

Aircraft *interiors* INTERNATIONAL

JUNE 2016

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Introducing a brand that heralds a unified direction for Airbus cabins

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SEATING SPECIAL

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DANGER ZONE?

IS SHRINKING SEAT PITCH PUTTING
PASSENGER HEALTH AND SAFETY AT RISK?

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The new PL3530 for the premium economy class

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FAIR TRADE

*W*ith the impending US elections, American politics have been a talking point around the world. There has even been a little something for aviation enthusiasts, with the gilded 'Trump Force One' B757 receiving a lot of airtime. However, it is New York Senator Chuck Schumer who has really grabbed my aviation interest, as he has become a crusader for passenger comfort in high-density economy cabins.

Schumer pushed the Senate to amend the pending FAA Reauthorization Bill to impose a ban on airlines further reducing the "size, width, padding and pitch" of seats and the width of aisles, and for the FAA to set minimum passenger space standards for their "safety, health and comfort".

His sentiment is certainly well meaning, but also certainly flawed. Firstly, the 1978 Airline Deregulation Act marked the end of government interference in airline operations, and secondly, the FAA does not have any say in passenger comfort. Safety certainly, but not comfort.

"It costs you an arm and a leg just to have room for your arms and legs," Schumer said – and that's where his thinking seems most flawed. It's a great sound bite, but it doesn't seem to account for the price of US air travel halving since the deregulation of airlines.

The Senate rejected Schumer's proposals, but let's imagine that his dream came true and airline

LOPAs became regulated beyond today's mandatory safety limits. Sure, the wider seats and greater pitch would be lovely, but that comfort would come at the cost of seat count. If supply falls, prices rise – simple economics. If prices rise, flyers on the tightest budgets would be pushed out of the airline market into rail and road options, while the better-off would enjoy a little more comfort. The resultant public outcry at air travel becoming more elitist would probably lead to a senator demanding deregulation to let market forces prevail and give more people access to lower cost fares.

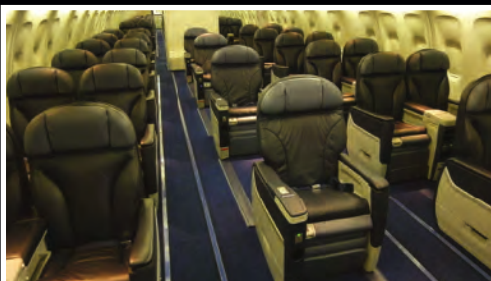
It seems odd that aviation is singled out, when it meets FAA safety measures. The rear legroom in a Mini is certainly less generous than that in a Bentley: should legislation require that Minis be made longer? What else: bathtub lengths, the height of grocery store shelves? Of course, flying in coach may be uncomfortable for many, but it is a travel choice – and everyone is in it together, in the same amount of space. Yes, customers in other classes have more space – but they paid more for it. My advice, as someone in the uncomfortable upper percentiles: if you're feeling a little cramped, just remember how little it is costing you to travel thousands of miles in a flying machine, and go for a walk around the cabin – it's included in the fare.

Adam Gavine, editor



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As chief marketing officer, I'm always looking for ways to immerse our passengers in a one-of-a-kind experience and build a closer relationship with them. At the same time we need to be cost conscious and demonstrate how we get a return on our investment in IFEC.

When I met with Panasonic, they showed me how they put together a solution tailored to those needs. We found a way to wow our passengers with an incredible onboard experience seamlessly integrated into our marketing strategy - for example through our airline app.

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Upfront

A bite-sized selection of the latest trends, developments and oddities entering the passenger experience airspace.

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The Boeing 707 was a milestone in giving the public greater confidence to fly and in improving the passenger experience

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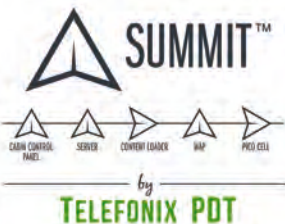
Left: CabinPinnacle (Server); Top Right: CabinVista (Cabin Control Panel);
Bottom Right: CabinAce (Wireless Access Point)

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The Telefonix PDT line of best-in class inflight entertainment and connectivity (IFEC) product platforms continues to grow and evolve with new features being added to our CabinVista™ (Cabin Control Panel), CabinPinnacle™ (Server), CabinAce™ (Wireless Access Point) and CabinPeak™ (Pico Cell) products. The line enables maximum flexibility, both in terms of customization opportunities and the ability for customers to mix and match components to create their optimal IFEC system.

These are just some of the ways that Telefonix PDT is bringing new ideas to the marketplace.

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today's bin systems, makes carry on anxiety a thing of the past and creates fast, efficient operations for cabin crew. With the **ecos™** bin, you will welcome your passengers with a smile.





China Airlines is the first airline to license Air New Zealand's Economy Skycouch seat. Find out how the license works on p22

INTERCONTINENTAL DRIFT

China Airlines is flying its A350s to Europe – and carrying a little European feel on board

The next stage in China Airlines' brand and fleet rejuvenation is due to be delivered in July, with the arrival of the first of the airline's 14 A350-900 XWBs. The airline says the new aircraft will bring in four key advantages, namely: reducing the average age of its long-haul fleet; improving fleet fuel economy; non-stop flights from Taipei to Europe, eliminating stopovers; and those faster European connections have inspired a more European style for the cabins.

When China Airlines launched its new B777-300ERs last year, Taiwanese designer Ray Chen was commissioned to create cabins that draw from Taiwanese history and culture, whereas for the A350s, Chen has mixed touches of European culture with a more modern Taiwanese style intended to reflect the country's youth, fashion, innovation and refinement.

The three-class, 306-seat cabin has 32 business class seats, once again the B/E Aerospace Super Diamond as found in the B777 fleet, but with a lighter palette further lifted by gold finishes on the lamps. This feeling of light and space is further enhanced by the airline's decision not to fit overhead center stowages in the business cabin, raising the cabin height. In premium economy, the 31 Zodiac Airgo FXs are also familiar from the B777, as are the 243 Zodiac slimline seats in economy. Some of the economy triples are Family Couches, which can be converted into a flat surface using special leg rests and loop belts licensed from Air New Zealand.

All five senses are targeted in the cabin to create an ambience that draws on modern European and Taiwanese culture, through mood lighting that changes according to the seasons and flight phase, 'urban chic' boarding and disembarkation music, a bespoke timber-toned cabin fragrance to tie in with the timber finishes – a new factor in airline branding – and a Sky Bistro walk-up bar in business class offering drinks and European cuisine such as Spanish tapas.

With an improved seat count compared with the airline's outgoing A340s (306 versus 276), a more tempting passenger offer and improved fuel economy, China Airlines should really benefit from the new A350s. ☒

1. THE SKY BISTRO IS A MORE COMPACT VERSION OF THE B777'S SKY LOUNGE, SUITED TO THE SMALLER DOOR 2 AREA OF THE A350

2. WARM TONES AND HIGH-TECH LIGHTING BRING TOGETHER A SENSE OF EAST MEETING WEST

3. THE LIGHTING PROGRAMS CHANGE ACCORDING TO FLIGHT PHASE AND SEASON



Visit the Airline Case Studies section of aircraftinteriorsinternational.com for details of China Airlines' B777-300ER cabins

CONNECT 5

The IFEC market is growing and evolving at an amazing pace. Here are five of the latest stories from the connected skies

What do experts see as the future of IFE technology? Find out on p46

2

AIRBUS MAKES IFE DEALS

Airbus has announced two lead IFE suppliers. In addition to the already selectable GX Connectivity solution for A350s, Thales has become an official line-fit and retrofit High-Bandwidth Connectivity (HBC) systems and related VAR services partner for the A320, A330 and A380 aircraft platforms.

Airbus has also selected Rockwell Collins as a lead supplier of HBC for the A320 family, A330 and A380.

As a lead supplier, Rockwell Collins will collaborate with Airbus to develop and deploy both a line-fit and retrofit HBC system for end-to-end managed SATCOM solutions.



4

BROADBAND ROAD MAP

Inmarsat has outlined its broadband road map to meet rising demand for connectivity over the next five years and beyond. Recent developments at Inmarsat include the launch of Global Xpress (GX) Aviation, a single-operator global connectivity solution, and the entry into service of the GX network, which uses three Ka-band satellites to meet near-term bandwidth capacity demand. The GX network also provides a global coverage underlay that will be built upon to meet future demand. Airlines will connect to GX Aviation using JetWave terminals, which are currently undergoing certification for 26 different aircraft models. Inmarsat's fourth GX satellite – now undergoing testing by Boeing – will provide additional network

capacity, while the company has also awarded Airbus Defence and Space a contract to build the first two satellites for its dual-payload Ka-band and L-band fleet, the first of which is due for delivery by 2020.

Another component in the road map is Inmarsat's European Aviation Network (EAN), which will integrate a satellite network and an LTE-based ground network across European airspace, with the first commercial EAN trials expected in mid-2017.



1

IN-SEAT NFC

In a first in the aviation industry, Panasonic's NFC reader is now available for in-seat production at multiple OEMs. The reader is EMV compliant with MasterCard, and Panasonic is in discussions to include further credit card providers including Visa, China Union Pay and AMEX.

Panasonic expects its NFC technology will also be used by airlines for non-payment applications including secure synchronization of personal data, recognition of passengers' frequent flyer status for promotions, crew check-in and check-out, and pairing of NFC-enabled devices with the embedded IFEC system.



3

KLM BOXES CLEVER

Since March, Dutch flagship carrier KLM has been trialling the AirFi box portable IFE system on board selected B737 flights within Europe. AirFi boxes have been positioned throughout the cabin in overhead bins, with no aircraft modifications required, and during the four-month trial passengers on aircraft equipped with the boxes can use their PEDs to

connect to a free onboard wi-fi network. Once connected, passengers enter the 'KLM in the Cloud' environment, in which they can access newspapers, destination information, retail, and seat chat.

During the trial, KLM will evaluate the content delivery capabilities, data collection opportunities, passenger uptake and operational feasibility of the portable IFE devices.



5

ENTICING IFE

GEE has launched Entice (Entertainment, Information, Communication and E-Commerce), a platform for wireless IFE on passenger devices that bundles hardware, software, content and services. Features of Entice include: up to 10,000 hours of content; an intelligent user profiling capability that provides content recommendations and a more seamless experience from flight to flight; and usage reporting and analytics for airlines, enabling more targeted advertisements and offers. Entice is powered by GEE's Airtime platform, and is bundled with an all-inclusive monthly charge for hardware, software, content and services.



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SUM PEOPLE

The latest industry figures show that while US flyers are satisfied, British ones may be deluded...



Air rage!

A study of several years of air rage incidents on a major airline found that:

- The chances of an incident in economy are 3.84 times higher when the passengers are aware of a first class cabin on board
- Front boarding can generate 2.18 times greater odds of an economy cabin incident than middle boarding
- Front boarding can generate 11.86 times greater odds of a first class air rage incident than boarding from the middle
- 72% of air-rage offenders were male and 83% were in economy

National Academy of Sciences paper



Crazy Brits?

What UK flyers think the future holds for aircraft cabins:

- Onboard fast food outlets (46%)
- Secure smoking areas (44%)
- Onboard shops (41%)
- Showers (41%)
- Tablet computers for every passenger (35%)
- Gym area (32%)
- Spa/treatment rooms (29%)
- Private rooms (23%)
- Work areas (19%)
- Standing economy class area (17%)

Jetcost.co.uk survey of British flyers



SATISFIED AMERICANS



With a 2016 consumer satisfaction score of **72/100**, US airline passengers are the most satisfied they have been since 1994

American Customer Satisfaction Index

78% of US airlines have onboard wi-fi

24% of non-US airlines have onboard wi-fi

AeroMod International market research



Frequent flying Americans

80% of US flyers are satisfied – including **35%** 'very satisfied' – with air travel

81% of American adults have traveled by air in their lifetime, and **45%** in the last 12 months

48% of US flyers took at least one flight for a leisure trip, and **31%** for business last year

Airlines for America (A4A) survey



Women book flights 1.9 days earlier than men, paying around

2% less for tickets

Carson Wagonlit Travel analysis of 6.4m bookings

There will be more than **4,000** W-IFE-equipped aircraft by the end of 2016, and **17,000** by 2024

Valour Consultancy research

Latin America will need

1,990

single-aisle and 550 wide-body aircraft worth US\$330m between 2015 and 2034 to meet long-term demand

Airbus Global Market Forecast

POWER HUNGRY!

66%

of flyers consider in-seat power to be important or very important

93%

of flyers consider the ability to access inflight Netflix to be important

Arconics survey

Fast Brits



97% would welcome the return of supersonic passenger jets



77% think supersonic passenger jets will make a comeback within five years



35% refuse to travel anywhere with a flight time of more than five hours



34% are put off long-distance travel by 'travel anxieties' such as fear of flying

sunshine.co.uk survey of 2,643 UK adults

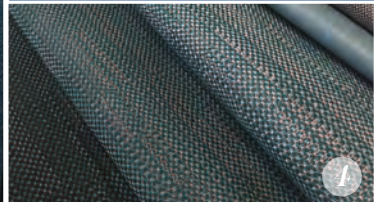
The IFEC market will be worth

US\$5.8bn

by 2020

MarketsandMarkets report

Visit aircraftinteriorsinternational.com for regular news updates



We love the clever Back Pack tray table. For more tray table innovation, see p54

QUIET CONFIDENCE

World exclusive: A first look at the interior of Cathay Pacific's A350-900 ahead of its long-haul launch in September

1+2. THE HEADREST IN ECONOMY CAN BE FOLDED TO SUPPORT THE HEAD, PRESERVING PASSENGERS' PERSONAL SPACE NEEDS

3. CATHAY PACIFIC HAS ORDERED 22 A350-900S AND 26 A350-1000S

4. NATURAL TEXTURES AND THE AIRLINE'S GREEN BRAND PALETTE WILL FEATURE THROUGHOUT

5. THE BACK PACK SEATBACK TRAY IS A SPACE-EFFICIENT SOLUTION TO MEETING ECONOMY PASSENGERS' INFLIGHT NEEDS

For its forthcoming A350 cabin designs, Cathay Pacific has aimed to capture the essence of its Hong Kong home, playing with the contrast between the buzz and glamour of the city and the beauty and tranquillity of the surrounding countryside. The cabin seating design projects have been split into economy, created by Tangerine; and business class and premium economy, created by Porsche Design, with Tangerine also having responsibility for the overall color, trim and finish work for the aircraft. *Aircraft Interiors International* has secured the exclusive first images and details of the economy cabin product, which begins a three-month regional trial period on June 1, before entering long-haul service in September.

A new customized economy seat will be introduced in the A350, which will bring "significant developments", according to Tangerine, with the features and design created based on its research into passengers' habits and needs. According to the studio, meaningful innovations in the seat design include a headrest designed for optimal lateral support to aid rest and sleep when seated in an upright position. The team has also integrated a 'back pack' in the seatbacks, which features a combined shelf and storage area for holding tablets and other personal electronic devices, storage for personal items, and a drinks holder.

The interior finishes are inspired by Asian minimalist tradition, for example the laminates on the bulkheads, which feature an embossed irregular-striped pattern

intended to be evocative of bamboo, contrasting with the natural textured finishes that will be incorporated throughout all cabin classes. Tangerine's color, trim and finish team focused on Cathay Pacific's signature green color palette, using three shades of green, blended with natural tones.

Commenting on the A350 interior design project, Leslie Lu, Cathay Pacific's general manager of product, stated, "The new design expresses Cathay Pacific through all the brand touchpoints, as we strive to offer the best possible customer experience to all of our passengers."

An in-depth feature on Cathay's A350 will follow in our September issue. ✕



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SECOND CHANCES

With the enormous research, development and investment that goes into aircraft cabin products, they are far too good to go to a landfill

There are more ideas for cabin hardware afterlife on p38

1

CARRY THE BRAND

If you have ever loved an Alaska Airlines flight so much that you wanted to take a little piece of the experience away with you, well now you can, thanks to a collaboration with Mariclaro, which makes fashion items from sustainable materials. Reclaimed leather from replaced seats on its B737s is being repurposed as The Atlas Collection, which includes carry-on bags, purses and laptop

bags, some with seatbelt buckle closures.

As Greg Mays, Alaska's VP of maintenance and engineering, said, "By partnering with these designers, we're not only diverting waste from local landfills, but we're giving people a chance to own a piece of Alaska's history. It's not often that people can own a bag that has already traveled more miles than they have."



4

RETIRED AND INSPIRED

While much of an aircraft seat can be recycled, an alternative is for the entire seat to be repurposed. From single economy seats converted into office chairs, to triples for space-efficient waiting areas, to vintage first class recliners for home cinemas, companies such as SkyArt let aviation enthusiasts enjoy their favorite aircraft seats at home, at whatever pitch they like. To complete the look, the seats can be complemented with anything from a galley unit repurposed as a home bar, to a wing flap converted into a credenza. We really want these in the *Aircraft Interiors International* offices!

2

ROLL UP, ROLL UP

Aircraft carpeting has a tough, short life, sometimes as short as three months, which can mean a lot of trash. However, Boeing developed a 100% recyclable carpet tile concept with InterfaceFLOR and Teague that sees tired carpet removed and returned to the manufacturer, where it is then recycled via a carbon-neutral process into new carpet tiles. Even better, by having tiles rather than



rolls, any localized carpet damage can be attended to without replacing the entire cabin carpet, and with the seats left in place. Southwest Airlines was the first to evaluate the concept on its B737-700 Green Plane and it is now available to all.

3

WHEELY GOOD IDEA

Galley carts are made from valuable lightweight materials that would be ideal for recycling once the carts have become too battered-looking to represent the brand. However, many carts are enjoying a relaxing retirement as there is a thriving market for them in the homes of aviation enthusiasts. From polished and customized versions to vintage Pan Am carts bearing the scars of millions of miles of service, many people love having a little aviation history in their home. Such is the popularity of the space-efficient design that cart manufacturer Bucher actually offers its products direct to the public.



5

TAKE A DC-9 FULL CIRCLE

Why should airlines get rid of all the good stuff? Delta may have retired its 1975 McDonnell Douglas DC-9-51 – known within the airline as Ship 9885 – in 2013, but she is still a key talking point of the airline's refurbished T5 at LAX.

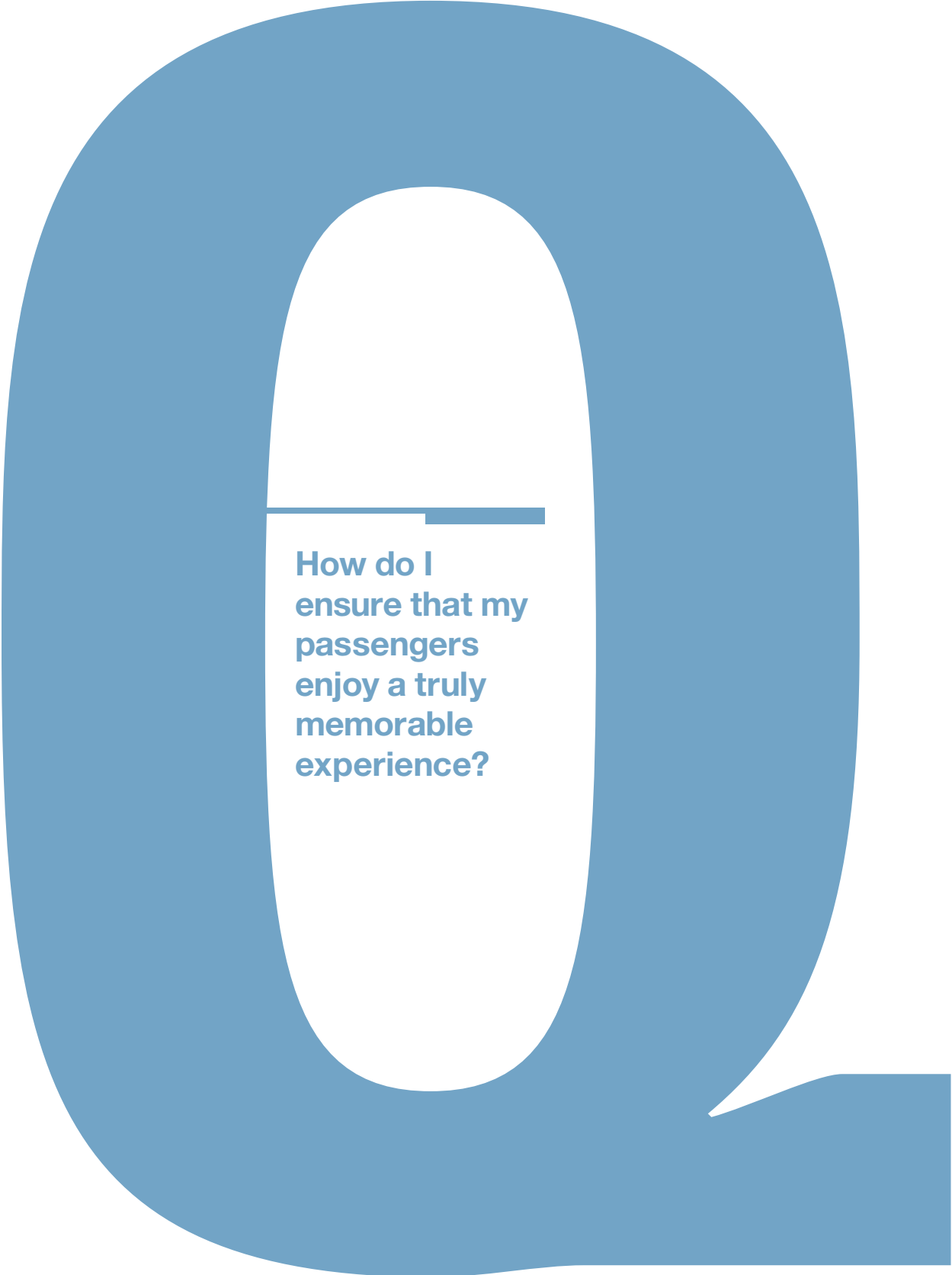
A crew was dispatched to 9885's retirement home in the Arizona desert, to dismantle the horizontal stabilizer from the aircraft and truck it to the MotoArt studio near LAX, where it would be converted into the stunning Delta ONE check-in desk.

