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Arcraft interiors INTERNATIONA THE INTERNATIONAL REVIEW OF AL RIOR DESIGN AND COMPLETION

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ALL YOU NEED TO KNOW ABOUT COLOR, MATERIAL AND FINISH, FROM TRENDS FORECASTING, TO ISSUES IN FLAMMABILITY TESTING

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GERMAN DESIGN AWARD 2015 FOR RECARO

The new CL6710 for the business class



The German Design Award is one of the most coveted international design prizes. RECARO Aircraft Seating has received special mention in the Transportation and Public Design category for the new CL6710 business class seat.

The RECARO innovation combines high comfort with the possibility of a high density cabin. It offers excellent living space, direct aisle access, and a variety of stowage opportunities. For the design of the business class seat, RECARO was inspired by contemporary interior design. Exclusive materials, clear lines, and contours emphasize the visual comfort and the premium quality of the product.







finishline

I've heard tales of color, material and finish experts not being held in such high regard as their industrial product counterparts – the 'proper' designers. For the more mechanically minded, it is easy to dismiss their work as simply playing with swatches and samples all day – 'fluffies' is one term I've heard used to describe CMF professionals – but their work creates the all-important first impression upon boarding; indeed a single pattern could be used across an entire airline brand experience, being seen and enjoyed everywhere from a ticket office in Nairobi to a first class lounge in Narita. Their work creates the tactile interface between passenger and seat – an airline's 'handshake'. But what must really be appreciated is that CMF design is not just important: it is skilled, difficult work.

We hope that our feature on flammability tests (page 60) will highlight some of the challenges being faced by CMF experts as they strive to keep abreast of new regulations, as well as continually working to ensure that their aesthetic goals meet the authorities' safety standards. For example, when designing the CMF for a seat, not only must each combination of materials work from a visual point of view, but it must also undergo stringent flammability tests, with each combination, complete with any fillers, becoming a new project, and with the flame-retardancy products used in the manufacturing process potentially harming the visual, tactile and durability qualities of the materials. In short, don't underestimate the expertise of CMF teams who have to work closely with their expert suppliers to make their visions a reality. Author Marisa Garcia knows the topic well, having worked personally on a particularly difficult certification program – the cushioned leather bulkhead panels for Continental.

There is also something for everyone – and we do mean everyone – in our feature on inclusive cabin design on page 24. Whatever their age, physical abilities, or any other human factor, everyone should be able to enjoy the flying experience in comfort, safety and dignity – and of course to enjoy the beautiful colors, materials and finishes.

Adam Gavine, editor

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Virgin Australia and Qantas reveal stunning new business class cabins; Thomson reveals a family-oriented future; some new ideas to get your head around; the latest industry figures and more

018 design briefs

An aircraft that meets the needs of athletic passengers; and a concept that maximizes the potential of OLED technology in the cabin





024 design for all

Everyone should be able to enjoy the full airline experience, no matter their level of mobility. Good design can ensure a quality, inclusive experience for all



036 virgin atlantic dreamliner

As Virgin Atlantic launches its Boeing 787 as part of its 30th birthday celebrations, could the fun-loving airline be showing signs of settling down?

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112 classic cabins

Could the Palomar seat on the Douglas DC-8 have been a design ahead of its time?





Meet Reuben Arnold, director of brand and customer experience at Virgin Atlantic, who is masterminding the strategies and details that shape the public's impressions of the airline

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050 PSU design

The Passenger Service Unit must be one of the least appreciated elements of the cabin. A panel of international experts give their vision of how the PSU could develop in terms of features and aesthetics



068 cabin mock-ups

Whether you need a mock-up for evaluation, sales or promotion, the latest developments in their design and manufacture make them nearly as good as the real thing



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076 A350 XWB IFE

From flat floors, to more footspace, to improved interaction, John Walton investigates the benefits that the A350's latest-generation IFE systems can bring to passengers

textile trends 084

This trends forecast will help ensure that your color, trim and finish scheme doesn't end up behind the times





094 lighting

You may have a fancy new full-color LED lighting system, but do you know its true potential? New interfaces are unlocking further possibilities



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UPDATED CLASSIC

The economy cabins in the 'red roo's' international A330s will be fitted with a next-generation model of the single-beam Recaro seat fitted to the airline's A380s and refurbished B747s, which was also designed by Marc Newson and has received international acclaim. Enhancements include larger seatback IFE displays, footrests and multidirectional headrests, and the armrest now folds away fully. The economy seats on the Qantas domestic A330-200s will also be refreshed, with new covers and cushions, and multidirectional leather headrests



01. Requesting the mattress gives extra comfort, and a chance to engage with the crew 02. Stowage

- space has been enhanced to meet the needs of business flyers
- 03. Pending CASA approval, customers will be able to recline throughout a flight

Following the success of previous design collaborations with top Australian industrial designer Mark Newson, Qantas has again teamed up with him for a new product that is critical to the airline's financial success: the Business Suites that will feature on its fleet of 28 A330s.

relaxed approach

The Qantas A330 fleet is receiving the Marc Newson treatment, including a heavily customized business seat and cutting-edge IFE

The suites are customized versions of the Vantage XL seat manufactured by Thompson Aero Seating, for which Qantas was the first customer (Scandinavian Airlines revealed its XL-based product first, but was the second customer). The seats have an overlapping 1-2-1 configuration, which combines high cabin density with direct aisle access and fully flat beds.

The Qantas model has some interesting features. For example – pending final CASA certification – the seats will allow customers to recline in their seat (up to 7in/25° on international flights and 5in/21° on domestic flights) all the way from take-off to landing. Following that CASA approval, crew can, upon request, fit the seat with a mattress, which can be used all the way from take-off to landing. Also, some discreet modifications have been made to enhance passenger comfort, following the results of ergonomic trials and inflight monitoring tests conducted by Qantas with a panel of experts and customers.

As Alan Joyce, Qantas Group CEO, explained, "We've listened to what matters most to our customers and done extensive ergonomic trials to deliver the highest levels of comfort, privacy and intuitive design. There's enough space to eat while continuing to work, which is something our business customers said was very important to them, and plenty of storage room to keep the range of electronic devices that people now travel with."

Creative designer, Marc Newson, added that intelligent design and functionality were the guiding principles behind the A330 business suites: "The design was based on a real understanding of what Qantas customers needed on longer domestic flights and overnight international flights from Asia, with practicality, comfort, privacy and style in mind to create a relaxing environment to work, dine or sleep".

The passenger experience is also being enhanced throughout the A330s as, beginning in December 2014, the airline is introducing Panasonic eX3 IFE systems, with larger touchscreens (16in in business) in addition to Q Streaming technology, enabling them to stream content from an onboard library directly to their own devices.

Business class customers on domestic Australian A330 flights will also enjoy eX3 systems, while economy customers will have either seatback systems or devices provided by Qantas in every seat.

The interiors refresh – which takes around one month for each of the 28 aircraft – is starting at Qantas' heavy maintenance facility in Brisbane in November 2014. The first of the domestic refurbished A330 fleet will take to the skies in late December from the east coast to Perth, and the first international A330 will commence flying in January 2015. ⊠

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Airline ancillary revenue will reach US\$49.9bn worldwide in 2014 - an increase of 17.2% from the 2013 estimate of US\$42.6bn. In 2013, airlines took **US\$31.5bn** in ancillary fees, compared with US\$2.45bn in 2007 - a growth of **1,200%** IdeaWorksCompa

56%

of passengers want inflight connectivity, and 45% of those passengers would use their connected device to purchase food, drinks or inflight shopping

17% of travelers would switch from a preferred airline to one that offers better wi-fi Honeywell survey



swelltimes

From seat supply to ancillary revenue, figures gathered during the final guarter of 2014 indicate strong growth in the aircraft interiors sector - and some changes in passengers' expectations

WORLDWIDE

The global commercial aircraft cabin interior market is estimated at US\$12,852.96m in 2014 and is expected to grow at a CAGR of 5.99% to reach US\$17,194.90m by 2019 MarketsandMarkets

NORTH AMERICA

3.41% The North American commercial aircraft cabin interior market is expected to grow at a CAGR of during the forecast period 2014 to 2019 Research and Markets

The super-first class seating market will achieve a CAGR of 10.6% from 2013-2023, while first class will grow at 7.1% and lie-flat business seating 8% **Counterpoint Market Intelligence**

Airbus and **Boeing aircraft** being delivered from 2014-2020 will require over 3.4m seats

Research and Markets



are in favor of banning reclining economy seats



The global IFEC market will grow at a CAGR of 7.69% over the period 2013-2018 Research and Markets

3 out of 5

3 out of 5 travelers would give up IFE, beverages or access to the lav in order to board the aircraft first Citi/AAdvantage survey

PRIORITY BOARDING

> The global commercial aviation aircraft seating market is estimated at US\$5,991m in 2014 and is projected to reach US\$7,910m in 2019 MarketsandMarkets

EUROPE

The European commercial aircraft cabin interior market is estimated at US\$2.29bn and is expected to grow at a CAGR of 8.51% to reach US\$3.45bn by 2019 Micromarket Monitor

SITTING COMFORTABLY



Asked which US domestic airline has the most comfortable economy seats. survey respondents said:

> JetBlue: 21% Alaska: 17% Hawaiian: 14% Frontier: 13% Airfarewatchdog survey



of respondents are okay with PED-based IFE, but 94% expect to benefit from the cost savings to the airline. Of those respondents:

• Around 50% expect more free IFE content

• 27% expect a cheaper ticket

• 18% expect discounted baggage fees

Osurv survey

head<mark>space</mark>

Some new ideas have seen airlines and airframers messing with passengers' heads for the good of the next-generation passenger experience

captivating casign is Thales' casign is Thales' immersive Seat immersive Seat concept. Visit the concept. Visit the concept. Section Exclusives section



Safe viewing

Some experts at Airbus are of the opinion that today's IFE systems may not sufficiently relieve passenger boredom or stress, and have filed Patent US8814266, for a seat headrest that incorporates an immersive IFE 'helmet'. The helmet features a visor that can show 2D, 3D or even holographic content and, together with the built-in high-quality headphones, can deliver sensory isolation from the cabin and give airlines a potential source of ancillary revenue in offering the system. Wearers can completely immerse themselves in films or music to help them forget they are on a long flight full of strangers – it even offers adjustable "olfactory isolation". If things get a little hot, the helmet can also be connected to an air flow source. Perhaps you wouldn't even need a PSU (see page 50)

2

Armchair tourists The creative team at Emirates' Innovation Lab in Dubai has been experimenting with Oculus Rift virtual reality headsets to give actual and potential customers an experience of the lounge, showers, and business and first class cabins on its A380s, without them having to step on board. The lab combined Google Street View technology with the Oculus headsets to give an immersive experience of the flagship aircraft, and is exploring new uses of such leading-edge technologies for potential

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use in cabin crew training. To see for yourself, explore Concourse A of Dubai International Airport on Street View. The team is also working on going a step further using motion sensor technology – similar to Microsoft Kinect – to see if it can create new interactive experiences for Emirates' customers and staff.

Quiet contemplation

Imagine sinking back into the headrest and enjoying a moment's peace. Now imagine doing that on an aircraft full of hundreds of people, with four giant turbofans doing their stuff out on the wing. Silentium, an Israeli company specializing in noisereduction technology believes it may have found a way to achieve that inflight peace without requiring noise-cancelling headphones. QB2 (QB standing for 'quiet bubble') is an active noise reduction system that includes 2-4 loudspeakers, 4-8 microphones and a DSP-based controller all mounted inside the headrest. The system is claimed to 'capture' all the ambient noise of the environment in the range of 100-1,500Hz, creating a quiet zone around the passenger's head. The system is claimed to offer all the benefits of a noise-cancelling headset.



Blanket approach

The Myndplay headband, a device that measures tiny electrical fluctuations in the neurons of the brain, doesn't sound like it has a place in an aircraft cabin. However, in an experiment to see the actual physical and mental effects on passengers of its onboard improvements, British Airways persuaded volunteers across all travel classes to wear these headbands on a flight from London to New York. The headbands were connected via Bluetooth to 'Happiness Blankets' into which fiber-optic lights were woven. Information from the wearer's brain was sent to the blanket every second. If the blanket turned red, the wearer was stressed; if blue, the wearer was relaxed. BA reported positive blue blankets as the volunteers tried the new menus and IFE content, the improved neck and back support, and the LED lighting.



