH THE HAT RACKS CAN BE INDIVIDUALIZED AND DISPLAY VARIOUS PIECES OF INFORMATION

degree of hassle during the boarding process. This is typically the most stressful part of a flight," says Mäder. "So our solutions contribute to the passengers enjoying a more relaxing boarding and seating procedure. And that's pretty much half the onboard passenger experience job done."

The harmonious look of the integrated linings is not just important to passengers. Airlines also benefit, as the sophisticated integration of the lining parts and the reduced number of – and need for – panel loudspeakers reduces aircraft weight. The integrated, pre-installed lining and the overhead stowage compartment can now be more easily and more quickly installed in new or in-use aircraft.

And of course the lining parts can be customized using a digital printing process, so more color can be brought into cabins. Also, displays can be used as virtual windows, meaning that extra seating can be installed alongside windowless frames.

Diehl Aviation also offers expertise in cabin lighting. The recessed, translucent strips in luggage compartments create a much lighter cabin than usual – 100 lux on the ground with closed covers.

Also, small displays can be used to replace conventional seat numbers. Unlike such seat number tags, the content of these displays does not have to be static and can be changed, meaning they can be used for a number of other functions, including providing information about individual passengers. Hidden latches on the overhead compartments and panel speakers are other innovative cabin


elements. The speakers integrated into the area around the overhead stowages create excellent sound quality and distribution.

## AFT AREA

Airlines exist in a harsh competitive environment. To be successful, market distinction is required and efficiency requested. Diehl Aviation considered this demanding market environment an opportunity to fundamentally rethink and improve existing solutions. The company believes that its High Density Solution – developed with Lufthansa Technik – is the answer. This highly integrated monument for the aft area is comprised of a galley and two lavatories, which can be converted into one larger lavatory space for use by people with reduced mobility. This integration also gives a considerable weight advantage and allows space for up to two additional rows of seating to be fitted – dependent upon seating position and configuration – which is equivalent to 12 additional revenue seats.

Furthermore the Stowalley provides the necessary storage space for the correspondingly larger catering requirement created by these additional seats. If this space isn't needed as a dry galley for standard units or trolleys (one full size or two half-size) then it can, with just a few latches, be converted into a wardrobe, for example.

The Plug & Stow modules further increase the flexibility of galleys. They can be quickly and easily exchanged with inserts for the galley to offer additional storage space for crew hand luggage or for emergency equipment – which in turn creates more storage space for the passengers' hand luggage. Using the Virtual Outside View, passengers seated in this area can look at the view outside via a display.

"The aft area is a key part of the plane," says Mäder. "Here our solutions definitively have added value – for both passengers and airlines. And of course, the same applies here as elsewhere: individualization is key – which is why we have a broad spectrum of solutions."

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In the aerospace industry, the name of Diehl is synonymous with the highest of competencies, excellent products, absolute integrity, and German engineering. Or, as we put it, we have kerosene in our blood and flying in our DNA. In short, we are flying. This is precisely what we are saying from this point on with our new, definitive name: Diehl Aviation.

**www.diehl.com/aviation**

# CREATING EXCITEMENT

New seating models across several classes are being developed by Aviointeriors, as a result of innovations from experienced designers and engineers, and fresh young talent

There have been numerous developments at Aviointeriors over the past 12 months, driven by the company's commitment to improving its product range, especially its long-haul seating models.

Following positive remarks from airlines operating Aviointeriors' economy class seats, the company has invested in further enhancing and renovating its economy class range, with the aim of producing unique products in the market. Thus the Italian company has established a new family of economy class seating. Named Columbus, the seating range includes a short-haul model (Columbus One), a medium-range variant (Columbus Two) and also a long-range version (Columbus Three).

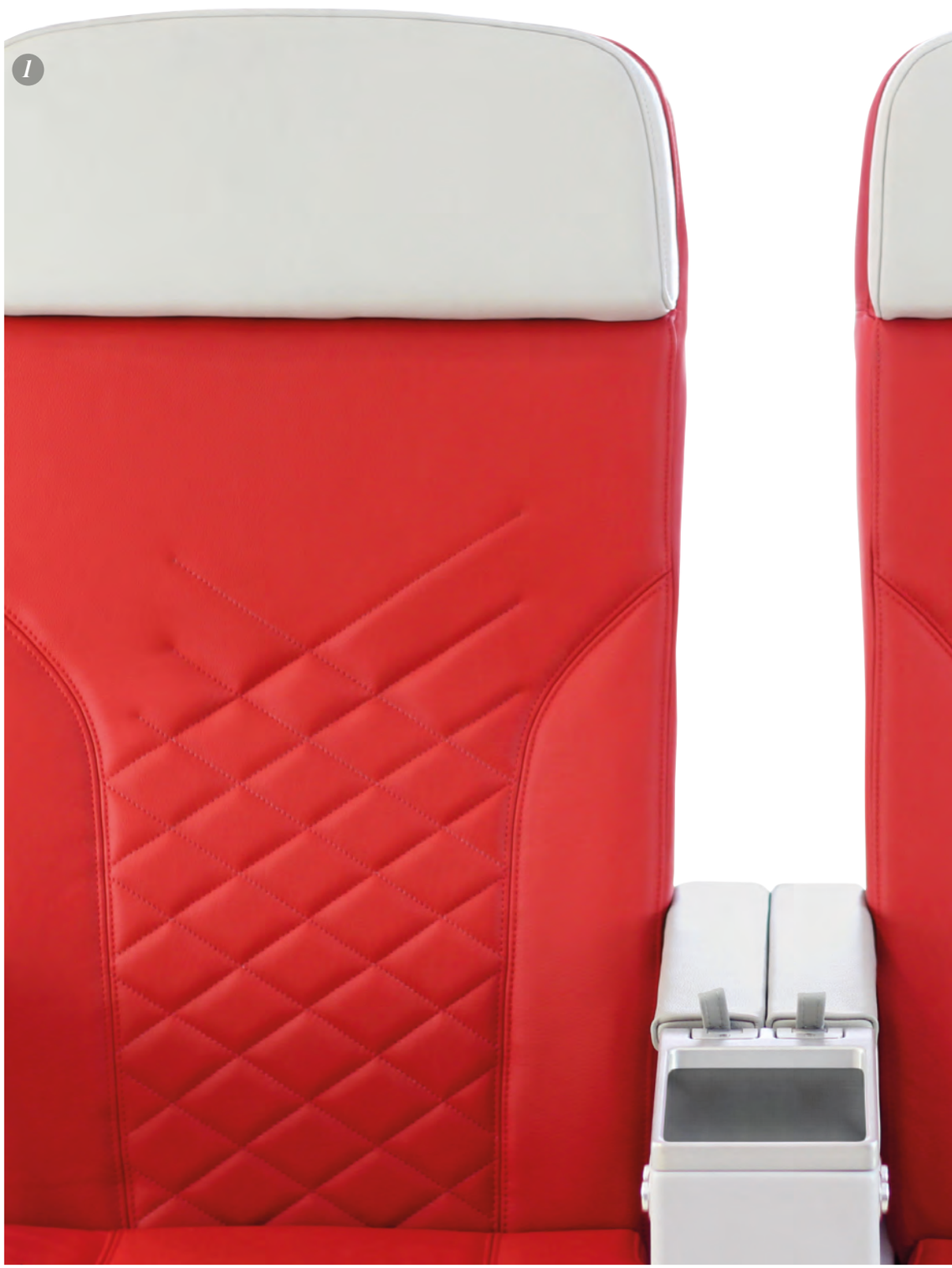
In other economy class developments, Aviointeriors had the pleasure of unveiling another family of seating at Aircraft Interiors Expo in Hamburg in April. The range is named Michelangelo, after the famous Italian artist from the Renaissance period, which has inspired Aviointeriors' engineering department to reflect his work in terms of quality, reliability and passion.

At its launch, the Michelangelo long-range seat received many optimistic and constructive comments. The seat features 13.3in IFE capability, numerous stowage spaces, and carefully styled bumpers and armrests, which combine to make it a competitive seat in the demanding long-haul market.

Aviointeriors has also been working on short/medium-range versions for the Michelangelo family, which will be presented at Aircraft Interiors Expo 2019 in Hamburg, Germany, April 2-4.

Aviointeriors' innovation efforts are not limited to the economy class sector, and the team has been continuing to improve its ranges of premium economy and business class seats.

The new Caravaggio premium economy seat has been designed to offer all the technical requirements needed to compete with and outmatch competitor products in



"THE COMPANY HAS INVESTED IN FURTHER ENHANCING AND RENOVATING ITS ECONOMY CLASS RANGE"

**Aviointeriors is celebrating 40 years in the aircraft seating business**

this category. The primary goal of the design was for it to be clearly differentiated from economy seats, enabling airlines to sell a true premium economy product, which will increase customer satisfaction.

Aviointeriors is working to ensure that Caravaggio will match and exceed customer expectations, through optimized comfort, quality components and generous storage, which combine to create a passenger experience similar to many regional business class seats.

The company's 40 years of experience in aircraft seat manufacturing is clear to see in its business class range, characterized by Italian design, comfort and quality. The wide product range and

1. THE CARAVAGGIO PREMIUM ECONOMY SEAT IS DESIGNED TO OFFER COMFORT LEVELS SIMILAR TO REGIONAL BUSINESS CLASS

2. MICHELANGELO IS NOW AVAILABLE IN SHORT, MEDIUM AND LONG-RANGE VERSIONS

3. THE ADAGIO BUSINESS CLASS SEAT PACKS BUSINESS CLASS COMFORT INTO A HIGH-DENSITY DESIGN

**Aviointeriors plans to debut a new business class seat at Aircraft Interiors Expo 2019**


the ability to produce both mechanical and electrical fully flat seats demonstrate the company's excellence and competence in this sector of the market.

Two business class seat models – the Andromeda and Canova mechanical seats for narrow-body aircraft – are appreciated by customers for their comfort, durability and style.

Adagio, the high-density, fully flat business class seat, represents the latest advance in the challenging business seat market. Adagio can be fitted eight abreast on B777s and B787s and seven abreast on A330s. Aviointeriors is also developing another product from the Adagio platform, the Adagio premium economy seat.

The company is working on another business class seat, which will be launched soon and will broaden its fully flat product range. Aviointeriors' team, from design to engineering, is pushing hard to present this new business class seat at Aircraft Interiors Expo 2019.

Aviointeriors is also working on an evolution of the Skyrider 2.0 saddle seat for short-haul economy that can be installed on aircraft without structural changes. The design will retain the key features of the previous version, but with better passenger comfort and a very innovative design.

"THE COMPANY IS STRENGTHENING ITS RELATIONSHIP WITH SEVERAL UNIVERSITIES TO ATTRACT EXCELLENCE"

The company has also recognized the importance of providing crew rest seats for flight attendants, and is producing new models for economy and business class cabins, compliant with regulations.

Aviointeriors' strength is to be able to look at the airline market as a whole, enabling it to serve the most demanding carrier requests in the fullest way.

All the above innovations have been made possible by the company's skilled designers and engineers, but also with help from the Aviointeriors Academy, which has employed around 20 new skilled resources. Young and fresh graduate engineers are being selected to join Aviointeriors, and they will further enhance the company's motivation and bring about great ideas.

"In addition to repeating the experience of recent graduates in engineering – five students have already joined the staff this year – the company is strengthening its relationship with several universities by planning medium-sized protocols to attract excellence. This will also increase the scope of action of our center of studies, which is set to become a true innovation lab," comments Ermanno De Vecchi, CEO at Aviointeriors.