"The DC-9 production line was just a few short miles from LAX at

Long Beach Airport and was repurposed by the craftsmen at a studio less than a mile from LAX. It's the ultimate round-trip journey for Ship 9885," said Jeff Coons, Delta's manager of customer experience.



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A330neo

A330neo

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More details of Space X are on p74 & 90, and image galleries are on our website

HUMAN TOUCH

A major name in design has entered the aircraft interiors arena. Meet Satoshi Wada, who wants to bring simplicity, elegance and a little more humanity to the cabin

1. THERE IS A STRONG AND UNIFYING DESIGN LANGUAGE COMMON TO THE X PROJECTS, WHICH WADA ALSO SEES AS A MEANS OF STRENGTHENING JAMCO'S BRAND IMAGE

2. WADA LEARNED HIS DESIGN CRAFT AT TOKYO'S MUSASHINO ART UNIVERSITY AND LONDON'S ROYAL COLLEGE OF ART. FOLLOWING HIS STINTS AT NISSAN AND AUDI, HE DECIDED TO OPEN HIS OWN STUDIO, SWDESIGN IN TOKYO. PHOTO BY SHINICHI KIMURA

If you haven't heard of Satoshi Wada, you are almost certainly familiar with his work. As senior designer at Nissan in Japan (1984-1998) he styled models such as the Bluebird and Cedric. If you don't recall those models, as senior designer at Audi (1998-2009) he designed the A5, S5, A6 and Q7 as well as several concepts – and indeed the Singleframe Grille, which is the 'face' of all modern Audis. Add in work for Issey Miyake and Japanese electrical company Balmuda and there's no doubting Wada's design credentials.

Wada's latest project is Jamco's Space X business and super first class designs, which undoubtedly look fantastic, but Wada's design philosophy goes much deeper than the styling. His approach is one of minimalism, simplicity and logic – qualities he attributes to his experience in Japanese and German design.

For Space X, he dismissed the idea of simply creating seating, instead wanting to create passenger spaces. He also had firm ideas of the philosophy of the designs: "Of course I wanted them to be cool, but different and with great performance. Our targets were 20% less weight and 20% less cost than our big rivals. The philosophy is to offer light weight, quality, simplicity and comfort."

Wada started by looking at the shop floor, where he set about simplifying the proposed production line for Space X – as well as for his Lavatory X and Galley X designs for Jamco. Modular designs are key, which can also reduce expensive casting work. "This isn't mass production, so we needed a mind shift," explains Wada. "We share parts and match materials – like we did at Audi; it's the same principle."

Other aspects of the X range benefit from Wada's experience, for example the emphasis on quality in passenger touchpoints such as trims to convey a feeling of quality across the brand (this was a major factor in Audi's recent sales boom), and a focus on simplicity of operation. For example, while electrical actuators are an option in Space X, Wada has conceived them primarily with simple manual mechanisms: "I don't like actuators," he says.

Thus the bed in the business model is deployed with a simple pull of a cushion, with Japanese paper draping over the exposed space – light and elegant. "Manual is simple and reliable, kids can operate it – and it's cool," he says.

The divider between the business seats is also deployed manually, with a pop-up mechanism. "Simple design can make communication easier. I am trying to create more humanity through simplicity. In the modern age people want auto, auto, auto. The new age of humanity is easier. We need light weight in aircraft and we need a new philosophy in the new age – this is a key issue.

"For me, the philosophy is that if people can feel quality, then that makes the airline feel dedicated to quality." ☒

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PLAN FOR SUCCESS

RECARO CEO MARK HILLER DISCUSSES THE BUSINESS CLASS SEAT SECTOR, FROM INDUSTRY ISSUES, TO SMARTER SEATS THAT FEEL LIKE A HOTEL ROOM IN THE SKY

What's your view on the business class seat supply situation?

New business class seat suppliers are definitely needed. That's what we hear from the industry.

What do you see as the main issues in the supply chain?

We are having very good performance in terms of on-time delivery and quality. We anticipated a lot of the growth in the industry and we have made a lot of investments in recent years in new sites, expansion of sites, engineering capacities and new products, and we have also changed our product development philosophy. So we have developed concepts, made sure they are mature and will pass tests, and only then worked on customization with customers. We have modular concepts that allow pre-development. Coming back to your question, I don't think this was done by some suppliers: if you don't make up-front investment and anticipate growth, then for sure you will have deficiencies, late deliveries and quality problems.

With all this growth, is there a danger that Recaro will become too big to control as efficiently?

No, we have made a lot of investments and we have thorough processes where we look at RFQs, look at risks and what we can offer, and do the evaluation up-front. We are not just looking for new business for the sake of it: we look at what is feasible and possible, and the market conditions. We grew the company 10% last year and will do so again this year. Our target is around 10% growth per year, but while we are gaining market share on one side, on the other side we really secure our performance.

Would you like your long-haul business class seat to be a catalog offer?

No. We believe in catalogs and SFE, especially in the single-aisle market, but for long-range interiors, we think BFE is the right model. You need to give that flexibility to airlines because the seat is their main differentiator in the market.

So a greater focus on SFE isn't a good way to safeguard on-time deliveries?

It's important to do more risk management to make sure that what is offered to airlines is mature – not just a concept or an idea. I think this needs to be made sure of, or problems can arise in an industry that is ramping up.



BUSINESS TAKES OFF

Portuguese carrier TAP is the launch customer for the CL6710, which will be fitted to its A330neos. Recaro is also working on a B787 program for the seat, which they can't announce yet. Both programs will be delivered in 2017

Are you considering moving into super business class and/or first class seating?

We are not in the first class seating business and we do not intend to enter that market. However, in the future there might be a 'business class plus', which is differentiated within the business class cabin through longer and wider beds, and additional features such as seat heating and cooling. This would give airlines that are reducing or deleting first class a differentiated product to offer their former first class customers.

Are you seeing demand for certain business class seat features?

There is a trend for personalization, which can be achieved in different ways. For example, seat control apps, mood lighting and climate control. There is also a constant demand for more stowage, and rising demand for second-screen IFE requires device holders.

What trends will influence future business class seats?

Even with today's low fuel prices, light weight is key. Another trend we are working on is digitalization of product – for example our smart seat can monitor the usage and condition of a seat via an app and identify if any preventative maintenance is necessary, if it is time to replace the seat foams, etc. It can also detect if the seat is in the right position for TTOL. We are mainly working on the maintenance aspects for business class, but the TTOL position feature is also good for economy class. These features give airlines much more intelligence about their product.

What is Recaro's goal for business class?

The mission we are striving for is the feel of a hotel room in the sky. In a hotel room you have maybe 20m², and our task is to give you the same features and comfort in 1-2m². That's our vision. ☒

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POINTS OF VIEW



BRIEF

How do you make one of the ultimate passenger experiences even better? We want to see something new and innovative for private jets that combines engineering excellence, beauty, luxury and the wonder of flight.

DESCRIPTION

The Lineage 1000E is about as good as private aviation gets, billed by Embraer as an “ultra large” jet. Based on the Embraer 190 regional jet, which in airline guise can accommodate 124 passengers, the Lineage 1000 can carry 19 passengers in sumptuous splendor for 5,200 miles. Add in a wide fuselage that can make your Gulfstream V and Bombardier Global Express owning friends feel a little inadequate and it is a space full of potential, with bedrooms, dining rooms and showers all on offer.

The 1000E is luxurious, highly capable and all the jet you could need – but what if you want something a little extra for your US\$53m? Embraer’s design team has come up with something really special with its Kyoto Airship concept, which not only looks fantastic, but changes the way passengers will interact with the aircraft during flight.

Guests in the lounge area can enjoy truly panoramic views through oversized rectangular windows and skylights, which create a floor-to-ceiling window effect that makes the view outside a much greater part of the passenger experience and bathes the cabin in natural sunlight or starlight.

Perhaps the most interesting part of the design is how close to the cabin floor the windows are set, meaning passengers can sit on the floor and look straight out, rather than peering over a sill. The Kyoto element of the design embraces the Japanese tradition of sitting *seiza* on the floor, both through the low viewing angles and the low dining table, with a maple tree motif running between the windows adding to the Japanese feel. Alternatively, owners could opt to have suitable cabin seating fitted next to the windows to enjoy some amazing inflight viewing.



VERDICT

We’ve seen ideas for large horizontal aspect windows before, but the vertical aspect of the windows really optimizes the viewing experience. There are, of course, heat and structural matters to consider in the design, but Embraer’s engineers are confident they can make the idea work. If Embraer makes the window design an option, it will surely be popular as this is not just another luxury item; it adds a new sensory experience to the journey and shifts the passengers’ focus from the cabin to the world outside. ✕



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FLAT OUT

Air New Zealand reports that Economy Skycouch is proving to be a financial and operational success, with its licensing scheme gaining interest from other carriers

Skycouch has been in operation for almost five years, a lie-flat economy seat concept made all the more interesting by creator Air New Zealand's (ANZ) decision to offer licenses on the intellectual property to other airlines. Kerry Reeves, program manager at the airline, told *Aircraft Interiors International* that as Skycouch has proved its value as a money maker and brand differentiator with ANZ and current licensees, it is gaining increasing interest from carriers. Current licensees include China Airlines and Azul, and he says that another, as yet unnamed carrier is about to put it into service, with others rolling out the product in the near future.

Asked why ANZ didn't want to retain Skycouch as a USP, Reeves stated, "We want to offer it as benefit for the world. Five years after developing it, Skycouch is the only real innovation we've seen in economy. It wasn't easy and we had certification challenges, but we persevered and got through, where many airlines faced with the same adversity and challenges would have given up."

One of the main challenges Reeves refers to was gaining approvals for the Skycouch features to remain deployed during events such as turbulence. The airline had to prove that all Skycouch scenarios were safe – no mean feat given the multitude of possibilities, whether lone occupants, two adults, adult and children, and a split of sitting and laying down. The seat has passed with New Zealand, European, Taiwanese and Brazilian authorities so far, and Reeves stated that having existing pre-approved data makes the process easier with each new authority.

"It's a win-win scenario – we get some compensation for all the money we invested in the development of Skycouch, and we give airlines the opportunity to take that product and operate it at a much lower price than if they had to develop the IP themselves and certify it," he stated.

So, the acid test for the design: would Skycouch have paid for itself without the licensing aspect? "The return we get just from selling to our passengers has been more than enough to pay for it. And the intangible return from the ANZ brand perspective has been even more significant." ✕

HOW THE SEAT AND LICENSE WORK

Any economy triple with a minimum 32in pitch can be converted into a Skycouch with the addition of flip-up leg rests (weighing around 4kg per seat), which when deployed create a flat surface, with a special loop belt attached to the standard lap belt meaning that occupants can remain reclined during turbulence. Licensees simply contract their chosen seat manufacturer to make the Skycouch conversion and ANZ partner SWS can handle the STC work. Approvals have been secured for the B777 and B787, with the A350 and A330 soon to follow, according to SWS and ANZ.

The financial cost is an up-front fee for the license, generally per aircraft, which might be for an annual or fixed period, depending on volume and fleet size. "When you look at the revenue opportunity that Skycouch creates, that fee is a small percentage of the return you're likely to get. Its not extravagant by any means," stated Reeves.

ANZ provides all relevant training material for cabin crew, check-in staff and sales teams, as well as sharing its commercialization strategy for maximizing the value of Skycouch, including how best to sell the seats, and how to manipulate and set up global distribution systems and online booking, all the way down to how to manage frequent flyer passenger upgrades, and how to market and use Skycouch when you also have premium economy cabins.

1. A CLEVER FEATURE OF SKYCOUCH IS THAT OCCUPANTS CAN REMAIN LYING DOWN, EVEN DURING TURBULENCE

2. THREE SEATS, ONE SURFACE, SO MANY POSSIBILITIES. ANZ CAN ADVISE LICENSEES HOW BEST TO MARKET AND OPERATE SKYCOUCH. CHINA AIRLINES (PICTURED) IS ENJOYING THE BENEFITS OF THE LICENSE, AS IS AZUL

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PARTS ADVICE

- Ahead of the maintenance check, send engineers on board to see if any items in the cabin look as if they will require repair or replacement. Engineers can then be prepared to effect specific repairs, or if replacement parts are required, contact your aircraft parts supplier to ensure that they are in stock in good time.
- If parts are required quickly, consider the aftermarket. A wide range of parts is available for immediate purchase and they may also be competitively priced.

SEAT POWER

Some 90% of all US travelers bring a portable electronic device on board aircraft, so it makes sense to offer them something they really need and appreciate: in-seat power. Power is available in most seat models today, but for a really quick way to offer it in existing seats, Armstrong aerospace has developed technology that provides in-seat power without requiring any modification or re-certification, as it is completely separate from the seat. The devices – named PowerBar and PowerBox – can be installed directly to the seat tracks without contact with the seat leg, and therefore do not conflict with the dynamic deformations/deflections of the seats.

SWAP OLD LIGHTING

Want to upgrade outdated and maintenance-heavy fluorescent lighting systems to LED without having to undertake a complicated and time-consuming cabin rewiring program? STG Aerospace has devised a clever 'swap-in, swap-out' solution that simply requires engineers to take out the fluorescent tubes and put LEDs in their place. To give an idea of installation times, according to STG the process of removing the tubes and installing the LEDs in an Avro RJ 100 takes no more than two hours. A B737 could be converted in an overnight shift.

WHILE YOU'RE THERE...

Looking to make a big difference in a short time during a maintenance check?
These ideas might be just what you need

SWIFT W-IFE

Creating a cabin wi-fi network can be achieved extraordinarily quickly nowadays, due to innovative new systems such as Lufthansa Systems' Boardconnect Portable, which combines a server and access points in a single device that can serve up to 50 passengers. The compact unit weighs less than 1.5kg and qualifies as non-permanently installed equipment, meaning it can be mounted or removed without affecting other components in the aircraft. Indeed the boxes can simply be placed in overhead bins. Other suppliers are entering this portable wi-fi sector, including AirFi, whose system is currently being trialed by KLM (see p10).

SECURE ODA STATUS

If you are looking to integrate an IFE or cabin management system, using Organization Designation Authorization (ODA) can reduce the time required for certification. ODA enables designated individuals within an organization to sign for a supplemental type certificate (STC) once the installation has been completed, which allows the aircraft to be released within 24 hours. Without an ODA, it could take a week or two for an authority to approve the STC and release the aircraft.

LAV UPGRADES

Want extra cabin density, as well as a new PRM-friendly feature and a more efficient galley? Zodiac Aerospace and Airbus believe their Space-Flex v2 integrated lavatory and galley module for the A320 can achieve just that. As the name suggests, this is the second version of Space-Flex, which maintains the original Space-Flex's benefit of facilitating up to six extra passenger seats compared with conventional lavs, and enhances it with a larger galley area. This new cabin option, due to launch imminently, will be particularly attractive for airlines that wish to provide a full tray-catering experience while still facilitating a PRM-capable lavatory at the rear of the aircraft. The galley's greater capacity for meal trays can also enable an operator to carry a sufficient number of trays to serve both the outward and return sectors. Boeing 737 operators also have the option of the Advanced Lavatory, created by B/E Aerospace in partnership with Boeing. This full-sized lavatory is ergonomically engineered to provide the passenger with a greater sense of spaciousness and to improve customer wellness and satisfaction. And even better, it requires no other modification to the interior of the aircraft.

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IS PASSENGER HEALTH AND
SAFETY BEING COMPROMISED?

Words by Marisa Garcia. Illustration by Tim Marrs.

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Reductions in average seat width and pitch in the economy cabin, implemented by airlines in response to a rise in load factors, have upset the flying public and raised concerns among legislators. But is the cabin crunch simply a matter of diminished comfort, or is the industry working against the best interests of passengers – their health and safety?

People in general – in western countries at least – are getting bigger, so more passengers are likely to feel uncomfortable, crushed or constrained in main cabin seats. Furthermore, getting into and out of a seat row can be a complicated process for passengers in window or middle seats, and passengers are also discouraged from walking around the cabin for safety reasons. Such prolonged constrained and immobile conditions may have negative effects on health.

EXISTING RESEARCH

A study conducted in the UK in 2001 for Europe's Joint Aviation Authority by experts from ICE Ergonomics, Loughborough University and Nottingham Medical School, examined the potential impact of seating dimensions on emergency egress and the risks of deep vein thrombosis (DVT).

The study considered anthropometric data of passengers in the 5th percentile female and 95th percentile male categories, using figures from PeopleSize and Adultdata. The test evaluated the minimum seating dimensions set by the UK CAA under its Airworthiness Notice AN64. The UK figures were used because it was the sole authority within the Joint Aviation Authority countries that had minimum seating dimensions in its approvals documents.

Those dimensions include a minimum seat pitch of 26in and it is important to note that, even in today's tight cabins, no airline currently uses a seat pitch that low – indeed the majority of airlines offer an average pitch of over 30in. This statement is based on a review of the cabin configurations of the world's top five airlines in passenger

LEGISLATIVE INTERVENTION

April saw the US Senate vote against Senator Chuck Schumer's proposals for a passenger rights bill that would maintain the current passenger envelope by preventing US-based airlines from further reducing the "size, width, padding and pitch" of seats, or aisle width.

Schumer also proposed that the FAA set standards for the minimum

space that airlines must provide for the "safety, health and comfort" of passengers. Other groups, both regulatory and legislative, have raised similar concerns over the past 15 years, with some even going so far as investigating the evacuation testing processes. None of these studies have led to the setting of global minimum seating standards.

"The study found inadequacies which could reduce comfort and create possible complications in achieving a brace position"

BELOW: THE HD 31 (HIGH DENSITY AT A 31IN PITCH) CONCEPT BY ZODIAC MAY LOOK CRAMPED, BUT IT INCREASES THE SPACE BETWEEN SEATS BY 15% COMPARED WITH CONVENTIONAL DESIGNS, AND GIVES OCCUPANTS AN EXTRA 4IN OF LEGROOM

numbers domestically, and the top five in passenger numbers internationally (see table on p36); in other words, the configurations the largest number of passengers around the world are most likely to encounter.

SIZE IS EVERYTHING

For its ergonomic review, ICE used CAD modeling and passenger surveys to consider the impact of these minimum dimensions on individuals within those 5th and 95th percentiles. The study was solely intended to make recommendations for further review.

It found inadequacies in these dimensions, which could reduce comfort on longer flights and create possible complications in achieving a proper brace position for impact for certain passengers. The dimensions also raised questions about the risks of DVT and the partners suggested that further studies should consider the needs of the overweight and of an aging population.

In their recommendations, the research partners suggested a minimum seat width of 19.6in, a minimum back width of 21.1in, folding armrests to ease egress, increasing the AN64 minimum seat pitch from 26in to 28.2in, and increasing the space between seats to enable the 95th percentile male to exit the row fully standing. The





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DOES FLYING IN ECONOMY REALLY CAUSE DVT?

Both the FAA and the UK CAA have found a direct link between prolonged, restrictive seating conditions in flight and an increased risk of deep vein thrombosis (DVT), also referred to as Venous Thromboembolic Disease (VTE) in the USA.

But there are a number of other health and lifestyle factors that can equally lead to exposure, medical advice sought by the regulatory authorities has determined.

Dr Nicholas Lomangino, deputy manager of the medical specialties division at FAA headquarters, states, "Although VTE during air travel is the focus of recent attention, lack of activity such as during a long car, bus or train ride, sitting in the theater or long hours at a desk are all causes of prolonged immobilization. However, review of the literature indicates that most cases of VTE seem to be associated with an underlying

disorder. Clinicians and the public at large should focus on existing medical conditions in addition to immobilization and be aware of measures to reduce the risk of VTE.

"Although there are numerous studies in the literature examining VTE disease, variability of population demographics resists combined analysis. There are no published prospective clinical studies in asymptomatic travelers identifying VTE or activation of the thrombotic system. Close examination of the literature clearly demonstrates that VTE is multi-causal in nature, resulting from differing etiologic and predisposing factors across different age groups. A dynamic model dependent on age and co-morbid factors is necessary to understand the relative risk for each set of clinical criteria."

Richard Taylor, of the UK CAA, shares the agency's advice on DVT: "DVT can occur in

individuals with specific risk factors at any time. The risk factors include age greater than 40, previous DVT or blood clot in the lung or a history of such conditions within the family.

"Other factors that are found to be important are hormonal changes associated with pregnancy, the use of the oral contraceptive pill and hormone replacement therapy. Recent surgery or trauma and many forms of cancer can also be associated with increased clotting of the blood.

"In addition to these factors, there are some inherited abnormalities of the blood clotting system that may predispose individuals to DVT and pulmonary embolism."

Regardless, both agencies advise reducing alcohol consumption, drinking water, moving around the cabin, performing in-seat exercises, wearing compression socks – and above all, seeking advice from a doctor.

writers acknowledged that the latter recommendation might be impractical, and suggested that final determinations on seat measurements should be made following egress trials.

Such egress trials were later conducted by Cranfield University in the UK on a Boeing 737 cabin simulator with seats at 29in and 36in pitch. The study was conducted and published in 2002.

Cranfield ran various trials with groups of up to 48 subjects. To instill a sense of urgency in the subjects, while encouraging collaboration, participants in half of the trials were told they would be paid a £2.50 (US\$3.65) bonus if all the passengers evacuated, without specifying a time limit. The other half were told that the first 50% who exited the aircraft could expect £5.00 (US\$7.30). Some of these competitive evacuations had to be halted over concerns for participant safety as individuals became quite aggressive with this simple motivating factor.