Quiet zone

If these ideas all sound a bit too high-tech, you can take comfort in the old-fashioned values and other-worldly styling of the Ostrich Pillow, created by the Kawamura-Ganjavian design studio and manufactured by Studio Banana. Part cushion, part pillow, part garment, the idea behind the item is that when you put your head and hands into the soft interior, it creates a relaxing, private space, even for an economy passenger in the middle of the middle row in the main cabin. A further benefit of the sensory deprivation is that wearers of the pillow cannot see the strange looks they are getting from fellow passengers. If you would like an Ostrich Pillow for your next flight then you're in luck, as following a successful funding campaign on Kickstarter, it can now be yours for €80, or €245 for a family pack of four.

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As Australian rivalry heats up. Qantas has also unveiled a fantastic new business class – see p8



SEVEN HEAVEN

As part of the changes to the Virgin Australia B777 fleet, four seats have been added to business class, and the business class bar and lounge area have been redesigned, featuring interconnecting angles that break up the conventional cabin shape. Space was created by removing a remarkable 16 seats from premium economy, making it a more intimate 24-seat space. That reduction in seats also makes Virgin Atlantic's premium economy a little more new 8787 also has 'premium', with an additional a new business seat, 3in of pitch (now 37in) and an redesigned bar and upgraded self-service snack area, while new seating fabrics and leathers add to the quality experience.

southerncomfort

Virgin Australia has gone fully flat to raise the interest of business travelers

01. Further seat features include a tablet holder. 16-18in IFE, multiple lighting settings and plenty of storage

enhanced premium

economy

- see p36

02. The B777 bar and lounge area has space for several auests to relax 03. The Panasonic eX2 IFE displavs in business will be 16in on the A330s

and 18in on

the B777s

As competition intensifies among Australian carriers keen to get their bottom lines back into the black, Virgin Australia has announced 'Virgin Vision 2017', a battle plan that aims to introduce measures over the next three years that will attract premium customers. As an opening salvo, the airline has unveiled innovations for the cabins of its wide-body A330 and B777 fleet.

At the heart of the upgraded passenger offer is the introduction of suites in business class, based on the B/E Aerospace Super Diamond platform - a major upgrade from the previous reclining seats in business.

The 1-2-1 configuration gives the all-important feature of direct aisle access, while the lie-flat bed (80in-long) brings the product in line with international business class offerings. Virgin Australia went a step beyond specifying a great seat though, and brought in design agency Tangerine London to customize the seat and the premium cabins.

Explaining the heavy customization of the Super Diamond, Tangerine designer Martin Mo stated, "We considered as many aspects as we could. Everything was rethought - the side profile, the return wall and the seat itself. We did a lot of work on the covers and changed the seat divider. We changed the monitor detail. No detail was too small. We made tiny changes to the ventilation gaps to help achieve the right passenger experience.'

The design teams at the airline and at Tangerine wanted to ensure that this premium product looks and feels premium, so they invested a lot of effort into the color, trim and finish, which features bold contrasts of warm metallics and black leathers, and smooth painted

areas with a range of finishes. The depth of detail meant that further cabin aspects, such as the bulkhead, storage spaces and divider curtains, received the designers' attention - indeed even the baby bassinets were remodeled and the wardrobes lined with textile.

According to Tangerine, particular consideration was given to how light and shadow play on surfaces such as the louvered privacy screens and the sparkle in the metallic paint on the adjacent surfaces, the combination of leather and fabric on the seat and the texture of the curtains at the end of the cabin

As Tangerine's creative director, Matt Round, explained, "I was particularly keen to introduce a lot of texture because one of the problems current aircraft cabins have is that there is so little variation in the surfaces because of the way so many of the components are made."

The refitted A330s will roll out from March to August 2015, with the B777s following from November 2015.

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THE HUMAN ELEMENT

The crew is a part of the seamless holiday airline experience, and using iPads, can offer personalized customer service, and can pass special requests and information over to the resort team before the passenger arrives, blurring the line between cabin crew and holiday rep. Indeed, there will also be an onboard 'HolidavMaker'. a member of the resort team who can share extensive knowledge of the destination. Perhaps the most valued member of the cabin crew will be the trained 'kids' club' attendant, who can help parents keep children entertained with arts, crafts and quizzes that relate to the destination.



perfect**getaway**

A UK leisure carrier is striving to really bring to life its idea of air travel as part of a wider passenger experience

01. The booths enable proper family time during a flight 02. The walk-up Beach Snack Bar is a fun onboard destination 02. Table for two? The Duo seats give couples a special way to begin a

romantic trip

As part of its five-year vision of how the onboard experience could be developed, UK-based leisure carrier Thomson Airways has revealed some exciting and innovative onboard product and service concepts that the airline says it is planning to implement across short-, mid- and long-haul flights.

The idea is that the airline can take advantage of having aircraft due for delivery in that period – Boeing 787s and 737 MAXs – which can be specified to make them an integral part of the vacation experience (Thomson Airways is the airline for the Thomson and First Choice vacation companies), and to show that a leisure carrier is no 'poor relation' to the scheduled carriers.

David Burling, managing director of parent company TUI UK & Ireland, said, "Our overall goal is to make travel experiences special and, as the flight marks both the start and end of the holiday, we see it as an integral part of the whole holiday experience. That is why we want to define and lead a new category of flying – the holiday airline category. This describes an airline designed for the specific needs of the holidaymaker and fully connected to the holiday experience in the destination."

Focusing on the short- and mid-haul experience on the B737 MAXs – of which the airline will receive 47 by 2020 – are the hard product concepts.

The design team had to consider the various types of people who would be traveling on these aircraft, and what their specific needs might be. The majority of holidaymakers will be content with a fairly standard economy seat offering on these lengths of route, but for those willing to pay a little more, they can really begin their holiday with a pop (or at least less screaming) in the Premium Club cabin, located to the rear of the aircraft. Thomson is also beginning a multimillion-dollar refresh of its B737 and B757 fleet this winter

For couples heading for a romantic retreat, the Duo seating concept sees a set of three seats in a pod become two, with the middle seat becoming a Eurobizstyle table, suitable for sharing a bottle of champagne – a nice way to begin a trip, and a nice potential source of ancillary revenue.

For families, or for a group traveling together, the family booths are ideal. Reminiscent of train travel, two seat triples face each other, with a table in between. In this rearward location, younger passengers will disturb fewer people if they make noise, so parents can relax a little.

Premium passengers also benefit from a walk-up Beach Snack Bar, where they can get a drink or snack.

The IFE systems have also been considered. The bedtime story channel for children, bespoke teenage content and destination inspiration channels are all great, but not ground-breaking. However, the feeling of the journey being part of the holiday – specifically as part of a Thomson or First Choice holiday – becomes clear as the IFE system can also be used to arrange room upgrades, checkin in advance and book resort experiences.

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alternativeview

BRIEF: We love being in the window seat, but we feel that windows have so much more potential to boost the passenger experience, while also reducing weight and maintenance. Ideas please.

DESCRIPTION: The Centre for Process Innovation (CPI) in the UK has answered this question with a cabin concept that completely does away with conventional windows, instead lining the interior with 50cm-high, high-definition OLED displays to create a virtual view. If you want to see the world outside, the displays can show a live feed from the external cameras (from any point of the aircraft), while internal tracking cameras can move the image in accordance with the movements of the passenger's head, to give the feel of looking around.

Beyond this party trick, the displays could show images of the destination as they board, so passengers really feel their trip is beginning – or they could be used as lighting features to show brand colors upon boarding, and to create mood scenarios during flight. Passengers can also use the screens in their immediate environment – including OLED displays mounted to the seatback in front – to personalize their experience, showing whatever content they wish, from movies to cityscapes, to using it as second-screen IFE. These seatback displays also mean that passengers in aisle seats will not miss out, as the entire seatback can act as their window on the world – similar to some moving map options today, but on a larger scale.

The sidewall displays can be mounted directly on the fuselage, or on modular lining panels that can be used to conceal cabin utilities. Rather than have a single screen panel running the length of the fuselage, to ensure that any faults are localized, and to give each window seat passenger their own personal sidewall display, several screens are instead installed in line with seat pitch. This arrangement also offers more flexibility in correcting the displayed images for parallax, which would increase the sensation of looking out of a window, rather than looking at a projected image.



VERDICT: CPI states that this is not just another 'blue sky' concept, as roll-to-roll manufacturing techniques being developed could see these screens produced in five years, at similar cost to current displays. As a concept, we love it, but think that its application would be a little more reserved. Full-cabin displays of the sky would unnerve even the most frequent of flyers, but there is no reason why a virtual window similar to a current cabin window couldn't be displayed, and perhaps a virtual 'glass floor' in a galley area could be fun. Also, using the sidewall panels for IFE would create a chaotic feel to the cabin, but the potential for lighting and decoration is really exciting. And we love the OLED seatbacks!



AEROLUX BUN WARMER



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slamdunk

BRIEF: Studies have found that when athletes travel across multiple time zones, they are more likely to lose. With the success of huge sponsorship deals at stake, global sports superbrand Nike needs an aircraft that not only transports professional athletes, but also removes the negative physical, physiological and cognitive effects of air travel to maximize their physical condition, ready for the next game.

DESCRIPTION: Nike collaborated with Teague to create the Athlete's Plane concept, intended as a 'complete training room in the sky'. The result is a concept that goes way beyond mere luxury seating – although the seats will accommodate even the broadest NFL linebacker or the tallest NBA power forward. The features of the seats are rather more specialized than a typical massage function, and include 'plug into plane' compression sleeves to ice sore muscles, as well as inflight biometric testing and analysis.

The concept centers on recovery, circulation, sleeping and thinking, which Nike and Teague identified as areas of performance innovation that are not addressed by commercial charters. For injured sports stars, the aircraft offers inflight biometrics and analysis to accelerate diagnosis and treatment, complemented by features such as massage tables and a walk-up 'nutrition zone'. Particular attention was paid to creating the ideal sleeping conditions, whether for a fatigued individual or a sleep strategy for an entire team, with a zoned cabin configuration separating noise; any grunts from the physio area won't disturb a teammate's sleep. Finally, to aid the thought aspect, the big screen in the lower lobe lounge can be used for analyzing game footage - or even just to watch a movie.



VERDICT: Nike, Teague and top athletes? Of course the concept is cool; it's so cool it could have been designed for Michael Jordan. However, what fascinates us is not so much the futuristic recovery and treatment rooms, but rather the potential trickle-down effects of the concept. If the well-being features truly work, they could in time benefit less athletic flyers on regular commercial airlines. For example, the sleeping technology excites us: imagine being able to book into a 'deep sleep' zone with an airline, with everything optimized for a truly restful flight. The biometrics could even indicate to the crew what you might need for breakfast. For us, the Athlete's Plane is a winner.



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universaldesignvalues

Air travel should not just be accessible for all – it should be enjoyable for all. Airlines need to truly embrace the needs of persons with reduced mobility in cabin design, or they will fail to attract a key market

MARISA GARCIA

Increasingly stringent international regulations and changing passenger demographics are drawing attention to a gap in aircraft cabin design practices. While cabins are designed to be attractive and comfortable spaces for passengers, a growing percentage of them may find the space unwelcoming, inconvenient or awkward. Persons with reduced mobility (PRMs) have tried to get the attention of the aviation industry for years, and while some accommodations have been made, there is still much to do to make the aircraft cabin a more <u>universally accommodating space</u>.

Eric Lipp, executive director of the Open Doors Organization (ODO), knows from personal experience that mobility challenges can be present at any age, and that the travel and transport sectors, including airlines, are illequipped to accommodate the needs of PRM travelers. On the day before his 30th birthday, Lipp was diagnosed with Von Hippel Lindau disease; a tumor had formed in his spinal cord. He was operated on to remove the tumor, but, because of the trauma from the surgery, Lipp lost his ability to walk. Rather than be defeated by this life-altering challenge, Lipp was motivated to found the Open Doors Organization, which would address the needs of all travelers with special restrictions, improving the quality of life for persons with disabilities. In 2002 and 2005, Lipp initiated the ODO/Harris Interactive studies on travelers with disabilities, which has become the definitive source for statistics on travel by Americans with disabilities.

UNIVERS

Over the years, Lipp and the Open Doors Organization have worked closely with a number of travel companies and manufacturers on large-scale projects to develop products suited to the needs of PRMs and disabled passengers. But he has found challenges in the aircraft interiors industry, specifically where cabin design is concerned. "Seating manufacturers have shown some interest," he tells us. "When we do get in front of them,

power chairs on board?