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# CREATING TEXTURE

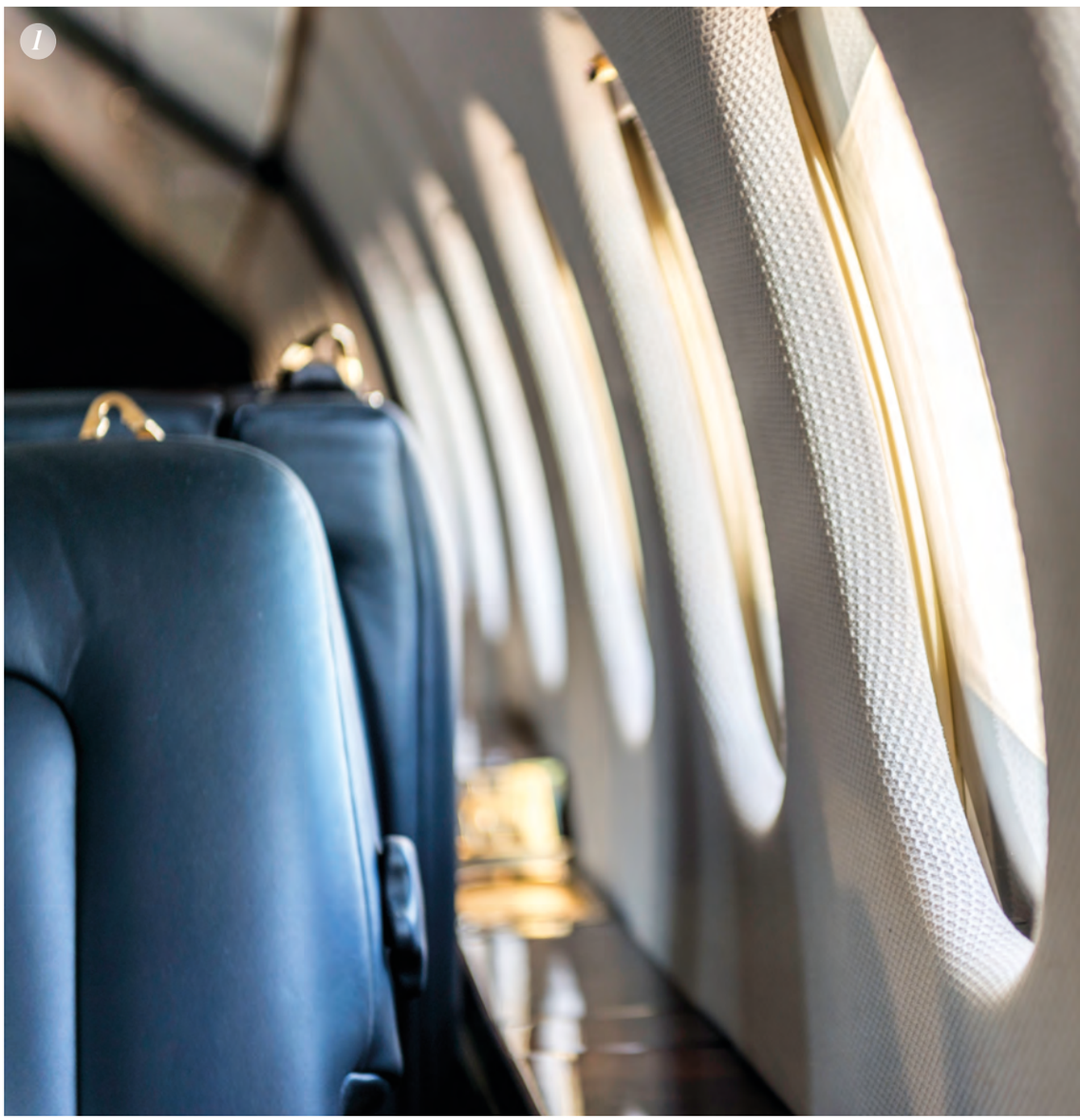
Passengers' senses and emotions can be further engaged with a new type of cabin design, thanks to fully digital and ecologically sound laser texturing technology

Just as the sophisticated textures in today's mid-range and high-end cars are designed to engage the senses and evoke emotions ranging from prestige to adventure, aircraft cabin interior designers can harness the power of latest-generation laser texturing to add value to the passenger experience and differentiate their molded plastic cabin interior components.

GF Machining Solutions' digital laser texturing technology – fully digital, highly precise and ecologically sound – is already a proven solution for adding distinct textures to molds for car interiors, and is poised to transform the texturing of plastic injection molds for aircraft cabin components, enabling designers to innovate without limits.

The global use of plastic materials has increased 20-fold over the past 50 years, is due to double in the next 20 years, and will continue to play an important role in cabin interiors due to their light weight and durability. Just as it pioneered electrical discharge machining and high-performance and high-speed milling, GF Machining Solutions is the pioneer of laser texturing, providing designers with a go-to technology for adding distinct, value-adding textures to three-dimensional (3D) molds. These laser solutions put uniquely flexible and innovative texturing capability at cabin designers' fingertips.

This future-ready technology can help designers accurately reproduce their distinct designs on 3D molds for a virtually limitless array of plastic features for aircraft cabins, overhead storage bins, dividers between classes, seatbacks, fold-down tray tables and literature pockets, lighting features, lavatory components such as vanity units, and moldings around windows, to name just a few. Each of these molded components presents designers with differentiation opportunities, and GF Machining Solutions' laser texturing technology provides a fully digital means that enables the company to execute its designs at the highest level of quality.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## SURPASSING CONVENTIONAL TEXTURING LIMITATIONS

Today, manufacturers relying on conventional texturing methods such as manual chemical etching face limitations with regard to design, the high risk of errors, environmental challenges related to the use of acids, and difficulties in accurately texturing complex 3D shapes.

GF Machining Solutions' laser texturing technology, with its all-in-one dedicated software package, answers all of those challenges and allows mastery of the full texturing process, from job preparation and graphic design, to transition-free patching and ultraviolet (UV) mapping for 3D simulation and applying texture.

"THIS FUTURE-READY TECHNOLOGY CAN HELP DESIGNERS ACCURATELY REPRODUCE THEIR DISTINCT DESIGNS ON 3D MOLDS"

Laser texturing is non-polluting and uses no caustic chemicals requiring disposal

1-3. LASER TEXTURING OF CABIN COMPONENTS HELPS CREATE A DIFFERENTIATED PASSENGER EXPERIENCE AND ALSO ENHANCES VISUAL APPEAL

Environmental sustainability, faster time to market with innovations due to laser texturing speeding up operations, and uncompromising innovation are all hallmarks of this fully digital technology. By positioning aircraft cabin designers for the future, these laser texturing solutions enable them to seize new design opportunities, explore new innovation horizons and produce perfectly textured 3D tools and parts with flawless quality.

## A FUTURE-READY SOLUTION

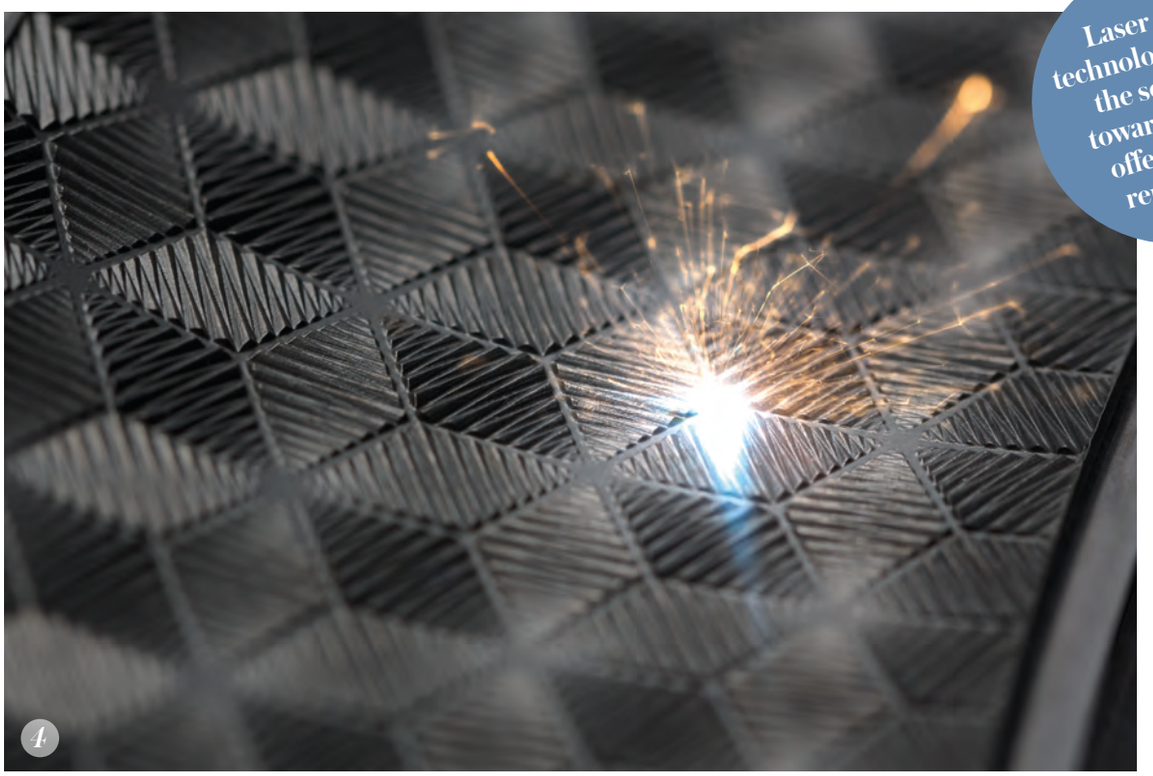
Behind these solutions is a wide array of proprietary software solutions that enable designers to innovate with confidence, reduce the cost-per-part gap between existing technologies, and eliminate guesswork in executing even the most complex designs and 3D surfaces.

GF's laser texturing machines and optimally aligned software position designers to keep pace with the advancing digital transformation in three main ways. Firstly, the laser texturing process becomes infinitely repeatable and dependent on the parameters programmed into the controller, rather than an operator's judgment. Secondly, the process requires no secondary handling or masking of the mold.

Thirdly, laser texturing is non-polluting, uses no caustic chemicals requiring disposal, and any resulting dust is simply vacuumed away. Furthermore, laser texturing uses no consumables such as blasting materials, acids or bases, and – in most cases – requires no secondary cleaning of the mold.

## SOFTWARE DRIVES SMART LASER TEXTURING

Enabling these truly transformative benefits is the GF Laser Workstation job preparation software, which enables use of the laser technology's full potential at the highest efficiency. Users save time and increase productivity because fast, accurate and easy surface calculation is built into these systems. Moreover, because it is a fully digital process, five-axis texturing and engraving are made



Laser digital technology reduces the scrap rate toward zero and offers process repeatability

4. LASER DIGITAL PROCESSES ELIMINATE RISKS OF HUMAN ERROR AND THEREFORE REDUCE RISK OF POOR QUALITY END PRODUCTS

easy. The integrated smart mapping solution manages random and overlapped textures to provide continuity of the design when it is applied to the end product.

## SMARTPATCH FOR INTELLIGENT MACHINING STRATEGIES

Improved texturing quality and uncompromised productivity are made possible by the patented Smartpatch, which constitutes part of the GF Laser Workstation software. Its intelligent machining strategies allow users to achieve perfect texture profiles at maximum efficiency.

Most existing laser texturing machines force manufacturers to make sacrifices in terms of quality or productivity, because they randomly apply textures to the workpiece surface, working from one area to the next to remove material in patches.

This lack of a smart patching solution compromises productivity and quality due to inefficient texturing strategies, as well as texturing errors induced by movement of the laser head.

Smartpatch boosts quality and productivity for even the most challenging textures, so users achieve unequaled texture quality, avoid patch lines due to smart tool path generation, and attain 30% productivity gains on average (depending on the texture applied).

"LASER BLASTING CAPABILITIES ENSURE PERFECT SURFACE HOMOGENEITY"

## SURFACE HOMOGENEITY

Unique laser blasting capabilities are an additional benefit of the GF Laser Workstation software, Laser Design. Laser blasting bombards a workpiece with thousands of laser points per square millimeter to create surface homogeneity.

Complete control of the texturing process is beyond the capabilities of conventional texturing methods, which pose the risks of human error, scrapped molds and poor-quality end products. With the laser blasting capabilities delivered by the Workstation software, users can ensure perfect surface homogeneity and regularity. Moreover, designers can play with grain texture to impart innovative textural characteristics to their surface designs.

## GREATER EFFICIENCY

Timing is always a key success factor in reducing cost per part, and Smartscan – now a standard component of the GF Laser machine software – is maximally optimized to deliver full efficiency with each patch machined. With the intelligence it adds to the machining process, users' efficiency and quality are considerably improved; in fact, with the latest generation of this software, the laser machining process can become 50% faster, depending on the specific application.

## PROVEN IN AUTOMOTIVE

Already proven in the automotive industry as a go-to texturing solution that improves the passenger experience across a broad variety of injection-molded plastic auto components, GF Machining Solutions' Laser texturing technology is poised to bring the same value-adding 'touch and feel' to airline passengers' cabin experiences.

The technology's zero defects, perfect repeatability and environmental sustainability demonstrate GF Machining Solutions' commitment to providing aircraft cabin designers with a cost-effective, flexible, precise and environmentally sustainable means of creating their distinct designs.

GF Machining Solutions

## 3D Laser texturing

# Open up new horizons

Aircraft cabin interior designers now enjoy limitless texture design possibilities and can dramatically enhance passengers' emotional experience thanks to state-of-the-art Laser texturing. Fully digital, highly precise and ecologically sound, GF Machining Solutions' 3D Laser texturing technology enables the creation of a variety of innovative molded plastic cabin interior components—with absolutely no limits.

www.gfms.com/advanced-manufacturing/en.html

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# MORE THAN SEATING…

Purpose-driven design and attention to detail make the difference in HAECO Cabin Solutions' Vector Premium seating

Across the globe, HAECO is recognized as one of the largest independent aircraft engineering and maintenance providers. Its range includes airframe services, line services, component services, engine services, inventory technical management, fleet technical management, cabin solutions, private jet solutions and freighter conversion, as well as parts manufacturing and technical training.