The study found that pitch had a major impact on evacuation times, but not in the way expected. Collaborative evacuations were faster than competitive ones, with the first 30 people evacuating in 23.64 and

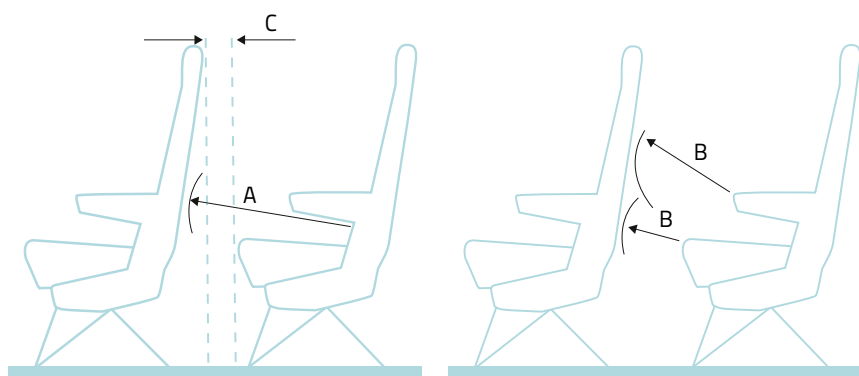
29.90 seconds, respectively. But evacuations with the tighter 29in pitch were faster than with the 36in pitch – 24.90 seconds versus 29.05 seconds. Because only one trial of the 36in pitch was conducted in competitive conditions, Cranfield's experts were loathe to attribute too much importance to this variance, but suggested in their conclusions that seat density, due to a sense of crowding, may generate a higher sense of urgency for evacuations.

On DVT, Cranfield noted that confined seating and prolonged periods of immobility "are known to be risk factors" but that no link has been proved between long-haul travel and DVT. Whether to set the minimum seat pitches to address this possible exposure, Cranfield's researchers suggested, should be a decision for the regulatory authorities.

"There may be a trade-off between passenger health and comfort on one hand, and the effect of seating density



"Seat density may generate a higher sense of urgency"



ABOVE: THE MINIMUM ECONOMY CLASS SEAT DIMENSIONS PROPOSED FOR EUROPE'S JOINT AVIATION AUTHORITY

and seat pitch on evacuation efficiency on the other,” Cranfield’s researchers concluded. “Hence the optimal seat space for comfort may not be the optimal seat space in terms of reducing the risk of DVT. In addition, the optimal seat pitch from either of these perspectives may not be the most desirable in terms of evacuation efficiency.”

TODAY’S PERSPECTIVE

We asked governing authorities for a current update on these questions, and their current findings on safety procedures and passenger health, given changes in the physical size of the general population.

The FAA’s representative, Les Dorr, says, “Changes in the anthropomorphic data of the general population would have to be very significant to warrant changes to our existing certification methods.”

He explains, “The FAA requires testing seats for emergency landings with a 170 lb (77kg) anthropomorphic test device (ATD) under prescribed test conditions to protect the widest range of occupants. Seats optimized for occupants at high or low weight extremes would be either too stiff to absorb energy for lighter occupants, or too flexible to provide protection for heavier occupants. The prescribed test device provides a representative method for loading the seat in prescribed test conditions, which provides a high level of safety. Although the FAA specifies the use of a 170 lb ATD for testing, the FAA requires applicants to evaluate a wide range (5th percentile female to 95th percentile male) of occupant heights to assess head impact protection, other injury criteria and restraint systems.”

At present, Dorr states, the FAA is “unaware of any efforts by the SAE aircraft seat committee to change the weight of the ATD used in testing.”

Currently aircraft cabins are approved based on evacuation trials conducted with live subjects, and manufacturers must prove that the maximum number of passengers approved for the aircraft could evacuate within the regulatory standard of 90 seconds.

What Dorr describes as a “small number of airlines” receive STCs to increase passenger capacity. However, this occurs only “where the airplane manufacturer certified

their airplane to a lower maximum passenger capacity than that permitted by the regulations”.

For a recent approval to increase passenger numbers on the Airbus A319/320/321 family by 11 passengers, Dorr says that the agency required “inexperienced participants to successfully show an increase in evacuation rate with the new configuration.” The approval was given, based on evacuation performance that was superior to regulatory requirements.

We asked whether any recent changes to cabin density had been approved by evacuation simulations. “Although the FAA may accept a computer simulation to substantiate certification of maximum passenger capacity, no applicant has ever validated a simulation sufficiently to support its use,” Dorr says. “The FAA accepts a combination of evacuation analysis and demonstration testing to determine maximum passenger capacity. The analysis method relies on comparing the new design and layout with previous successfully tested designs.” The relevant standards and processes are set in the FAA’s Advisory Circular 25.803-1A.

“This approach is typically used for derivative airplane models after a full-scale evacuation demonstration



“No applicant has ever validated a simulation sufficiently”

HEALTH BY NUMBERS

A study conducted in the UK in 2001 for Europe’s Joint Aviation Authority by ICE Ergonomics, Loughborough University and Nottingham Medical School examined the potential impact of seating dimensions on emergency egress and DVT.

They proposed a set of minimum dimensions for economy class seats (pictured above): A) a minimum pitch of 26in (660mm); B) a distance of 7in between a seat and the seat or other fixed structure in front; and C) a minimum vertical distance between seat rows, or between a seat and any fixed structure in front, of 3in. Measurements considered seats in

the upright position, without cushion compression.

In their recommendations, the research partners suggested a minimum seat width of 19.6in, a minimum back width of 21.1in, folding armrests to ease egress, and increasing the AN64 minimum seat pitch from 26in to 28.2in, ‘B’ from 7in to 9in or 10 in, and ‘C’ from 3in to 12in, which would allow the 95th percentile male to exit the row fully standing. The writers acknowledged that their recommendation for ‘C’ might be impractical and suggested that final determinations should be made following egress trials.



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substantiates the evacuation performance of the initial airplane model on a type certificate,” Dorr adds. “One important reason the FAA typically accepts a combination of evacuation analysis and demonstration testing, instead of requiring another full-scale evacuation demonstration for derivative airplane models, is that we must consider risks to demonstration participants.”

THE POWER OF COMPUTING

To work around the physical limitations and risks of live testing, regulators have for decades been reviewing computer models to supplement and validate live tests. The FAA’s Civil Aerospace Medical Institute has reviewed such modeling systems as far back as its own first attempt using mainframe computers in the 1970s, continuing to more sophisticated simulation test programs run on smaller computers in the 1990s, which led to the publication of a document in 1994 entitled *A Review of Computerized Evacuation Models and Their Data Needs*. Evaluation of such models continues, but the validity of computer models depends in part on the amount of live test data that populates the various virtual scenarios, even with more advanced computers.

On the whole, seat width is seen as a comfort factor, not as an impediment to evacuation nor a health factor, even by the standards of the original ICE study. As Richard Taylor from the communications team at the UK CAA, states, “This is not generally within the regulatory remit of aviation safety authorities, certainly not the CAA. The issue is whether a comfort issue can translate into a safety issue – as in, whether restricted seating might



“The issue is whether a comfort issue can translate into a safety issue”

ABOVE: AVIOINTERIORS’ SKYRIDER CONCEPT COULD WORK WELL FROM A DVT AND EGRESS PERSPECTIVE



hamper evacuation. Intuitively this would seem unlikely as evacuation generally involves moving to the aisle and joining other passengers to gain access to an exit, nominally anticipated to be a process taking in the order of 90 seconds from the certification point of view, although the accident experience time may be greater. This duration might be expected to allow the effects of restricted seating on movement to be minimized.”

THE WIDER VIEW

Airlines have expressed concerns over proposed regulations. IATA CEO Tony Tyler suggested in a recent interview that a return to excessive regulation might undermine or perhaps reverse progress made by airlines as businesses since deregulation and privatization.

None of this addresses or eliminates the concerns of a flying public that finds itself increasingly cramped in crowded cabins. Both the media and government representatives maintain vigilance in this regard, and social media has given passengers greater voice to express these dissatisfactions in public.

Despite the recent decision in the USA not to establish legislation on seating dimensions, dialog is ongoing.

An air travel and health report, prepared for the UK’s House of Lords in 2000 and intended to answer public concerns, led to the creation of the Aviation Health Working Group (AHWG) of the UK Department for Transport in 2001. The AHWG reviews these topics and has been called on by the House of Lords for updates.

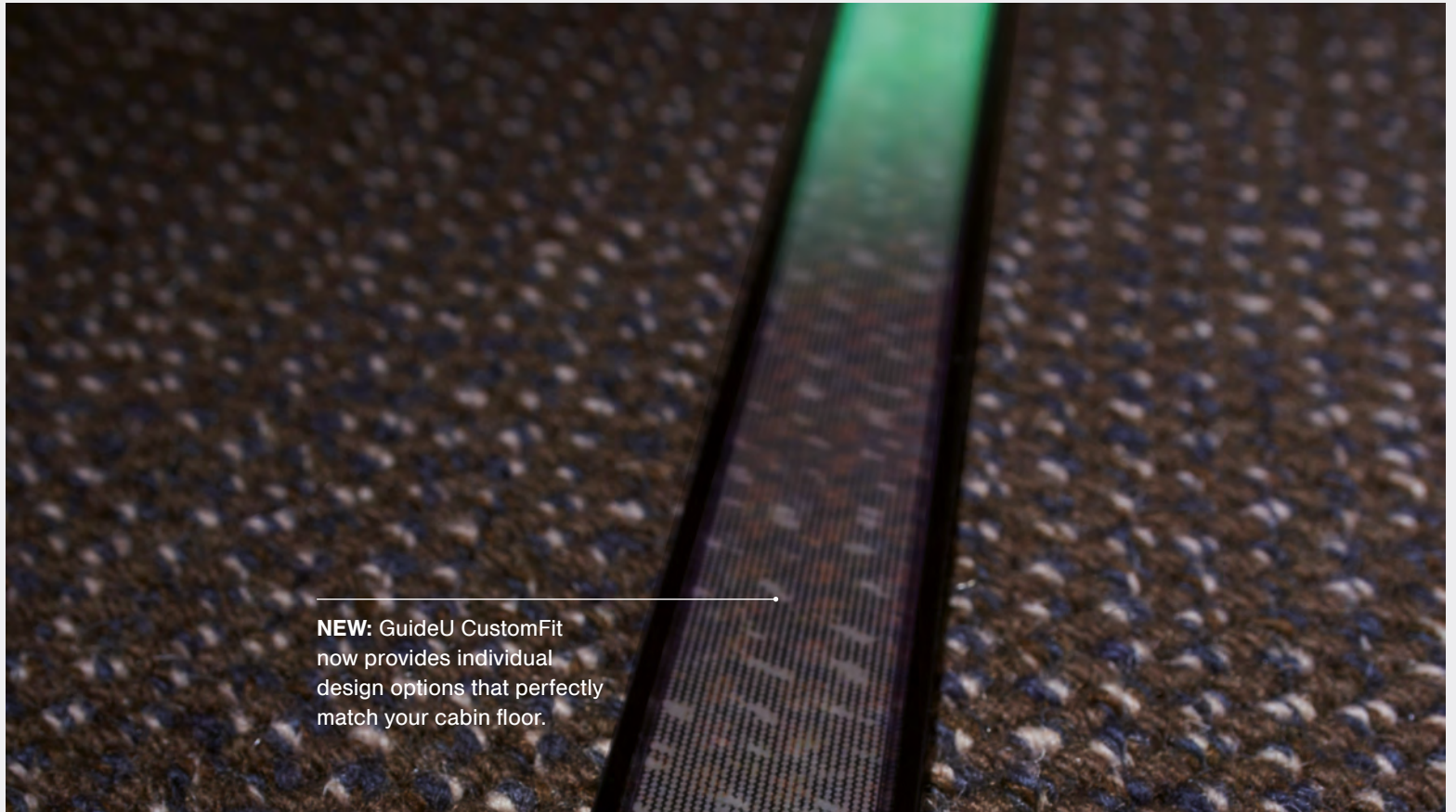
Raising questions on passenger health and safety at least results in the necessary funding to research these matters, and the anticipation of potential regulations has led both airlines and manufacturers to carefully consider their product choices and their health and safety procedures. ☒

MOST COMMON SEAT PITCHES AND WIDTHS (MINIMUM MEASURES)

	Pax (thousands)	Pitch (min)	Width (min)
Largest international			
Ryanair	86,370	30	17
easyJet	56,312	29	18
Lufthansa	48,244	31	17
Emirates	47,278	31	17
British Airways	35,364	30	17
Average		30.2	17.2
Largest domestic			
Southwest Airlines	129,087	31	17
Delta Air Lines	105,190	31	17.2
China Southern	91,729	29	17.1
American Airlines	67,761	31	17
United Airlines	64,731	30	17
Average		30.4	17

Passenger numbers source: IATA; Seat dimensions source: Seat Guru

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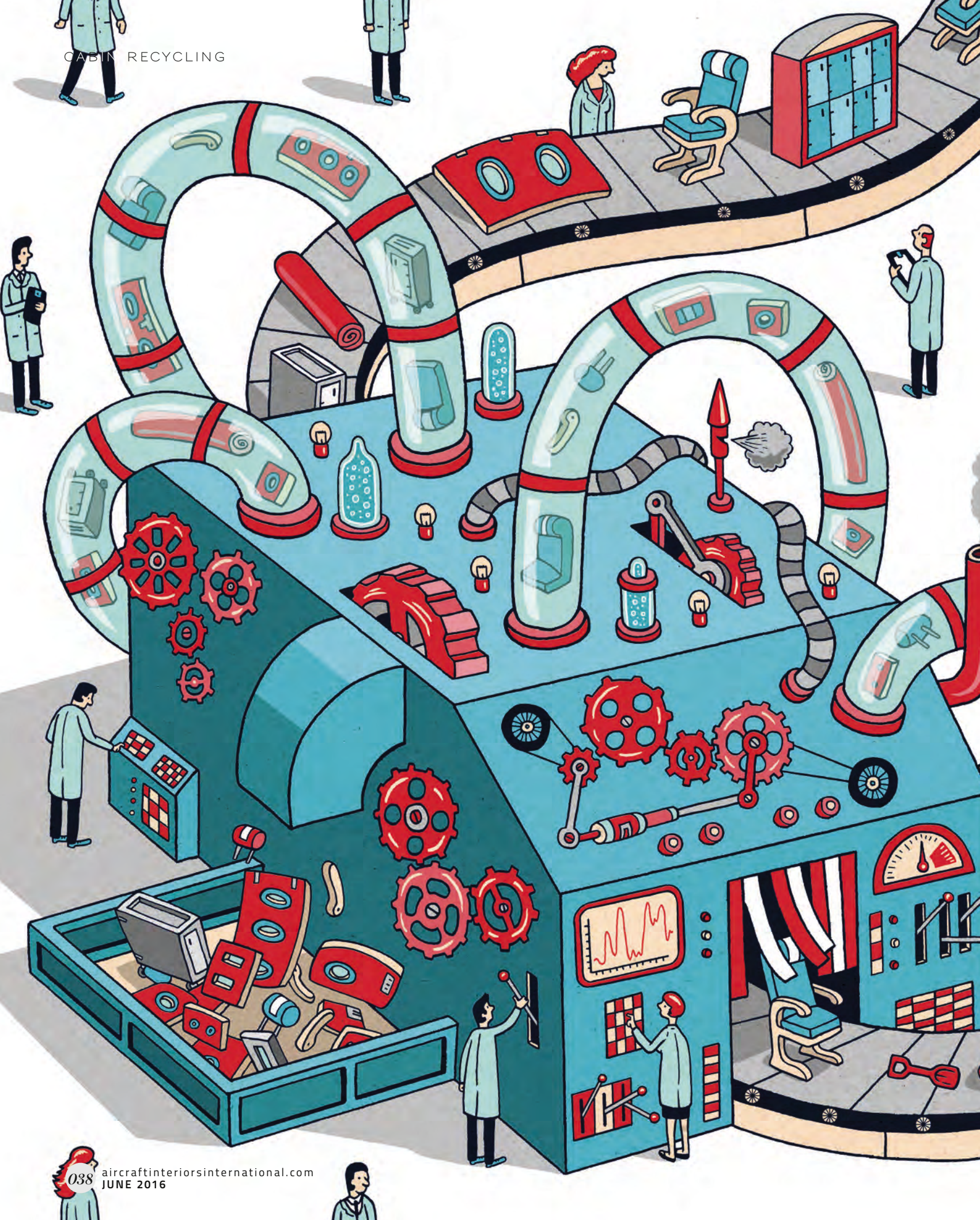
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SELL, SCRAP, RECYCLE OR
UPCYCLE: WHAT SHOULD
HAPPEN TO AIRCRAFT
INTERIORS WHEN THEY
ARE RETIRED?

Words by Marisa Garcia. Illustration by Phil Hackett



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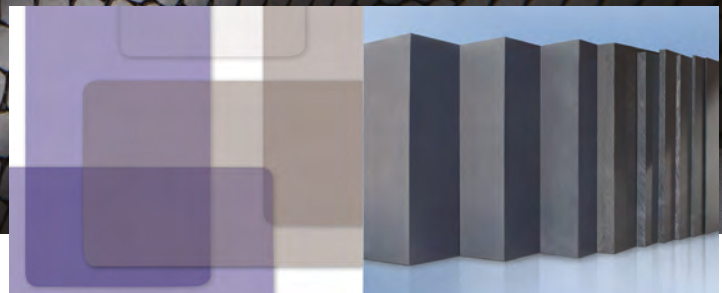
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Sheet products that make aircraft components excel

The recent boom in aircraft interiors programs is a good reason to celebrate, but it also raises questions about what should happen to the large quantities of old interiors as they are removed from service. Does the industry have a satisfactory retirement system in place, or will mountains of interiors landfills dot landscapes around the world?

For years, aircraft interiors have found an afterlife of sorts, broken up into spare parts to address service issues, or retained intact to support old-design cabins still in service. An aftermarket has also existed of aircraft cabin component refurbishment, especially for seats, which can be given a new lease on life and appear fresh in the cabins of airlines that decide not to buy brand new production interiors.

But record sales of new aircraft are changing these market dynamics, resulting in more retired aircraft with old interiors, and more airlines buying or leasing new airplanes. When older aircraft have reached their end of life, they are sent to companies such as Air Salvage to be broken down, recycled and repurposed. Old aluminum airframes become new aluminum products used elsewhere, but what of the interiors?

Mark Gregory, managing director of Air Salvage, tells us that most of the interiors in old aircraft never reach his shop and are instead retained by airlines to support the existing fleet. For those that do get to him, repurposing is complicated.

"You'll probably find that three of the aircraft we strip have the entire interior," he says. "The rest will be bits and pieces. It really depends on the age of the seats. If they're the current generation, they'll go back to the operator. When we're dismantling newer aircraft, they will have more of their interior removed." Older interiors are either scrapped or sold on for other uses, such as flight training schools and film sets.



ABOVE: SOUTHWEST'S LEATHER SEAT COVERS CONTINUED FLYING THROUGH THE AIR WHEN THEY WERE RECYCLED INTO SOCCER BALLS FOR CHILDREN IN AFRICA

Some of the aircraft Air Salvage receives aren't destined for scrapping but instead form part of Air Salvage's storage program with lessors, destined to be re-leased or resold. In most of those cases, the aircraft are taken in an 'as is' state, with interiors present if the previous owner included them.

"We may get some operators who come down and don't want the seats because they have their own," Gregory says. "We'll take them out of the aircraft, but we don't get asked to remove the interiors for most stored aircraft."

Gregory says that, in his experience, about 10-15% of customers interested in formerly leased aircraft also want their interiors. "It depends on the condition of the seats and whether they are heavily branded," he says.

Aftermarket suppliers also buy commonly used seats, which could be used for spare parts. "On older aircraft, we're removing a limited number of their interiors so they can go back into the supply chain," he says. Generally these are the parts that need frequent replacement in service.

RECYCLING

What isn't retained by airlines, sold on for spares, or destined to appear in a training mock-up or future blockbuster, must be disposed of in another way. Some parts can be more easily recycled than others.

UPCYCLING

Some airlines have found clever ways to turn their old interiors into brand awareness and marketing tools, while helping charitable causes and the environment.

Southwest Airlines recycled leather from its interiors – such as old seat covers – into soccer balls for underprivileged children in Africa. The airline also participated in a program to use recycled carpet panels and recycled leather on a 'green' plane, which incorporates other recycled materials.

KLM converted its old interiors into travel comfort items and also ran a competition for Dutch design students to come up with the best 'afterlife' repurposing of its old interiors trim.

Airlines including JetBlue and Alaska Airlines have converted old uniforms and seat covers into attractive travel goods, sold through online shops.

All these programs have received attention on social media and traditional media.

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“The metal parts of the seats can be recycled. We take the foams and fabrics off,” Gregory says. “We’ll use the foams for packing flight controls and things like that. The fabrics are disposed of. The seat frames can be sent to the metal recycler to be chopped up.”

But the types of materials interiors components are made of can pose a challenge for recyclers, especially on older aircraft.

“The sidewalls and luggage bins are made from composite materials that can’t be recycled into other materials,” Gregory says. “We break it all up, it goes to a skip and it will go to a landfill. I would say 90% of an older aircraft interior can’t be recycled.”

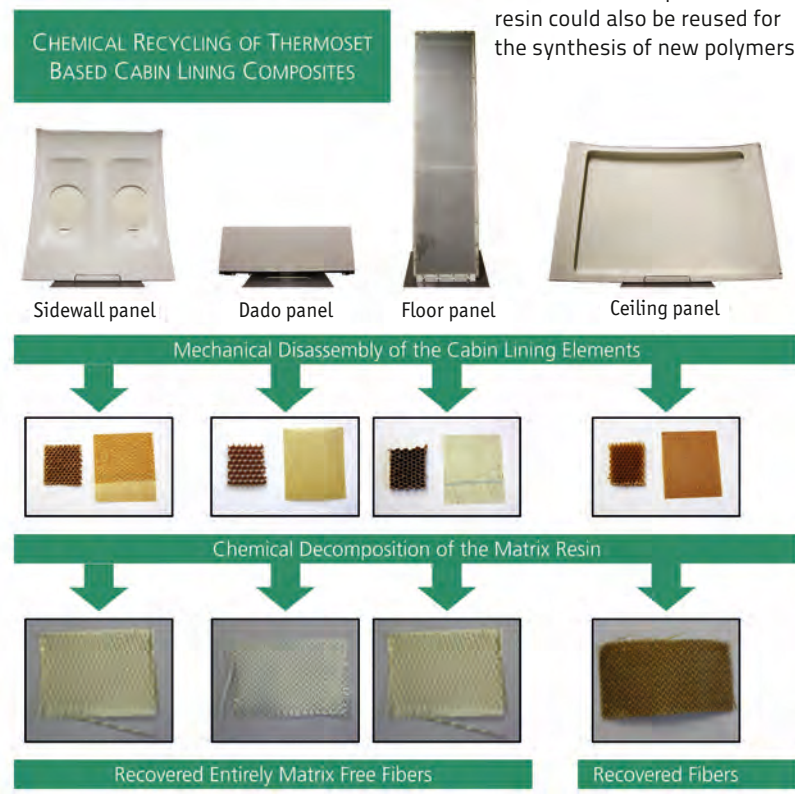
RIGHT: SOUTHWEST'S B737-700 GREEN PLANE IS USED TO TEST NEW ENVIRONMENTALLY RESPONSIBLE CABIN INTERIOR MATERIALS AND PASSENGER COMFORT PRODUCTS



CHEMICAL RECYCLING

Cabin and cargo linings – especially the composites consisting of thermosets and reinforcement fibers – can be difficult to recycle. There are different thermal, mechanical and chemical recycling approaches for composites available, but many are cost- or energy-intensive.