Two women in Texas have started a petition requesting that US citizens with severe disabilities be allowed to remain seated in their customized wheelchairs during air travel, for health and safety reasons. Presently, 1.6m people use wheelchairs in the USA, and of these, more than 200,000 use power chairs. The petition, which has garnered more than 21,500 signatures in two months, will be delivered to President Obama, Congress, the major airlines, aircraft manufacturers, and disability rights organizations.

Michele Erwin, founder of All Wheels Up, a non-profit organization whose mission is to advocate accessible wheelchair flight, with a focus on crash-testing wheelchairs for commercial flight, says, "A large majority of the work and reports have already been conducted, regarding crash testing wheelchairs. The FAA would only need to expand on the research already done..." Erwin cites tests that have seen wheelchairs pass 20g crash tests, surpassing the 16g aircraft passenger seat requirement.

01. PriestmanGoode developed the Air Access concept with a view to facilitating air travel for PRMs by easing the transition from gate to aircraft, while also making the process more dignified they get excited about the ideas of inclusive design." He adds, however: "Honestly, people with disabilities are just not on aircraft interiors list of 'things to do'."

Mobility is a key consideration, but not the only challenge that PRMs and disabled passengers face when flying. "Bathrooms!" Lipp emphasizes. "Many do not fly for that simple reason. The poor quality of inflight aisle chairs for use in the restrooms is problematic. Most crew do not even know how to unfold these chairs, and flight attendants are not properly trained for transferring people into and out of these onboard aisle chairs."

This problem touches on a point many experts have made. Universal design must consider not only usability and comfort, but also dignity. Passengers have the right to expect that they will be able to use all of the necessary facilities on an aircraft, but often they cannot. As Lipp explains, this is especially inconvenient on long-haul flights.

Industry regulators and governments have already demonstrated that they take the needs of PRMs and the disabled seriously, by introducing new regulations and imposing steep fines for non-compliance. The European legislation (EC) 1107/2006 (PRM Regulation) came into full force in 2008 and provides legal rights for disabled persons and PRMs wishing to access air travel. The regulation covers the whole of the passenger journey from point-to-point and requires that there be no discrimination. This same rule is adopted and enforced by the UK Civil Aviation Authority (UKCAA). The US Department of Transport (USDOT) Office of Aviation Enforcement and Proceedings has also imposed Section 382.7 – the Amended Air Carrier Access Act Regulation – which provides similar protections for PRMs and the disabled and their companion aides, as well as for their service animals. Despite ongoing debates from industry groups on the scope and enforcement of these regulations, many agree that catering to the needs of all passengers is not only a social obligation of the public transport system, but can also be a competitive advantage.

NOW IS THE TIME FOR CHANGE This is a historic time of growth for the interiors industry, with both Airbus and Boeing predicting that the world's fleet will nearly double by 2033. The number of new aircraft going into service, and the corresponding new aircraft interiors programs that will be in development in coming years, represent a unique opportunity to rethink aircraft cabin interior design to make it universal, beneficial and convenient to the needs of all passengers, regardless of their mobility restrictions. Because of the certification requirements for



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01

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dignified boarding

Mark Peurifoy, senior industrial designer at B/E Aerospace, explains the PRM benefits of one of the company's latest seat designs.

"The MIQ seat features a drop-down armrest for easier, more dignified, boarding," he explains. "A seat arm that pivots upward meets the regulatory requirements, but is unattractive and can make seating awkward. We considered dropping the arm down to the seat pan height as a better solution. It makes entry easier. The MIQ seat is a small step in the right direction, but we have always used these principles as part of our strategy to design better products.

"Our MIQ seat was a prototype incorporating this design philosophy," he adds. "We used it as a challenge internally for developing functional design that is also attractive. For now, it's a proof of concept, but it reinforces our confidence in the value of universal design."

WE HAVE UNMET NEEDS FOR THE PEOPLE WITH THE MOST MONEY TO SPEND

aircraft interiors products, and the lead-time required to bring a program to market, it is timely to consider this topic now. Aviation is a public service, and reacting to rather than anticipating the introduction of more stringent regulations can only lead to a costly rush to compliance. Changing passenger demographics also make universal design a priority.

Peter Knapp, global creative officer at Landor Associates, who has previously pointed out the need and benefit to airlines of caring for the 'Silver flyer' demographic of the 60-plus passenger (see *Peer Pressure*, June 2014, p56), gives us an interesting statistic to ponder. "In the UK, 80% of the disposable income is with the over 50s," he tells us, "who represent 20% of the population. This means that we have unmet needs for the people with the most money to spend." Knapp believes that our failure to care for the needs of older passengers – whose mobility may be less than that of younger people – is setting aviation up for a "social and cultural tsunami" when a growing portion of frequent travelers, with the funds to spend on premium travel, cannot find a product suited to their needs.

'Global Population Aging in the 21st Century and its Economic Implications', a 2005 study by the Congressional Budget Office for the United States, supports Knapp's figures. 'The world is undergoing a centuries-long demographic transition that, when complete, will leave the global population larger and much older, on average, than it is today,' states the report.

Rising life expectancy, among other factors, will see many live well into their eighties by 2045. Though the figures vary by region, the worldwide trend is on the rise. The global population will include a larger percentage of elderly citizens by 2050; the share of the global population over 65 years of age will rise to more than 16% – close to the figures Knapp presents for the UK.

Knapp is not alone in his concern over the inadequacy of current design practices. Other industry experts we spoke to agree. The numbers of PRMs and disabled passengers are not made up of aging passengers alone, nor will all aging passengers require special accommodations, but many older passengers and PRMs will benefit greatly from a universal design philosophy – as will all passengers.

A SUPPLIER VIEW One manufacturer firmly committed to inclusive design is B/E Aerospace. As Mark Peurifoy, the company's senior industrial designer, says, it is all part of basic universal design principles, which should be incorporated in the planning and development of any product. "When conducting research and development," Peurifoy says, "it's essential to consider usability issues, which include addressing the needs of PRMs. We focus on universal design principles in our development process, in order to make an attractive seat, without stigma associated with the special accommodations. PRMs should not only have cabin features which address their needs, they should also be able to travel with dignity."

Peurifoy believes there are a number of good reasons to make universal design a standard. "We have a responsibility as designers to consider the needs of people with diverse abilities. Designing for a wide range of persons is just good design practice," he says. "As a public environment, aviation especially needs to accommodate all types of passengers. We must ensure inclusive travel." He also predicts that the aging population trend will make considering the needs of PRM passengers a priority. "With Baby Boomers traveling more," he says, "it makes good business sense to ensure that their future mobility requirements are accommodated. Boomers are increasingly interested in leisure travel and are willing and able to pay a premium for comfort."



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Ultimately, Peurifoy suggests, designing with the needs of PRMs in mind enhances the overall cabin product. "Universal design is beneficial to all." He adds: "The brand experience for the airline passenger is dependent on the airline elevating the cabin experience. That is true for all passengers."

UNIVERSAL

DESIGNER PRINCIPLES Jeremy White, head of transport at design consultancy Seymourpowell, explains that universal design principles influenced the development of the Morph aircraft seat concept, a design which focused primarily on addressing economy cabin design challenges including the needs of PRMs.

"Airlines are supposed to allow a seat most suitable to the needs of PRMs, but it's not easy, especially in economy class, where seats are very tightly packed," he says. "There is limited choice of the way to travel in economy. That is why we developed the Morph seat. It not only conforms to the body better, accommodating ergonomics, it can be modified from three across, divided between large, medium and small passengers, or into two sections to accommodate larger passengers. This gives flexibility to airlines on the space they can provide."

This recognition in the industry that PRM design is important, and the progress made by some, is not yet apparent to Lipp. "There's not much interest," he says, "but that's because they are afraid to 'do it wrong' so they just shut themselves out until regulation or bad press [drives change]." JAPANESE INNOVATION The difficulty of complying with PRM regulations in aviation is not as great as it is in other travel and transport sectors, as several of our experts point out, but that is changing. There is an increased focus from governments and regulators on addressing the needs of PRMs in aviation. Waiting until the pressure builds from regulators to act is undesirable, our experts suggest – and short-sighted.

One airline that has woken up to this reality is Japan Airlines (JAL), which has a well-established and formal policy in place, requiring that universal design principles are applied to all its cabin products. As Ben Orson, managing director of JPA Design, which has worked with Japan Airlines on programs where these principles have been applied, says that the airline is uncompromising when it comes to designing for PRM needs. "JAL made it clear from the initial briefing that this was a requirement for them. It is a more forward-thinking attitude to the design of the cabin."

Orson continues, "Japan Airlines promotes design for special needs passengers in all details and requires features which consider the needs of PRMs as part of its Universal Design Directive. This work includes ensuring that graphics for the seat controls are high-contrast, and that buttons on seat controls are raised and shaped so that people with poor eyesight could better sense the buttons. It also includes features like oversized and rounded edging on seat furniture to help passengers with arthritis get a better grip."

simple logic



Nigel Goode, director of PriestmanGoode, explains some of the design house's recent ideas for improving air travel for PRMs: "Solutions like our extendable lavatory privacy screen on the Embraer E2 aircraft will appeal to

manufacturers and airlines as they are a relatively uncomplicated and cost-effective solution that can have near-immediate benefits to passengers. This is because a solution like this doesn't require the same level of R&D as our Air Access seat (see p26), and can therefore be implemented quickly. I think any improvements, even small ones, within the cabin, will go a long way to help airlines attract PRMs.

"Other areas for improvement could include the accessibility of passenger service units for those with reduced mobility. That said, efforts should be focused on the seats and lavatories, which remain the biggest issues at present.

"When we were conducting research for our Air Access concept, we spoke with dozens of people in wheelchairs, including Olympic athletes, who live completely independent lives, yet when they fly, have to raise their hand to ask to go to the lavatory. It's absurd and inadmissible.



Orson adds that, "It's important to realize that design that benefits people with special needs generally has the potential to benefit all users. Making things easier to use does not really have a downside."

GOODE IDEAS "I think this is a serious issue and one that the aviation industry really needs to address," adds Nigel Goode, a director of the PriestmanGoode design agency. "After the launch of our Air Access concept, I was asked to give evidence on a number of panels for the UK government and the US Senate, about ways in which we might be able to tackle the passenger experience for passengers with special needs.

"One of the issues is that airlines don't want to invest vast sums of money into research, and manufacturers don't want to invest into something that there's currently no demand for. But things need to change. Everyone will at some point face mobility issues, and the airline that wakes up to this and works on developing a solution will find itself with a great competitive advantage."

Goode also points to benefits of universal design practices. "A lot of research has been carried out into the value of the disability pound, as it's called, and airlines and manufacturers can see the potential value and market share that developing a concept like Air Access will attract. In fact, the reaction was so positive that we are currently working with a manufacturer on R&D."

But this doesn't mean that the industry has caught up with the needs of these passengers, or the opportunities available to airlines and designers to create more universally friendly spaces.

"It's important to remember that the inflight experience of PRMs isn't just about the physical environment in the cabin, but about the way they are treated by airline and ground staff and, importantly, the way their equipment and wheelchairs are treated," Goode says.

"The industry needs to ensure that staff are properly trained to deal with PRMs on a human level. We still hear far too many horror stories where passengers have been made to feel like second-rate citizens. Only once this improves will design within the cabin make a real difference to the overall experience for passengers with special needs."

Goode leaves us with one last thought, echoing the sentiments of all the experts we spoke to. "Passengers with special needs and reduced mobility are seen as a problem, but they shouldn't be. With the right systems in place, and the right design, they would be treated just like any other passenger. Only through good design can we make this situation happen."

single-aisle PRM lavs

According to Bombardier, its forthcoming CSeries model will be the first single-aisle aircraft to offer a truly PRM-accessible lavatory that does not require secondary partitions in order to afford disabled passengers privacy and dignity.

Two PRM lavatory positions are offered on the CSeries, to support airlines with different catering requirements and cabin service levels, each of which can accommodate a folding onboard wheelchair with the door closed. Live tests and consultations were performed with actual PRMs (paraplegic and quadriplegic), as well as senior citizens and bariatric patients to support design choices. Space was allocated, and assist features were incorporated, to ensure that safe and efficient independent transfers are possible for capable passengers.

Also, in the cabin concept for Embraer's E-Jet E2, the lav features integrated handrails for PRMs, and to further help such passengers, an acoustic curtain can be drawn across the entrance area to create a larger, private and soundproof space for accessing the lavatory.