Over its 60+ years of operation, HAECO has built strong and lasting relationships with its customers, who value the company's outstanding track record of quality, safety, efficiency and resourcefulness. Customers also appreciate the firm's customer-centric approach and its dedication to ensuring support is given as and when it is needed.

In 2014, the company broadened its capabilities in design engineering and cabin integration, as well as aircraft seating, monuments and other interior products with the acquisition of Timco Aviation Services, inclusive of Timco Aerosystems with its more than 20 years of seat manufacturing experience. The two divisions were rebranded as HAECO Americas and HAECO Cabin Solutions within the HAECO family. Today, HAECO is a trusted provider of dedicated one-stop services and solutions that support aircraft throughout their entire lifecycle. The team demonstrates technical expertise, operational excellence and a customer-focused attitude in everything it does, striving to exceed customer expectations.

1

## CUTTING-EDGE PRODUCTS, INTERCONNECTED CAPABILITIES

HAECO Cabin Solutions provides turnkey cabin integration solutions that include design engineering, testing, certification, manufacturing, equipment and logistics, as well as reconfiguration and interiors installation services. As a holder of FAA Organization Designation Authorization (ODA), HAECO Americas provides additional time-saving benefits to

"THE VECTOR SEATING PLATFORM FEATURES LIGHTWEIGHT, DURABLE CARBON-FIBER CONSTRUCTION"

**HAECO Americas holds an FAA Organization Designation Authorization (ODA)**

1. VECTOR PREMIUM CAN SERVE AS A PREMIUM ECONOMY OR REGIONAL BUSINESS CLASS SEAT

customers through the design and development process.

As an authorized and original equipment manufacturer of aircraft seating and cabin interior products, HAECO Cabin Solutions offers a complete range of seating, galleys, lavatories and stowages. The Vector seating platform in particular features lightweight, durable carbon-fiber construction, excellent passenger living space, and fast, easy maintenance. Vector is available for a full range of cabins, from single-aisle economy to twin-aisle premium economy. HAECO's extensive experience in MRO provides customers of its cabin products and services with an additional degree of value.

## VECTOR PREMIUM PLATFORM

Based on its proven Vector platform, HAECO Cabin Solutions now offers Vector Premium for seating in premium economy and business class cabins. With a focus on comfort, light weight, customization and ease of maintenance, Vector Premium is a new approach to the design, manufacture and certification of seating for single-aisle business class and twin-aisle premium economy customers.

Design innovation is the hallmark of Vector Premium – design that benefits airlines by minimizing the costs of acquisition, installation and maintenance through pre-certification, modularity, parts commonality and streamlined manufacturing. Innovation is also evident in Vector Premium's comfort – proved through ergonomic studies – its reliability, and its flexibility that allows airlines to customize the configuration of the seats.

Basic design features include part commonality with other Vector seating

"VECTOR PREMIUM IS IDEAL FOR A VARIETY OF CABIN CONFIGURATIONS"

The Vector Premium platform is suitable for fitment in any size of commercial aircraft

2. VECTOR PREMIUM WAS GRANTED TSO AUTHORIZATION IN 2018 FOR THE A320 AND B737

models, and durable and lightweight carbon-fiber seat pans, backs and baggage bars. The modular design allows airlines to customize and brand Vector Premium to their liking, and speeds repair or replacement with several snap-in elements that can be replaced in about five minutes.

Vector Premium integrates several features as 'zones of flexibility', allowing airlines to add and customize features such as privacy wings, reading lights and PED holders. Airlines may also brand seat surfaces by means of metal or thermoplastic finishes. Living space and comfort are optimized with convenient cubbies and best-in-class legroom between seat sides, and generous thigh clearance with the tray table.

Other novel features include the location of the buttons for reclining the seat and extending the leg rest. Audio and power provision are also well-situated for passenger convenience. Seamless waterfall bottom cushions offer superior leg support and maximum passenger comfort while adding a crisp, fitted look.

Vector Premium achieved TSO authorization in 2018 for all seat configurations on Boeing 737 and Airbus A320 aircraft. In addition, HAECO Cabin Solutions and Airbus announced in July that they have launched the offerability process for Vector Economy on A320 Family aircraft, and Vector Premium for both the A320 Family and the A350 XWB Family. At the same time, HAECO Cabin Solutions revealed that it had secured a launch customer – a "sizeable" carrier in Asia – for line-fit A320 series seating.

Vector Premium is ideal for a variety of cabin configurations: 2-2 on single-aisle aircraft; 2-4-2 on a B777 or downstairs A380; 2-2-2 on a B767; and 2-3-2 on an A330, B787 or A350. Yet given the flexibility offered by its platform design, Vector Premium may be configured for other seating arrangements.

Doug Rasmussen, president and group director of HAECO Cabin Solutions, states, "In Vector Premium, HAECO has developed a true platform-based product that is built upon a lightweight composite design and shares many parts and features of the Vector Economy class seat. This solution allows airlines to enjoy lower total cost of ownership while delivering best-in-class comfort to passengers."

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# AN OPEN ECOSYSTEM

Gogo discusses why airlines should keep an open mind about their inflight ecosystem

The increased importance of inflight internet in driving an airline's digital transformation creates a series of strategic questions for airlines, including the decision whether to base their strategy on an open ecosystem.

For inflight internet, an open ecosystem is broadly defined as having the ability to work with multiple vendors to reduce cycle times and create tailored solutions that differentiate the airline and delight its passengers. How an airline approaches digital transformation is specific to its operations and brand. There is no 'one size fits all' solution. However, the right inflight ecosystem offers increased ownership of the passenger experience, greater risk management on technology investments, and the seamless addition of technologies that drive toward long-term goals.

While buzzwords like 'open', 'flexible' and 'self-managed' are touted by most connectivity providers, airline professionals should understand that a truly open approach must extend across all aspects of the inflight ecosystem. It must go beyond portal apps and passenger services to encompass hardware and software, satellite networks and support.

## WHAT DOES 'OPEN' MEAN?

Let's look at what 'open' really means across the entire inflight ecosystem. For passenger services, the most important consideration is how much an airline wants to tailor the experience it creates for passengers (and employees). Is it an airline brand that prides itself on innovation or is it comfortable using the same services and portal design as other airlines?

There are tradeoffs with both approaches and, with an open ecosystem, you can choose either. Whether an airline

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1. ONE OF THE MOST IMPORTANT REQUIREMENTS OF CABIN CONNECTIVITY IS ALSO ONE OF THE SIMPLEST: IT SHOULD WORK SWIFTLY AND SEAMLESSLY

2. GOGO'S KU-BAND ANTENNA

**Gogo has been involved in inflight connectivity for more than 20 years**

"IT IS POSSIBLE TO INTEGRATE DISPARATE IFC AND IFE SYSTEMS"

leverages third-party developers or creates services in-house, it can own the overall passenger experience better. But this flexibility may also introduce greater complexity, as responsibility for managing it all now falls on the airline.

Many connectivity providers talk about an open ecosystem in the context of services or portal design. In an open ecosystem, airlines should have access to standardized, modular hardware that absorbs new technology and works with multiple systems from several vendors.

If in-cabin hardware must be paired with only one vendor, the ecosystem is not open. Today it's possible to integrate disparate IFC and IFE systems, along with other onboard services and future connected aircraft systems. Likewise, an open software platform should enable quick plug-and-play capabilities, simple integration and easy upgradability. When exploring connectivity vendors, it's important to understand how much time, money and effort on the part of the airline will be required to innovate and ensure long-term performance.

In any discussion of an inflight ecosystem, one area clearly distinguishes open versus closed – the satellite network. Reliance on one or two satellites to deliver coverage and capacity for all flights is, by definition, a closed system. This is the case with Ka band. The satellites are launched, the ability to change or enhance their

3. GOGO'S NWAP ON BOARD AIRCRAFT WI-FI SYSTEM

4. THE 2KU ANTENNA, ONE OF THE INDUSTRY'S MOST POWERFUL CONNECTIVITY TECHNOLOGIES

**In 2018 Gogo Commercial Aviation is celebrating a decade of delivering inflight internet to the world's airlines**

## "IT IS IMPORTANT TO WORK WITH PARTNERS THAT ARE TECHNOLOGY-AGNOSTIC"

3

capabilities is very limited, and airlines are 100% dependent on the performance of these few satellites for years to come.

The alternative is an open and interoperable ecosystem of satellites using the Ku band. In this scenario, airlines can access dozens of geostationary satellites that cover a high percentage of global flight routes. Risk is minimized since users can simply switch satellites, should one be damaged or 'go dark'. And because new Ku satellites are routinely launched from multiple providers, airlines continuously benefit from leading-edge performance.

Because an open inflight ecosystem incorporates key technologies from multiple providers – from satellites and modems to portal service developers – it is important to work with partners that are technology agnostic and have a proven history of collaboration with related vendors. Specialization in aviation is another important facet of support. Look for partners with the expertise and knowledge to support the airline business.

Understanding the nuances of what an open inflight ecosystem should deliver is the first step to evaluating potential connectivity partners and finding one that aligns with an airline's short- and long-term strategies.

4

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# COMFORT FOAMS

A new generation of foams developed by Aerofoam Industries for aircraft seating offers comfort, weight, health, safety and durability benefits

Development work on a series of new foam materials is now complete. The foams have undergone exhaustive testing and are now flying with two of the world's leading airlines. They are unusual in having been developed specifically for the aircraft seating industry rather than being 'adopted' from another industry, such as furniture or bedding, in the hope that they would work. The foam material requirements for the aerospace industry differ considerably from those of other markets, requiring materials with enhanced tear strength and higher resilience, at lower weight points. Adopting foams from other industries is therefore always a trade-off.

The new range includes comfort foams, lamination foams, memory/visco foams, and flotation/structural foams. Each of these materials is unique to the aviation industry, and is specifically formulated and developed for its intended application.

The seating or 'comfort foam' range features six highly resilient foam materials that were formulated with specific properties to address common problems found in seat cushions. These issues include lack of comfort, rapid cushion height loss, shear or tearing due to movement, and weight concerns.

The new foams feature a higher resilience than their conventional foam predecessors. Their improved resilience has been achieved by formulating a staggered cell structure rather than a linear cell structure. The staggered cell structure acts like tiny springs that rebound against the passenger's body, greatly adding to the foam's comfort and at the same time preventing height loss. The rebound forces of these new foams can best be described as 'alive' in contrast to the 'dead' feeling of conventional foams commonly used in aircraft.

Six grades of graphite-filled foams are available, all with antimicrobial and/or temperature-regulating phase-change coatings. The entire range of foams has


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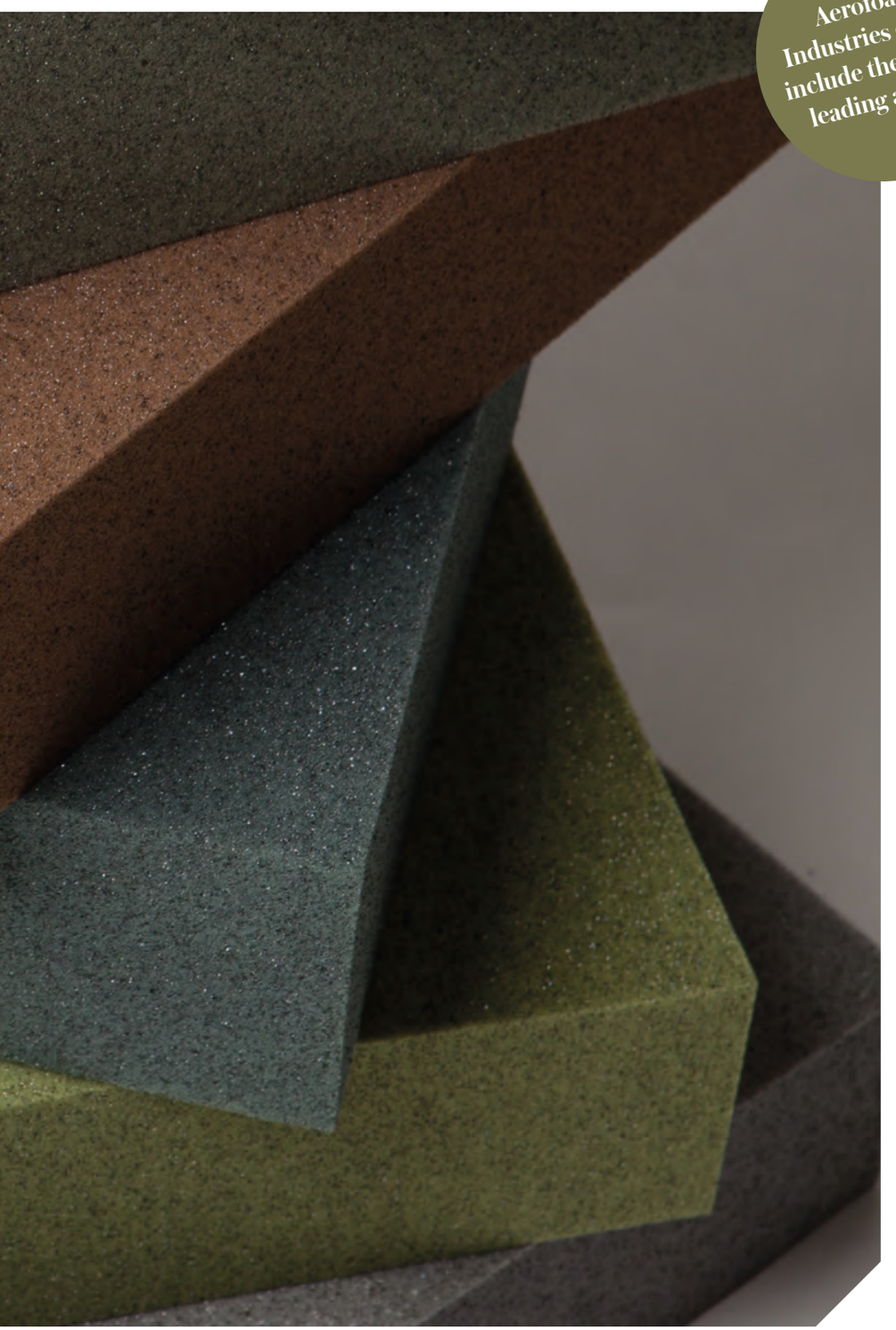
"THE STAGGERED CELL STRUCTURE ACTS LIKE TINY SPRINGS THAT REBOUND AGAINST THE BODY"