Therefore the Fraunhofer Research Institution for Polymeric Materials and Composites PYCO has developed a chemical recycling process for end-of-life cabin lining composites. By using this process, not only can honeycombs and long fibers with excellent mechanical properties be recovered, but the decomposed matrix resin could also be reused for the synthesis of new polymers.



Gregory believes the landfill issue is being addressed by aircraft interiors suppliers. “Newer aircraft are made out of more durable materials that can be effectively recycled,” he says. “I think the manufacturers are aware of this now. They’re thinking of the future. When they manufacture a new aircraft today they want to try to make it 100% recyclable in 20 years’ time. They are giving that some great thought now.”

THE COMPOSITES PICTURE

The handling of one popular material – carbon fiber – is more complicated. “There are processes that can recycle carbon fiber, but they are limited,” Gregory says. “They can only recycle clean carbon fiber that is not contaminated with other materials. So if you have a carbon-fiber panel and it has a piece of aluminum attached, and some pieces of plastic and wire, it all needs to be removed before the carbon fiber can be recycled. They don’t have the processes yet to do that.

“The metal industry will take a whole aircraft and shred it. Out of that shredding the aluminum goes one way, the steel goes another and the copper somewhere else. The process for scrap metal recycling is quite refined now. They have certain processes to take care of that, but it’s more difficult with plastics and carbon fiber.”

ONE MAN’S TRASH IS ANOTHER MAN’S TREASURE

There are suppliers finding ways to make the most of ‘fluff’, with more Earth-friendly processes that claim to recycle most parts otherwise destined for landfills. For example, the Aircraft Interior Recycling Association (AIRA) has partnered with Falcon Aircraft Recycling in the UAE, based at Ras Al Khaimah International Airport. It operates on a zero waste to landfill policy. Its process is

supported in part by aftermarket demand, but AIRA has found ways to handle materials previously considered garbage.

"All materials in the aircraft interior can and are recycled into other products," says Tony Seville, business development director of AIRA. "Textiles such as carpets, seat covers and curtains are recycled and new yarns are produced to make new carpets, carpet tiles and underlay for commercial use.

"Seats are recycled, and they contain cushions, plastics and metal frames. The plastics are generally recycled in pellet form and used in the car industry to make new plastic parts. Cushions are used for packaging by AIRA and Falcon for parts that are sold on to customers, who in turn use it for their packaging. The cushions are shredded into small bits and then vacuum bagged."

AIRA has developed a proprietary process to convert Nomex to fuel through a collaboration with its recycler. "Nomex panels make up the majority of the cabin – galleys, lavs, sidewall panels, overhead bins, floor and ceiling panels," Seville says. "AIRA has been working on this for the past two years with its chosen recycler and there are certain companies here in the UAE that will be the first to benefit from this in the near future.

"Every 15 tons of Nomex that we process and recycle can save 10 tons of fossil fuel. This has been key to our development and understanding as a company: the



ABOVE: JETBLUE SELLS A RANGE OF BAGS MANUFACTURED FROM RECYCLED CREW UNIFORMS

complexity of materials used in the cabin and finding out how to recycle them."

AIRA's aim is to develop processes that keep landfills from growing. The sale of parts salvaged from discarded interiors pays for recycling costs. "Parts that are sold on to new customers are traced, so that the new customer knows where to send it back to be recycled at the end of its life," Seville says.

The recycling program also solves inventory management issues for airlines and other companies that have unusable surplus stock in their warehouses. "We can first look at the market for particular parts and make a decision about whether the interior articles are of value," Seville says. "This way the companies know whether what they have in surplus is worth keeping or having recycled."

Though airlines are eager to off-load their inventories and old aircraft, some are less keen to write old interiors off the books, hoping to earn back some of the value of their expensive investments. However, Seville says that the recycling business model that AIRA and Falcon have developed can't accommodate that, though they offer a revenue share for any spares parts sold to aftermarket suppliers.

To keep things honest, AIRA gives airlines certificates that document the parts that have been recycled. Such certificates can serve as evidence of the airline's commitment to green, sustainable and carbon-neutral programs currently underway in the industry. ☒

GREEN COMMITMENTS

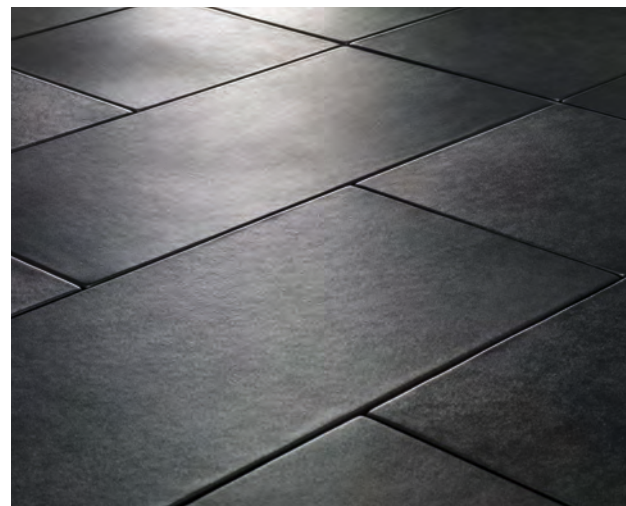
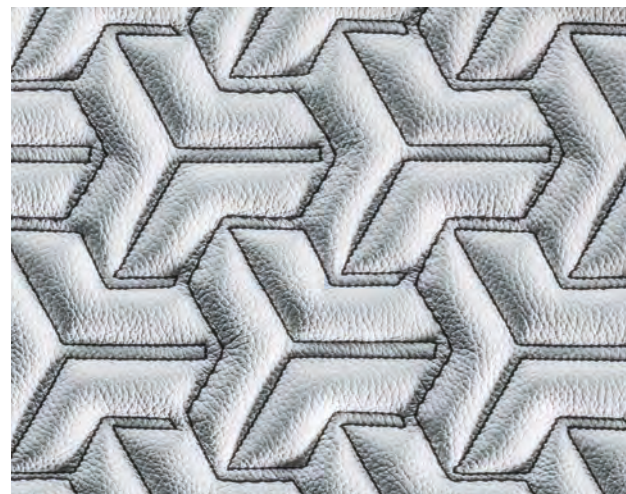
Public concerns over aviation's carbon footprint, and the recent signing of the COP21 agreement, give airlines every incentive to plan green initiatives such as the repurposing and recycling of old interiors.

The industry has committed to a three-step 2020 program for improved environmental performance, consisting of improved fuel efficiencies and stabilized net CO₂ emissions, followed

by a reduction in CO₂ emissions to 50% of 2005 levels by 2050.

ICAO's Committee on Aviation Environmental Protection (CAEP) and the Aircraft Fleet Recycling Association (AFRA) are actively researching ways in which manufacturers can design their products for a recycled afterlife. They encourage the active participation of airlines, manufacturers and aftermarket specialists.

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decade

WHAT CHANGES
COULD HAPPEN IN IFEC
OVER THE NEXT DECADE?
A PANEL OF EXPERTS
SHARES ITS THOUGHTS
ON THE TRENDS THAT
COULD LEAD THE WAY

of discovery

IMAGE: INMARSAT

ABOUT THE EXPERTS

JEFF SARE
is vice president of air transport cabin solutions sales and marketing at Rockwell Collins

HUGO PINTO
is associate partner and innovation expert at IBM Interactive Experience

JON NORRIS
is vice president of sales and marketing at Lumexis Corporation

PAIRING PEDs

To get an airline's perspective, we asked an IFE expert at Etihad, who did not wish to be named, and got the response:

"The next generation of IFEC will bring higher-definition display technologies to screens, increasingly pair guests' personal devices to IFE, increase personalization and guest recognition on board, and add newer technologies such as wireless headsets, for example. Not only will each guest's personal device control their IFE, it will also help them control the environment around them. So seat functions such as recline and massage, window shades and mood lighting may possibly be managed via airline apps.

"The next generation of connectivity is expected to give the guest higher bandwidths and connection speeds for onboard wi-fi, live chats and video streaming. Connectivity will also continue to supplement the IFE offering via live TV and be put to good use for real-time communication with the guest through their own phone or tablet. This latter functionality is very beneficial in managing irregular operations, disruptions or delays."

What do you think the next generation of IFEC could bring?

JEFF SARE AT ROCKWELL COLLINS PREDICTS THE IFEC EXPERIENCE WILL MOVE BEYOND THE AIRCRAFT

ECOSYSTEM OF SERVICES

Hugo Pinto: "There is so much happening and about to happen in the industry. If you look at the explosion in the number of sensors we have with smartphones and fitness bands, they all collect real-time data about you, how you feel, etc. This data could indicate if you need support during a flight.

"Passengers are starting to expect staff at airports and airlines to know who they are, which brings

up opportunities, especially in flight. When you connect to the internet during a flight, that could open up an ecosystem of services. Companies don't need to be on the airplane to know who you are and what services you need, and they have the channels to serve those needs. That will be an interesting disruption trend in which airlines will become intermediaries in the service area."

METADATA AND ONBOARD DATA

Michael Childers: "For all the talk of HD, high dynamic range (HDR) will be more important to IFE than HD. There are also going to be enormous opportunities for improving audio quality. While there are important limitations, virtual reality can have a place, and passenger interaction is certainly a fertile field. Among the most promising opportunities are those that can be developed leveraging a combination of embedded metadata and onboard data capture to make IFE a personal and immersive experience."



MICHAEL CHILDERS is a content management consultant, a member of the APEX board of directors, and chair of the APEX Technology Committee

PETER LEMME is a renowned IFEC expert and 'satcom guru'. He is also chairman of the Ku/Ka-band satcom subcommittee at the AEEC, and founder of several technology companies

JAN-PETER GÄNSE is director of project and certification at Lufthansa Systems

MICHAEL PLANEY is a strategic consultant for airline/rail product development and design

IBM thinks IFE could have major implications for the cabin in the future. See the Articles section of our website to find out why

FREQUENT REPLACEMENT

Jan-Peter Gänse: "In terms of connectivity, we will see an increase in bandwidths and a reduction of latency (air-to-ground systems, low-Earth orbiting satellites). Both will give the passenger a truly connected experience in the air. Displays will get bigger with better resolution, and the fast evolution will require airlines to replace screens much sooner than they do today, triggering new modular concepts."

MORE PASSENGER ENGAGEMENT

Michael Planey: "The best new IFEC systems will give passengers the same level of freedom that they find while at home or in the office. People are used to engaging with multiple devices simultaneously and having them interact with each other – think streaming content from your phone to your HD TV while tweeting from your tablet about what you're watching."

"Wearable technology will also have a place inside the cabin as more passengers bring smartwatches, glasses and fitness trackers on board and want to have the connectivity available to seamlessly link with their private networks. I think that much of the virtual reality technology for the inflight environment will prove to be just a fad in the short term. Until there is widespread consumer adoption, the airlines will only trot it out for the occasional 'wow' moment, or for ultra-premium passengers."

STITCHED TOGETHER

Jeff Sare: "Connectivity will be faster and faster. You can imagine a trend that capability will exceed Moore's law, doubling faster than every 18 months. The more important part of connectivity for the future is that it will become more integrated with the aircraft and more part of the interaction and the entertainment in itself. We don't really think about the fact that when we walk into our homes, our cell phones automatically connect to the wi-fi network. Aircraft connectivity will become more deeply ingrained and more deeply part of the airline experience itself."

"There will also be tighter integration of IFEC with the whole travel experience. The airline experience will link end-to-end across the travel journey, and then probably beyond that into our lives, homes and workplace."

FLEXIBLE SATELLITES

Peter Lemme: "Flexible satellites using beam hopping, beam forming, unfurling apertures, electric propulsion, and reusable first-stage launch vehicles will deliver enormous capacity at a fraction of today's cost. Alternative air-to-ground communications will emerge using non-geostationary (NGSO) satellite constellations, new line-of-sight terrestrial networks, and stratospheric unmanned vehicles."

"A free, basic wi-fi session will access most applications, but with modest streaming resolutions and overall performance, and personalized commercials and promotions driving revenue to the airline. Premium wi-fi service will be available through promotion or charge, enabling higher streaming resolutions and business applications."

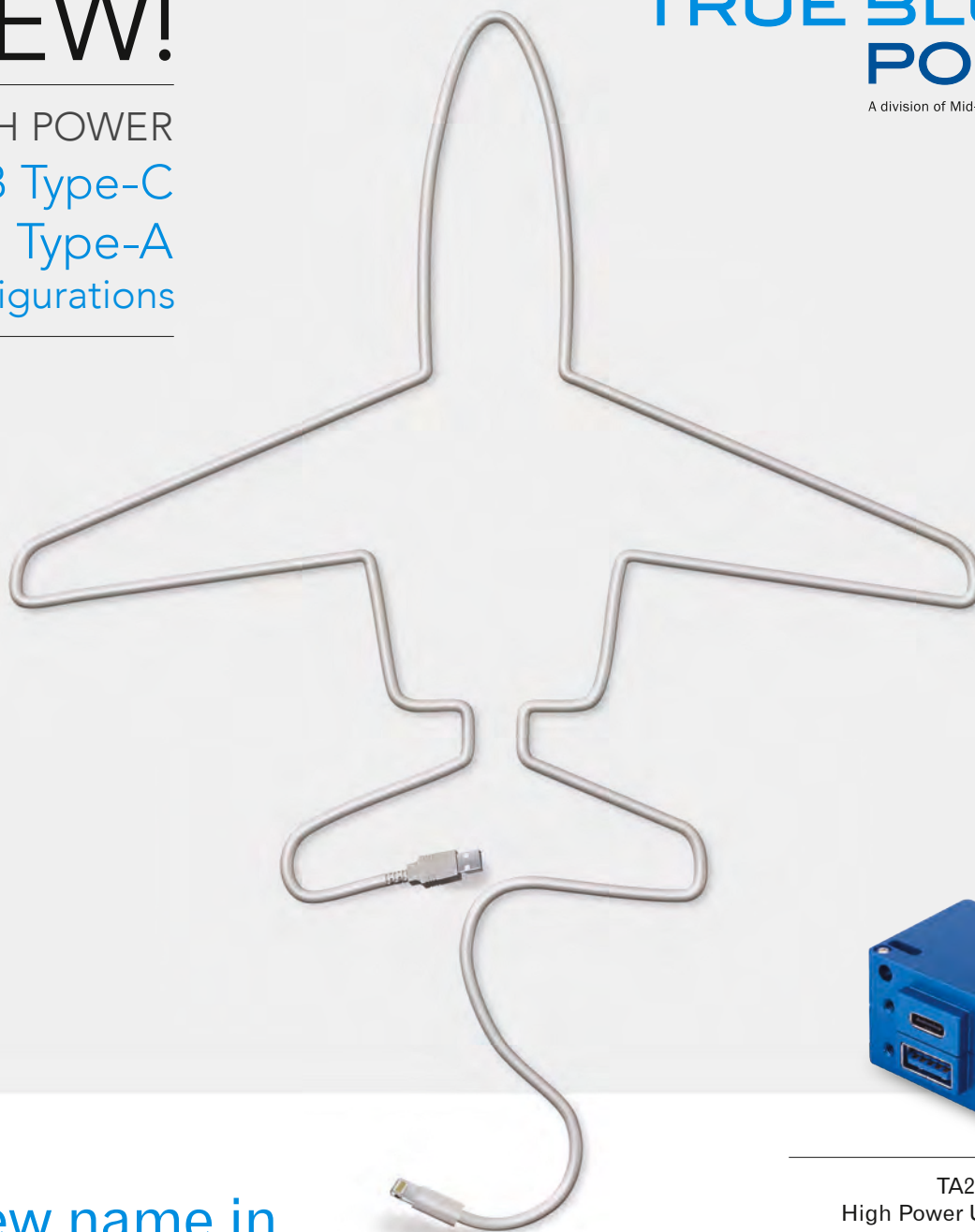
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Is there a future for embedded IFE systems or is wireless the future?

LAN NO MORE

Jeff Sare: "I do see life for embedded IFE. Will it look the same a decade from now, will it have the same functions and purpose? No, I don't think so, but if you look at the terrestrial world today, you see more of a multiscreen environment, not fewer screens. There will be more and different types of screens depending on what airlines want to do, but it won't be IFE in the way it is today – although large screens will be embedded. But what I don't think you'll see is a local area network infrastructure like there is today. I think that if the bandwidth is economically viable, content will be streamed over the top. There will be a way to interact with the IFE."

SEATBACK IS STAYING

Michael Childers: "Given that IFE systems have a 10- to 12-year lifetime, embedded IFE is not going to go away anytime soon. However, to the extent that wireless systems can support the bandwidth required by the services being offered, wireless offers many advantages."

ANOTHER 10 YEARS

Michael Planey: "Five years ago I said that embedded IFE had a 10-year horizon, and I still believe that is true for twin-aisle aircraft. The IFE screen is still the best use of seatback real estate for creating positive passenger interactions and generating ancillary revenues. But wireless is where the most substantial growth will happen as it expands the market into smaller aircraft that previously could not sustain traditional IFE systems."

SINGLE- AISLE SURGE

Jon Norris: "There's certainly a market for PED solutions for some airlines, such as LCCs. However, what we're seeing is no appreciable reduction in the install rate of seatback IFE systems on almost all wide-body line-fit deliveries, and in fact an increasing number of single-aisle aircraft being delivered with seatback IFE."

MORE MODULARITY

Jan-Peter Gänse: "I strongly believe that some kind of embedded system will remain on wide-body aircraft – especially in the premium cabins, which will also expect superior video quality. However, I am using the term 'embedded' loosely here, as it might very well be fixed screens that are connected to the head end over a wireless connection. I also believe that there will be a need to be able to replace screens more quickly. I believe wireless will be the future, with fixed screens in premium cabins. Those fixed screens will be connected wirelessly and follow a modular approach so that they can be replaced [upgraded] on a regular basis."

EMBEDDED IS INCLUSIVE

IFE expert, Etihad: "We believe that there is value in having embedded IFE, especially for those aircraft operating long-haul routes over a global network. Embedded IFE gives guests the freedom to watch entertainment on larger, high-definition screens while enjoying their meals or working at the same time. In-seat video touchscreen controllers also make gaming more enjoyable, and guests with no personal devices – such as children – do not get left out. Wireless IFE is a great cost-effective solution for single-aisle aircraft operating on routes with flight times less than three hours and is definitely the future for airlines with mainly regional networks."

EMBEDDED IS BEST

Peter Lemme: "Embedded IFE systems offer the greatest passenger engagement with content, advertising and promotion. Seatback displays are on all the time, never need charging, can be big and beautiful, and offer a fresh experience compared with passengers' own devices. Connected devices are best for powering social, messaging and business applications."

Will airline-provided IFE content still be required?

STUDIOS LOVE AIRLINES

Michael Planey: "Yes! Especially as long as the major motion picture studios release early-window feature films to airlines. Other sources of original content have found that the inflight market is a valuable source of potential new subscribers and that partnerships with airlines generate positive brand awareness of their products."

KEEP THE CACHE

Jan-Peter Gänse: "There will always be a need to entertain passengers, and better connectivity will allow for streaming services into the aircraft. However, a need for cached/locally provided content will remain for the foreseeable future."

EWC REIGNS

Jon Norris: "Airline-provided early window content still remains hugely popular with passengers and shows little sign of abating until the current licensing models are dramatically changed. In addition, wireless technology cannot yet provide a commercially viable way of streaming from passenger's terrestrial content providers such as Netflix and Amazon to their PEDs."

NEW DELIVERY METHODS

Jeff Sare: "As with any business, airlines are looking to drive efficiency into their systems, and the logistics associated with moving content to and from aircraft involve a great deal of effort and cost. The more automated, the more direct to the aircraft the content delivery becomes, the better for everybody – with the exception of companies putting content on aircraft today. Movie theaters today get their content by satellite and not reels of tape – so why wouldn't airplanes?"

BROAD OFFER

IFE expert, Etihad: "Yes, there will be demand for airline-provided content until satellite connectivity becomes affordable and increased bandwidths are available to all guests to live-stream on board. Apart from entertainment content, there is still a considerable amount of airline-branded content and communication that airlines will want to continue to provide their guests."

GET CREATIVE

Michael Childers: "There will always be demand for curated content, but as connected bandwidth increases, and passengers can access their own content storage lockers, passenger-owned content will play a bigger role in IFE. The IFE providers need to creatively develop content offerings that passengers cannot create for themselves."

OVER THE TOP

Peter Lemme: "Over the top (OTT) streaming, along with the ability to download content before or during a flight, opens up access to nearly infinite content catalogs, dwarfing any airline option. Airlines can provide linear streaming channels with commercials for free, and on-demand regional or premium/early-window content as a differentiator."