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Virgin Atlantic has created a confident, sophisticated interior for its Dreamliners, which puts the crew at the heart of the experience

ADAM GAVINE

As fun-loving airline Virgin Atlantic celebrates its 30th birthday, it has been reflecting on its strengths and what makes the brand so popular. The answer is simple: its people. As Virgin looks to the next 30 years, it has put its staff at the heart of its end-to-end passenger experience, as reflected in the design of Birthday Girl, the first of its 16 Boeing 787-900s.

There are many product innovations on board, all geared toward showcasing the crew and maximizing their interactions with customers. To emphasize the point, fashion designer Dame Vivienne Westwood, known for her bold and daring style, which flatters and celebrates the human form, was brought in to design new uniforms. With the female crew in scarlet outfits with pinched waists and high collars, and the males in sharp burgundy suits with contrasting gray waistcoats, there is no denying they look glamorous. So glamorous, in fact, that the crew are the focal point of the Dreamliner interior, which has been designed to act as a sophisticated backdrop to the service.

BOTTOMS UP The first impression for every passenger as they board through Door 2 is the bar in the Upper Class

cabin. In contrast with the bar in the A330, with its red 'jetstream' pattern and chrome helix stools – which perhaps stole a little too much of the limelight – the B787 bar design is more subdued, with monochrome tones letting it perform as a frame for the crew standing behind and the cabin beyond.

Everything in the area is bespoke, including the bar unit, stools, decorative ceiling, and stowages, and is the result of a collaboration between Virgin Atlantic's in-house design team and VW+BS (now known as Viewport Studio), with the manufacturing undertaken by Altitude.

The airline felt that its onboard bars weren't working hard enough to justify their real estate, so the design began with a brief that the space has to work effectively as a multifunctional social space throughout a flight.

Thus the area features four bar stools, as well as a perch on the bulkhead wall and a lean-to, so eight passengers can enjoy the space. The design team's love of furniture shows in the bar stools, which have been designed to be of a style and quality that would meet the standards of any high-end furniture store – indeed the pared-back styling and palette meant that every detail of the bar had to be







the bar creates a dual dining space 02. The irregular patterns of the Kydex finishes create visual intrigue as light moves over them 03. The mockup bar can be used to trial new lighting

scenarios









no red here

With a more conservative approach to the color, trim and finish for the Dreamliner, and with LED lighting creating new effects, the Virgin Atlantic design team had to create a real depth of quality and intrigue in the new cabins.

A new finish found on the Upper Class Suite shields is a 'geishawhite' paint with a mica finish, which ties in with the paint finish on the B787 livery. Rather than having red in the CMF to reflect the Virgin brand, this subtle approach is believed to be better. "You already know you're in a Virgin aircraft, so we chose to let customers experience the brand on a more subliminal level," says Nik Lusardi, the airline's design manager for customer experience. In some lights the finish looks flat, but as sunlight and mood light moves across it, the surfaces shimmer.

The leathers on the Upper Class seat surface and armrests are espresso-colored, complemented by a black-cherry leather on the ottoman. While the leathers are dark, the space does not feel dark, with that mica white shield to the left and a bespoke 3D fabric in gold to the right, which also ties in with the A330 palette. The textile has a hexagonal 3D weave and is also used on the bed surface.

A nice touch is that the economy seats also have a hexagonal textile, used on a slightly larger scale, with dark red on the

outboard triples and espresso in the middle (well, there had to be some red), gold on the extra legroom seats, and all with espresso leather headrests. The black-cherry seatbacks also tie in with the ottoman color in Upper Class.

The premium economy seats are also clad in espresso leather, with geisha-white seatbacks, so there is a design narrative running throughout the forms and textures of the entire aircraft, from front to rear.



04. The real stars of the Dreamliner experience: the crew, in Vivienne Westwood

THE BAR HAS AN ARCHITECTURAL, MONOLITHIC STYLE

considered and executed to a higher standard than with previous projects.

Two of the stools are now opposite each other, opening up the option of dual dining at the bar. As Reuben Arnold, director of brand and customer experience at Virgin Atlantic explains, "Dual dining was a big aspiration for us. We wanted to create not just a bar, but somewhere to meet to discuss work or have a meal together. We can also use the new space to offer more experiences at the bar, such as wine tastings, a cocktail hour before dinner, or tapas sharing menus. We want to use the space to encourage social interaction."

The bar has a monolithic, architectural style, with the lower part clad in a dark finish so that the eye is drawn to the cantilevered white Corian bar surface – the space where the atmosphere is created and where guests mix with crew.

An exciting part of the bar design is the textured backlit paneling, manufactured from Corian with geometric star and diamond shapes milled down to such a fine gauge that light can show through. This isn't just a static backlit installation, as the LEDs installed behind are programmed to make the panels into living, moving surfaces. We'll come back to the lighting systems in a moment, but those





that's entertainment

Virgin Atlantic specified Panasonic's eX3 IFE system, with Android running on a QT engine. There are widescreen capacitive touchscreen smart monitors at every seat, with 11.1in displays in Upper Class and premium economy, and 9in in economy, with the bar area also having a 24in touchscreen monitor showing mood scenes and the moving map.

Named Vera Touch 2, Virgin's system features a simple intuitive GUI that allows passengers to swipe and scroll through movies, TV shows, music and games to select what they want to watch (there are over 400 hours of entertainment), with closed captions as an option.

All seats also have an integrated USB port to upload and view photos and audio files, as well as access to power.

The IFE system also runs the Skymap 3D moving-map system from Betria Interactive, which shows flight data and progress, plus highresolution 3D views of the destinations and various viewpoints from the aircraft. Passengers can also check out where they are in the journey by viewing the flight tracker bar on the main menu.

Virgin Atlantic has also teamed up with Panasonic and T-Mobile to offer eXConnect Ku-band wi-fi connectivity on board the B787. Customers can connect their devices to the wireless onboard internet service for £14.99 (US\$24) for the duration of the flight, though they can browse destination and aircraft information, inflight shopping and further Virgin Atlantic services for free.

THE DRAMA AND DEPTH IS PROVIDED BY THE LIGHTING RATHER THAN BOLD DETAILS

05. Premium economy passengers enjoy the same 11.1in IFE display, IFE handset and geisha white finish as in Upper Class 06. The 35-seat premium economy cabin

 \bigotimes

geometric shapes are important, and are an element used in the Clubhouses, now being carried throughout the Dreamliner, from the bar and bulkhead decorative panels, to the thermoplastics for the bar units, bottle racks and ceiling panels – at various scales, from macro to micro.

To manufacture all the panels with their irregular patterns as individual projects would involve huge tooling and production costs, but Viewport came up with a clever solution. The studio worked out how large a sheet of vacuum-formed Kydex would have to be in order to include all the patterns needed, and then created a tool around 2.5 m x 1.5 m in size to form them. This means that only one piece of tooling is required to form all the necessary parts, which are then cut out and sprayed in different finishes.

"From an efficiency point of view, we invested the minimum amount for the biggest bang. It's about being clever, not necessarily spending more. It's about finding ways to be different through intelligence and technology and manufacturing skills, though finding someone to build a tool that large wasn't easy," explains Viewport designer Gareth Southall.

The bar looks amazing – and another amazing thing is that Altitude completed the project in just 18 months.

SEEING RED The more understated cabin palette has also enabled the design team to be a little playful with the B787's full RGBW LED mood lighting system.

As Arnold says, "Wherever we could customize the aircraft, we did so. The lighting adds Virgin Atlantic's flair and enhances the feel of the aircraft. Generally the palette creates a blank canvas, and that's possible because we worked so hard on the lighting. The drama and depth is provided by lighting rather than bold details."

Virgin Atlantic's in-house design and engineering teams, as well as the staff at Viewport, worked closely with Boeing and Diehl Aerospace to develop the lighting systems and the various mood scenarios. However, they went a step further and convinced Diehl to develop 8in-long, individually programmable segments for use in the bar units and the decorative panels.



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07

In all, more than 400 of those 8in segments have been installed in the B787, and when you consider that each decorative backlit panel can have daytime settings, nighttime settings and animations, that can add up to around 50 different lighting scenarios.

The smaller lights work in tandem with the main cabin lighting, so they can be actuated together by the crew, who also helped to develop the preset scenarios, including a soft 'rose champagne' for boarding, 'purple haze' for inflight comfort, 'amber warmth' for a candlelit dining effect and 'silver moonlight' for sleeping. The team is also working on route-specific scenarios, to set the right mood for flying to Antigua or Las Vegas, for example.

Diehl developed new software specifically to support the development of this lighting system, which may find its way into the B787 catalog as there is a tripartite agreement between Diehl, Virgin Atlantic and Boeing to develop the system to have more capability from a programming point of view.

The teams made good use of Diehl's full-size B787 lighting rig in Nuremberg – Boeing only has a half rig – and also Virgin Atlantic's own mockup bar kept near Gatwick, where it can develop new mood scenarios. The Virgin team has two dedicated and secure Boeing laptops at their disposal, which can be used to push the data for new lighting scenarios to the aircraft in hours via wi-fi – perfect for private charters such as NFL team flights, when custom scenarios such as team colors might be wanted.

Better still, rather than replacing physical hardware for a cabin refresh, Virgin's design team can simply change

VIRGIN CAN SIMPLY CHANGE SEAT COVERS

seat covers and use new lighting scenarios to upgrade the interior, reducing costs through the aircraft's lifetime.

While the lighting systems may make life a little easier for Virgin in the future, the teams involved in the project say they will always remember the extensive programming and development work required in their creation.

DISCREET SUITE We've seen Upper Class evolve from the bright aubergine tones of the B747s to the darker leathers and metallics of the A330s launched in 2012. The 31-seat B787 Upper Class is subtler still; you won't find any Swarovski in here.

As Nik Lusardi, Virgin Atlantic's design manager for customer experience explains, "It's easy to be loud, and in a bygone age we were, but now our brand has changed massively. That's not to say it's less fun; we just do things in a slightly more measured way."

The new seat (named UCS3) has been designed as an evolution of the suite, using the form of the first version, as found on Virgin's B747s and A340s, with some color, trim and finish cues from the later A330 version. A little input also came from Air New Zealand, which uses a customized form of the seat.



cherry pops

The Recaro 3620 seat was selected for the 198-seat economy cabin, at a 31in pitch. The seat was chosen for its knee room, comfort and ergonomics, according to Virgin Atlantic, and all seats have been fitted with Recaro's adjustable 'hammock' type headrest, as well as a flush-mounted 9in eX3 monitor, USB port and access to power.

The seatbacks are finished in black cherry, which is surprisingly dark for the economy cabin, but the design team say that the color adds a sense of sophistication and is made possible because the mood lighting lifts the cabin.

Fixed shell seating was not considered, as the Virgin Atlantic team have not found current options to be sufficiently comfortable for long-haul flights, though they do like the product as a short-haul proposition.

WE WENT BACK TO THE BARE BONES OF THE SEAT TO FIND MORE SPACE

09. The RGBW lighting system made the black cherry seatback finish in economy a viable choice Thus the key features remain, including the flip-over bed, the ability to recline all the way from boarding to landing, direct aisle access and an ottoman for dual dining. However, the shields have been sculpted for a little more privacy when sleeping, the flexible LED reading light has been replaced with a flush-mounted light that pops out with the touch of a finger, and the cartridge system for the dining table has been altered to make it lighter and easier to deploy. Enhancements that fit in nicely with the B787 include switching from screw-fed motors to actuators so that the seat operation is quieter, in line with the quieter aircraft experience. A few internal tweaks have also made the seat operation a little smoother, such as a small cam introduced between the headrest and seatback that makes the movement seem more effortless.

The flip-over feature, as well as allowing dedicated and uncompromised sleeping and seating surfaces (which have also been upgraded by seat manufacturer Zodiac Seats, to smooth out joins), also gives passengers a chance to interact with the crew, who offer a turn-down service where they put the seat into bed mode and add a sleep sheet, duvet and pillow while you change into pyjamas.

WORLD OF WANDER A major development in the Dreamliner is the 35-seat premium economy cabin, which is a strong revenue generator that the airline really has been working hard to differentiate from the economy cabin. As Arnold explains, "Premium economy is working very well for us. We often have a challenge in the USA to show that premium economy is a separate product, not

just 'economy plus'. But we are now getting that message across in all markets and it's working really well. New seat technology with thinner seatbacks allows us to maximize knee and leg space without compromising comfort, even when the seat in front is reclined."