**Aerofoam Industries clients include the world's leading airlines**



1+2. THE GRAPHITE-FILLED FOAM IS AVAILABLE IN SIX GRADES

been subjected to ASTM D3574 testing and has also undergone extensive testing for height loss through constant pounding testing, as well as for shear. These foams meet FAR 25.853 (a) and pass the C burn test without ned for additional fire block.

The memory or 'visco foam' series is unlike anything currently on the market. The tensile and tear strength has been adjusted to allow it to be used on the top surface of bottom, back and headrest cushions without suffering from breakdown or degradation; something that happens all too frequently with the mattress-grade foams that are commonly used. These aerospace-grade memory foams are available in soft and firm

**Aerofoam Industries has developed the lightest graphite-filled memory foam in the industry**

3. CROSS SECTION OF A FLOTATION CUSHION PROFILE

versions and are the lightest density foams available, meaning they can even be used in economy class seat cushions, without any impact on weight.

The new lamination foams were formulated specifically for lamination with dress covers. This series is the first of its kind and was purpose-designed for seat cover lamination. It was developed to bond through pressure lamination systems and does not require any specialty fire block materials to be compliant. These foams are compatible with all dress cover materials, including fabrics, PU leathers, e-leather and leather.

What makes these foams unique is their highly increased tensile and tear strength, which prevents shearing and rapid breakdown of the foam material: something that is all too common with the standard foam materials commonly used for this application. There are four new grades of lamination foams, offering a wide range of comfort options.

Lastly, the flotation foam series was developed to address weight savings and comfort without sacrificing any of the performance properties that these foams are known for. Working in conjunction with the world's leading foam extruder to develop this series of foams resulted in three densities: 1.3, 1.7 and 2.2 lb/ft$^3$. These foams do not take a compression set and are truly closed cell, allowing even the lowest density material to pass flotation testing.

"WHAT MAKES THESE FOAMS UNIQUE IS THEIR HIGHLY INCREASED TENSILE AND TEAR STRENGTH"

4. CROSS SECTION OF A COMFORT CUSHION PROFILE

In addition, this series has successfully passed flotation requirements after a grueling 50,000 cycles of constant pounding. These flotation/structural materials are almost half the weight of traditional flotation foams, and when used correctly in seat cushion design, can increase the comfort of any conventional flotation cushion.

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# MATERIAL CHANGES

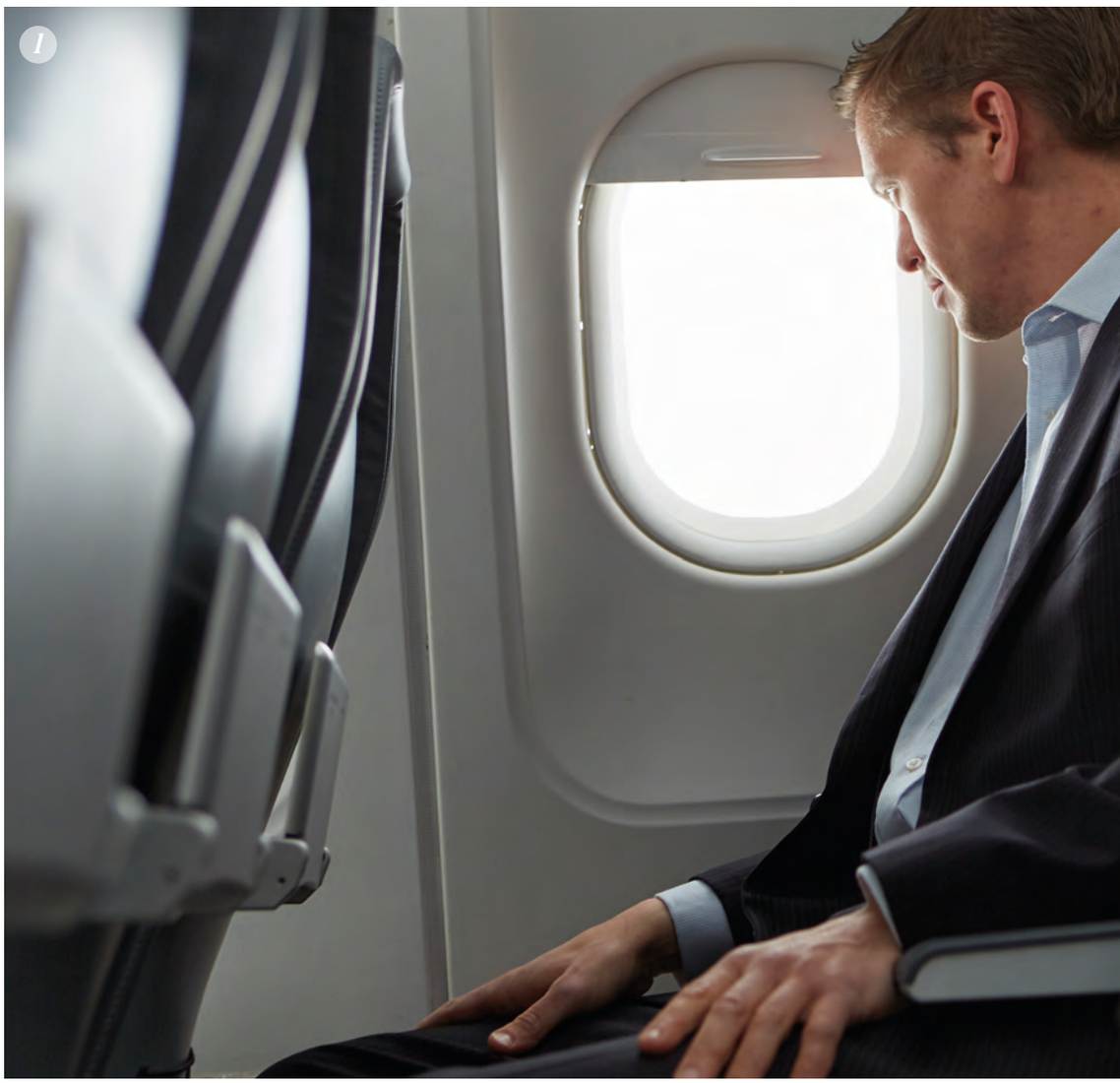
Passengers are sitting comfortably as airlines upgrade to ELeather. Here's why airlines across the world are considering a move from fabric seat covers

For decades we have seen the aircraft interiors industry dominated by fabrics, especially in the seating upholstery sector. Industry reports indicate that this majority share of the market could continue through to 2024, with up to 70% of the overall soft goods market being attributed to fabric. There are many reasons – emotional as well as commercial – why fabric has been the material of preference in the past. But one major reason is that until a few years ago there weren't many alternatives to choose from.

In the past few years material suppliers in the aerospace supplier industry have diversified, offering airlines a wider choice of materials with a much broader spectrum of commercial, performance and passenger experience benefits. With the increase in passengers leading to growth in airline fleets, the number of seats requiring upholstery will also increase. This, together with the wider choice of materials, has led to a shift in certain regions to consider alternatives to fabric, resulting in some new material technologies, such as leather fiber composites, growing at a fast pace.

The North American market has led the way with this movement, with four of the largest airline operators making the decision to upgrade to ELeather leather fiber composite.

Louise Gear, head of sales at ELeather says, "When ELeather went to market in the aviation industry with our leather fiber composite products, North America was quick to recognize the multiple benefits that a new, more sustainable and higher-performance material could offer. People were very open to change and new material innovations, which is perhaps why this product has been adopted so heavily."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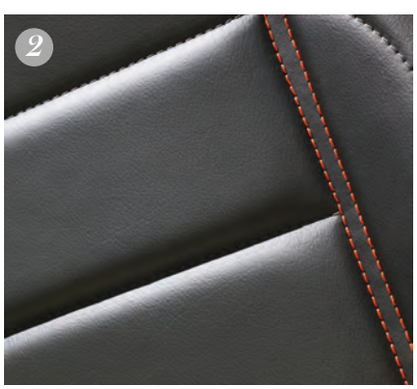
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Understanding the pros and cons of each material option is critical in selecting the right product for individual airlines.

Using fabric can be attractive to designers and brands due to the ease of branding by mixing colors and patterns, and fabric is often considered to have a connection to comfort due to the soft texture. The difficulty with fabric is that spills and stains can be a problem, particularly dark liquids like red wine and coffee. Even when immediate action is taken, it's more about damage limitation than a complete fix.

Fabric seats are not often the best option for quick cleaning or retaining hygiene and freshness, meaning that replacement and spare covers are needed,

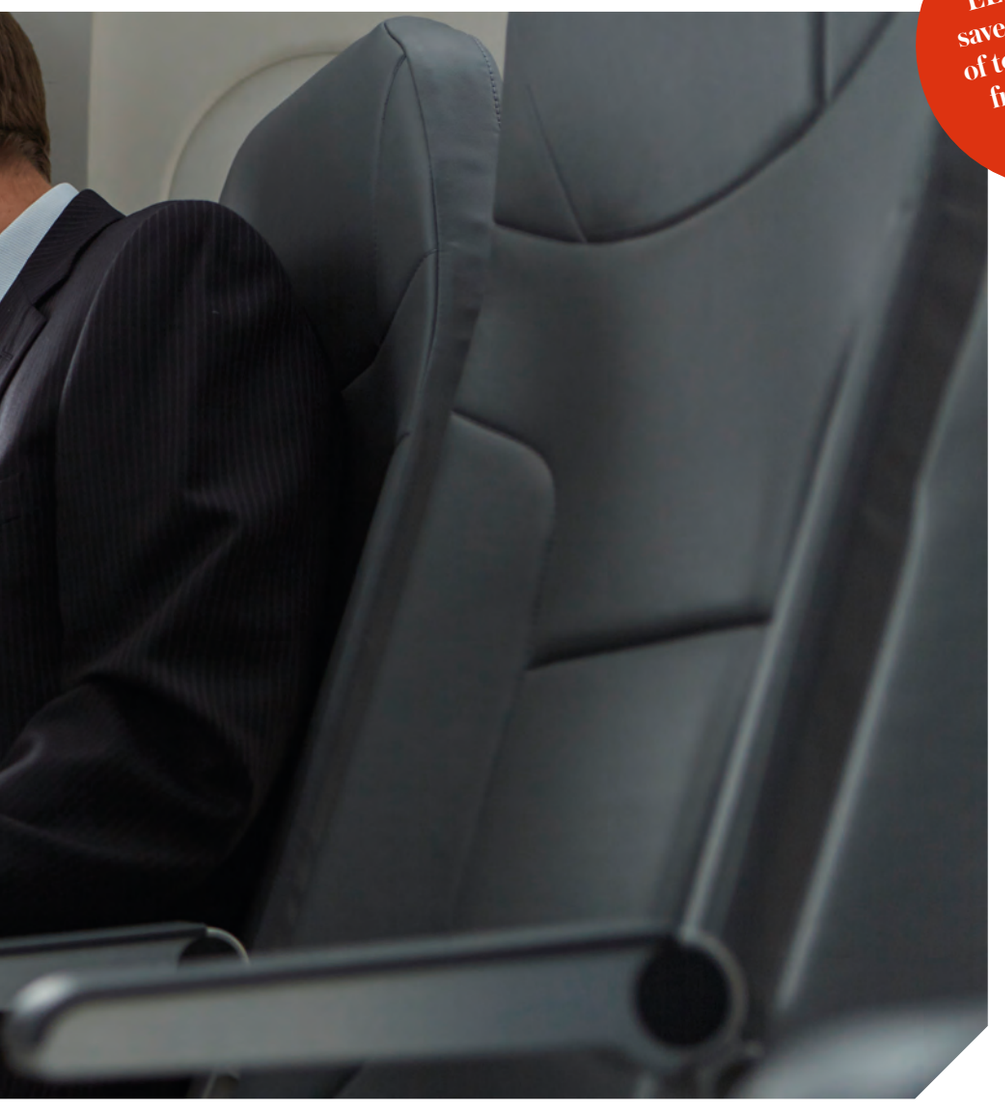
# "THE PRACTICAL REASONS FOR SELECTING ELEATHER ARE CLEAR"

1. ECONOMY SEATS FROM ACRO, TRIMMED IN ELEATHER

2. CONTRAST STITCHING CAN ADD VISUAL INTEREST

3. 3D EFFECTS CAN BE INCORPORATED TO TRANSFORM THE APPEARANCE OF ELEATHER

**ELeather has saved thousands of tons of leather from going to landfill**



which can cause downtime between changeovers. In addition, fabric covers may require renewing after the specified number of cleans has been reached, due to the loss of flammability protection.