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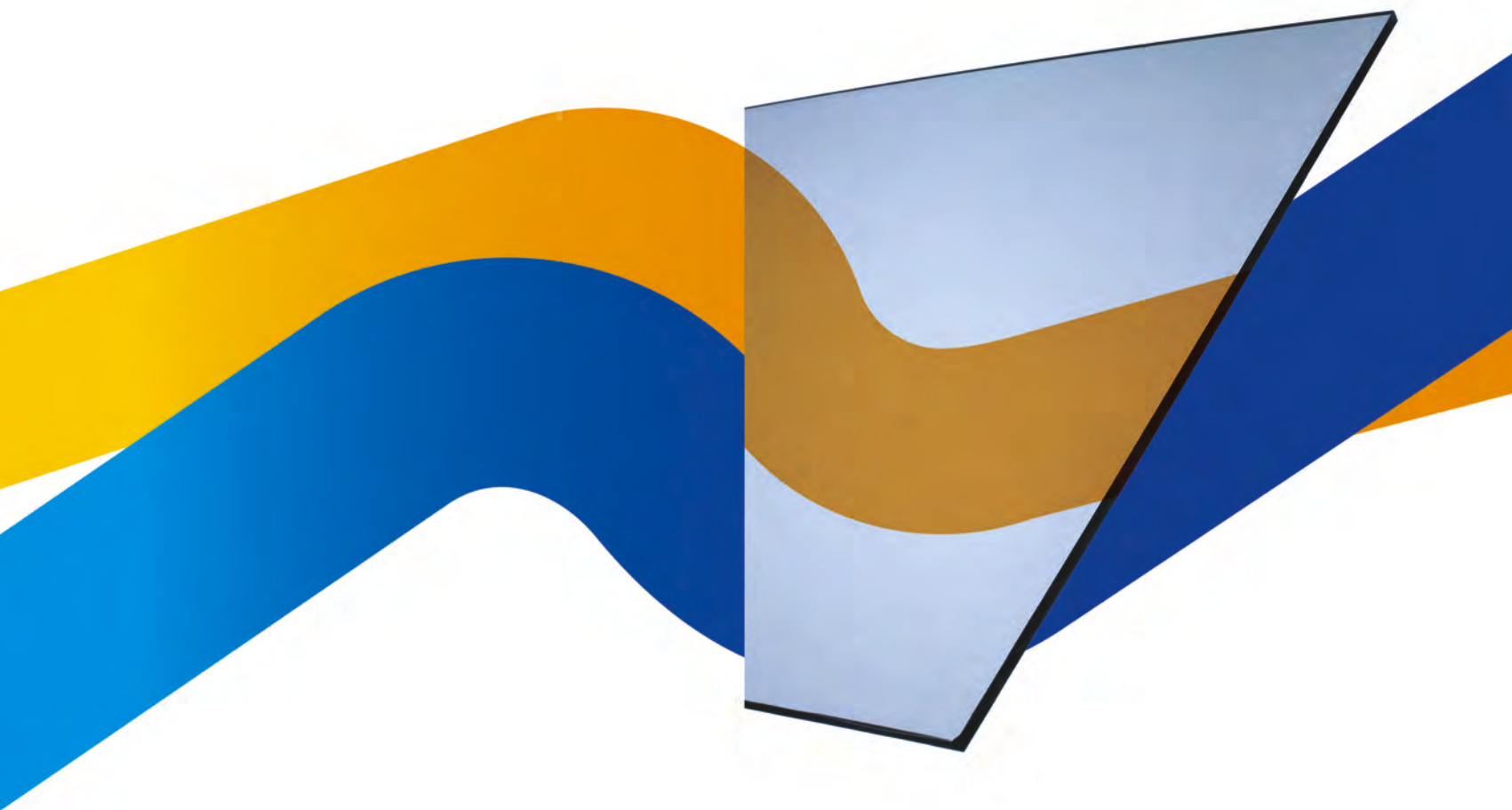
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COUNTER ARGUMENT



IS CURRENT
TRAY TABLE THINKING IN
LINE WITH TODAY'S PASSENGER
NEEDS, THEIR PERSONAL
ELECTRONIC DEVICES, AND THEIR
INCREASING EXPECTATIONS OF
HYGIENE? PERHAPS IT'S TIME
TO BRING SOME NEW
THINKING TO THE
TABLE



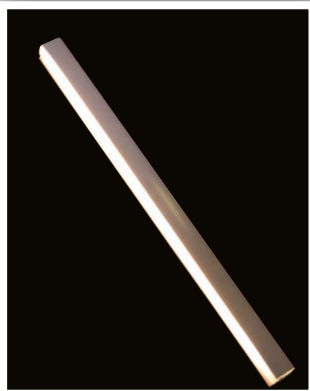
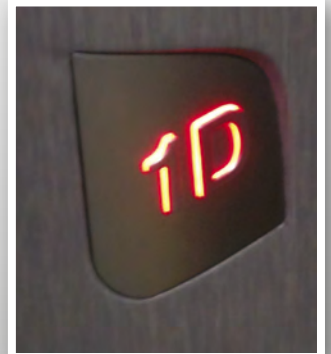
FACTORYDESIGN HAS A VISION OF TRAY TABLES INCORPORATING TOUCHSCREENS THAT CAN BE USED FOR ANYTHING FROM ORDERING FOOD, TO BROWSING THE WEB OR PLAYING GAMES



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TABLES GET SOCIAL

Surely the table has potential beyond being a mere surface for trays and beverages. James Tanner, an associate at Factorydesign, has some ideas to make it more central to the economy class flight experience: "Tray tables are about to get a lot more sophisticated. When the table is stowed, a touchscreen on the back will serve as a dual-screen between the table and the IFE monitor. This would enable passengers to use Facebook while watching the latest blockbuster, or it could simply be used to display the time, flight details and weather at the destination.

"When folded down, the tray table becomes a multitouch, multimedia smart surface, allowing you to do everything we have come to expect iPads to do, and more. With built-in apps you can control the IFE, order food and drinks on demand through interactive menus, paint pictures, play games with fellow passengers, post on social media, catch up with emails, customize the seat settings, and more.

"The tray table will also interact with objects. When a meal or drink has been placed on the table, the background image will change to become a tablecloth or bar top. When a phone or tablet is placed on the table surface it will dock with the seat, enabling passengers to view and share holiday photos and videos, while the phone is being wirelessly charged."

BELOW: PAUL WYLDE CAREFULLY CONSIDERED THE APPROPRIATE DIMENSIONS FOR HAWAIIAN AIRLINES' SHORT-HAUL ECONOMY CLASS TABLES



Flipping business class

Changes in cabin service methods could influence tray table design, particularly in business class, as Daniel Baron, owner of LIFT Strategic Design, posits: "More and more airlines are moving to an à la carte restaurant-style service, which does not involve trays. At the same time, the tables themselves are getting smaller: this is inevitable as the seat geometry must prioritize flat beds in shorter pitches. Origami-inspired tables with multiple folds will be needed to provide larger or new surfaces so that premium customers are able to enjoy gourmet meals served on delicate crockery, while watching their own PED without angst or awkward positioning of items around them."

COLORFUL LANGUAGE

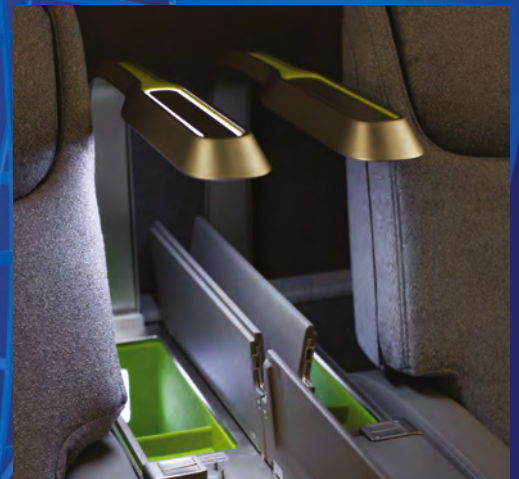
A recent example of a rethink of table design is Hawaiian Airlines' upgraded tray tables in short-haul economy. The PaulWylde design studio added a few magic touches to the tables, as studio founder Paul Wylde explains: "The main innovation was the unexpected and refreshing splash of color on the table surface: it's a little touch that adds a big impact. The strategy was to have an unexpected and delightful layer of color that is revealed later in the guest experience. It's a metaphor for Hawaii – a destination that doesn't reveal all its secrets all at once.

"The big learning is not to lose sight of what guests need on short flights: simplicity, ease of use, functionality and space. Typically, guests bring their own entertainment devices for short flights and don't have the time or the inclination to unpack vast amounts of personal items as they do on long haul.

"The smaller table answers all these needs for the flight time and the color treatment adds to the Hawaiian Airlines experience. It works in terms of integration with the airline's long-haul cabins, conveying comfort and luxury, and is true to the short-haul personality in terms of performance, speed and convenience."



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Engaging thoughts

Given the proximity of the tray table to the embedded IFE display on economy class seatbacks, perhaps they could work together in some way.

Cristian Sutter, a cabin design specialist with experience at Thomson Airways, British Airways and Jet Aviation Basel, has some ideas: "With the current trend of ever-expanding embedded IFE screens competing for backrest space in economy class seating products, the humble tray table will have to be reinvented from a mere multipurpose

surface to an extension of the connected passenger experience to justify its real-estate footprint in the cabin.

"Future tray tables could evolve into an active element of the IFE system, displaying augmented information relevant to the content shown on the main screen, or becoming a digital touch keyboard to interface with navigation and emailing/messaging functions, taking advantage of its flat surface, which nowadays accounts for its main service function.

"Wireless device charging and even smart device recognition and automatic pairing with IFE could be in store too. During meal service, NFC-enabled food packaging will communicate with the table and display the meals' nutritional information, and even the origins of the ingredients and the recipe, and this information could be transferred to nutrition apps in personal devices. With these features, the tray table would make the crossover to becoming a 'smart table'."



ABOVE RIGHT: CRISTIAN SUTTER PREDICTS THAT TABLES WILL BECOME A SMARTER, MORE INTEGRATED PART OF THE EXPERIENCE

A SMART SURFACE



The tray table has a lot of unexplored potential as a smart surface, as Nick Goodwill, senior designer at JPA Design, considers: "The modern traveler has an increasingly varied

set of needs, and future innovations in table design will form an important part of the experience. Virtual reality has the potential to be hugely transformative, and the 'BYOD revolution' appears to be leading toward the removal of IFE monitors in economy. This presents an opportunity for the tray table to become the focus of seatback functionality.

"JPA imagines that this evolution will involve enhanced levels of connectivity and digital convenience through smartly

integrated technologies such as inductive charging, passenger information provisions, and adjustable temperature elements for hot or cold drinks.

"We believe that suppliers will continue to embrace advances in material technologies and manufacturing techniques. Lightweight principles will always form the foundation of successful aviation design and composite materials offer obvious benefits, as well as minimizing wasted space. Away from aviation, we've observed the development of technical coatings with myriad fantastic properties such as self-healing, water resistance and anti-slip. When integrated into the seat of the future, any one of these could have a vastly positive effect on the passenger experience."





IDEAS FROM ABOVE

Daniel Baron, owner of the LIFT Strategic Design studio in Tokyo, has some ideas for addressing hygiene concerns: "Unlike public toilets in restaurants, which in many countries are obligated to post a cleaning schedule, one has no idea when the tray table was last disinfected. It is essentially a petri dish with a cup recess. We know that airlines often do not disinfect tray tables between flights. We also know that ultraviolet light is commonly used to exterminate bacteria and viruses in hospitals. Perhaps the reading lights in the PSUs above seats could be re-purposed as disinfection devices and operated by cleaners or cabin crew prior to boarding."

BELOW RIGHT: THAT COCKTAIL TABLE MAY LOOK STANDARD, BUT IT IS A SIGNIFICANT APPLICATION OF 3D PRINTING

AIR NZ LEADS THE WAY?

An interesting project that could soon be applied to tray table manufacturing is Air New Zealand's 3D printed cocktail tables in its Business Premier cabins.

The airline has been working with Auckland University of Technology to manufacture the fold-down cocktail trays using additive layer manufacturing technology.

"Aircraft interiors are made up of tens of thousands of parts. Not only can't we hold stock of every replacement part we might need, but we often require only a small number of units, which can be really expensive to produce using traditional manufacturing methods and can involve frustrating delays while a replacement part is delivered," explains Air New Zealand's chief operations officer, Bruce Parton. "A big advantage of 3D printing is that it enables us to make cost-effective lightweight parts ourselves, and to do so quickly without compromising on safety, strength or durability."

Parton says the airline is exploring opportunities to introduce further 3D-printed components. "It seems the possibilities are limited only by our imagination."

Daniel Baron, owner of LIFT Strategic Design, sees a future for 3D-printed tray tables: "The 3D printing of seat components is inevitable, and the day may come when customers 'print' part of their experience at the airport prior to boarding. That might include the tray table (HIC issues notwithstanding). For example, options could range from having no table for a lower fare, to one that doubles as a PED charger or entertainment device (and is disinfected!), in various dimensions to accommodate different body sizes." ✕



First class ideas

Daniel MacInnes, associate director at PriestmanGoode, considers the importance of new thinking in tray table design: "An important driver of innovation in aircraft interiors today is passenger expectation. Economy passengers want a clean, hygienic table that is large enough to hold their possessions. Additional features such as tablet stands are not yet seen as standard: they come at an additional cost to the airline, but can provide a good differentiation point and reflect an airline's attention to improving the passenger experience."

Speaking specifically of tray tables in first class, MacInnes has noticed huge investment in their design: "In these cabins the quality of the tables is on a par with VIP aircraft, showcasing the craftsmanship you would find in a home or a yacht. These tables can be made from materials like solid wood interlaced with wood marquetry. But this innovation has come in large part because of the level of bespoke detail that first class passengers expect."

"The hope is that innovation at the front of the aircraft will over time trickle down to the back of the aircraft."

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AIRBUS IS CONSOLIDATING CABIN DESIGN AND THE PASSENGER EXPERIENCE ACROSS ITS MODEL RANGE WITH THE AIRSPACE BRAND, WHICH MAY JUST GAIN AIRLINES A FEW MORE 'LIKES' ON SOCIAL MEDIA

Words by Adam Gavine







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Visit our website for a closer look at the styling aspects of Airspace, and a video walkthrough of the design

“Airspace offers the aircraft equivalent of a luxurious apartment”

A viation enthusiasts aside, do the flying public really notice or appreciate which aircraft type they are traveling in? According to Airbus research, they do. As an example, over a two-year period Airbus used in-house metrics and sites such as Routehappy and TripAdvisor to measure the sentiment of passengers who had taken a flight in an A380, and found that when the A380 is associated with an airline, that aircraft generates a better brand sentiment with passengers than the airline's name alone.

This finding that aircraft type can be important to airline brand perception has led Airbus to create a new brand of its own: Airspace by Airbus, which will fly on the A330neo in late 2017 with launch customer TAP Portugal. By offering strong, consistent and recognizable cabin characteristics that passengers appreciate – such as the minimum 18in seat width in economy – Airbus hopes that passengers will actively seek out flights with Airspace cabins, favoring airlines that fly them.

“Airspace is a tool that helps airlines better face the challenge of social media,” explains Kiran Rao, Airbus's EVP of marketing and strategy. “When passengers book

ABOVE: THE LATERAL STOWAGE BINS IN THE A330NEO CAN ACCOMMODATE 66% MORE BAGS THAN THOSE IN THE A330CEO. THE DESIGN TEAM WORKED TO GIVE THESE FIXED BINS THE AESTHETIC APPEAL OF PIVOTING BINS, WHICH INCREASES THE PERCEPTION OF SPACE IN THE CABIN, BUT WITH REDUCED WEIGHT AND COMPLEXITY. THE TEAM PUT MOOD LIGHTING STRIPS BEHIND THE BINS TO MAKE THEM LOOK LESS BULKY AND MORE ELEGANT

flights they look at social media to compare airlines, seats and experience, and that is driving change. In the past we created a great product and enabled airlines to customize it as they wanted, but today we're reaching out to passengers because they make big decisions based on product and experience. So we've listened to our customers and our customers' customers.”

CROSSING BRANDING LINES?

The question is, isn't ensuring the happiness of customers' customers the job of the, well, customers? After all, airlines will surely be more concerned about immersing passengers in their own onboard brand experience, rather than the Airbus brand.

“We've had this debate with airlines,” responds Rao. “Think about an apartment. If the rooms are wrongly proportioned, the floors are of low quality, the windows are badly positioned and the lighting is poorly placed, then even if you bring in the best furniture in the world, the apartment will still be poorly designed. Airspace offers [the aircraft equivalent of] a luxurious apartment for you to bring in your own furniture and make it

fantastic. We are not interfering with airlines' branding; we are actually providing a way to enhance it."

(JANA) WHITE SPACE

The key is that an Airspace cabin is a blank canvas, finished in floor-to-floor white, a shade named Jana white that was introduced in the A350 and designed by Airbus to work well with LED light of any color (16.7 million variations are available). Airbus first experimented with this 'any color as long as it's white' concept with the A350, about which François Caudron, SVP of marketing, says Airbus "didn't get a single negative message".

"The key customization feature for airlines remains the seat and all its attributes, its features, the trim and finish, the custom carpets, the features in the galleys, and the decoration on monuments," explains Caudron. "What is being offered is the framework. It is white for everyone and they paint the cabin with light. Airlines love it, as they can project the exact ambience they wish by programming the system. We didn't get any messages about Airspace being too restrictive when we disclosed it to customers."

Perhaps the biggest fan of the commonality of Airspace cabins will be leasing companies, which, according to Caudron, account for 48% of Airbus aircraft

THE FACE OF AIRSPACE

The Airspace brand experience begins before passengers set foot in the A330neo cabin, as François Caudron, Airbus's SVP of marketing, explains: "It is really important for us that the outside of the aircraft looks like the A350, so when passengers get to the gate the first thing they see is the nose of the aircraft with the mask, and they immediately know it is an Airbus aircraft. And then they know that when they walk into the cabin it will be an Airspace cabin and they will have a great flight. Then they experience the specific features and services of the airline."

An example is the Door 2 entryway, which features welcome panels that work with the galley monuments, conveying to passengers both the airline brand and that they are entering an Airspace cabin.

orders. If a leasing company is placing an aircraft with a new operator, the work required to convert the cabins to the new carrier's interior choices will be minimal.

"For lessors, having an Airspace cabin guarantees strong residual values

for the aircraft," states Caudron.

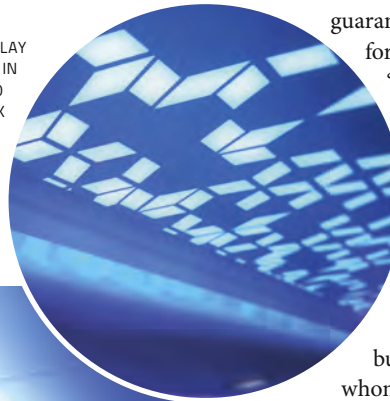
"High residual values are good for airlines as well – it means they are investing in the right product. That's what Airspace is bringing to the community."

Many airlines will be happy with this approach, but there are a few carriers for whom a standard cabin could be considered anathema, a prime example being Etihad. We posed the question of how the customization demands of an airline like Etihad could be met with Airspace to Paul Edwards, head of industrial design at Airbus: "It's always a balance between delivery of aircraft, cost of aircraft, and how much they are able to customize. It would become an individual definition discussion between them and Airbus about what is achievable, how long it would take and where the costs lie."

Something that all airlines will like is the space efficiency of the A330neo cabin, which in the same footprint as the A330ceo can accommodate an additional 10-14 passengers without the cabins feeling more cramped. Features such as

RIGHT: DESIGNERS CAN PLAY WITH SHAPE AND COLOR IN THE LIGHTING SYSTEM TO CREATE THEIR OWN LOOK

BELOW: THE A330NEO DOOR 2 ENTRY AREA HAS OPTIONS FOR BRAND CUSTOMIZATION



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Visit our website for an exclusive interview with Airbus' Ingo Wuggetzer on the new A330neo cabin

LEFT: AN AIRLINE'S BRAND IDENTITY IS EXPRESSED THROUGH THE LIGHTING SCHEMES AND THE FURNITURE THEY BRING ON BOARD



THE FOUR PILLARS OF AIRSPACE

- 'Comfort' is offered without compromise to provide a more personal and relaxing space
- 'Ambience' is enhanced with mood lighting, quietness and an overall sense of space
- Next-generation 'Services' throughout the cabin provide interactive entertainment and connectivity, contemporary lavatory features and an enhanced working environment for the crew
- 'Design' elements that create visually appealing customizable cabins and ergonomic features and are also 'designed to perform' for the benefit of the airlines' operations

"With Airspace we're trying to create something really timeless, something that lasts"

space-efficient lavs have enabled Airbus to carve out this extra space, and a new overhead stowage bin design with a claimed 66% extra capacity means there is also more than enough room for the additional baggage.

As Rao states, "We are using the space more wisely and efficiently. The Airspace concept actually gives passengers a greater feeling of space and a better experience through the design language and design concepts."

SPACE LANGUAGE

When Airbus first had the notion of creating the Airspace brand, it began an intensive design research process. Studies were carried out from a passenger point of view, information gathered from social media, and customer focus teams that consulted key members of airlines about products, pain points, what is important to them, and what they thought would be important in the future.

A 40-strong design team at Airbus's Hamburg and Toulouse centers then used this research to develop the Airspace cabin concept, including trim and finish

designers, lighting designers, product designers and a few engineers. An unnamed design agency was also brought in to give an external perspective on the project.

"We wanted to create a clear and defined design language about how we design the cabin, with straight parallel lines, continuous split lines, continuous surfaces, and using lighting to make elements like the bins 'float,'" explains Edwards.

"Our design language is built on our European heritage. We have a really classical, contemporary and simple approach, with simple, straight lines. We do make shapes curvaceous where needed though – for example, flat sidewall panels would look great, but they are curved to give every possible millimeter to the passenger.

"We're trying to create something really timeless, something that lasts. But it's not just about creating a style, because if you create a style then it dates, and that's something airlines don't like. It's about leveraging our



European heritage of classic, simple versatile design. Everything we do is for a reason; it's a balance of the visual, the aesthetic and the functional. Nothing is there as a superfluous piece of beautification. It all goes back to us creating a backdrop for the airline branding."