The seat in question is the Zodiac Reverb at a 38in pitch, the same model that Virgin is already flying, but with ergonomic enhancements and slightly more recline.

Lusardi explains, "We went back to the bare bones of the seat to find all the space we could and give it to the passenger from a comfort and usable space perspective. We scalloped the backrest and pared back the top of the shoulder area and backrest, and made the headrest a bit flatter and more pillow-like."

Passengers will enjoy the 11.1in IFE display, but they also have a new source of escape – a dedicated premium economy destination space called the Wander Wall. This is a self-serve area complete with mini-fridge and water fountain, where passengers can stretch their legs, socialize, and help themselves to snacks and refreshments.

The wall is integrated into the back of the Upper Class bar unit, and it feels a part of the same product, especially with the geometric shapes being carried through into the Wander Wall finishes. As the wall is located in a galley zone, this feature does not come at the direct expense of a row of seats, but it still has to earn its space and can hold three galley carts, so not an inch of space is wasted.

With the luxury finishes of the seats and the Wander Wall, the premium economy cabin really does feel like a product situated between economy and Upper Class, and will be aspirational for economy flyers and no hardship for Upper Class corporate regulars paying for their own vacation tickets. Think of it like the iPod and iPod Nano – it is not a lesser-quality product, just a product at a different price point that meets different needs. ⊠





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lovingfeeling

As Virgin Atlantic continues to invest in its passenger experience, meet Reuben Arnold, the man masterminding everything from sponsorships to high tea, to make that experience as positive as possible

ADAM GAVINE

As director of brand and customer experience, Reuben Arnold is responsible for ensuring that customers have positive feelings and impressions of the entire Virgin Atlantic experience, whether browsing the website for destination ideas, ringing the call center, relaxing in a Clubhouse, watching the safety video, talking to the crew, or enjoying the inflight ambience. The 'brand' element involves overseeing overall strategy, including sponsorship decisions, advertising and marketing communications. In short, Arnold carefully crafts anything that could shape your impression of Virgin Atlantic.

It is fitting then that when asked what he considers to be the most important aspects of the passenger experience, Arnold says the entire end-to-end experience is critical. "You can have a fantastic onboard experience with a great meal and a great seat, but if you have a bad experience at check in, that event can be your lasting memory burn. I think everything is important to the experience; it's the sum of the parts, and that's why we are obsessive about details. The experience is the meals, the IFE, the seat, the limo service for Upper Class – all the way from thinking about a trip, to the booking experience, to the journey afterwards – all those details add up to the Virgin Atlantic experience. I know this sounds like an advert, but I genuinely believe it is our focus on those details that makes us different."

Arnold has also identified a new target for his attentions: inflight connectivity, as introduced on the

EVERYTHING IS IMPORTANT TO THE EXPERIENCE; IT'S THE SUM OF THE PARTS, AND THAT'S WHY WE ARE OBSESSIVE ABOUT DETAILS



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OUR CUSTOMERS EXPECT INNOVATION. I THINK IT'S A FUNDAMENTAL PART OF OUR BRAND, OF WHO WE ARE

66



01. One of the many initiatives introduced since Arnold began work at Virgin: a trial of Google Glasses for concierge staff at Heathrow's Upper Class Wing airline's new Boeing 787s. "Now we're rolling out connectivity there is even more opportunity to think about how customers using their own devices will interact with the aircraft, and it's an exciting opportunity," says Arnold.

Arnold has a strong pool of designers to draw upon, with teams specializing in each part of the experience. "We must have that strong in-house design function," he asserts. "We might bring in specialists from time to time, but the design aspiration and thinking comes very much from within Virgin. For example, we might bring in specialists for some technology projects, but it will be our thinking behind them. We do all our IFE work in-house; we don't outsource it. This approach adds up to a unique experience. For example, we developed our new safety films and are carrying those themes into new safety cards."

Speaking of design teams, does 49% shareholder Delta have any input into the Virgin Atlantic experience? Arnold is very clear on this subject: "Delta has absolutely no input. We work closely on a lot of things, but we are clear that our brand is our brand and our product is our product, and that theirs is theirs. It's as important for them as it is for us. One reason they wanted to be part of Virgin Atlantic is because they recognized our special brand. They don't want to replicate any of our product."

Virgin Atlantic has been investing heavily in all areas of the passenger experience, from new fleet additions such as

well trained

Reuben Arnold joined Virgin Atlantic in December 2012, having gained seven years of experience at the Eurostar international highspeed rail operator, where he held a similar role, being in charge of improving the end-to-end passenger experience. Improvements undertaken under Arnold's guidance included introducing new classes of travel, heading up the design process of the new Eurostar fleet, and leading the design and build of Eurostar's stunning flagship terminal at St Pancras International in London. the 16 Boeing 787s, to new cabin interiors, to Clubhouses. There is no question that passengers benefit from these investments, but we asked Arnold if he believes that innovation truly benefits the brand. "Our customers expect innovation. I think it's a fundamental part of our brand, of who we are," he says. "Therefore innovation does pay off, as it's such a fundamental part of our brand."

He goes on to explain that aircraft interiors have always been an important part of the Virgin Atlantic brand, and that for the B787, they aimed to maintain fleet consistency while also enhancing the passenger experience.

"For us, the B787 has been a catalyst for enhancing the experience across our fleet," says Arnold. "Wi-fi is one example. With the B787 coming we thought it was time to get wi-fi onboard, but we will also introduce it across the fleet. New service concepts at the bar will also be introduced across the fleet, but the B787 is the catalyst.

"People don't expect us to be bland. Lots of people have B787s, B747s and A330s, so we need to make ours unique – not just different for the sake of it, but to make the customer experience better. A great example is the cabin lighting. There are a lot of standard features in a B787 that help to make sure passengers feel better when they disembark, such as the pressure and humidity features, but we wanted to take that a step further to make sure passengers feel better when they get off the aircraft because of what we've done with lighting and service."

Innovation is one thing, but Virgin Atlantic's design teams rely on the cooperation of airframers to make it a reality. With regard to the B787 project, Arnold is very pleased with the airline's relationship with Boeing, stating, "Boeing has been fantastic in the design process and was excited to work with us as it's an opportunity for them to showcase what a great aircraft the Dreamliner really is. They have been very accommodating. Any time you want to do anything with an aircraft, there are a lot of challenges and a lot of reasons why something can't happen. I think what we do very well is to challenge any obstacles, ask how they can be overcome, and keep pushing to get the desired result."

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aboveandbeyond

Could the humble passenger service unit be redeveloped to become an important and integral part of the future passenger experience? Experts from around the world believe so ADAM GAVINE

The passenger service unit, or PSU as it is usually called, is perhaps an unappreciated piece of design. After all, it does bring together very rarely used functions such as oxygen masks, with infrequently used functions such as air gaspers and attendant call buttons, all in one tidy panel, just where you need it. However, is this panel all it could be? Does the operation of the PSU controls bring pleasure? Is an overhead panel really the right place for all the typical PSU features, or have we just got used to them being up there? We contacted a range of experts from around the world to find out what they think about current designs, and to invite them to challenge the status quo, and they all seem to agree on one thing: PSU design is due for change.

IMPASSIONED PLEA For Juliane Trummer, strategy director at Madrid-based design consultancy Mormedi, PSUs are long overdue a major rethink. This isn't just from the point of view of a design expert, as she views current designs as "somewhat of an anachronism", especially with their 'no smoking' signs, since everybody knows that smoking on aircraft has been banned for decades.

"Which functions apart from the oxygen mask and air nozzle really need to be connected to the cabin systems running overhead? Which ones could be brought nearer to the passenger, for example through integration into the seat? Which additional functions might be considered? How could function control be improved and refined?" ponders Trummer. "This is just the beginning of a long list of questions to be asked."

Her suggestions for improving PSU design, based on aviation experience including the development of Iberia's new A330-300 interiors, include the passenger being able to choose different intensities of light depending on what he or she is doing; being able to order specific items from the flight attendants, whether a glass of water, a blanket, or help with something; and controlling the immediate environment from a smartphone app.

"Clearly PSUs represent one of those 'orthodoxies' – things that have stayed around from an earlier context and we have become used to, but have neglected to question, evolve and adapt to the user needs and technological possibilities of our time," says Trummer. "Designers, engineers and manufacturers: this is a prime opportunity to take the flying experience to the next level!"

01. The louvers on the PSU in Embraer's E-Jet E2 were inspired by automotive air vents WHY CAN'T THE OEMS OFFER GREATER FLEXIBILITY TO INTRODUCE MORE CUSTOMIZATION OF THE PSU PANELS AND CEILING?

02. Boeing strived for a smoother, more passengerfriendly design for the PSUs in the B737 Sky Interior
03. The PSUs in

the Bombardier CSeries can incorporate video displays: a step up from the usual 'no smoking' and 'fasten seatbelt' icons A BRANDING OPPORTUNITY The key functions of a PSU can be concealed behind elegantly styled panels, but for the creative team at Honour Branding, which has worked on recent projects such as the new Etihad A380 and B787, and the new Saudia interiors, future work can go beyond the aesthetic to benefit the passenger experience and the airline's bottom line.

Philip Bailey, project manager, discusses his views of the future of PSUs: "PSU designs have changed little over the years in terms of their design and function. The styling of these panels has evolved with the times, as interior aesthetics change with the decades and new aircraft types come on stream.

"Traditionally, an airline can only apply its brand through seats, bulkhead tedlars, curtains, lighting and carpets within the cabin environment. Almost all other materials and finishes are from the respective aircraft catalogs. Perhaps the OEMs could offer greater flexibility with the PSU design to enable airlines to create more unique, branded ceiling features."

However, while there is still a lot of potential, Bailey believes that innovative changes are taking place right now. "There is a growing trend for airlines to think differently about PSU panels in their premium cabins, removing some of the components and relocating them to the seat environment. This arrangement gives passengers greater access and control over their personal comfort, for example through having better control of lighting, or by having more personal benefit from the air vents. In some cabins, even the customary 'fasten seatbelt' and 'no smoking' signs have been removed, leaving only the oxygen drops in the PSU," he states. "Some airlines such as Etihad have gone even further and removed the overhead bins in the first class cabins, creating a more dynamic and architectural ceiling that makes the cabin feel brighter and more spacious, with signature branded lighting features and starlight effects."

02

Mike Crump, partner and product and innovation director at Honour Branding, is excited by this development. "This approach is quite revolutionary for aircraft interiors as the ceiling is usually an untouchable zone for customization. In retail and commercial interiors, designers and architects would spend as much time on the ceiling design as on any other part of the space. So why can't the OEMs offer greater flexibility to introduce more customization of the PSU panels and ceiling? This would then enable airlines to perhaps introduce a ceilingmounted piece of sculpture, projected imagery, or to develop more intricate lighting features in these spaces, making their cabin experience more unique. After all, the flatter the seats go, the more of the ceiling and the PSU area you will look at while flat on your back!"

GO ON, TOUCH IT ZEO and Zodiac Aerospace have been working on what they claim is a revolutionary PSU – the Pax Pod – which is no mere concept, as ZEO says it will be flying in Q1 2015 with a major carrier. The PSU is a signature part of ZEO's Innovative Space Interior System for the A320, and as Scott Savian, EVP of ZEO, says, "It is definitely not today's PSU."





PSUs with displays

The PSUs in Bombardier's forthcoming CSeries narrow-body jet are fully integrated to keep all passenger services together on a single panel, which minimizes the number of parts that engineers need to install and manage, while maximizing seat pitch flexibility, from as short as 28in. The PSU panels are designed to accommodate an optional fixed overhead video display from Panasonic Avionics, the supplier of the cabin management system (CMS). The 4.3in LED display can be used to show safety briefings, connecting gate information and passenger flight information, among other applications that are under development by Panasonic. As a further example of integration, the wiring within the overhead bins includes part of the CMS Ethernet network, so fitters installing displays need only swap out the panels.

Savian explains that while there are many pure technology advances available for upcoming PSUs, the Pax Pod is the first to break the basic architecture of the cabin, becoming a key design element, not simply a utilitarian channel of parts. The pod integrates cabin lighting into the PSU to create an individual luminaire for each seat row, so cabin illumination is based on seat rows and passengers, not aircraft frame pitch. The Pod also increases headroom and shoulder space by removing outboard lighting, and the PSU panel is sized to match seat pitch, so multiple panels and filler pieces are eliminated, for a clean look.