Over time, daily wear and tear will not affect the high-quality look and feel of ELeather as it won't sag or bag. Scratches or bumps from baggage are minimized, so airlines can rest assured it will withstand a large number of flights.

Gear continues, "We are working with a number of well-known airlines that have switched from fabric to ELeather due to the significant benefits it offers them and their passengers in terms of ease of maintenance and hygiene – as well as the fact it's a more environmentally friendly product to make and use."

One North American legacy carrier realized that by switching to ELeather seats its onboard maintenance between flights was reduced, resulting in overall on-time performance improvements. Similarly European low-cost carriers have been impressed with ELeather's easy maintenance whereby spillages can be removed with a quick on-wing wipe down.

Gear concludes, "I've been in the industry for a long time and have seen a lot of innovation in aircraft interiors. Recently there seems to have been a sharp rise in this area and we are excited to see other airlines across the world starting to follow suit with their material choices. The practical reasons for selecting ELeather are clear, but what's great is that operators tell us it has also enhanced passenger comfort."

ELeather is an environmentally friendly material that is clean-tech manufactured from unused traditional leather fiber. The company operates a zero manufacturing waste to landfill policy and recycles over 90% of all waste, converting it into energy that is fed back into the process. The carbon footprint is minimized by selecting local partners for waste management and supporting local farmers by supplying them with waste converted into fertilizer.

There are no harmful adhesives used during the hydroentanglement process – only the power of water, 95% of which is recycled. In addition there are no harmful chemicals required to keep the seats clean and looking like new.

# WHAT IS COMFORT?

Unbeatable comfort and ultimate performance: Ultrafabrics and Tapis are bringing the science of comfort to aviation seating

What is comfort and how important is it in the airline passenger purchasing decision? Comfort can be defined as being in a state of physical ease and freedom from pain or constraint; something that contributes to physical ease and well-being; and a satisfying or enjoyable experience. Within aircraft interiors, a new term is starting to have an impact on airline decision making: perceived comfort. So what is perceived comfort, and what effect does it have?

Studies have shown that, depending on flight length, 20-40% of air passengers consider the cabin environment as the most important factor when choosing an airline. If we were to apply an order of priority in the decision-making process when purchasing a ticket, it might look like the list below.

With aircraft designs becoming more technologically advanced, we are seeing longer flights and an entirely new criteria of flight experience, with ultra-long-haul travel often exceeding 16 hours. The next-generation Airbus A350 XWB ULR (Ultra Long Range), has a range of 9,700 nautical miles or 18,000km, which equates to a 20-hour flight time. Launch carrier Singapore Airlines will fly this aircraft non-stop from New York to Singapore – a flight duration of 18 hours and 45 minutes.

At what point does the perception of comfort within the cabin interior start to become a higher priority within the passenger decision-making process? Airlines now have better options to address the implications of strapping someone into a seat for almost 19 hours and diminish the harsh physiological effects that may have on the fare-paying passenger.

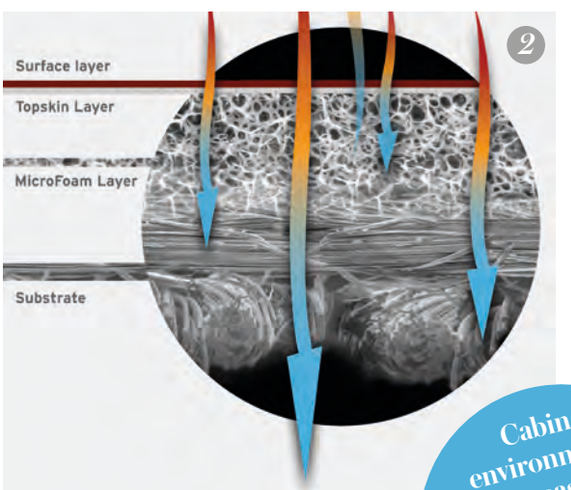
One of the key factors in determining whether a seat is comfortable or uncomfortable is the build-up of heat. Human bodies are very sensitive to the smallest change in temperature. Research has found that the wetness of skin in different areas affects the

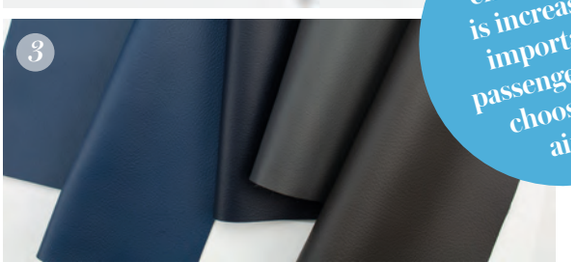
1

## PRIORITIES WHEN SELECTING AN AIRLINE TICKET

1. *Route availability*
2. *Total journey length*
3. *Price*
4. *Frequent flyer programs*
5. *Comfort*
6. *Airline customer service*
7. *Flight delays*
8. *Baggage issues (lost, damaged, etc)*

"ONE OF THE KEY FACTORS IN DETERMINING WHETHER A SEAT IS COMFORTABLE IS THE BUILD-UP OF HEAT"




1. THE ULTRAFABRICS RANGE HAS VISUAL APPEAL. PHOTO: LIFT BY ENCORE. SEAT: LOT POLISH AIRLINES
2. A CROSS SECTION OF ULTRAFABRIC SHOWS HOW COMFORT IS ACHIEVED
3. PROMESSAAV FEATURES A PROPRIETARY BACKCLOTH
4. ULTRALEATHER IS A PORTFOLIO OF PREMIUM POLYURETHANE FABRICS


**Cabin environment is increasingly important to passengers when choosing an airline**

perceived thermal comfort of the body. And increased humidity from sweating, a common factor when sitting in ultra-long-haul flights, can lead to a perception of discomfort.

Since 1977, Tapis and Ultrafabrics have collaborated to help change expectations of what performance fabrics can be, and what they can do and feel like, as well as to provide superior animal-cruelty-free materials to the aviation industry.

Inherent in the creation of all Ultrafabrics polyurethane materials is the company's proprietary Takumi technology, a process that can achieve the perfect balance of comfort and performance. The company's innovative process engineers mastered performance directly into four layers – all designed and optimized to provide the maximum comfort and aesthetic performance possible from a lightweight high-performance fabric.

The foundation of all Ultrafabrics is the base layer, which is made from proprietary blends of fibers that have a controlled amount of elasticity in both warp and fill orientations. The second layer, an open-cell structure foam layer, allows high moisture transfer and provides ultimate thermal comfort for body climate regulation. The final layers are the top skin and surface layers, both of which are made using the highest grades of polycarbonate resins, engineered for high strength and flexibility built into a thin layer that increases heat transfer and improves comfort.

Within Ultrafabrics' unique manufacturing process, there are no plasticizers or treatments that can block vapor transfer, effectively dissipating heat and moisture from the body without creating additional surface condensation. This allows a consistent surface temperature and regulates the heat generated by passengers as they experience their journey. And by reducing the human body's propensity to perspire, it removes a key factor in influencing a passenger's perception of discomfort.

While we cannot overlook the impact of other factors in the cabin interior, such as seat pitch, seat width and cushion design, perhaps Ultraleather is the perfect companion for ultra-long-haul seating?

FREE READER INQUIRY SERVICE
To request more details from Tapis, visit www.ukimediaevents.com/info/aim

# FEEL AT HOME

With 85 years of furniture industry experience, rohi really knows what it takes to create a true 'feel at home' atmosphere on board an aircraft

When seeking to craft a comfortable cabin experience rich in detail and informed by years of insight into what drives a satisfying, sensory and superlative living room, bedroom or office environment, it's natural for an airline to turn to a design firm that has knowledge of the domestic interior market.

However, when it comes to seeking specialist manufacturers to help realize such a cabin vision, it is very rare indeed to find an established aerospace supplier with a profound understanding of the domestic furniture sector, capable of balancing the precise engineering requirements of aviation with the attention to detail demanded by discerning domestic consumers.

One company stands out in its ability to bridge both of these worlds. Bavaria-based textiles manufacturer rohi, which in 2018 celebrated 85 years of serving the domestic interior sector, is also well established in the aeronautical world, having won its first contract to supply an airline back in October 1978.

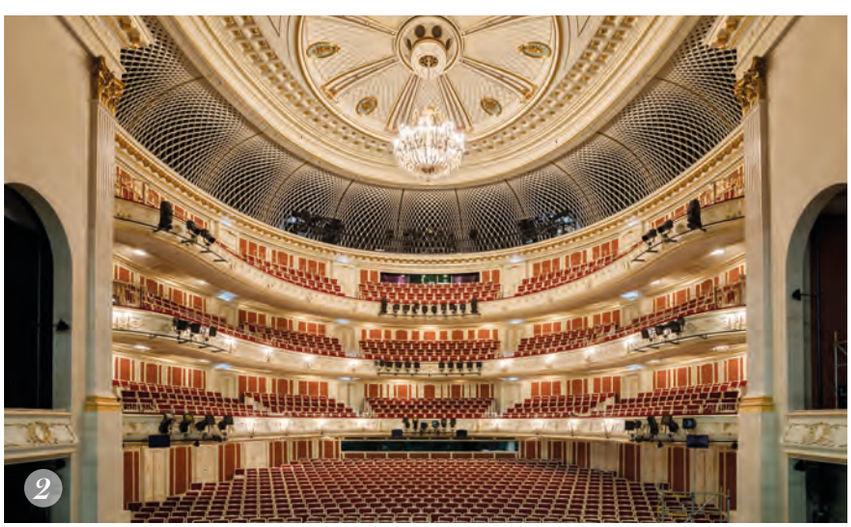
1

"Airline customers profit from rohi's knowledge in the decor and furniture industry, which helps create the perfect 'feel at home' atmosphere inside the cabin, as well as from our expertise in public projects, which require high-demand, hard-wearing fabrics with good acoustic properties," explains rohi's managing director, Philipp Dahm, who is married to fellow managing director, Katrin Hielle-Dahm.

**rohi won its first airline textiles contract in 1978**

The family-owned German business has strong roots in the furniture industry. "It all started in 1933, when Marga Hielle-Vatter, Katrin's grandmother, began creating fabrics for domestic furniture, winning numerous design awards," explains Dahm. "And then Katrin's father, Bernd Hielle, established an in-house test lab at our headquarters, south of Munich, to ensure our fabrics were able to meet the highest quality standards and outperform the tough technical specifications set by the airlines, aircraft manufacturers and aviation authorities."

Many aerospace suppliers continue to reference domestic interior trends when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"ROHI KNOWS EXACTLY HOW A FABRIC CAN GIVE PASSENGERS A SENSE OF WELL-BEING"

trying to capture an airline contract, but few are able to call upon decades of ingrained experience and knowledge of what works and why.

"It's all about understanding comfort," says Dahm. "To be able to create a 'feel at home' atmosphere using soft, warm and cozy accents that promote well-being and a space on board where you want to spend a lot of time."

Of course, an aircraft sees a great deal more wear and tear than your average room at home. However, rohi's successful track record in public sector furnishing ensures it is able to enrich its understanding of domestic comfort with a strong dose of durability.