THE FUTURE

The Airspace cabin design you see in these pages is largely what will appear in TAP Portugal's first A330neo in late 2017. However, that is just the beginning, with Airbus's plan being to progressively roll Airspace out across the complete product family, with the initial focus being on wide-body models.

As Rao explains, "If you look at the A320 and A380, they are individual products with individual features, but as we work through the Airbus family, they will all become Airspace aircraft."

Looking further ahead, Airspace will evolve to reflect new technologies and trends. Airspace is a brand, not a set of rules, so as new technologies such as 'bionic' 3D printing – as shown in Airbus's recent 'bionic partition' concept – become relevant, they can be applied in the cabin.

"The response we've received so far from airlines is very positive," concludes Caudron. "They say it's great that Airbus is investing money in where airlines make their money – the cabin. They say it's great to see Airbus backing innovation and harmonizing cabin product across different aircraft. That is really being perceived very positively." ✕



ABOVE: THE FOURTH-GENERATION IFE SYSTEM OPTIONS ARE COMPACT TO MAXIMIZE LEGROOM IN ECONOMY, AND OFFER A COMMON EXPERIENCE BETWEEN THE A330NEO AND OTHER NEW AIRBUS AIRCRAFT SUCH AS THE A350

LEFT: WITH LIGHTING A KEY PART OF THE CONCEPT, AIRBUS HAS REALLY INVESTED IN DRAMATIC OPTIONS

A NEW DIMENSION OF CUSTOMIZATION

Airbus is investigating 3D printing as a means of customizing product for airlines. "There's always a balance between customization and delivery of aircraft, so 3D-printing technology is something we're exploring," states Paul Edwards, head of industrial design at Airbus.

He adds that 3D printing would lend itself well to customized welcome

panels at the Door 2 entry, which could be quickly created for customers with brand patterns or logos.

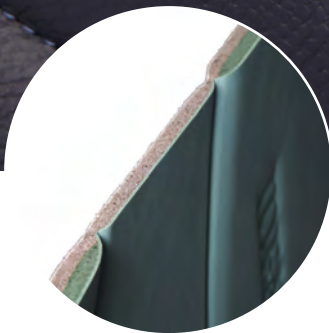
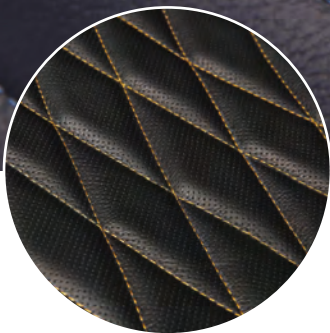
"When you combine the potential to customize patterns with the ability to customize the lighting in terms of scenarios, colors and intensity, then you have a very strong way for airlines to create a great welcome and also to project their brand," adds Edwards.

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First class

JAMCO 'NEW FIRST CLASS SEAT'

Aircraft Interiors International is privileged to have been the first to experience Jamco's stunning new 'Space X' seating designs, which are a continuation of its recent Lavatory X and Galley X concepts, created by the Jamco Product Innovation Office in a collaboration with top Tokyo designer Satoshi Wada. The reason the designs are named Space X and not Seat X is because Jamco wanted to focus on creating comfortable passenger spaces for eating, sleeping, relaxing, socializing, watching movies and working – not just on creating a pleasant sitting position.

There are two seat – sorry, space – concepts: the 'New First Class Seat' (a working title) and the 'New Business Class Seat' (also a working title, see p90 for details). The first class design is a flexible space that can be easily modified during flight to create whatever experience passengers want during different phases of the journey.

The concept fits six double suites across a wide-body aircraft (1-1-1), each with twin seats and double beds, creating interesting revenue possibilities for double occupancy. With two occupants each, a cabin specified with these seats could even be considered a high-density, six-abreast layout. If the spaces have been individually booked, that configuration will remain, but if passengers are traveling together, the layout can be adapted to create a more communal space. For example, the partition between two suites can be slid away to create a communal living room, a dining space, or a meeting space.

It all starts with everyone sitting facing forward for TTL. After take-off, the suites can be quickly

reconfigured by the crew, depending whether the occupant/s wish to have a double bed, a single bed and seat, a sitting area, a restaurant-standard dining area or a cinema (complete with a 40in display), for example. For the bed, cushions slide out from underneath the sofa to create a large, flat sleeping surface. For the dining table, the surface is deployed from the sidewall area and folded into place.

The beauty of the design is that it doesn't rely on heavy actuators: all moveable panels and the table feel lightweight yet solid and run on a system of rails, meaning they can be moved quickly and easily. Actuators are an option for the seat and bed, but they don't fit so well with designer Wada's aim of creating a lightweight and simple concept.

Another fantastic aspect of the design is that it has a ceiling, so when lying in bed, the view above is of a finely crafted finish, not greige plastics. The ceiling also creates an interesting acoustic, which removes occupants' senses from the larger aircraft cabin. Jamco has really taken advantage of this feature, integrating directional speakers so no headphones are required. The curtains on the aisle side also help absorb noise.

Another interesting aspect is that the space really does feel more akin to being in a small boutique hotel room than in a luxury aircraft suite. But fear not, flying fans, the view out of the windows on the outer suites is still there to remind you that this amazing space is actually 30,000ft in the sky. The suite is currently undergoing certification, with a target launch date of 18-24 months.



ABOVE: LUGGAGE CAN BE STOWED IN OVERHEAD BINS WITHIN THE SUITE. NOTE THE COOL CEILING LIGHTING

LEFT: OPTIONS FOR THE SUITE INCLUDE ACTUATED MOVING CENTER CUSHIONS AND A MANUAL BACKREST TILTING MECHANISM

This design follows Satoshi Wada's design language from Lavatory X and Galley X, which can be combined to create a cohesive cabin experience

The 'X' range, from seating spaces to galleys to lavs, aims to give passengers enjoyable spaces and flexibility in how they use them



ABOVE: JAMCO HAS GONE ALL-OUT WITH ITS ENTRY INTO THE FIRST CLASS SECTOR

RIGHT: MENUS, PATTERNS AND EVEN ROMANTIC MESSAGES CAN BE PROJECTED ONTO THE DINING TABLE SURFACE



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- Layout: 1-1-1
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First class

THOMPSON VANTAGE FIRST

Since its Vantage business class model entered production in 2009, Thompson Aero Seating has become a big player in the seating market, with a major factor of this success being the cabin density of its designs. Building on that strength, the company is set to enter the first class sector with Vantage First, billed as a true first class product with the same cabin density as a traditional all-business class cabin – although it can also serve as a super business class offer.

Vantage First is ideal for airlines that don't want to fit a dedicated first class cabin or want to remove their first class cabins, as it works with the business class seats, with the integrated cabin divider providing privacy and differentiation – no additional monuments required.

Within that efficient in-line footprint (76in minimum pitch), first class passengers in the cabin can enjoy direct aisle access, a minimum 23in seat width, a fully flat 80in-long, 24in-wide bed (1in more than



Thompson Aero Seating has signed an Airbus BFE agreement for its Vantage and Vantage XL business class seats to be offered on the A320 and A330

Vantage or Vantage XL), a large table, fixed 32in IFE monitor capability, and extra privacy if the optional suite doors are specified. A relaxed TTL position is also certifiable, enabling passengers to maximize their rest and relaxation time from the moment they board the aircraft.

Vantage First is suitable for all wide-bodied Airbus and Boeing platforms, and will enter service with an unnamed launch customer in late 2017.

Lead time for orders is 12-14 months



Full customization offered as standard



First class

See p66 of our 2016 Design Showcase edition (available on our website) for full details of Formation's concept

FORMATION AIRCRAFT SEAT

Atlanta-based Formation Design Group has developed a lie-flat seating concept that it is billing as "the next major evolution in premium seating". The configuration features lie-flat beds arranged to allow seat counts comparable to angled lie-flat seats while providing larger beds than those in staggered arrangements, as well as direct aisle access for all. This efficient arrangement is made possible by the use of vertical cabin space through a small elevation change incorporated into every third seat.

Formation is seeking airlines or seat manufacturers to license and co-develop this concept, which was a finalist in this year's Crystal Cabin Awards (see p107).



FIRST SPACES

London studio Seymourpowell conducted research with passengers that found that privacy was the main reason for those choosing first class. For those customers, discretion, along with a sense of personal 'unshared' space, is everything.

With this in mind, Seymourpowell created the First Spaces concept, initially devised for the upper deck of an A380. There are three key elements to the concept: the provision of a room with

a contemporary boutique hotel feel; the delivery of 'prescient service' enabled by new technologies; and a new expression of contemporary luxury.

As in a hotel, there is a choice of rooms: four singles and two doubles, with the latter having the option to be sold with either single or double occupancy. With single occupancy, airlines can sell the doubles at a premium (a new price point), giving solo passengers the option of more space, a 42in IFE screen, and a 70 x 75in king-size bed (the singles have a 44.5 x 75in bed).

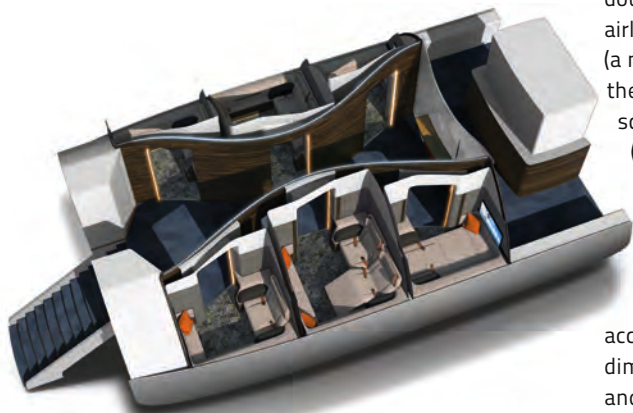
Couples could enjoy the doubles at a lower cost than two single rooms.

If passengers provide measurements in advance, the seats in First Spaces can be accurately pre-configured to their dimensions before they board the aircraft, and once configured, the seat's kinematic movement automatically maintains



those critical dimensions, irrespective of seat position. This is achieved by separating the adjustment kinematic from the deployment kinematic (mostly through software rather than hardware adjustment), with the former working within the envelope of the latter.

Prescient service is enabled by a smart inflight service system, which draws information from sensors and which references information about each passenger and their preferences to create a dynamic picture of potential passenger needs throughout the flight, to ensure staff are informed and able to respond before they are even asked.





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Economy class

REBEL.AERO S:two

You may recall the first reveal of Rebel.Aero's innovative economy seat in last year's review, but this year it has a new name – the S:two – and a major change in construction.

The fixed-back design of this remarkable seat is intended to maximize passenger living space, with unique features being the fold-up 'booster' seat function that enables passengers to stretch out within the confines of their own seat and aids ingress and egress, the three-point safety belt, and the integral child seat option created when the seat is folded up.

The sculpted form optimizes space and comfort at pitches as tight as 27in, enhanced by a width of 18in between the armrests. Customization options such as sculpted foam covers, USB power, tablet holders and IFE can create further comfort.

But what are the big changes for 2016? When Rebel.Aero showed the all-composite monocoque design in 2015, it discovered that EASA had no method for actually testing it with the proposed set of materials.

According to the company, EASA was keen to work with it to develop a new testing procedure, but the time and expense required were prohibitive, so the seat has been re-engineered using more conventional aluminum and composite materials to create the S:two. The new model uses the same geometry and features as the 2015 model, though according to Rebel.Aero a few minor enhancements have been made to the design following feedback from Aircraft Interiors Expo.

According to Gareth Burks, managing director at Rebel.Aero, the company is in talks with various airlines with a view to securing the first order.

S:two won the Passenger Comfort Hardware category of the Crystal Cabin Awards

- Fully dressed weight: circa 12kg/pax
- Lead time: first shipset 12 weeks from certification (the seat is currently mid-way through ETSO C127 certification)
- Minimum pitch: 27in
- Suitable for: B737 and A320 family, although the main chassis of the seat can be adapted for any aircraft



Economy class

LIFT TOURIST CLASS SEAT

There has been a major development with LIFT's Tourist Class Seat, which will be of interest if you have any Next Generation B737 or B737 MAX aircraft on order. The company – and EnCore subsidiary – has revealed that it has collaborated with Boeing so that the seat specifically complements the B737 Boeing Sky Interior, optimized spatially, structurally and aesthetically for the cabin's architecture and aesthetics – and is now an SFE offer on the B737.

We featured the prototype seat in last year's review, but following feedback from its reveal at the 2015 Aircraft Interiors Expo, the design has been refined and finalized. There are two variants, the first being a fully featured seat for a 29-36in pitch, with a 4.5in recline and features including a headrest, tray table, water bottle holder and amenity pocket. Options for the seatback include embedded IFE, PED holders and power sockets.

The second version is a fixed seat suitable for leasing companies and LCCs, which has been optimized for comfort at a 28-30in pitch (though certified for a 28-36in pitch), helped by subtle changes such as shortened armrests and a small snack tray incorporating a PED slot. Whichever version is selected, the styling works with the Sky Interior to create a unified feel in the cabin space.

By focusing on the specific dimensions and curvature of the B737 cabin, the LIFT team could really work on optimizing the design, achieving a genuine 17.9in seat width between the armrests – no trick measurements – while retaining an 18in aisle. Recent developments include raising the seat pan by 1.5in to accommodate more tray table depth, and shortening the armrests from 1.8in to 1.6in to give a little more room to maneuver.

However, the really clever stuff lies below the seat cushion, itself fitted on top of the structure rather than within it, so it can be flat and wide. In the reclining model, the centrally located actuator can be easily accessed and replaced by flipping up the cushion. A 'pancake' IFE box can also fit under the actuator – together with the life vest – to maximize passenger space.

The Tourist Class Seat is a simple and effective design, and LIFT intends to offer a simple and reliable delivery of the product. The seat is currently going through the CDR, PDR and FAI processes and will be ready to order in Q3 2017 as both a line-fit and retrofit option.

"A seat designed in such close collaboration with an airframer is an industry first," states Alan Wittman, director of seat integration at Boeing. "This collaboration will enable airlines and leasing companies to build on the success of the Boeing Sky Interior in a whole new way."

BELOW: SMALL CAGES FITTED BENEATH AND BETWEEN THE SEATS ARE USEFUL FOR HOLDING WATER BOTTLES. THIS KEEPS THE SPACE LOOKING NEAT AND MEANS THAT BOTTLES DON'T TAKE UP VALUABLE LIVING SPACE

There are big developments underway at LIFT. See p98 for details



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Economy class

COMFLY CFY01

Introducing one of the newest seating designs, from one of the newest seating companies in the market. This new Italy-based manufacturer is keen to inject Italian style into its products, so it designed the short-to-medium haul CFy01 seat with Italian design partners GV-Design and Get-Shaped. Continuing the style theme, the company says that its tailor-made option means that ComFly and its partners can take the off-the-peg modular CFy01 and customize the aesthetics to customers' needs, without affecting cost or the delivery schedule. A further initiative – One Project One Customer (1P1C) – is intended to give clients special attention for customization and aftermarket support.

The base CFy01 is constructed from aluminum alloys, steel, polycarbonate, graphite foam, high-performance fabric, and a little brass, nylon and Teflon. However, for customers looking for something a little more exotic, the ComFly team is also working to offer materials such as carbon fiber, magnesium and titanium, which could further reduce the base seat's weight of 9kg/pax.

ComFly says is currently in talks with airlines to formalize a first order, with the launch customer expected to be announced in June 2016 – possibly for a Bombardier Q400 application.

CFy01 is currently in the ETSO certification progress with EASA, which ComFly expects to be complete by September 2016. The beauty of the CFy01 is that it is a really flexible offer. The ComFly team is currently evaluating further ideas such as fixed-shell options.

ComFly recently signed agreements with specialist partners to develop a new seat, to be launched at Aircraft Interiors Expo Asia



- Maximum IFE display size: 9in (can be increased if requested)
- Lead time for orders: 8-10 months for the launch customer, due to the initial certification process; six months thereafter
- Distance between armrests: 18.15in
- Backrest cushion width: 17.5in
- Minimum and maximum pitch: 28in/32in
- Weight: 9kg/pax
- Recline: 14°/6in

RECARO BL3710

The short-haul, slimline BL3710 is a truly lightweight seat (9.5kg), with a modular design that can be adapted to any cabin environment. The BL3710 weighs about 20% less than its predecessor model thanks to its backrest being made of composite material.

That lightweight and durable backrest is also claimed to cushion occupants from any impact from passengers sitting behind, removing the pain point of children kicking or knees intruding. The modular design means that all details, such as electronic connections, customized cushioning, PED holder, storage options and cup holders, can be added individually in the ordering process, with flexibility in their positioning.

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Premium economy

DIGITAL SKY

With the Digital Sky concept, Thales is striving to push the boundaries of industrial design and IFE in the economy environment. Economy and premium economy versions have been devised, both with seatbacks featuring edge-to-edge HD touchscreen surfaces that create several possibilities.

For example, claustrophobic passengers could set the entire seatback space to display a meadow or sky, while content-hungry flyers can choose split screens for simultaneous combinations of shopping, gaming, food and beverage ordering, web surfing, TV or movies.

The display on the economy model is 22in wide, while the premium economy version is 26in. Clearly a little space is required to fully appreciate the displays, but Thales has found that the screens can be comfortably viewed at a 33in pitch in economy, or 34in in premium economy (with a 6in recline). Digital Sky would be an amazing offer in economy, but would also make a truly compelling reason to upgrade from a standard economy ticket. Thales has researched the health effects of the display and found it has no adverse effects, and has also reported positive results from in-house HIC tests conducted with partner B/E Aerospace.



The PED holder is integrated into the upper literature pocket and can accommodate multiple PED sizes. An edge support holds PEDs in place for viewing, even when the forward seat is reclined



HAECO VECTOR

HAECO's experience as a major MRO provider means that its seat manufacturing division really knows how to make seats that need minimal maintenance, achieved through durability, common parts and quick-change features. The Vector model, now available in economy, premium economy and mechanical business class variants, combines traditional manufacturing processes with advanced composites and carbon-fiber construction to create a stable platform that maximizes weight efficiencies.

For the passenger, comfort features include an articulating seat pan on long-haul models, tapered armrests for additional lateral/thigh space, a body-hugging backrest, a responsive fabric diaphragm seat support, a supportive leg rest (on premium economy models), a recline of up to 6in, a forward-placed baggage bar to create 11in of under-seat clearance, and a backrest pivot to maximize shin and knee clearance for the row behind. The ergonomics have been designed and tested to suit passengers ranging between the 95th percentile male and 5th percentile female.

- Lead time for orders: from six months, depending on feature set
- Aircraft suitable for: B737, A320, A350, B787, B777, A330
- Maximum IFE display size: 10in with single-leaf tray table, 12in with bifold table, 13in on premium economy model
- Minimum pitch: 28in

Premium economy

RECARO PL3530

Recaro has created a second version of its PL3530 model for long-haul premium economy travel, with features that the company claims offer the same level of comfort as regional business class. These features include backrest adjustment of up to 9in, a wide calf rest that can be adjusted in length and inclination, and an adjustable headrest. As with the Premium Traveler regional business class model (see p93), the wide armrest can be used comfortably by two people at once.

The seat also features a bifold meal table that can remain deployed when exiting the seat, PC power and USB ports, an optional IFE display of up to 13in, and a handheld passenger control unit.



Boeing isn't the first airframer to have an SFE narrow-body seat supplier (see p98). Recaro's 3530Swift is an SFE offer for the A320



AVIOINTERIORS C4

Another product of the renaissance underway at Aviointeriors is the C4, the latest addition to the Columbus family of economy class seating. Aviointeriors took the already certified C1, C2 and C3 Columbus seat models as a base and built on them to create the C4, which launches the company into the growing premium economy seating market. The aluminum C4 is intended for wide-body application and features an articulated seat pan, a recline of up to 10in and memory foam cushions, in a seat that can be pitched from 28in.



- Layout: In-line (3-4-3 or 3-3-3)
- Basic weight: 13kg
- Pitch: 28-34in
- IFE options: Tablet holder, 12.1in monitor. Aviointeriors is also investigating the integration of a 20.5in vertical monitor
- Lead time for orders: 6-8 months

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Business class

Jamco is also working on a business premium variant

JAMCO 'NEW BUSINESS CLASS SEAT'

In addition to its super first class suite, *Aircraft Interiors International* also secured exclusive access to Jamco's elegant 'New Business Class Seat' (a working title). The design is different to the company's Journey and DoveTail business class products, and like the first class suite (p74), is designed in collaboration with Satoshi Wada as part of the Space X initiative. Simplicity and elegance are the key themes of the design, which has simple mechanisms and no actuators to help achieve Jamco's target 20% weight and cost savings over rival products.

The aesthetic of the prototype is striking, with elegant fretwork effects achieved through

the use of simple, lightweight board – the same material used in first class – which is easy to customize to individual airline needs and design languages. However, Wada's extensive automotive experience with Audi shows in the finishes such as the chrome trim, which, for a tiny weight penalty, gives passengers a high-quality touchpoint.

The in-line configuration is also simple, suitable for a 2-3-2 or 2-2-2 LOPA on a wide-body. Whichever is chosen, all seats have direct aisle access, and in the case of the 2-3-2, the center passenger benefits from a little extra seat width (26.4in versus 25.6in) and a larger





- Suitable for: All wide-body aircraft
- Layout: In-line 7 abreast (2-3-2) or 6 abreast (2-2-2)
- Minimum pitch: 79in; 89in including aisle access path
- All direct aisle access? Yes
- Options: Manual backrest tilting mechanism, actuated moving cushion, seat heating/cooling, humidifier, directional speaker, wireless power supply

How the seat measures up when 2-3-2 on a B777:

- IFE: 24in display (28in for center seats)
- Seat width: 25.6in (26.4in for center seats)
- Bed length: 74.9in
- Bed width: 25.6in (26.4in for center seats)

IFE display (28in versus 24in). Simple pop-up divider screens mean that the spaces can be as social or private as passengers want.