The sleek styling of the Pod integrates all the features one would expect of a PSU, but ZEO believes it has re-imagined the passenger interface. As Savian says, the Pod "wants to be touched and looked at. At the cabin level, the overall effect of these pods is quite stunning."

Savian explains the design goals of the Pax Pod: "To create an engaging, exciting passenger interface that dramatically improves the passenger space. The key innovation here was the integration of the cabin lighting, moving it from the sidewall, at a 21in frame pitch, to the perimeter of the Pod. This design places the local cabin lighting at the passenger's seating pitch so that each seat row is individually illuminated. The effect is fantastic.

"Within the premium cabin, the Pod becomes a key feature in the branding of the space. In an efficient, plugand-play manner it allows us to vertically extend the premium passenger's space. The custom panel and luminaire creates a more cohesive environment by effectively tying the cabin into the seat." CONTINUOUS REINVENTION Acumen Design is of the view that in recent years almost every element of the passenger environment has benefitted from thoughtful design treatment, which has transformed the passenger experience. During a flight, however – especially long haul – a passenger will scrutinize these very intimate environments, which are ultimately only as strong as their weakest link. "In the majority of cases, the weakest link is arguably the PSU rail," says Anthony Harcup, an associate at the design consultancy.

03

"Hugely varied seating layouts and passenger counts fuel the need for a flexible solution to the installation of basic passenger amenities. Meeting the customization requirements of the airline would seem to be the most challenging aspect for the airframers – driving the splitline-heavy assemblies with often awkwardly spaced fillerpanels," he states. "This issue calls for a fundamental



04. The Pax Pod will be flying in Q1 2015 and is "definitely not today's PSU"



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rethink of the interface between the consumer and the required hardware in this area, and perhaps also a little thought about what other value this prime passenger realestate might add to the travel experience."

So what does Harcup envisage for the future? "In the not-so-distant future, the synergy between intelligent software and smart materials will enable complex human interfaces to be simplified, driving more intuitive, human-centric product design. The future will see smart materials increase the intimacy with which we interact with our environments in every industry – especially those that are spatially challenged, such as aircraft interiors.

"Each PSU rail could potentially be an active smartpanel spanning the length of the cabin per seat row. With the use of a single smart-surface in this area, airline customization would not only be simplified, but perhaps more easily reconfigured further down the line. This idea could eliminate multiple split lines and make way for a slicker and more integrated passenger environment."

He goes on to suggest that passengers might be able to operate and customize their seated areas using app-style controls to navigate and operate all existing functionality. For example, in addition to being able to select the reading light's intensity and position, they will also be able to define its color and shape.

"With IFE being phased out of some short-haul economy seating products to save weight, this area has the



the great dc-8



Cristian Sutter is a true interiors enthusiast, with an enviable collection of books on the subject (and an extensive collection of *Aircraft Interiors International* magazines). He explains a little about the history of the PSU: "Most airlines need flexible aircraft cabins, especially in economy, which need to be able to be quickly reconfigured

to meet changing market and operational demands. When seating is reconfigured, the ceiling-mounted PSUs must also be rearranged to align with the new seating layout, which adds complexity, downtime and cost to a cabin reconfiguration exercise that would be simply redundant given a proper integration of the PSU with the seat.

"The first attempt at PSU-seat integration was with the Palomar seats that were installed in the Douglas DC-8 back in the early 1960s. With the PSU integrated in the backrest, the Palomar seat was a concept ahead of its time and was technologically very complex, so eventually it was replaced in the second-generation DC-8 interiors by a conventional seat, and the PSU found its way onto the ceiling, where it remains today."

potential to become a primary passenger/aircraft interface – expanding its existing functionality beyond basic signage, lighting and gaspers," continues Harcup. "Passively these surfaces would not only add to the cabin ambience, producing a range of mood-enhancing effects and imagery from sunrise to starry night, but may also subtly reinforce airline branding and allude to cultural references of the destination. They may even enhance the cabin safety signage with animated escape path lighting.

"The simplicity of this technology would allow continuous reinvention and ultimate flexibility, so aircraft can be reconfigured and customized at low cost."

BACK TO BASICS Ugur Ipek, managing director of Hamburg-based Ugur Ipek Design, has taken part in many design projects and concepts for Airbus, and also has extensive automotive design experience. Considering current PSU designs, he strips the unit into its core functions: "On long-haul flights, the ATA 21 guys don't 05. Anthony Harcup of Acumen's vision of future PSU design



Ugur Ipek breaks down the PSU into its core requirements:		
Comfort function	Function requirement	User requirement
0 ₂ mask	Oxygen supply	Reachable
Fasten Seatbelt/		
Return to Seat sign reminder	Reminder	Visible
No smoking sign	Reminder	Visible
Speaker	Pilot's instructions	Understandable
Attendant call button (illuminated)	Call an attendant	Reachable, visible for crew
Reading light	Personal Light	Reachable button





personal PSUs

Daniel MacInnes, project head at PriestmanGoode, is presently deeply involved in a PSU project for Embraer's new E-Jet E2. He explains the work: "The E2's PSU is the first individual PSU. Until now, there has always been a joint PSU, which all passengers in a row share. If you are in the middle seat and the passenger next to you wants to press the reading light button overhead, they have to encroach on your personal space to do so.

"We wanted to enable passengers to reclaim their own space, which means controlling their immediate environment and not having to reach over anyone else to do so. The design takes styling cues from automotive interiors, with the new style of venting giving passengers a higher level of control for direction and airflow."

06

WE CAN FEEL THIS KIND OF DISSONANCE... YOU CAN SEE THE FUTURE, BUT HEAR THE PAST

06. The easily reconfigurable PSU rails of the Embraer E-Jet E2 are a key factor in the cabin's flexibility like air nozzles. For them the nozzles cause disturbance in the general ventilation system of the cabin, and therefore many wide-body aircraft don't have them. But for me, the real personal elements are the buttons, the reading light, the air nozzles and the oxygen mask."

Running with the theme of these elements of a PSU being truly personal, Ipek embarks on his wishlist for units in the future. "I would love to be able to dim the reading light. Sometimes it feels so bright, especially when the general illumination is turned off. You feel like you are on stage under a spotlight.

"I would love to redesign the air nozzles: some nozzles are so tight that you need to be built like the Incredible Hulk and have the fingers of a hobbit to adjust them. I fully understand that the nozzles have to be kept in position through bumpy flights, but *that* tight? I have seen many people give up in frustration when trying to adjust them. If pulling the nozzle released a clamp, they could be easily adjustable by anyone. The next level of service could be adjusting the temperature in the seat area."

And what of the audio quality from the PSU? "I would love to understand the captain's speech. Your eyes are treated to HD quality on the IFE, but the sound from the PSU speakers doesn't fit with this picture. We can feel this kind of dissonance," he says. "When movement isn't synchronized in the eyes and brain, you don't feel well, and I get a similar feeling regarding perceived quality and reliability when it comes to sound and audio in the cabin. You can see the future, but hear the past. Skilled sound engineers should be able to adapt the output sound and harmonize it with the general buzz in the cabin to achieve crystal-clear sound."

For some, the design of the PSU means that things can get a little too... personal, as Ipek has found out. "I would love the flight attendants to keep a certain distance from passengers. In Germany we have accepted zones of proximity from other people around us.

"A flight attendant trying to reset the attendant call light on the PSU sometimes needs to lean over the passenger, who if in economy is already sitting in a tight cabin, and bear in mind that in some cultures it is mandatory to keep a defined distance between a man and a woman. I would love to see a grand and dignified service, keeping the appropriate distance. Thus the attendant call reset button is a candidate for redefinition. NFC could be the solution. Near-field technology integrated into nameplates could be used to turn off the attendant call light. It would be a bit *Star Trek* with the crew tapping their nameplates, but I would love to see it."

Moving from NFC to smartphones, Ipek would also like to see smartphone apps that offer more functions than just booking flights and checking flight data. "The app could invite me to interact and even build up the picture of 'my cabin' by customizing and controlling my personal space. I can control my devices at home, so why can't I turn on my seat lighting, adjust the temperature of my air nozzle, and save these settings for next time?

UP CLOSE AND PERSONAL There are many passenger benefits of PSUs, but their overhead location can be awkward, especially for passengers with reduced mobility. Cristian Sutter, a cabin design specialist with experience at Thomson Airways, British Airways and Jet Aviation Basel, has pondered how these units could develop to benefit all.

"The PSU of the future will lose its ubiquity as a physical service module, and it will be discreetly





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07

FUTURE IN-SEAT PSUS WILL HAVE AN APP-BASED INTERFACE, ENABLING PASSENGERS TO CONTROL AND CUSTOMIZE

07. Special ceilings have been created in Etihad's A380 that take the idea of PSU design a step further, adding lighting effects to the usual functions integrated into the seat, breaking the current rigid relationship between seat layout, PSU arrangement and cabin ceilings. New and more efficient passenger oxygen generation and distribution technology will allow feasible, cost-effective and reliable in-seat installation."

So what does this mean for the passenger? "Spaceefficient LED reading lights – currently only seen in premium seating offerings – will be incorporated into economy seats. Also, in-seat electric hot and cold ventilation systems will allow control of individual environments, and customizable light beam projection technology will replace seat identification and passenger information signs," he predicts.

These ideas certainly make the cabin functions more personal, but in Sutter's view they can go a step further, being linked to personal devices. "Currently a few of the PSU functions, such as the attendant call button and reading light, can be controlled via the IFE interface. However, future in-seat PSUs will have an app-based interface, enabling passengers to control and customize the in-seat services using smartphones, smartwatches and tablets by connecting these devices to the cabin wi-fi.

"With these future PSU-seat integration and IFE-app user interface options, passengers will be able to adjust reading and mood light settings, set individual seat zone temperatures, and even program those functions via a timer, creating a personal environment to suit their needs or mood during the different phases of the flight.

"By losing the paradigm of a grouped service unit and offering a personal experience, the dated PSU could evolve into a PSE – a passenger service experience." \boxtimes

the bigger picture



"The central PSU on an aircraft is an often overlooked passenger interface, giving light, air and information at the touch of a button. However, it also represents an opportunity, often forgotten,

to enhance the customer and brand experience, because as part of an SFE fit, change can have big implications. Considered detailing of the PSU at the start of a project can make a big impact for relatively little change, creating effects that can greatly enhance the interior." These are the thoughts of Adrian Berry, a director at Factorydesign, which has worked on recent projects such as the jetBlue Mint experience, the new Aer Lingus business class and the interiors that everyone is talking about – Etihad's A380 and B787.

Indeed Berry and his team put these sentiments into practice in the Etihad interiors: "On the upper deck of the Etihad A380, the PSU was considered a major part of the overall design of the cabin. By creating a PSU with dedicated lighting panels and by integrating Gobo lights - dedicated spotlights with etched projector plates - a special 'ownable' lighting effect was created. The appearance on the floor is of sunlight or moonlight filtering through trees and, with specific placing and focus of the Gobo, the system also allows a wash of the same effect down side panels and walls. The added effect of the light playing over people as they walk underneath the panels creates a softening and interactive effect that normal cabin lighting just does not achieve. This effect extends through first class and into business."

The effect can be taken even further, deepening the airline's intended experience. "Importantly, by developing such an 'ownable' theme, it offers continuity of idea. So the lower deck also has a dedicated ceiling between the main galleys at the Door 2 entrance, occupying the PSU channel, which integrates oxygen, signage and, importantly, the lighting effects.

"By creating a special ceiling – effectively a superenhanced local PSU – the lighting effect could be taken to a much greater scale, to create a specific feature and entrance highlight as passengers board into economy," explains Berry. "Again, the integration of pattern and spotlight projects a pattern on the floor, which also runs up the galley fronts – and as people board, the light plays over them, producing an animated effect that enlivens the mood."







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Anyone who thinks CMF work is easy clearly hasn't undergone an FST test program. New regulations and challenges in the world of flammability tests are making imaginative textile and leather designs difficult to achieve – but also making them safer to fly

MARISA GARCIA

Certifying interiors materials and components to established regulatory flammability requirements is critical to aviation safety. The development of testing standards, and vigilant compliance with those standards, has undoubtedly saved lives and reduced passenger injuries in aircraft accidents.

However, the process of certification can be confusing to those trying to introduce new materials into aircraft cabin designs. If their compositions have not been previously tested, these can react in unexpected ways when exposed to flame. Test failures delay components and force a rush to find alternate materials, or to find new ways to configure combinations of materials which adequately self-extinguish and produce low heat and smoke emissions. These complications can stifle innovation, but they don't have to.