"Over time, rohi has won prestigious projects for public spaces such as the Berlin Philharmonic Hall and the Munich Olympic Hall, as well as hotel interiors and office buildings," explains Dahm. "In all these projects there are always tough requirements for fabrics to meet specifications regarding their abrasion qualities, flammability and acoustic performance. The fabrics need to perform in very demanding, high-use areas, not too dissimilar from your average aircraft."


1. ROHI HAS CUSTOMIZED UPHOLSTERY TEXTILES FOR MANY AIRLINES AROUND THE WORLD SUCH AS AIR CANADA. PHOTO: AIR CANADA

2. STAATSOPER UNTER DEN LINDEN IN BERLIN. PHOTO: GORDON WELTERS

3. AIRLINES CAN BENEFIT FROM ROHI'S EXPERIENCE IN LUXURY DOMESTIC TEXTILES FOR CLIENTS PHOTO: COR

Overall, Dahm is convinced the positive synergy that results from rohi's three business segments offers a real benefit to customers.

"Thanks to our decades of experience in the furniture sector, rohi knows exactly how a fabric can give passengers a sense of well-being in an aircraft cabin, while our understanding of the public sector ensures that the fabric will last and provide good value for the airline. We are proud that this in-house experience remains unique in the market and is valued by customers."

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To request more details from rohi, visit **www.ukimediaevents.com/info/aim**

# E-JETS E2

## The Embraer E-Jets E2 cabin design enables passengers to take control of their personal space

**The Embraer E2 cabin design won a Crystal Cabin Award in the Industrial Design category**


Nobody likes a middle seat on an airplane. There is, however, an exception to that statement: people do like a middle seat when it is empty next to them, a coveted space due to the distance it creates between fellow travelers. When that middle seat is occupied, personal space is reduced and everyone becomes territorial. The armrest instantly defines the boundary of personal domains.

Embraer recognized the importance of personal space when it designed the cabins for its first-generation E-Jets. The absence of a middle seat, combined with an extended floor-to-ceiling height, large windows for lots of natural light, and unobstructed under-seat stowage, set new standards in spaciousness and comfort among aircraft of similar capacity – even when compared with some larger narrow-body jets.

When Embraer began designing the cabin for its second-generation E-Jets – the E2s – Embraer took the concept of personal space to the next level. It built a mock-up of its proposed cabin and invited cabin staff and very frequent flyers to evaluate the interior. Their feedback was enlightening, with one theme emerging above all others – a need to control one's territory.

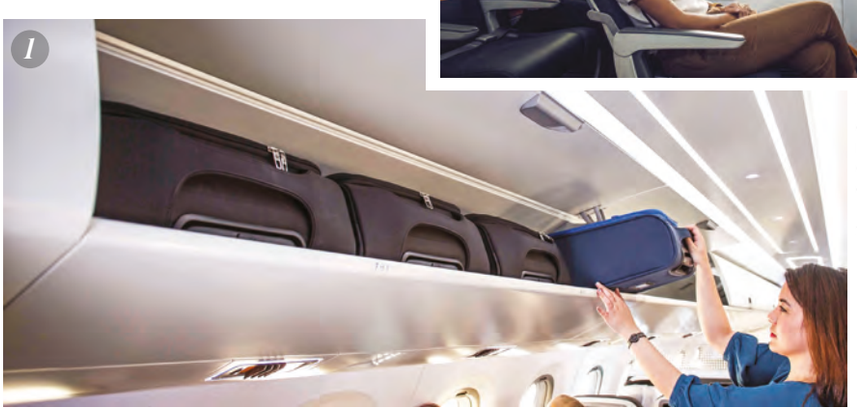
Embraer engineers worked with UK aircraft interior design firm Priestmangoode to give E2 passengers more control over their realm of personal space. Overhead bins now fit 90% more carry-on bags per passenger than the first-generation E-Jets, and they can accommodate them wheels-in. Passengers find it easier to stow their bags near their seat rather than having to hunt for available bin space several rows away and struggle to reclaim them when deplaning.

The PSUs have been completely redesigned. Instead of reaching across and above the head of a seatmate to adjust gasper direction and flow, or to turn a reading light on or off from a central, common panel, E2 passengers have individual air vents and light controls directly above them. Every seat has its own power outlet – nothing is shared. Even the E2's seats are wider than those on most narrow-body jets.

These small changes have made a big difference. E2 passengers frequently comment about the extraordinary space in their immediate and extended seat areas. More space reduces stress and gives people a greater sense of control over their domain.

Embraer engineers know that airlines value space as much as passengers. The E2 has a unique seat-rail design that lets operators pitch seat rows in half-inch increments for more flexibility in cabin configurations. Many interior structures are modular for easy access and maintenance.

The innovations in the E2 cabin are so impressive that Embraer won a 2015 Crystal Cabin Award in the Industrial Design and Visionary Concepts category. But, like the first-generation E-Jets, the most impressive feature of the E2 is that everyone can now claim his or her own territory – in peace, in comfort and in control.


1+2. THE E2 CABIN FEATURES INDIVIDUAL OVERHEAD CONTROLS AND 90% MORE STOWAGE SPACE THAN THE FIRST E-JETS


COMFORT SEEKERS FLY E2
NO MIDDLE SEAT MEANS UNRIVALLED PASSENGER SPACE AND COMFORT
• The most efficient single-aisle aircraft
• High aspect ratio wing for increased efficiency
• On time, on budget, better than original spec.
#E2ProfitHunter
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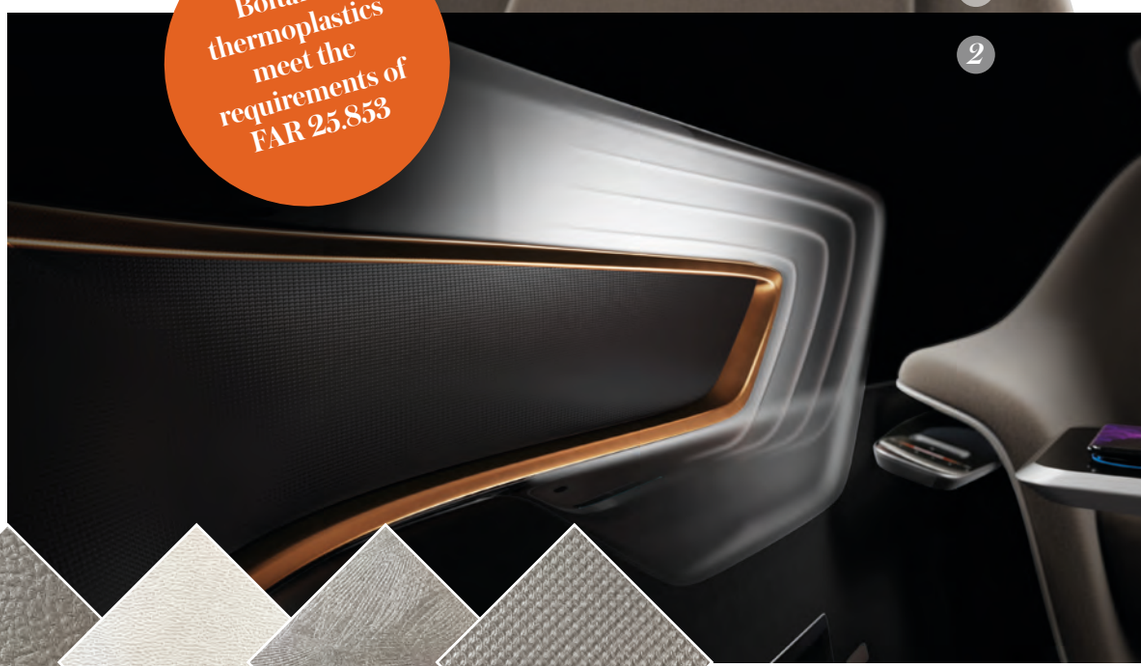
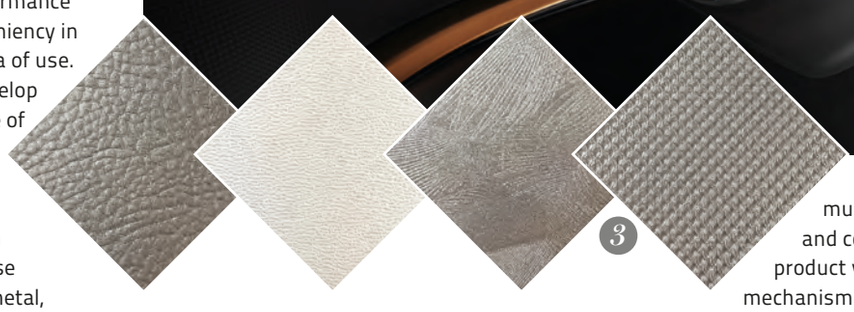
CHALLENGE.
CREATE.
OUTPERFORM.

# PERFORMANCE PLASTICS



**Boltaron thermoplastics meet the requirements of FAR 25.853**



Boltaron is creating eco-friendly, long-lasting and lightweight performance plastic for the aircraft interiors industry

Reducing aircraft cabin weight to minimize fuel consumption is not a new topic of conversation; however, the push for airlines to become more environmentally friendly and more fuel-efficient aircraft operators remains strong. One area where there is room and opportunity for more development is in aircraft interior components, which must meet FAA compliance for performance and safety, but offer greater leniency in adaptations, depending on area of use. Therefore, the race is on to develop new materials that are capable of replacing older, heavier aircraft interior components.

For private and commercial aircraft carriers, the focus is on finding new opportunities to use lightweight plastic to replace metal, aluminum, or even a heavier plastic material, without compromising performance or safety. Depending on where the component is used, several code requirements such as impact strength standards or fire-retardant ranges may need to be met. For example, the weight of six thermoformed aircraft seat shells using Boltaron 4330L would be equivalent to the weight of five thermoformed seat shells using standard FAR materials – offering unimaginable weight and material savings.

Lighter aircraft use less fuel, which opens up endless opportunities for new routes with fewer stopovers, in turn offering greater cost savings.

Performance cannot be compromised when designing lighter weight material for aircraft interior components. Thermoplastics used for seatbacks, tray tables and IFE bezels are nearly half the weight of the same components made of metal. In many cases, performance plastics that replace other materials outlive the life of the aircraft itself. When altering material chemistry, there are many performance requirements that still need to be met. Some of the most notable are: outstanding flame, smoke and toxicity characteristics (all plastics must meet the flammability, smoke and heat release requirements of FAR 25.853(a) and (d)); high temperature resistance; superior resistance to impact, vibration and abrasion; and UV resistance, chemical resistance and scratch resistance.

The environmental aspect of producing lighter weight options for aircraft interior components includes a standardization process. When design engineers can source components for use across a variety of applications in the cabin, the new product design process is less costly.

Aerospace OEMs are also investing in higher production tooling for lower overall program costs. In addition to the cost and time savings provided by designing a standardized mechanism, this also enables OEMs to use one solution across multiple aircraft platforms and considerably reduce the product validation process. Proven mechanisms ensure reliability of operation and consistency, which can ultimately influence a passenger's perception of airline quality.

1+2. THIS SEATING CONCEPT SHOWS HOW BOLTARON THERMOPLASTICS CAN BE APPLIED THROUGHOUT FOR A LIGHTWEIGHT, HIGH-QUALITY DESIGN

3. SEVERAL COLORS AND FINISHES ARE AVAILABLE

One concern when replacing traditional component materials with lightweight performance plastics is that new components will not convey top quality to the passenger, or may negatively influence the inflight experience.

In fact, fabricators are finding new ways to enhance the aesthetics of high-performance plastics through thermoforming and other techniques and tools. Boltaron's 4330L, for example, is a lightweight thermoplastic sheet that meets FAR 25.853 with a 20% reduction in weight compared with standard thermoplastic material. This provides limitless ways for designers to bring dreams to life and delight customers.

# CUSTOM SHEET DESIGN MEETS DOOR TO THE FUTURE

Boltaron® 9000 Series thermoplastic materials are ideal for business class seat sliding doors and dividers. These impact tested translucent panels can be customized with decorative prints and interesting textures to invent a private space with a sophisticated appeal.

Partner with Boltaron for hands-on design and engineering support to create interior components that will meet the demands of tomorrow's aircraft interiors.

**Visit us at Aircraft Interiors Boston in stand 610.**

**RELIABILITY** MEETS **INNOVATION**

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# DYNAMIC DATA

Whether airlines need technologies for crew engagement or content streaming, stowage space monitoring or device charging, Astronics and its subsidiaries have developed effective solutions

**Astronics was recently granted several US patents for its intelligent bin solution**

For years, data between crew and passengers was limited to an illuminated sign on the wall or closed overhead bins. Not any more.

Through its many subsidiaries, Astronics brings connectivity, data, power and other technologies to the aircraft to not only improve the passenger experience, but also boost the crew's ability to serve customers efficiently.