The simplicity of the divider screen deployment mechanism is carried over into the seats themselves, which have been conceived as small sofas, with just a simple manual action required to convert it into a flat bed. There are no TTOL and 'lazy Z' settings: the shape of the thick seat cushion allows passengers to sit in several positions without requiring reclining functions in the seat itself. Wada points out that people don't have

complex electrically operated seats at home, and they aren't needed in the air. He also states that the simple manual action is nicer to operate than a switch or button – and lighter, cheaper and more reliable. An electrical mechanism is available as an option.

"I hate seats that remind me of the dentist, where you have to press buttons to move the seat – that's the modern age. The new age of humanity is easier, and you just pull the seat to make it into a bed. Like at home, the furniture is not electric," says Wada.

According to Wada, another benefit of the simplicity of the mechanism is that it feels very stable, giving passengers confidence in using it, and a positive impression of the seat's quality – and thus the airline's approach to quality.

The simplicity of the modular design means that customization is also simple, helping Jamco in its goal of the seat being a highly cost-efficient option. The seat is currently going through the certification process, and Jamco expects to launch it in 18-24 months.

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Business class

RECARO CL6710

We featured Recaro's first foray into the long-haul business class sector in last year's review, but it qualifies for the 2016 review due to some developments in the design since the first reveal, including new features such as a tablet holder, and a maintenance tablet that enables the usage profiles and service requirements of the seats to be monitored wirelessly or via USB. The latter is part of Recaro's vision for an intelligent cabin.

The CL6710 design – created with Acumen and Honour Branding – is based on the ratio of 1:1.8, which Recaro believes is the ideal ratio of pitch to bed length for passenger living space and cabin efficiency. For example, at the minimum 42in seat pitch, the bed length is 78in, and at the maximum 46in, bed length is 82in.

Weight is another key consideration, with a simple construction of aluminum and fiberglass keeping weight down to around 80kg.

Working together with partner companies, Recaro can also offer flexible front-row monuments that offer comfort features for first-row passengers and maximize stowage space for the crew.

July 2017 will see the airline launch of the CL6710, on board Portuguese flag carrier TAP's 14 new A330-900neos.

KEY FIGURES

- Configuration: 1-2-1 staggered
- Bed length: 78-82in, depending on pitch
- Pitch: 42-46in
- Seat cushion width: 21in
- Shoulder clearance: About 30in
- Maximum IFE display size: 18in



RECARO PL3530

The PL3530 Premium Traveler model is the successor to the PL3510 model, and is intended as a short- to medium-haul business class seat. Engineers at Recaro have equipped the seat with a backrest that can be reclined by 9in, as well as an adjustable-length leg rest, a three-layered cushion, and a headrest that can be adjusted in height as well as in form and position to create a flat and comfortable resting position. The center console has been made extra-wide so it can be used simultaneously by two passengers as an armrest without 'elbow wars', as well as providing stowage space.

Many customers in these seats will be between meetings, so workspace requirements have been considered, with numerous stowage options, integrated power and USB connections, a bifold meal table that can be used as a desk and which doesn't need to be folded away if the passenger leaves the seat, leaving a laptop and papers in place.

A 13in display can be specified, which can be operated easily and intuitively with the PCU

Business class

AVIOINTERIORS CANOVA

There are subtle but significant changes afoot at Aviointeriors, which is going through a relaunch with the aim of strengthening its position in the market. The company is consolidating its seating product lines, redefining its production facilities, introducing new models – including a super first class model – and refining its current model range.

One of the first results of these changes is the updated Canova narrow-body business class seat, which features a redesigned aluminum structure and mechanical actuation system, a new center console with a single-slab meal table instead of the current bifold option, and privacy and comfort enhancements, including the use of memory foam.

Aviointeriors has issued an RFP for a high-density premium business class product to be launched at Aircraft Interiors Expo Asia



- Layout: in-line (2-2)
- Weight: target is 25kg
- Minimum pitch: 37in
- Recline: 9°
- IFE: up to 17in
- Lead time for orders: 8-10 months

AVIOINTERIORS SOPHIA

Another relaunched Aviointeriors product is the narrow-body business/wide-body premium economy Sophia model. The aluminum structure means it weighs in at 21.5kg, with comfort features including memory foam cushions and an articulating seat pan, and options including a mechanical leg rest and an adjustable lumbar support pillow.



- Layout: in-line (2-2)
- Weight: 21.5kg
- Pitch: 34-38in
- Recline: 7°
- IFE: Up to 16in
- Lead time for orders: 8-10 months



Aloha

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Business class

Waterfront was a finalist in this year's Crystal Cabin Awards – see p108



WATERFRONT

This beautifully integrated concept is the result of a collaboration between B/E Aerospace, Teague, Panasonic and Formation Design and shows the benefits of partners working together. The aim is to satisfy the comfort and technology needs of today's connected travelers, with the Super Diamond model serving as a solid foundation, enhanced with the latest electronics. Waterfront creates a truly individual environment for the occupant, allowing them to set their own climate

through seat heating and cooling and in-seat airflow controls, and tailor their lighting colors and intensity.

The embedded IFE hardware is superb, including a 24in 4K touchscreen monitor, second-screen controller and an intuitive handheld remote, all of which can be used to complement the passenger's own devices to create a holistic environment.

Simply settle in, close the suite doors, point your device at the screen, and the space is under your control, from your favorite movie genres and seat settings being automatically offered, to the crew knowing your favorite food and beverage options. Select privacy for the suite and crew will know to leave you alone, but with a simple swipe, they will come to offer you refreshments, or you can order them from your device. If your device is running low on power, there is no need to fumble for a cable as inductive charging surfaces offer a more elegant solution.

Upon landing, the system can send your device information on which baggage carousel to head to, the location of your rental car, and even remind you to check the many stowage areas for belongings. Or of course you can opt not to use any of the technology and simply have a comfortable rest during a flight.

AURA HD

In 2015, Zodiac Seats unveiled a high-density business class concept named Aura HD, which was based on the company's Aura model. It was created to respond to a new market demand: a fully flat bed at a 60in pitch.

This year, Aura HD has been officially released as a new product, which the company is billing as one of the most contemporary business class seats available today.

Aura HD has been designed to ease and emphasize the process of customization. Thanks to its forward-facing V configuration, this seat also offers comfort and privacy and a balanced, and spacious feeling for passengers.

According to Zodiac, Aura HD offers passengers a 15% improvement in bed surface area over some rivals' beds at the same pitch, particularly in the shoulder area and footwell.





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The seating industry is craving predictability

LIFT BOSS TOM MCFARLAND DISCUSSES OVERCOMING INDUSTRY ISSUES, BECOMING BOEING'S FIRST SFE SEATING PARTNER, AND PLANS THAT GO WAY BEYOND B737 ECONOMY SEATING

Words by Adam Gavine

One of the biggest talking points at this year's Aircraft Interiors Expo was the announcement that Boeing had appointed an SFE seat manufacturer for its B737NG and B737 MAX aircraft with Sky Interiors. However, it wasn't the SFE deal itself that really got people talking: it was that the supplier selected – LIFT – hasn't actually produced a single seat before.

LIFT was launched in 2015 and is the seating division of California-based EnCore, a major interiors supplier, itself only founded in 2011. However, the company's founders, Jim Downey and Tom McFarland, have great respect within Boeing and the interiors industry, having set up and run C&D Aerospace before selling it to Zodiac in 2005. Now reunited, Downey and McFarland are seeking to repeat their success, with the Tourist Class Seat being core to the success of LIFT –

although there are also ambitious plans for the future (more on that later).

The seat has been conceived from the drawing board to complement the styling of the Boeing Sky Interior, and optimized to its specific cabin dimensions. Key selling points are its 17.9in width and a simple modular offer of pre-certified options that promise reliable, on-time delivery, with programs anticipated to take just six months from order.

This is no mere concept: the seat is progressing through the certification process and will be pushed through to production readiness, irrespective of any initial orders, with first deliveries available in mid-2017. "The aim is to have all options pre-certified, so a year from now we can offer it certified. If someone wants IFE, a PED holder or other option, it is easy as they are all certified as a baseline," says McFarland. "We can help

“We have committed to Boeing and they’ve committed to us, so it has to work”

with branding and customization, but by using pre-certified options, the lead times are greatly reduced.”

As a sign of its commitment, LIFT is currently constructing its own in-house crash test sled facility, which has required a 12ft-deep trench to be dug and filled with a million pounds of concrete and rebar in order to cope with the massive forces involved in 16g sled tests.

“It’s a major investment, but it’s very necessary,” says McFarland, explaining that it means his engineering team can make adjustments to a seat design, test the effects of those changes, and make any further refinements in a short and predictable time.

“I think this is critical,” adds McFarland. “There are a lot of seat manufacturers out there, but the number that can actually certify a product is much smaller. If you have your own in-house facility it helps tremendously. One big thing about certification is that you want to be sure you will pass. Development tests are very expensive for many manufacturers, and they can’t plan their time well because there are only a few external test centers. Having your own sled facility is critical: certification is a formality, not a time for experimentation.”

This all helps LIFT’s aim of creating a stable offer for Boeing 737 customers in what McFarland sees as an “industry craving predictability”. But what if an airline wants their seat to be something a little less ‘off the peg’?



ABOVE: MUCH OF THE TOURIST CLASS SEAT IS CONSTRUCTED FROM COMPOSITES, MEANING ITS CONTOURS COULD BE SCULPTED TO REDUCE PITCH WITHOUT LOSING PASSENGER COMFORT



“We’re trying to capture as much of the market as possible with the pre-certified options, so if someone comes along and wants something else, they’d better order a lot of airplanes. It would have to be a really serious strategic move for us to do that.” Most customization will be through options and dress covers, the testing of which is helped by the company’s in-house flammability lab and prototype shop.

And what if an airline wanted to install the LIFT seat across a mixed B737 and A320 fleet? “We’re fully committed to Boeing for line-fit orders. If someone wants to retrofit to a mixed B737/A320 fleet, we’ll cross that bridge when we get to it,” states McFarland. “But that’s me saying that: I can’t speak for Boeing, and we’re committed to Boeing,” he adds.

So what of LIFT’s future? With an ambitious duo like McFarland and Downey at the helm, plans must extend beyond a B737 economy seat – and they do. “Our partnership with Boeing is planned to be more elaborate than just the B737 program. We want to make sure we’re successful in that venture before we move on to something else, but the evolution to wide-body economy class seats and business class seats is already on the cards.”



JIM DOWNEY

Jim Downey founded C&D Aerospace in 1972, growing the organization organically to a multinational, 4,000 employee, US\$400m enterprise before selling the business in 2005.

The other half of the EnCore ownership, Tom McFarland, joined forces with Jim at C&D in 1986 to help build the business, and remained after the sale to continue the growth to over 5,000 employees and US\$650m sales before reuniting with Jim in 2011.

Jim and Tom have reunited to “start again” with EnCore. Following two strategic acquisitions in 2011, the EnCore group has grown organically at an aggressive pace.

ABOVE: LONDON STUDIO PEARSONLLOYD WAS BROUGHT IN AS A DESIGN PARTNER FOR THE TOURIST CLASS SEAT

ABOVE RIGHT: HAVING INVESTED HEAVILY IN IN-HOUSE TEST EQUIPMENT AND FACILITIES, LIFT CAN CONTROL TIMESCALES

BUSINESS CLASS IS NEXT

Assuming success in the B737 program, the next stage for LIFT is to enter the business class seating sector. Indeed, given that a business class seat takes three or four years to develop, design work has already started, with a formal announcement pencilled in for 2018.

“It will probably happen in stages,” reveals McFarland. “For example, people are already asking us about a B737 business class seat, because if we have an SFE offer in economy, that would be the next logical stage: a narrow-body business class seat to complement the whole cabin. After that we’ll see where the market takes us, whether that’s premium economy or a lie-flat business class suite,” he says, adding that programs will probably roll out in increasing order of complexity.

“The pinch points in the market are more at the front end of aircraft than in economy. Boeing would love it if we had a business class suite now because that’s where a lot of the delivery problems are, but we’d rather get the tourist class model established first. We’ll start on the design phases of the others and make sure we’re fully ready before we announce, but they are in the cards.”

A further sign of a solid future is LIFT’s relationship with Boeing. “We feel that with the seating market being so big, there is plenty of opportunity to start collaborations. We have committed to Boeing and they’ve committed to us, so it has to work. We’ve put all our eggs into Boeing, and they realize that, but if for some reason the SFE offer doesn’t work, we’ll be fine as a BFE player. We’re committing fully to this project, but there’s a Plan B if it doesn’t work. It’s a very positive relationship.” ☒

POWER OF TEN

2016 IS A SPECIAL YEAR FOR THE CRYSTAL CABIN AWARDS, AS IT MARKS THE 10TH ANNIVERSARY OF THE EVENT. THIS YEAR ALSO SAW A RECORD 95 ENTRIES FROM 18 COUNTRIES AND THE MOST CLOSELY FOUGHT CONTEST IN THE AWARDS' HISTORY. LET'S TAKE A LOOK AT TODAY'S FINEST CABIN INNOVATIONS, AS SELECTED BY AN INTERNATIONAL JURY OF 24 AVIATION EXPERTS





CRYSTAL CABIN AWARD

HOW IT WORKS

The competition was launched by Hamburg Aviation and is organized by the Crystal Cabin Award Association. A preselection committee assists the judging panel in the early decision-making process, deciding on a shortlist for each category, including only the best entries according to the Award's criteria. The independent, high-profile panel of international aviation experts then decides on the relative merits of each shortlisted entry. The three entries of the highest standard make their way to the top of each category. The winners are chosen in a second scoring process held in Hamburg. Throughout the whole process all evaluation bodies of the Awards remain neutral.

Cabin concepts

WINNER: ETIHAD AIRWAYS

The Cabin Concepts category – new for 2016 – replaces the previous 'Premium Class & VIP' category, and entries are at a far more advanced stage of development than those in the Visionary Concepts category.

Etihad Airways' A380 cabin won the Premium Class & VIP category in the awards last year, but this year the B787 first class cabin has secured the Cabin Concepts trophy. This cabin, designed in conjunction with Acumen as part of the Etihad Design Consortium, is a highly innovative space with a unique curved aisle that presented many certification issues to overcome.



FULL
DETAILS OF
ETIHAD'S B787 &
A380 CABINS
ARE ON OUR
WEBSITE

RUNNERS-UP: TANGERINE/VIRGIN AUSTRALIA

In 2015 Virgin Australia unveiled a major redesign of its long-haul A330-200 and B777 cabin interiors, designed by Tangerine and engineered by B/E Aerospace.

Within the constraints of the space and certification requirements, Tangerine rethought everything. Key to getting truly differentiated product in the sky quickly was to use pre-certified product such as the B/E business class seats, but with rich variation in surfaces to add luxury and help distinguish the brand. A highly efficient and effective piece of work.

SEYMOURPOWELL

Research by this design firm found that there is a market for a very high-end first class service, with true privacy being a key requirement. With this in mind, the studio created the First Spaces boutique hotel-like concept for the A380, complete with single and double rooms. See p78 for more details.



Electronic Systems

WINNER: LUFTHANSA SYSTEMS

For airlines looking for a low-cost way to offer IFE, Lufthansa Systems' BoardConnect Portable system combines all the technical components needed for an IFE system (such as a server and access points) in a single small device. The Li-ion battery-powered Mobile Streaming Unit (MSU) weighs less than 1.5kg, fits into an overhead bin and can stream 1TB of content to up to 50 passenger devices. Even better, since MSUs qualify as non-permanently installed equipment, airlines don't incur high installation and certification costs if they choose the system.

BoardConnect Portable is already proving popular: Lufthansa subsidiary Eurowings will soon be flying it (two boxes per 150-seat A319), as will Air Dolomiti.

The next step? Lufthansa Systems says that the major Hollywood movie studios will soon approve the system for displaying Early Window Content.

RUNNERS-UP: GOGO 2KU

One of the most hotly anticipated aviation launches of 2016, Gogo's 2Ku technology, is now in the air, onboard select Aeromexico B737s. 2Ku uses dual-antenna technology – one for the uplink (receive-only) to the aircraft, the other for the downlink (return) to the ground. The result: 70Mbps to the aircraft.

THALES

The Digital Sky concept by Thales really puts the 'wow' into economy class IFE. The giant seatback display – another Tangerine design – can be used to show a movie or split into sectors, for example with part showing IFE content and part showing clouds or a meadow to give a greater feeling of space. If an airline implemented Digital Sky as a premium economy product, it would make quite a compelling reason to upgrade. Thales has researched the health effects of the display and found it has no adverse effects, and has also reported positive results from in-house HIC tests conducted with seating partner B/E Aerospace.



Lufthansa Systems



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Visionary concepts

WINNER: ZODIAC AEROSPACE

The Lifestyle concept by Zodiac Aerospace is a vision of how wide-body aircraft interior architecture could be reconsidered for 2025, with the interior considered as a system rather than as separate components. Instead of the traditional layout of cabins arranged by class, there are areas for sitting, sleeping, meeting and lounging, with options for passengers to access the spaces above and below the main cabin deck.

The concept – co-developed with New Territory design studio in London – seeks to challenge the industry in the way it proposes new revenue models and new ways for passengers to move around the cabin. The concept has initially been devised for a B777, with the idea being that airlines can select the parts of the concept they wish – it is not a one-size-fits-all proposal. Some parts of the concept have drawn criticism – the additional cabin sidewalls for example – but Lifestyle provides some interesting food for new thought, especially in its use of space in the crown and cargo areas.

RUNNERS-UP: POPPI BY TEAGUE

The Teague design studio developed many new ideas to address passenger pain points and potential airline benefits for this airline concept, such as a rethinking of cabin baggage allowances to reduce the size and weight of overhead bins.

FORMATION DESIGN CABIN CONCEPT

The highly efficient seating arrangement is made possible by using some of the cabin's vertical space to layer bed and seat arrangements, with a first class suite overlapping premium class lie-flat seats. Formation is seeking airlines and seat manufacturers to license and co-develop this concept. See p78 for more details.

Cabin Systems

WINNER: B/E AEROSPACE

B/E Aerospace scored well with its flexible LED lighting system, Viu Flex, which can be installed in hard-to-reach areas of the cabin and can create an endless variety of color moods. The physical part of the system is a lightweight LED strip that allows a tight curve radius, but it's the software that really brings the technology to life with stunning effects.

RUNNERS-UP: LUFTHANSA TECHNIK

The induction technology used in Lufthansa Technik's hotplate enables fresh meals to be prepared in the galley using a pan. Just securely fix the pan, set it to heat up, and add ingredients. As the food cooks, the integrated extractor unit can be pulled directly over the pan to ensure safe and odor-free cooking. This idea could really bring new opportunities to premium class catering.

DIEHL SERVICE MODULES

Diehl's Smart Galley features a modular construction that makes it possible to reconfigure the galley for individual flight needs, whether they require more of a particular insert or more space to stow food. Diehl reports a 5% weight penalty for the galley over a standard model, but also a lower purchase price.



Materials & Components

WINNER: SEKISUI

Sekisui SPI took victory with an innovative thermoplastic surface design process. The technology, called Infused Imaging (similar in principle to skin tattooing), enables the creation of detailed and creative designs on cabin elements such as seat shells and partition walls, without stretching. Launch customer Air China has been happy with the material and process, as used to replicate the elegant patterns of artist Han Meilin on its B747-8i fleet.

RUNNERS-UP: F. LIST

F.LIST made it into the final with the first wooden floor certified for use in an aircraft cabin. This innovation, weighing around 7kg/m² is laid on top of the cabin floor and is sure to bring the Austrian company to the attention of the VIP cabin market.

AWP

The ERMS (Easy Release Modular System) concept is an efficient electromechanic/electronic release system for gas springs, suitable for backrest adjustment mechanisms. Benefits include light weight, a small pressure requirement on the button and, best of all, with the systems linked to a cabin control system, crew can centrally deactivate all backrest reclines during take-off and landing.

Greener Cabin, Health, Safety & Environment

WINNER: BOEING FRESH LAVATORY

Many passengers dread the prospect of visiting the lav, fearing germs and the often suspiciously wet floor. Boeing hopes to put an end to this passenger pain point with the Fresh Lavatory concept, which uses UV light to sanitize the space between uses, and a dry floor technology, the details of which the company won't disclose, but which will apparently make shoes less necessary. Boeing says the system takes mere seconds to work, with an external indicator letting the next user know the space is clean and dry. The UVA light used does not damage plastics or burn the occupant's skin if they somehow find themselves inside during a cleaning cycle.



RUNNERS-UP: APPARATEBAU GAUTING

Apparatebau Gauting reached the final round with an innovative and environmentally friendly halon-free fire-extinguishing system for the cargo hold, which sprays a mixture of water and nitrogen when things become serious. All together, including water supply, the system weighs 50kg for narrow-body use, and 100-150kg for wide-bodies.

FRAUNHOFER PYCO INSTITUTE

Researchers at the Fraunhofer PYCO Institute in Germany have developed an environmentally friendly recycling process for the composite materials used in the cabin. It works, but its business case is yet to be proved.

University

WINNER: DELFT UNIVERSITY

RUNNERS-UP: DELFT UNIVERSITY

The eagle-eyed among you may have noted that Delft University of Technology enjoyed a runaway victory in this category. The Dutch university stormed the early rounds this year, eliminating last year's winner, the Hamburg University of Applied Sciences, to dominate the final round. This means that students from Delft were competing against each other.

Manon Kuehne created an innovative headrest for economy class that allows passengers to rest their heads securely, while Ting Yu Chen devised the FiO multimedia onboard lounge, and a team of six students developed Modulair, a concept study for a moveable galley. The winner was the simple and elegant headrest concept. There are a few issues related to hygiene to address, but this idea could be flying soon.

FAMOUS FRIENDS

There was a very special guest at this year's Crystal Cabin Awards ceremony: Sir Tim Clark, president of Emirates Airline. Sir Tim underlined the significance of the Crystal Cabin Awards in his speech at the ceremony held at the glamorous Hotel Atlantic Kempinski in Hamburg: "Hardly any industry is as open for creativity as the aviation industry. Every day we embrace new trends

– in design, in sustainability, and of course in the area of safety and security.