For designers, manufacturers and airlines, success depends on striking a balance between the desire to innovate and the need to clear the hurdles of testing. By understanding the importance of the regulations, communicating effectively, collaborating on certification issues when they arise, and ensuring adherence to the letter and spirit of the laws, new programs have been realized and new materials introduced.

THE CMF DESIGNERS' VIEW We spoke to experts who have confronted certification challenges and overcome them in different ways, without compromising safety.

Maria Kafel Bentkowska and Yod Suntanaphan are senior CMF designers at design firm PriestmanGoode, whose department takes up an entire floor of the firm's new offices in London. These experts like to be increasingly involved in the certification processes, in order to understand the technical requirements.

As Bentkowska says, "The more you understand, the more you know, the better you can use that experience to

select materials which are more likely to pass, but which also have the aesthetic properties you want to incorporate in a design program. Some are trickier than others."

Some materials are more volatile, or more likely to produce toxic smoke emissions than others. Very few can make it into the aircraft cabin untreated. Some natural materials have inherent favorable flammability properties – sheepskin and wool, for example – but they may not meet the aesthetic needs of particular design concepts, nor fit a particular application. To ensure that many attractive materials and composites pass the tests, chemicals are used to make the materials flame-retardant, but finding the right flame retardant is a delicate process, with no guarantees. Using such chemicals also increases the risk of the aesthetics, malleability, durability and service life of a material being altered.

"There is no standard formula of getting flammability to pass," Suntanaphan says. "The materials suppliers know how to adjust the formulas accordingly, so that any product features that affect flammability can be resolved. They are the ones making the product and they are familiar with producing materials that pass."

Bentkowska believes the secret lies in working with suppliers from the beginning. "We work closely with the suppliers on these certifications," she states. "It's their business to understand precisely how the treatments and fire test properties of these materials work. We work with them to identify high-risk items as early as possible, which leaves everyone more time to find solutions in case there are complications."

Incorporating new and innovative materials requires buy-in from all stakeholders in the project: the airline, the materials suppliers, the component manufacturers and the aircraft manufacturer. Because the manufacturers are responsible for the ultimate certification burden of the aircraft, they have a strong influence on materials





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selection. To avoid delays in their production line, both Airbus and Boeing encourage proven materials and components, already approved as part of the catalog.

"The aircraft manufacturer's classification of the materials can also influence the flammability testing process," says Suntanaphan. "If a product is considered under its standalone properties, then that is one thing, but sometimes the certification is incorporated as part of the bulkhead or seat certificate. This affects the development time, and project timelines can sometimes be short. The process for approval of these material combinations in aviation can be lengthy."

COMPOSITE TESTING It is difficult enough to pass a new standalone material, but the complications are multiplied when running composite testing because the chemical interaction of the various elements can change the results of the tests. Even materials that pass the tests as a standalone material may not pass when combined. This failure sometimes results from the way the chemical properties of each material interact when set aflame. At other times, especially if an adhesive is required to bond the materials, the adhesive changes the flammability properties of the standalone materials, leading to test failure.

Aviation interiors consultant Vern Alg, who has 30 years of experience working in aviation, and has worked for more than 20 of those years as director of projects and senior manager of interiors engineering at Continental Airlines, agrees that adhesives can generate serious difficulties in certifying composites. "The adhesive is particularly problematic," he says. "Nearly every time you encounter a problem with composites, it's the adhesive."

The chemical properties of the adhesives which have the best performance in their primary function often mean they result in test failures. To create a firm bond, those adhesives often contain volatile chemicals, and that volatility of the adhesive causes the composite material to fail. To counter this failure, the other material layers must be even more flame-retardant. However, treating the other materials with alternative flame retardants in order to better absorb the flammability properties of the adhesive

carpet tests not realistic enough

Maurice Pijnen, Desso Aviation's certification manager, considers how the FST process could be improved to make carpet testing more effective: "With respect to aircraft carpets, 12 seconds of vertical flame test, according to FAR/CS 25.853(a), is the basic requirement. For this test, only a sample of the carpet itself will be tested. The real-life situation in the aircraft is that the carpet will be installed on floor panels using an adhesive or adhesive tape. Both floor panels and/or adhesives will not be taken into account when testing the carpet for flammability, even though the combination of materials could react differently compared to testing materials separately. Combined testing would come closer to the real-life situation."

can detrimentally affect other properties of the composite, such as color, durability and texture. Fixing one problem generates another.

Alg understands the frustrations of these challenges and has some advice for airlines, designers and manufacturers running the gauntlet of experimentation. He suggests starting with the right frame of mind and taking nothing for granted. "Flammability is key to safety," Alg says. "There is no generalization on flammability. All material in the substrate must be specifically tested, and each must pass. Every vertical surface needs to be tested. If you change one element of a composite, it needs to be tested."

The prospect of having to validate so many variables may be daunting. Creating new material combinations takes time, so the program timeline must have room built-in for a few rounds of trial and error, and increased product development costs.

SOUND ADVICE Alg says that the work involved in materials testing should not discourage innovation. With adequate planning up-front, and the counsel of experts, the likelihood of passing increases. "Work with good laboratories," Alg suggests. "There are many excellent laboratories in the USA and in Europe. Work closely with your suppliers. Get the testing coupons for all the component materials, and be really up front with the FAA. There are no shortcuts."

Alg acknowledges that some programs are difficult, but by planning ahead and verifying the compliance of individual materials and their combined effect, he suggests, the process can be smooth.

Both Bentkowska and Suntanaphan from PriestmanGoode agree with Alg that careful planning,



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"Combination tests are complicated because of the different requirements for each of the component materials and the different glues or adhesives used to bring them together," says Suntanaphan. "Materials might be certified on their own, but when combined, it can go really wrong. The suppliers we work with specialize in resolving these issues when they arise."

Should an issue be particularly troublesome, Suntanaphan has a plan in place: "We always maintain fallback options for programs, in case there is a problem with a particular material passing."

SUPPLIER VIEW Kevin O'Brien, director of operations at Tapis Corporation, an aviation textiles supplier, has firsthand experience of just how complex composite flammability tests can be, and what can go wrong. According to O'Brien, failures lead to innovation, which can have long-term benefits, such as expanding the company's palette for aircraft interiors, and generating new materials that address the most baffling problems.

"The biggest challenge we had a couple of years ago with our Ultraleather product was that vertical surfaces are required to meet OSU Heat Release," he says. "In the past, we only flame-treated our materials through a postmanufacturing secondary FR process, which presented many challenges when our product was used in various composite build-ups. We've since developed new manufacturing procedures that incorporate the flame retardants right into the manufacturing process. It's made the material very flame-resistant and stable.

"This new specification has also made it possible to incorporate Ultraleather into composite combinations: on thermoplastics and honeycomb composites, for example. The customer can now use their adhesive of choice, without dependency on water-based adhesives."

The test O'Brien refers to is FAR 65/65, which governs vertical surfaces and has stringent heat-emissions and



smoke-emissions limits. "FAR 65/65 specifications may not work for all combinations of materials," he says. "If the product did not go through the proper treatments for FAR 65/65, then it limits the combinations it can be used for. We can treat the baseline product appropriately so that the 65/65 passes, in the combination of materials intended, with fewer limitations.

This new material specification resulted from solving a common problem, and, according to Tapis, it represents an important step forward for materials flammability options. However, it would never have happened without the willingness of others to try something different, and to stick with the program through the flammability challenges until a solution was found. Test failures can be a catalyst for innovation, rather than the end of it.

A NEW WORLD OF CERTIFICATION Alg points out that the aircraft interiors industry has made great progress in this area, and that a number of new materials, adhesives and processes have emerged that make certifying easier

test consistency needed

Kevin O'Brien, director of engineering at Tapis Corporation, considers how the FST testing process could be improved for its textiles: "I think the biggest challenge with FST testing is reproducibility and consistency among test facilities. Better standardization of test procedures, calibration and test apparatus, specifically with OSU Heat Release Testing, needs to occur in order to ensure consistent and accurate test results between test facilities."

today. "It's a whole different world," he says. "We've really come a long way."

O'Brien agrees with Alg on the level of progress in the industry, but he also points out there is still much work to do – especially on the standards for the tests themselves. "One challenge still to overcome is that the test is imperfect," O'Brien says, referring to the OSU Test for FAR 65/65. "There are great variances from laboratory to laboratory. The testing variability between facilities is a problem."

Few know flammability testing better than Tim Marker of the FAA's William J Hughes Technical Center, located just outside Atlantic City. Marker spends his days at the world's premier flammability laboratories, testing materials no one has ever used and developing new tests when no established tests are available. He creates experiments to develop the standards, in order to ensure that aircraft safety remains assured and that new developments can find their way into the aircraft cabin. Marker is working on



hot tips

A panel of experts offers advice on getting materials through certification safely and efficiently

Maria Kafel Bentkowska, CMF designer, PriestmanGoode:

"When time is of the essence, we work with our clients to identify issues which could arise for certification. As a consultancy, we are here to bring these potential complications to their attention, but we need the airline's support and their commitment to the design concept to incorporate new materials and design features. Everyone has to be on board with the program, to create all these new materials in a sound manner, which meets the regulations, but also meets the design objectives."

Yod Suntanaphan, CMF designer, PriestmanGoode: "Flammability objections can drive a push for catalog options. Aircraft manufacturers have a preference for this because these are their fully certified materials, which ensures a smooth production flow, but for airlines it's about creating a unique passenger experience. Selecting a mixture of catalog and customized products could be an option when time is of the essence."

Kevin O'Brien, director of engineering, Tapis Corporation: "Our products are selected by the designer, so we may not know the final application of the product. When we have a better understanding of how the product will ultimately be used, we can help develop solutions that can address flammability problems. We have a variety of flammability specification packages, tailored to the material with which they'll be combined. By picking the right FR package for thermoplastic or honeycomb core, for example, we can ensure the tests are stable. We can treat our products based on those variables. In the past, we were reacting to a situation of failure notifications. Advance knowledge of where the product will be used helps us to select the right material properties."

a new project, still in the development phase, which will ultimately improve the OSU testing issue that O'Brien raises.

"The HR2 Flammability test work we are doing is a research project," Marker emphasizes. There are still many steps to take before the research is completed, and more trial and error to go through before the test protocols can be defined and standardized, but his efforts will yield improved FAR 65/65 testing.

"HR2 is a newer OSU apparatus, a modified version of the test which will ultimately reduce inter-lab variability. We're trying to make the tests more repeatable. The International Materials Fire Test Working Groups can benefit from the new methodologies. There would ultimately be bilateral adoption. The regulatory effort we currently have in place is about doing research. The NCRM would come out in stages, once we have completed our research."



FIRE SAFETY WORKING GROUPS Developing the new OSU test for FAR 65/65 is not the only item on the agenda for Marker and the FAA team at Hughes.

"We have a general regulatory effort to put together a new flammability workbook, which puts all flammability questions under one roof," Marker states. Such a book would make finding the right regulation for different applications an easier process, and also make the flammability process on the whole easier for stakeholders to understand and manage. "When that book is implemented, we will also pass along advisory language, which discusses the various processes of flammability," Marker says.

Even as these projects are underway, industry representatives can gain important insights into flammability through participation in the open Fire Safety Working Group meetings.

"The next Fire Safety Working Group will be in February in Long Beach," Marker tells us. "We have three meetings a year, two in the USA and one in Europe."

Marker gives us one more bit of good news, which could help innovators better predict the results of new testing combinations. "There is work on the industry side to develop a catalog of products," he says. "QA arrangements could be made with the certification office to reduce the steps for approval of virgin products."

But Marker also reminds us why these regulations and tests are vital for aviation, and how much importance we must place on ensuring that we respect and adhere to the requirements. "All the flammability tests are based on fullscale testing at the Hughes Technical Center lab. None of them are arbitrary. They come as a result of the insights we gain from intensive testing, which reveals the safety risks of various materials. The intent is to reduce fatalities."

As Bentkowska says: "The safety of aircraft is the priority. Everyone has a role to play in ensuring that." \boxtimes

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01. The mock-ups of Etihad's new A380 and B787 cabins have been repurposed as an innovation center in Abu Dhabi

mocktrial

Cabin mock-ups are a great way to impress management, media and customers, and are getting more sophisticated every year. Prototyping experts share their views about the trends and changes in this highly specialist field GUY BIRD

Cabin mock-ups have been used in the aviation industry for decades, rendering design ideas and engineering concepts physical and allowing them to be evaluated up close and personal.