Rising passenger expectations range from how they charge personal entertainment devices (PED) to how they connect those devices to wi-fi, and from the availability of IFE to how they interact with PSUs. Astronics is working to help its airline customers meet passenger and crew demands.

Astronics Ballard Technology is helping enable airlines to increase operational efficiency through its new IoT bin-sensing technology. Crew members can wirelessly gather information to understand exactly how much space remains above passengers' heads as bags are stowed. Improving boarding times through this insight increases efficiency and starts the passenger journey with a positive experience. This simple and secure technology also increases cabin safety by delivering real-time alerts during flight when problems occur in bins. The crew can take proactive measures to avoid aircraft diversions, increasing operational savings, and helping ensure passengers arrive at their destination on time.

While in their seats, passengers don't always know the best way to interact with crew. Call buttons are efficient to an extent, but they don't allow passengers to indicate in advance exactly what they need. PSUs also don't provide passengers or crew with a lot of information. This not only delays service, but can also be a safety concern for crew, who have to walk from the galley to the seat/row in question, and back again. Astronics PECO is working to improve the PSU to enhance communications between passengers and crew for better safety and faster service. Looking beyond upgrades to lighting, airflow and the emergency oxygen system, Astronics PECO is now building 'smart' into the conventional PSU.

1. BIN-SENSING TECHNOLOGY ENABLES THE REMAINING OVERHEAD STOWAGE SPACE TO BE PRECISELY CALCULATED FOR CREW

"PASSENGERS EXPECT PED CHARGING TO BE AVAILABLE ON EVERY FLIGHT"

Passenger needs/desires today include the expectation to be able to charge all their PEDs seamlessly and enjoy their entertainment options as they would at home. In fact, with many narrow-bodies employing a 'bring your own device' system, power is essential to provide a satisfactory IFE experience.

When it comes to their PEDs, passengers expect charging to be available on every flight, compatible with their device, and conveniently placed. Two technology trends in PED power are also driving new passenger power trends in the cabin: USB Type-C availability, and wireless charging options. For these reasons, Astronics Advanced Electronic Systems (AES) recently introduced its EmPower USB Type-C outlets as well as a new EmPower® wireless charging module.

To answer the challenges of meeting passenger expectations for uninterrupted streaming, Astronics Connectivity Systems and Certification (CSC) is delivering newer and better technologies in IFE hardware systems for improved passenger experiences. Astronics CSC sees the ability to stream video-on-demand (Netflix, Hulu, etc) as becoming more commonplace in aircraft, and is developing technology solutions within its line of servers, wireless access points and content loaders to deliver more bandwidth at higher speeds.

Additionally, Astronics AeroSat's FliteStream SATCOM antenna systems are now certified and available to provide high-bandwidth signals to Astronics CSC's IFE hardware components. The next-generation FliteStream F-310 satellite modem technology provides passengers with maximum internet and data speeds from a single antenna.

As a trusted partner to the airline industry for 50 years, Astronics leverages its unique and diverse industry knowledge to move the commercial aircraft world forward with new ideas, new products and new services.

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# Aircraft interiors INTERNATIONAL

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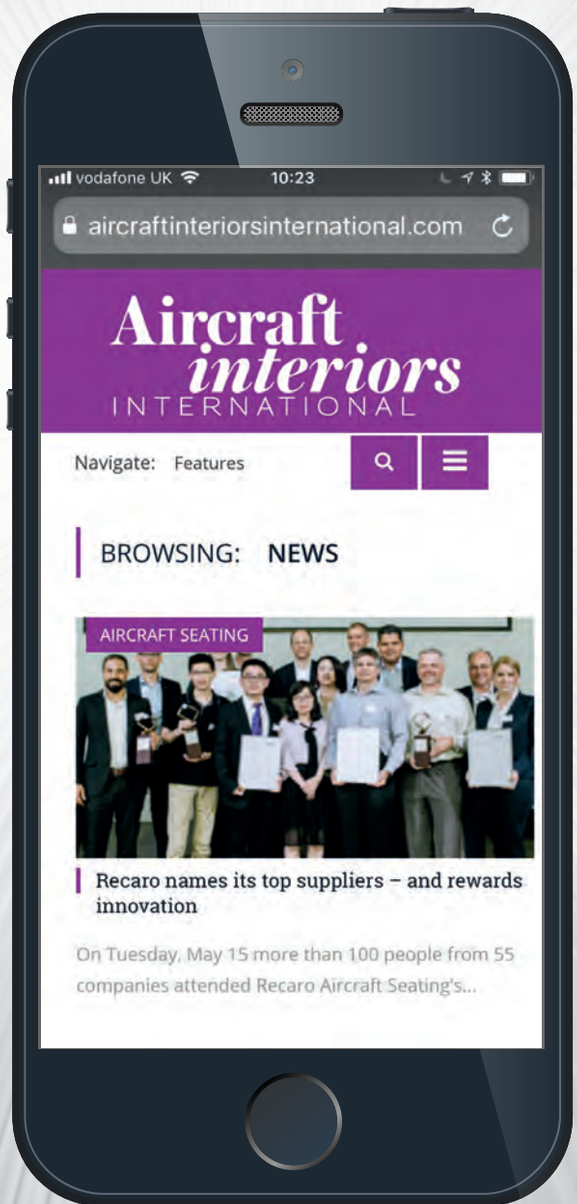





**www.aircraftinteriorsinternational.com**

# TIME AND MOTION

Reliability and performance are in the DNA of Stelia Aerospace, as shown in its delivery record and its latest passenger experience innovations

1. THE SYMPHONY SEAT HAS ENTERED SERVICE ON SINGAPORE AIRLINES' B787-

**Stelia Aerospace has a 100% record for on-time delivery and quality**

Choosing the right partner for premium seating projects is more critical now than ever before. Indeed, premium class seats are essential to the image and values of airlines, a factor that is boosting demand for innovative solutions and original design. Stelia Aerospace is taking up this design challenge through an original collaborative approach and has proved itself to be a reliable supplier by maintaining its 100% record for on-time delivery and quality.

Among recent events at the company was the successful entry into service of a new business class seat for Singapore Airlines' B787-10 fleet. This seat was developed in close cooperation with the airline and features no fewer than 14 customized items that perfectly illustrate Stelia Aerospace's industrial capacity, performance and reliability.

From generous dimensions to enhanced privacy, the Symphony seat has been developed with passenger comfort in mind. The trim and finish was also given particular attention with the inclusion of luxurious items such as Alcantara padding, which also helps create a natural noise-canceling passenger envelope.

The co-creation and development work carried out for the Symphony business class seat has been successfully applied to other projects, creating variants of Stelia Aerospace's existing Opal and Equinox business class seat portfolio, as well as an A380 first class suite project for a confidential customer. This remarkable rework of existing platforms means that they match the specific needs of Skytrax 5-star airlines and top-tier customers, while reducing lead times, simplifying the selection process and helping throughout the whole customization process.

2

Through a specific and agile process developed internally, innovative ideas are flowing from designers, program managers and engineers to airline focal points and decision panels.

The ideas are being tested and quickly adopted at every stage of the project development process thanks to the knowledge of Stelia Aerospace's team of experts and its long-standing design partners. This expertise is bringing blue sky thinking to ultra-long-haul passenger experiences.

Stelia Aerospace is passionate about technologies. It showcased a smart seat during Aircraft Interiors Expo 2018, and the positive reception to the design is seen as a clear endorsement of its R&T team's work on new and high-tech solutions to improve the passenger experience.

The company is making progress in design and technology, and is steadily pushing the technology readiness toward full offerability. The scope of solutions can be categorized as 'home' for a feeling of a home from home, 'well being' for noise reduction and smart sleep, and 'crew support' to enhance cabin service and enable smart maintenance solutions.

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combining passenger comfort and cabin space optimization

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STELIA
RELIABILITY. PERFORMANCE.

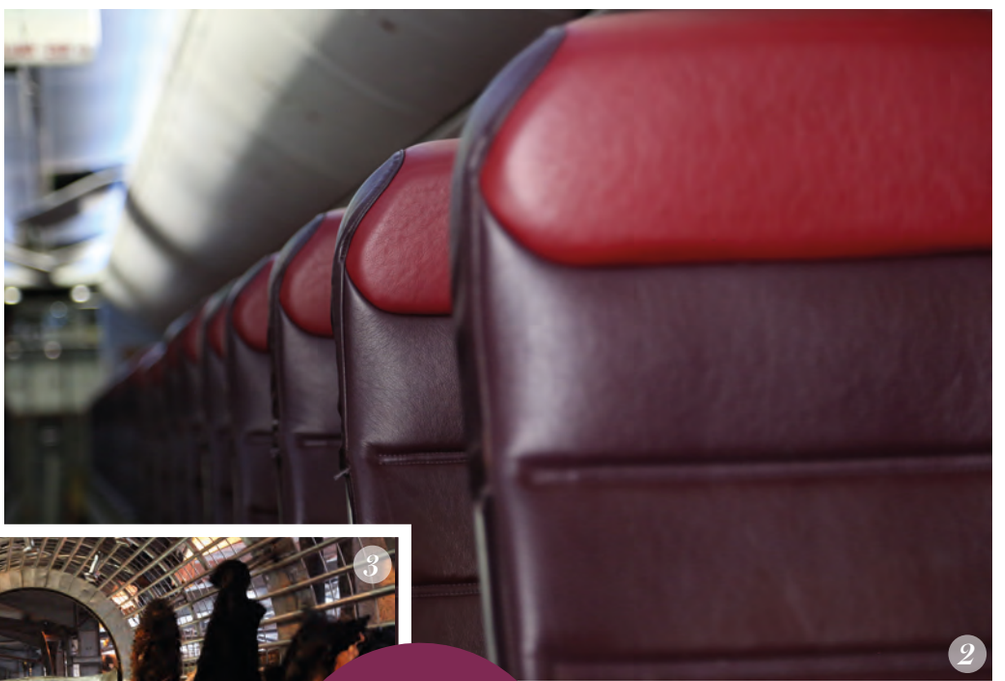
# NATURE CALLS

Genuine leather offers many benefits as an aircraft seating material, especially when it has been processed by Muirhead Leather using environmentally sound principles


1

With so many manufacturers and traders claiming their alternative aviation seating materials are the lightest, best performing and most eco-friendly, the question that comes to mind among all the greenwashing is: which one is truly sustainable? Traditional leather or man-made alternatives?

To be called leather, the raw material must come from an animal: anything else cannot legally be called leather. In the case of seating leather, that typically means from cattle. Cattle are generally reared for meat or dairy products, and therefore leather is mostly a by-product of the food industry and is sustainable so long as people consume meat and milk. If that hide was not converted into leather and went to landfill, it would have a bigger negative impact on the environment. It is a generally accepted fact that good meat comes from cattle that have benefited from a high standard of animal welfare. Quality meat usually means a quality hide whose source is transparent and traceable.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3

Next, one has to look at raw material sourcing. Where do the hides come from? Shipping raw and partially processed hides around the word increases the carbon footprint and is not environmentally friendly. The leather manufacturing process itself has to be considered, which includes the environmental integrity of the whole supply chain.

Scotland-based Muirhead Leather, part of the award-winning Scottish Leather Group, the UK's largest manufacturer of leather, and whose environmental credentials are of the highest standard available anywhere, have placed their future on a truly sustainable manufacturing process.

Muirhead hides are typically sourced within 300 miles of the factory, working with abattoirs and meat processors who practice the highest animal welfare standards. Muirhead subscribes to the Five Freedoms set of principles drawn up by the Animal Welfare Council. The manufacturing process takes the unprocessed hide right through to finished leather. The company is unusual in this respect, but benefits from having the entire manufacturing process under its control.

**Muirhead Leather also runs an apprentice scheme for leather production**

Data analysis following an EU Benchmark shows that Muirhead produces each square meter of leather using half the amount of water of any European leather. Over 50% of the water used by the Scottish Leather Group is recycled through its Ultra Filtration Plant. The group has reduced its carbon footprint from 10kg of $CO_2/m^2$, to under 4kg.

The natural skin grease is extracted from the waste from the manufacturing process and sold to produce biodiesel, and the solid waste is processed through a £6m (US$7.7m) groundbreaking, patent-protected thermal energy plant developed by the company to convert solid waste into energy for use in the manufacturing process. It is the only plant of its type in the leather producing industry.

So what does the future hold? Muirhead is constantly looking for ways to further reduce its carbon footprint and thereby increase sustainability. Development is ongoing into reducing weight, and alternative methods of chemical processing are continuously being adopted. Development of leathers that look and feel more natural but retain the highest level of durability required by aviation is also ongoing. The company looks upon its waste products as a resource and is continually developing products from them, all of which assist the sustainability of its product and process.