"It is essential that we encourage and appropriately reward experimentation with new materials, the questioning of established approaches, and the empathic adoption of a customer perspective. This is the only way we can continue to motivate the industry to think outside the box."

Passenger Comfort Hardware

WINNER: REBEL.AERO

With its folding mechanism and three-point harness, the S:two may sound like another seating concept, but for Rebel.Aero this folding short-haul economy seat is very real.



The folding mechanism is simple – raise the seat pan and the occupant can stand up in their own footwell, with clear benefits for ingress and egress, and they can even sit on the folded part during flight, creating a second seating position around 4.5in higher, which enables them to straighten their legs and stretch the lower back.

In its folded position, the seat could also function as a child's booster seat, which, combined with the three-point harness, would make an attractive proposition for parents flying with children.

RUNNERS-UP: DIEHL AEROSPACE

German company Diehl Aerospace has been getting attention with its Dandelion concept, which enables the projection of images and films in segments of the cabin, for example to create a relaxing or jetlag-reducing lighting mood. In the demonstration Diehl gave the Crystal Cabin Awards judging panel, the ceiling of a cabin became a giant slot machine for a passenger game on a flight to Las Vegas. Just an idea, but it showed the possibilities...

TEAGUE

Teague's second entry in the awards is the Waterfront business class seat, developed with B/E Aerospace, Panasonic and Formation Design. This long-haul seat concept is based on a proven, certified seat, but neatly integrates a number of innovative elements such as inductive charging, in-seat climate control, 4K IFE, and clever stowage options for devices. See p96 for more details. ☒



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THERMAL COMFORT

The next level of luxury for premium travelers will be the ability to tailor their personal in-seat microclimate

The first and business class travel experience has improved vastly over the past decade.

Advances in interior design, seat design and connectivity have greatly improved the level of comfort for travelers, but to compete for premium passengers, the premier airlines must also provide the kind of immersive luxury experience to which these travelers have become accustomed in their daily lives. Increasingly, this luxury is found in the passengers' ability to customize their environment and, while premium class accommodations offer many choices, missing from this set of luxury amenities is the ability to personalize the passenger's thermal environment.

Inspiration can be found by looking at the luxury automobile and how it caters to the well-being and comfort of passengers. The average first and business class passenger travels to and from the airport in the luxury of an automobile that offers in-vehicle wi-fi, luxurious interiors, high-fidelity entertainment and thermal comfort choices, resulting in a personal microclimate, centered around their climate-controlled seat. On board the aircraft, most of these same amenities remain, with the exception of thermal comfort. In their automobiles, passengers are able to personalize their thermal environment through adjustment of seat and surface heaters, active seat cooling and multizone climate control systems. This personalization ensures that, regardless of outdoor temperature or other occupants' preferences, a luxury automobile passenger can control their individual microclimate to match their current need and optimize their travel experience. This same luxury, if applied to aircraft seating, can increase relaxation, productivity and sleep continuity; all



Everything from the seat cushions to the hard seat surfaces can be adjusted

LEFT: THROUGH SEAT AND SURFACE HEATING AND COOLING, PASSENGERS CAN CREATE THEIR OWN MICROCLIMATE

luxury experiences that premium passengers have come to expect. But this innovation, so ubiquitous in luxury automobiles, has not been made available to aircraft interiors – until now.

Gentherm, a leader in automotive thermal comfort systems, and a pioneer in microclimate solutions, is shifting the paradigm for premium passenger comfort by making personally controlled thermal comfort on board aircraft a reality. Providing this comfort requires the ability to individually control and deliver energy and airflow on demand to targeted surfaces for each passenger – something current aircraft environmental control systems are unable to deliver. The seat surface, which is the largest, single contact area for a given passenger, makes it the ideal anchor for efficient thermal comfort and a personalized microclimate.

With 40 years of thermal comfort experience in the luxury automotive industry, and millions of systems sold

worldwide, Gentherm's solutions have proven to be consistently high performing, safe and reliable. The company's solid-state thermoelectric heat pumps, proprietary air distribution systems and other heating technologies, offer an array of solutions that allow the seat OEM and airline to optimize system performance based on specific power, weight and reliability requirements.

Gentherm understands that each passenger has unique thermal comfort requirements and its engineers can solve the most complex thermal management problems. Gentherm systems provide customers with uniquely tailored thermal technology that creates a personalized thermal comfort environment and enhances the prestige and value of the air travel passenger experience. ✕

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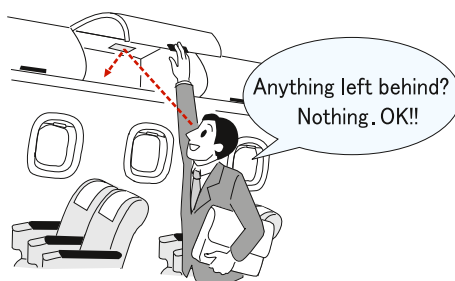
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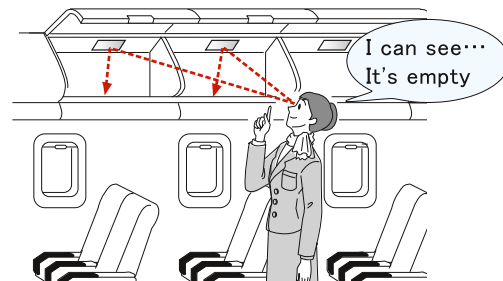
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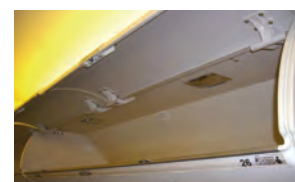
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CLEAR THINKING

The use of advanced materials and resins can expand cabin interior design options

Cabin interior design is all about the passenger experience, as it greatly influences traveler choices about which airlines to fly with. So many factors can add to or detract from a cabin's ambience, which is why carriers and tier suppliers put such care into virtually every aspect of design.

And while good design – whether it's a seat, the look and feel of interior elements such as cabin dividers, cabin environments for each class of traveler, or lighting – plays a strong role in comfort, experience and repeat business, other factors also come into play: weight reduction, ease of maintenance and updating, overall cost containment and, of course, compliance with safety regulations and OEM requirements.

Understanding what resources – particularly new materials – are available to help achieve these objectives is a challenge. While some materials may help in one arena, few are capable of achieving multiple wins. Let's look at two that stand apart.

With the increasing prevalence of LED lighting comes the need for materials that are LED-compatible while still meeting weight and safety considerations. A specialty material from SABIC – Lexan CFR5630D resin – is a material of choice for LED lighting. The product offers wide-angle light scattering for excellent aesthetics combined with optimal light diffusion and transmission. The resin is also ultraviolet-stabilized for improved color stability over the lifetime of the lighting part. To support design freedom, SABIC offers this material in five diffusion colors. The material can be used in very thin and lightweight walls (down to 1.0mm) while meeting the requirements of the FAR 25.853 vertical burn test – a milestone for polycarbonate materials. To ensure

SABIC's Lexan XHR transparent sheet won a 2015 Crystal Cabin Award



ease of manufacturing, Lexan CFR5630D resin is capable of being used in either extrusion or injection molding processes, and is 'lot-to-lot' certified from a compliance perspective.

The second material that stands apart is Lexan XHR sheet, a 2015 Crystal Cabin Award-winner in the Materials and Components category, which enables virtually unlimited choices for distinctive cabin designs and solves the long-standing industry problem of the lack of a transparent material that also meets safety standards.

The forecast growth in new aircraft, as well as the healthy demand for retrofits, presents ample opportunities for creative designs that have the power to underscore a brand while surprising and delighting flyers. As aircraft interior designers seek to achieve modern, light-filled cabin environments, they require

a range of transparent materials that meet the industry's vertical burn standards and are amenable to different processing technologies.

Lexan XHR sheet offers the highest level of light transmission available in an OSU-compliant sheet material today, meeting OSU 65/65 heat release and typical industry FST requirements. But its versatility expands well beyond transparency. With lamination, it is possible to specify a wide range of colors or textures including brushed, matte, moire, stucco, gloss and more. Add-ins such as foils or organic material such as coffee beans or bamboo can be used to create a custom effect. Lexan XHR sheet can also be mirrored. ☒

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AHEAD OF THE CURVE

Rollon presents an innovative telescopic rail with curvilinear motion and a customizable radius that opens the way for new cabin designs

The aeronautical sector has demanding technical characteristics and performance requirements, of which Rollon is well aware. Some fundamental requirements of linear motion components supplied to the aviation sector are that they must be lightweight, compact in design and quiet in operation, as well as having high strength and load capacity. All these needs must be met in linear motion components, while still guaranteeing excellent rigidity and smooth motion.

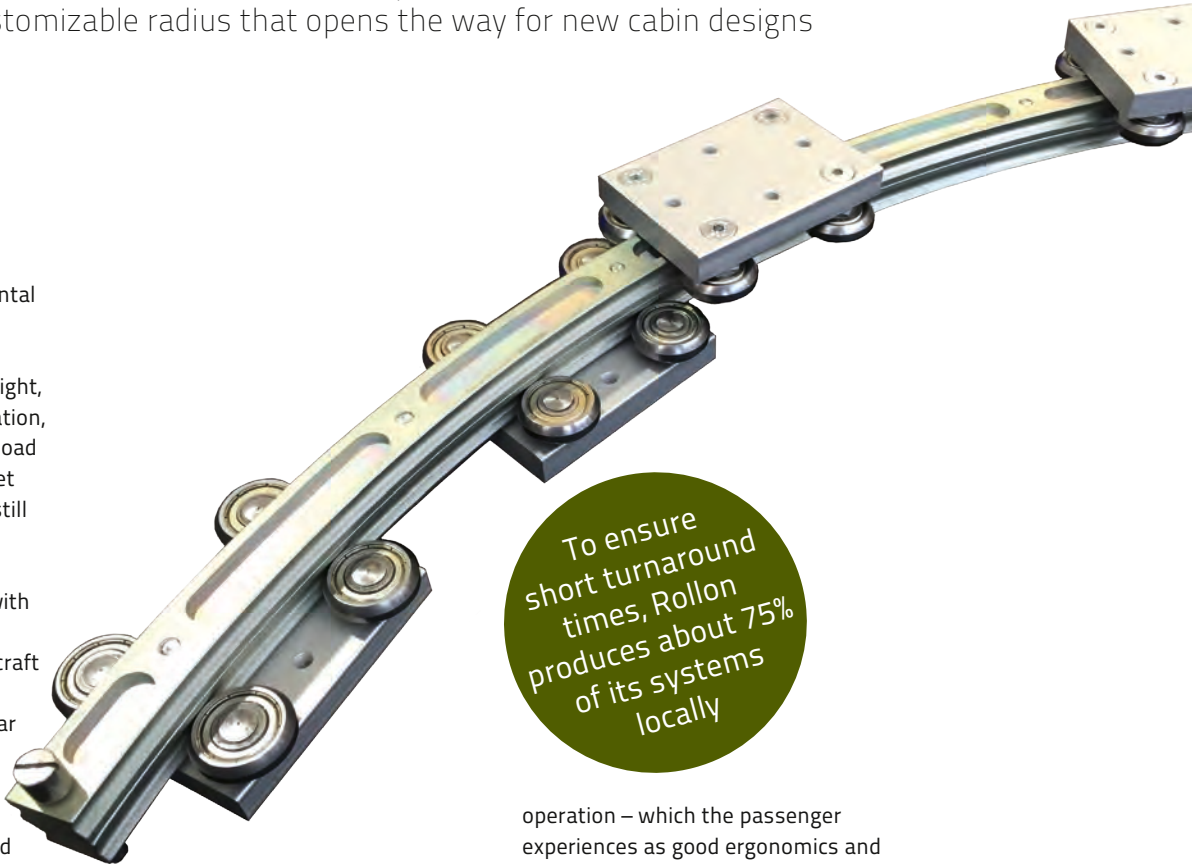
This is why Rollon, which works with key players in the design of first and business class aircraft seats and aircraft interiors, is taking an innovative approach to the development of linear and telescopic rails that fit the requirements of numerous applications in this sector. These applications include seat tracking and movement mechanisms for headrests, footrests, armrests, privacy screens and extractable tables.

Because Rollon pays close attention to the particular needs and trends of the aeronautical sector, the company has been able to develop a new product that can open up innovative options for designing applications for aircraft interiors: Curviline, a new telescopic rail able to manage curved movements with a variable, customizable radius that can be adapted to a specific application.

The rail itself is made of steel, and therefore offers solidity and rigidity in a small amount of space. In order to achieve a lighter weight, the metal profile was redesigned to eliminate excess material, while still maintaining a high level of quality and reliability. The sliding motion is handled by sliders with ball bearings, to offer maximum fluidity of movement, absence of friction and quiet

ABOVE: TELESCOPIC RAIL WITH CURVILINEAR MOTION AND CUSTOMIZABLE RADIUS. THE RAIL PROFILES HAVE BEEN LIGHTENED COMPARED TO STANDARD CURVILINEAR PRODUCTS

BELOW: CURVILINE CAN BE ADAPTED AND CUSTOMIZED FOR SPECIFIC APPLICATION REQUIREMENTS



To ensure short turnaround times, Rollon produces about 75% of its systems locally

operation – which the passenger experiences as good ergonomics and comfort. In addition, a special surface treatment gives the rail sufficient resistance to corrosion, which is an indispensable quality in aviation.

The new telescopic rail with curvilinear movement can be used in several different applications inside the aircraft. It can be part of the movement mechanisms of seats, extractable tables, and sliding divider panel systems.

This product is a great example of the Rollon group's aptitude for customization and its ability to create new solutions based on its clients' requirements. The company is headquartered in Italy, with branches in Germany, France, the USA, India and China, and offices in Russia, Brazil and the UK. ☒



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QUALITY APPROACH

EBCO applies the latest production and management methods to ensure quality in its tray table and armrest manufacturing

EBCO is an experienced supplier of tray tables and armrests for aircraft seating. Using its special PUR-filler product, the company is able to offer customers a very lightweight, yet hard and dimensionally stable, aircraft passenger tray table with a long life.

The single or bifold tables are available in many shapes and can be printed with anything from logos, to images, to text. In addition to these tray tables, EBCO can offer a new antibacterial and germicidal PUR armrest with a high level of abrasion resistance, available in any color.

EBCO PUR materials for tray tables and armrests fulfill the highest aviation standards, including ABD0031 and FAR25.853b, and have a proven track record of millions of air miles.

Over the course of more than 15 years, the company says it has perfected its production methods and can supply the entire assembly for tray tables and



armrests, including all components, all tested and approved according to the strictest criteria. EBCO says it can ensure a high standard of quality for customers, right across its daily output of approximately 600 tables and more than 800 armrests, delivered around the world,

Quality is ensured by the use of a highly diversified range of measuring and testing equipment, which includes a color light chamber, an alternating climate test furnace, abrasion and hardness testing

machines, and internal flammability test equipment.

EBCO also strives to further optimize its operational mechanisms and improve production workflows. The company works steadily and with high intensity, sometimes supported by external advisers, to improve its production processes to ensure high-quality product.

Methods such as Kaizen, Kanban and 5S are used, in combination with efficient lean management in production and administration. Using these Toyota management methods, the company strives for effectiveness and efficiency. EBCO constantly applies lean management practices to optimize its working mechanisms, as it believes the improvement of production processes is a continuous task. ☒

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FIRST-CLASS COOKING

Aerolux offers a range of galley inserts that can help airlines differentiate their cabin service from the competition

Founded in 1988, Aerolux has become well known for producing quality custom-engineered galley inserts for commercial and corporate/business aircraft. Starting off in the early days with a range of refrigeration products, and in particular a wine chiller, at the request of its customers Aerolux has developed specific products to enable differentiation of the cabin service, not only for the standard and premium galleys, but also from airline to airline. These products include an award-winning espresso coffee maker, a skillet, a rice cooker, warming ovens and fridge freezers.

The Aerolux coffee maker is a self-contained unit designed for inflight preparation of espresso. This is the only coffee machine approved for aircraft use to carry the Nespresso brand name, using its patented coffee capsules. Aerolux has also designed a unit to prepare toast and even toasted sandwiches in the galley. The Aerolux toaster will toast two or four slices of bread, light or dark. The unit has been designed and built from food-grade materials. It enables easy cleaning and features a removable crumb tray.



For the complete breakfast in the air, Aerolux has developed the Aero-Skillet – a safe and easy-to-use hot-plate suitable for cooking eggs and hash browns. The rice cooker unit, initially designed for the preparation of rice on Asian routes, has also been adapted for heating liquid food such as consommé. The unit has been designed and built to maintain hygiene and to be easy to clean. ☒

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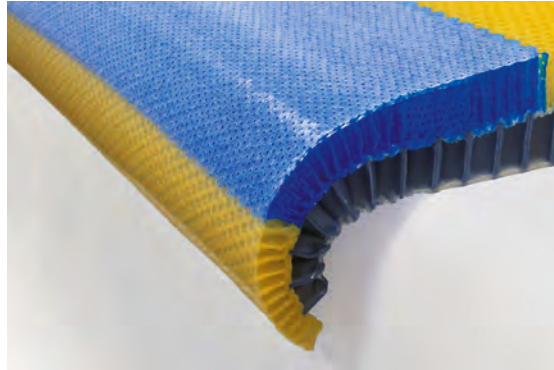
AIR SUPPORT

Engineering comfort: the science behind Stimulite honeycomb cushions

Most people would agree that comfort is subjective. When comparing seat cushions, some passengers prefer a soft cushion while others prefer one that is firm. But the composition of a cushion can also influence comfort.

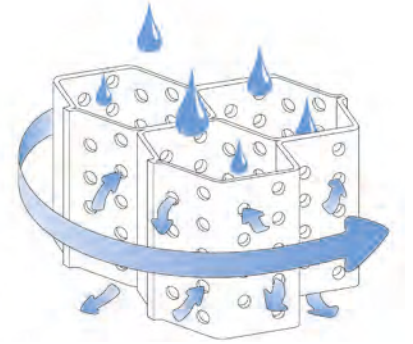
Unlike traditional foam cushions, Stimulite honeycomb cushions are comprised of a cellular matrix that is more than 90% open space. The elastomeric cells are fused together in a pattern of alternating thick- and thin-walled cells. This geometry makes the cushion lightweight and also anisotropic, having different degrees of resistance in multiple directions – thickness, length and width. Anisotropy is what enables the cushion to contour to the body. When sitting on a Stimulite cushion, the cells radiate outward to surround the anatomy, giving a comfortable sensation of support.

Perforations in the cell walls circulate air and evaporate moisture to prevent the heat build-up and resulting discomfort that can occur during several hours of sitting.



And because the cellular geometry creates an optimum strength-to-weight material, Stimulite cushions can support weight at much less thickness than most foam cushions, giving on average 50% reduction in thickness and weight. A thinner cushion gives more living space and therefore more passenger comfort.

In instances where thickness cannot be reduced due to seat pan contours, Stimulite can be combined with a foam base layer. Made from thermoplastics, Stimulite cushions can be made in any firmness – stiffer for regional flights for



example, with a softer honeycomb under the legs. The cushions are also fully customizable to any shape, and are washable and completely recyclable.

A leading technology for pressure sore prevention for more than 20 years and a critical component in fighter jet ejection seats, Stimulite cushions are now flying in economy on Swiss International Airlines' new B777, giving comfort to passengers on long-haul flights. ☒

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Boeing 707

"Only one drawback – the trip was too short!" This is the sort of comment that airlines dream of hearing passengers saying after a flight, the kind of sentiment that cabin designers strive for. This aim is nothing new though, as it was an advertising tagline for the Boeing 707, launched in 1958. At a time when the public was a little apprehensive about jet travel, especially given the safety catastrophes of the first passenger jetliner, the de Havilland Comet, this long-range narrow-body was marketed at the public as much as airlines, with the safety, smoothness and comfort of the B707 given as much emphasis as its speed.

The B707 informed many of today's cabins, with the seating aligned to its 100+ windows to give passengers light and a view that connects them with the flying experience, passenger boarding on the left (now standard), and overhead hat-rack stowages that inspired Boeing's future cabin architecture.

Following marketing efforts to demonstrate the safety of the aircraft, bookings began and the public was quickly

ABOVE LEFT: A HISTORIC MOMENT ON BOARD THE AIR FORCE ONE B707 IN 1963 AS LYNDON B JOHNSON TAKES THE OATH OF OFFICE FOLLOWING THE ASSASSINATION OF PRESIDENT JOHN F KENNEDY

ABOVE: MARKETING MATERIALS FOR THE B707 PUSHED THE COMFORT AND SAFETY ANGLE

ABOVE RIGHT: ROLLOUT OF THE FIRST 707 AT RENTON, MAY 1954

convinced of the B707 experience, with it becoming a popular and even fashionable way to travel – the launch customer being über-trendy Pan Am may have helped a little. Indeed the B707 experience was one that the public actively sought when selecting an airline (a quality pursued today, as shown in Dreamliner and Airspace by Airbus marketing).

With growing passenger confidence and a strong US economy, passenger numbers in the USA doubled from 1958 to 1965, with 100 million people taking to the skies, many switching from road and rail alternatives. The aftereffects were huge, in terms of airport design and infrastructure, inflight catering and air traffic control – with the success of jet travel through the B707 and its competitor DC-8 being partly responsible.

Boeing made a massive investment in the B707, and it certainly paid off. However, those soaring passenger numbers also meant that airlines began to need larger aircraft in order to cope. Boeing's answer was the twin-aisle B747 – and the rest is history. ✕

Visit our website to see a video of Operation Guillotine, part of Boeing's safety marketing for the B707

"Not a ripple in your coffee aboard the 707"



Carpeting can be made using more or less.
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LESS

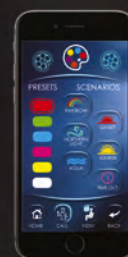
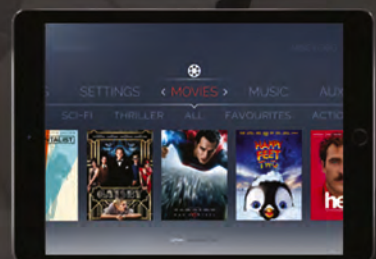
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