1. THE ULTRA FILTRATION PLANT MAKES MUIRHEAD VERY WATER-EFFICIENT

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3. ALL RAW MATERIALS ARE SOURCED LOCALLY

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# HIGH ENERGY

True Blue Power has developed a range of efficient charging technologies to meet growing demand for USB and wall outlet power in the cabin and cockpit

From accessing charts and up-to-date weather data, to downloading passenger information and assisting with food and drink selections, pilots and flight attendants are now turning to tablets, electronic flight bags (EFB), point-of-service card readers and other electronic devices more than ever. This increasing reliance on technology means that pilots and crew members are in need of reliable USB and wall-outlet power, in addition to the usual power requirements for galley equipment.

True Blue Power inverters, voltage converters and USB charging ports are the answer. These technologies can supply this much-needed power, and they are designed to be compact and highly efficient. FAA/EASA certified, and typically installed as a minor alteration, True Blue Power products offer non-stop productivity on the fly, and are currently providing power to the crews and passengers of more than 50 airlines worldwide.

## 250W OF WALL-OUTLET POWER

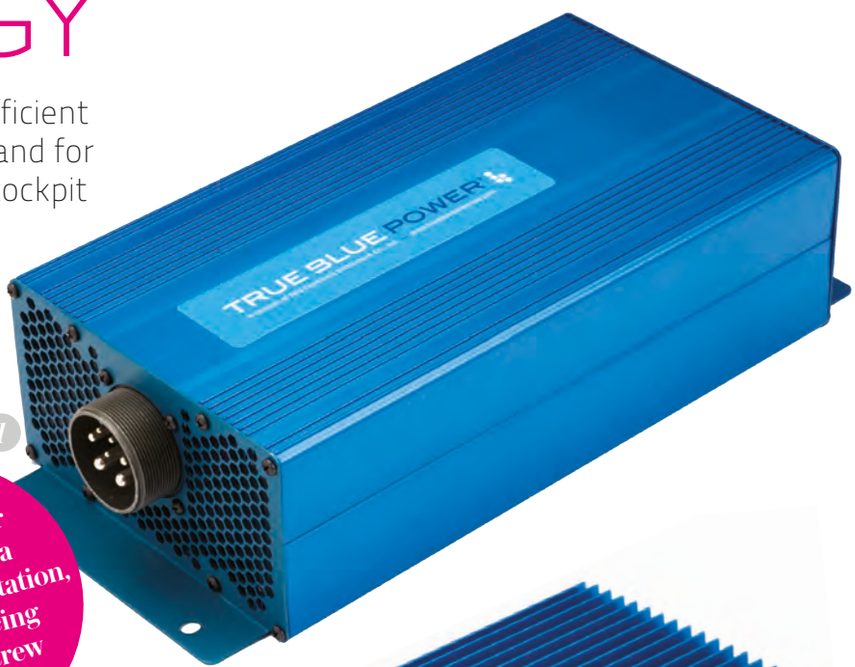
True Blue Power's TI250 delivers 250W of AC power from the aircraft's 28VDC input. The 250W inverter is TSO/ETSO certified and is ideal for EFBs and the power-hungry electronics found in the cockpit. Engineered to run cooler and featuring a fanless design, the highly efficient TI250 saves energy and reduces weight.

## 2,000W OF WALL-OUTLET POWER

The TI2000 inverter provides 2,000W of wall-outlet power to cabin and galley equipment, including personal electronic devices, microwave ovens and coffee makers. This 2,000W, TSO/ETSO-certified inverter is small, light and efficient.

1. THE TC2000 DC POWER UNIT

2. 280W VOLTAGE CONVERTER




1

**In-seat power is becoming a passenger expectation, as well as being useful for crew**


2

3. THE TA202 USB CHARGING PORT

4. THE TA102 USB CHARGING PORT

## 2,000W OF DC POWER

The TC2000 delivers 2,000W of DC power for IFE systems, interior and exterior lighting, and in-seat USB power. Just one TC2000 can power more than 100 single True Blue Power USB charging ports. This voltage converter is TSO/ETSO certified, lightweight and easy to install.

## 280W OF DC POWER

Weighing just 2 lb (0.9kg), the TSO/ETSO certified, 280W voltage converter delivers enough energy to power 18 single-port or nine dual-port USB chargers. The TC280 is currently installed on board several Boeing 737 aircraft, supplying power for LED cabin lighting. It can be found in use by many European airlines, providing power to in-seat USBs on Airbus 320, Boeing 767 and Boeing 757 aircraft.

## USB CHARGING PORTS

True Blue Power's TA202 high-power USB charging port provides a cutting-edge power source for current and next-generation devices. With the option of single and dual USB Type-A and Type-C configurations, each unit delivers 3A per port.

The TA102 USB charging port can simultaneously charge two USB devices at full power so that tablets and EFBs can stay fully charged and connected. The sealed units offer water-resistant protection against spills and surface-cleaning products. True Blue Power's USB charging ports are TSO/ETSO certified and RTCA DO-160G qualified.

3

4

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There's an ongoing power struggle on most aircraft today — not enough power for all the electronic devices pilots and passengers bring on board. The solution is True Blue Power®. The TA102 and TA202 Series USB Charging Ports power consumer products requiring a USB interface. These next-generation in-seat, cabin and cockpit power sources enable nonstop entertainment and business productivity on the fly.

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# SUPERSONIC CABINS

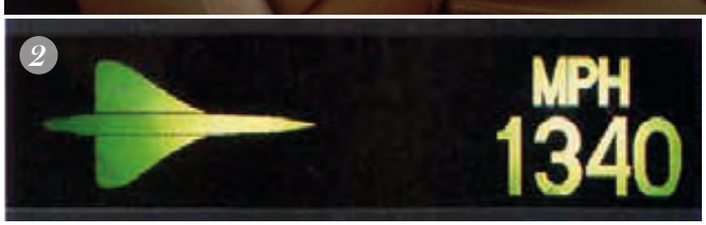
The second generation of supersonic commercial flights is coming, and the cabin designs look set to build on those of the legendary Concorde, finds Jennifer Coutts Clay

Second-generation supersonic aircraft development (as reported in previous issues of *Aircraft Interiors International*) has given cabin designers unprecedented opportunities to showcase advanced materials and innovative methods – manufacturing and installation processes unavailable during the early days of Concorde.

Examples include regular-size, instantly dimmable windows (instead of Concorde's basic window panes measuring just 6.5 x 4.5in); ease of accessibility (Concorde's 16in aisle width posed problems for mobility-impaired passengers); LED mood lighting (instead of warm white/cool white fluorescent tubes running along the ceiling panels in Concorde's cabins); and almost limitless, multiscreen in-flight entertainment options and virtual reality headsets (instead of Concorde's purely audio-channel content).

This new generation of supersonic aircraft cabins can also benefit from advances such as cabin coatings that are resistant to dents, marks and scratches; recyclable carpets, modular floor tiles and non-textile hard floor coverings; seats with microclimate features, massage facilities and lightweight seat foams that can be contoured to any shape; sustainably sourced, stain-resistant seat cover fabrics that adjust automatically to balance body temperature needs; and wi-fi enablement, PED connectivity and stress-reducing noise-cancellation systems.

You can download the e-book on Amazon, Apple iTunes and Google Play


1. ONLY AUDIO-CHANNEL IFE CONTENT WAS AVAILABLE ON CONCORDE

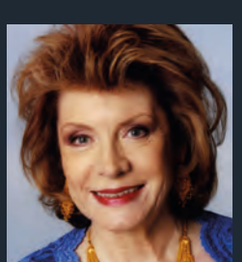
2. HOWEVER, THE SPEED INDICATOR ON THE FRONT BULKHEAD WAS ESSENTIAL VIEWING

Further advantages include antimicrobial surface treatments and UV lights to sanitize heavy-use areas; stylish bathrooms with touchless water-supply and garbage-disposal units; upgraded galleys with induction stove tops for onboard chefs to cook fresh meals; and biodegradable catering accessories and easily maneuverable galley trolleys.

Those flyers lucky enough to have experienced supersonic flight before will hope for cabin pressure to be maintained at Concorde's extremely comfortable level of about 5,500ft, and they will certainly welcome technological and green developments in the cabin environment.

However, there might be a revolt if airlines ventured to serve next-generation superfoods, as lauded by health gurus (e.g. fermented-seed chips with antioxidant powders). The *crème de la crème* clientele would never want to relinquish the superlative menus and dining standards pioneered for Concorde by chefs such as Alain Ducasse, the Roux brothers and Anton Mosimann. From the passenger perspective, these star chefs are the enduring guardians of the legacy of the glory days of Concorde.


## JENNIFER COUTTS CLAY



Jennifer Coutts Clay is the author of *Jetliner Cabins: Evolution & Innovation*, available on Amazon, Apple iTunes and Google Play. This e-book app provides details of hundreds of aircraft cabins.

As controller of corporate identity at British Airways, Jennifer was responsible for the cabin refurbishment and upgrade of the airline's supersonic fleet, as well as its subsonic fleets.

"The only comprehensive survey of the aircraft cabin environment from the 1970s to the present day."
*Airliner World*



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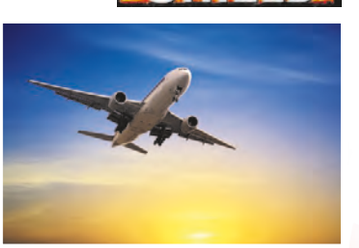

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# A year in numbers

LET'S FINISH WITH SOME KEY FIGURES FROM 2018, ANOTHER SUCCESSFUL YEAR IN THE AIRCRAFT INTERIORS SECTOR

Airline profits are expected to reach US$38.4bn by year end – up from US$34.5bn in 2017
**ResearchAndMarkets**

Inflight sales via cabin wi-fi will create US$1bn of additional revenue from e-commerce, advertising and premium content. This figure will grow to US$30bn by 2035
**SKYdeals research**

THE GLOBAL INFLIGHT CATERING SERVICES MARKET WILL GROW AT A CAGR OF 6.41% FROM 2018 TO 2022
**ResearchAndMarkets**

The global commercial cabin interiors market is estimated at US$26.02bn, and projected to grow to US$38.85bn by 2022
**MarketsandMarkets**

IT IS THE 50TH ANNIVERSARY OF THE BOEING 747 BEING UNVEILED TO THE WORLD
**See p38 for a celebration of the jumbo passenger experience**

Between April 2017 and March 2018, British Airways earned more than US$1bn in revenue from the JFK-LHR route
**OAG report**

**6.41%**

**747 is 50**

The global commercial aircraft market, valued at US$191bn in 2018, will reach US$255bn by 2028 – an expenditure of US$2.3tn
**ResearchAndMarkets**

IFEC REVENUES WILL GROW FROM US$3.7BN IN 2018 TO EXCEED US$8.4BN BY 2023
**Juniper Research**

The aircraft refurbishing market will bring in revenues of more than US$7.13bn by 2026 – up from US$4bn today
**Research Report Insights**

In 2018 Boeing delivered 568 airplanes: 407 B737s, 106 B787s, 37 B777s, 13 B767s and 5 B747s

AIRBUS'S OVERALL BACKLOG OF JETLINERS STOOD AT 7,383 AIRCRAFT AS OF SEPTEMBER 30. BOEING'S BACKLOG IS 5,849

In March, Boeing celebrated the 10,000th B737 coming off the production line. This particular airplane, a 737 MAX 8 for Southwest Airlines, broke the Guinness World Records title for the most produced commercial jet aircraft model

**40.73%**

EMBRAER CELEBRATED THE 50TH ANNIVERSARY OF THE FIRST FLIGHT OF THE BANDEIRANTE, A TWIN-ENGINE AIRCRAFT THAT LED TO THE CREATION OF EMBRAER IN 1969 FOR THE SERIAL PRODUCTION AND COMMERCIALIZATION OF THE DESIGN

**US$8.4BN**

In July, Air Baltic received the very first A220, a new joint venture between Airbus and Bombardier

Research conducted by Inmarsat during the year found that 55% of passengers consider inflight wi-fi to be essential

Traffic to ***aircraftinteriorsinternational.com*** grew by 40.73%

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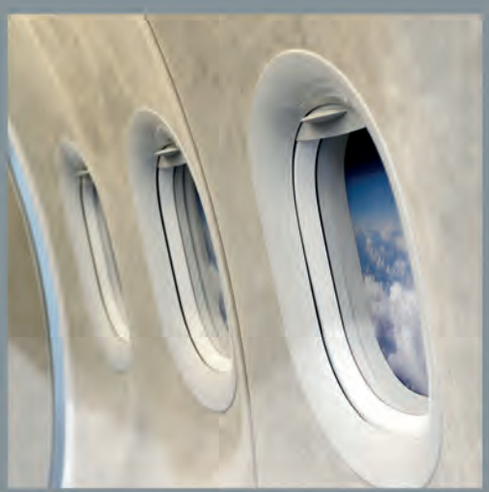


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