But speaking to a variety of experts in the field – from designers and model makers, to color and trim experts – all agree that the quality of what is now being demanded and supplied in the cabin mock-up industry is rising markedly. The reason? "Fierce competition" between the airline carriers, reckons Mick Bonney, director of sales and business development at EDM, a UK-based modeling business that specializes in aviation mock-ups.

These types of mock-up are not just pretty, fragile models, but are often complex, functioning prototypes, as Bonney explains: "This need for authenticity is resulting in our mock-ups featuring mood lighting covering day and night scenes, cabins with full color and trim, fully functioning seats (which we manufacture ourselves), fully functional galleys and cabin communications systems."

A notable example from EDM is its mock-up for the COMAC C919 aircraft featuring an 18m fuselage section complete with high-fidelity flight deck, cockpit displays, passenger seating, in-flight entertainment system and a range of detailed features. Initially intended as an engineering tool, Bonney says it has been used as a prototype simulator for flight crew training and was also displayed at international aviation trade events such as the Zhuhai Airshow in China to demonstrate the new aircraft to potential airline customers and the media.



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WHO YOU GONNA CALL? The fully working training mock-up is just one example, of course. There are many other reasons for building a mock-up and thus different types to consider, as Adrian Gander, managing director of Advanced Tooling Systems (ATS) UK, says: "Design houses use them for verifying designs and proving them to their clients, manufacturers use them for preliminary design review (PDR) and critical design review (CDR) models, and airlines use them for show models and crew training."

Is there a parallel to concept cars, which are often literally just 'vehicles for ideas'? Gander reckons such mock-ups are rare but cites the 2011 'Not for Wimps' gaming concept aircraft seat by Factorydesign for Zodiac (and modeled by ATS) as a good example of a more 'bluesky' approach, adding: "I believe this was one of the first concept seats created purely to make people think. It was a great success and created a huge level of publicity. I think the true meaning of concept models is only just starting to be used in the aircraft industry."

MOST MANUFACTURERS GENERALLY ARE NOT SET UP TO MAKE FAST TURNAROUND MODELS

Most of the time, though, the aircraft industry uses mock-ups in a much more practical way, as Len Martin, managing director of UK-based industrial model-makers Ogle Models, says: "The aircraft industry is much more attuned to production reality."

WHERE TO MAKE THEM? The UK would seem to be a hotbed of mock-up makers, with all the experts we spoke to based there (due to a heritage and skill set in the art of pattern making, according to some). ATS UK's Gander goes on: "Some design houses have their own smaller model-making capacity. Most manufacturers – although having manufacturing capacity – generally are not set up to make fast turnaround models using non-aircraft manufacturing techniques and I do not know of any airlines with the capability to make their own models."

EDM designs, engineers and manufactures its mockups in-house, using a 100,000ft² facility in Manchester, UK, where its staff can assemble and test large structures 02. Lighting scenarios being demonstrated in the COMAC C919 cabin mock-up
 03. Even the exterior of the C919 mock-up is authentic, which is ideal for events such as airshows





04. The C919 mock-up has enabled COMAC to gather a lot of customer feedback prior to production 05. A mock-up of Garuda Indonesia's business class, created by EDM such as aircraft fuselages, motion platforms and fabricated structures. The site provides access for long trailers or lowloader vehicles for the loading and transportation of the finished assemblies, and Bonney says EDM is working with a partner company in China to develop mock-ups there too. Such is the complexity of the overall job that EDM doesn't cover the whole process from start to finish; for instance on the COMAC C919 job it worked in partnership with Design Q for the design.

So first you need to find a designer. Dave Cox, director at trimming experts Prototrim, deadpans, "We do the fluff and feathers part," albeit for clients as prestigious as British Airways on its new short-haul cabin – but explains that one scenario might involve a carrier briefing three design houses. They would ask for a quotation, the carrier then chooses a design and then "the mock-ups will invariably go to be made by three different model makers". The carrier might then take the best bits from all of them to move forward to something that could be used for further evaluation. The former Aston Martin coach trimmer says that some models are made out of ureal – a hard, millable timber-like material which is quick to form but less durable – while other mock-ups can utilize carry-over production seats onto which Prototrim will add new foams and upholstery (and can be more expensive).

AIRFIX THIS AIN'T Talking of costs and, given the varied ways models are made according to their intended purpose, most suppliers we spoke to were naturally wary of being too specific on price. However, ATS UK's Gander says his firm's models can cost "from £2,000 to £1,000,000" – these include simple spatial models, full-size interior and exterior models for uses in spatial awareness, design confirmation, CDR and PDR, show models and crew trainers. EDM also gives a guide, citing rough figures ranging from "narrow-body two-class models for £600,000, to wide-body two-class models with multiple galleys at approximately £1.5m".

In terms of timeframe, it's hard to say, again due to the variety of jobs undertaken. Tom Glacken, director at specialist model makers Ultimate 3d – based in Essex, UK and behind the acclaimed Aura seat for Contour, among many others – reckons on "two to three years for a totally new concept", but many others will be much quicker.

FUTURE GAZING So what's changed in cabin mock-ups in the last 5 to 10 years, and what might another 5 to 10 years bring? Ultimate 3d's Glacken has seen a definite fall in scale model work. "We used to do full cabin layouts with 60 little chairs all laid out, maybe 1:25 and also 1:12 – Action Man kind of size – as single seats with more detail. But that dwindled in the last six or seven years because of 'walk-through' 3D software. There's no need for those models anymore."

Elina Kopola, independent trend, color and trim specialist for TrendWorks, believes the way airline carriers interact with suppliers and modern customer expectations is a key driver for change, as she explains: "In the past,



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where did that mock-up go?

Given the high costs of mock-ups, it's great for the client if the model can multi-task beyond its original use. Adrian Gander, managing director of ATS UK, says this is just what happened with a recent Etihad project.

"We designed the model to be dismantled so it could be shipped to Abu Dhabi and yet robust enough so it could be used as a crew trainer after the design was signed off. It is always best for all our clients to use the models for as many situations as possible, allowing the budget to be maximized. There is always a balance to create; for example, lightweight models can be made for visual effect but still with a good level of finish, but functional models need to be more robust and therefore more of the budget needs to be used in the structure. Crew trainers need to be the most robust as these will be used day-in, day-out by the new crew when working out service. A lot of the seating models are used for marketing tours and some of the models also end up in company HQs."



06. A bar concept created by Ogle for B/E Aerospace

some airlines permitted access to aircraft, so we would often take a selection of materials to assess in the right cabin and lighting conditions. Now it is much harder to get airside access, so therefore mock-ups need to be more realistic and simulate the onboard conditions correctly.

"Aircraft mock-up quality has definitely improved. The big driver is escalating consumer expectation in all sectors. What was until very recently luxury is now mainstream. For example, leather has become ubiquitous even in the main cabin, and new manufacturing techniques like heatwelding are adding the kind of detail and refinement often seen in fashion and accessories. A good example is Singapore Airlines' next-generation business seat. To add value to the decision-making process, it's critical that a mock-up can replicate this same high standard."

London-based design firm SeymourPowell is pressing on with new software to make current and future processes easier, as Jeremy White, head of transport, enthuses: "We're already using virtual reality technology to showcase our models. Often it is more cost-effective to mock-up a basic generic interior and augment the CMF into the model.

"We can see other technologies becoming commonplace in the future, such as 3D projection mapping and holographic projection too. But, as in the automotive industry, traditional forms of modeling, like clay, will always have their place. Digital tools are



powerful, but physical models will always convey a sense of sculpture that is difficult to reproduce digitally."

It seems that every expert in this field agrees on this point. Ultimate 3d's Glacken is philosophical: "We embrace as much technology as possible. One five-axis CNC milling machine replaces what would have been in the 1940s probably 20 human pattern makers. It works 24/7, never has a day off and doesn't get ill. But you still need skilled people to turn what comes out of the machine into top-quality models. It's very easy to lose a concept of size when looking at a computer screen."

For ATS UK, it won't so much be fewer full-size mockups in the future, as different ones. Again, drawing parallels with the car industry – in which it also works – managing director Adrian Gander says, "The automotive industry is generally producing fewer prototypes but this is on an engineering level, not on a design level. Indeed, Jaguar Land Rover is now producing more design models than it ever has in its history."

Ian Nisbett, design director at Coventry-based transport development business Envisage Group – which has its own in-house prototype and technology specialist brand called Visioneering – agrees, adding: "Virtual experiences are getting better all the time and their use will inevitably increase. The use of digital modeling allows a finer granularity in the interrogation of the design at a far earlier stage in the development cycle. However, there will always be a need for the physical model. I imagine it will become more specialist, of higher quality and be reserved for the 'final' stages of the development process, while the virtual model will fill the earlier stages, leading to faster research and development, and more innovation."

TrendWorks' Kopola puts it more simply still, from the perspective of the color and trim work involved in the 'last layer of the process', concluding: "Virtual reality technology is great to gain a first impression, but material and color are notoriously fickle in VR conditions. I believe there will still be a need to see, touch and feel actual materials in the real proportions to be able to demonstrate the impact they have on the passenger experience. Nothing beats the real thing!"



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JOHN WALTON



"Passenger at heart, airline in mind." That's how Airbus's head of aircraft interiors marketing, Zuzana Hrnkova, describes the A350 XWB's design process. And she should know.

"I feel very lucky because I had the opportunity to follow the A350's development from the beginning, by translating passenger and airline expectations to our engineers, all the way up to today, when we have the opportunity to present the aircraft and the product to our airline customers," Hrnkova says.

Slovakia-born Hrnkova, a qualified pilot who started working with Airbus 20 years ago, previously worked extensively on the stretched and re-engined A340-500 and -600 aircraft. It is clear that her perspective on cabin design has been influenced by this experience, constrained by the decisions made for the TA11 design prototype in the late 1970s and early 1980s, which would become the A340, launched in the early 1990s.

Talking with Hrnkova, it's easy to see a pattern of incremental, iterative evolution for Airbus, which had originally intended the A350 to look much more like the A330neo. But she is bold about the impact that manufacturing-side changes can have. "I believe that we can improve the aviation industry, the product, and the passenger experience with new ways of working. We have to work smartly, integrating in a much more optimized manner."

When asked how that translates into passenger experience differences between the A350 and earlier generations, Hrnkova explains that the biggest change is passenger interaction. "Passenger interaction through the in-flight entertainment system is a step change," she says.

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CABIN INTEGRATION MEANS BETTER PASSENGER

INTERACTION As an example of this integration philosophy, Airbus worked more closely with suppliers and customers – and helped them work more closely together – early in the A350 design process, thanks to the experience the airframer had gained a decade and a half ago when stretching the A340.

Matsushita, the Japanese conglomerate now known as Panasonic, ran A340-500/-600 development workshops with airlines and airframers to learn from each other and create the best possible airframe and cabin interior, with the goal of improving passenger comfort.

A key leitmotif of the sessions, which involved the full gamut of participants, from engineers to marketers, was greater integration within the cabin. In particular, the teams needed to work with the IFE suppliers in advance. "It can't be just 'here's a hole you have to fit something in'," Hrnkova says.

The A350's integration of IFE and passenger interfaces is a result of this thinking. Some of the improvements are not unique to the A350, coming from fourth-generation IFE systems such as Panasonic's eX3 or Thales' TopSeries Avant. Of course, the A350 will only be equipped with fourth-generation systems, which reduces the need for backward compatibility and enables Airbus to make expansive statements about up-to-date IFE. But the A350's design itself also enables specific improvements. IFEC CABLING FLUSH WITH SUCCESS (AND THE CABIN

FLOOR] As part of the A350's integration drive, Airbus has worked with ARINC to allow the IFE power and data cabling to run in dedicated channels, flush with the floor, alongside the seat tracks.

At launch, one of these dedicated channels will be in use for IFE, power and other at-seat uses, while another will be left free on most configurations to enable later additions to be made with minimal refit time and cost. Reconfiguration flexibility is a key theme of the design of the A350's cabin interiors.

The drive for integration is not just in terms of what's on the aircraft, but also in terms of how the design process works. An advantage of working with a defined catalog of suppliers containing fewer specific line-fit product offerings is that the number of companies whose product requirements need to be taken into account is reduced.

At floor level in economy, the 2cm-high ridges of protective plastic covering that typically run parallel with the aisles have been reduced in the A350 to one single track that sits flush with the floor. Up front in the premium cabins, weight can be saved because the requirement for thick carpeting to cover such cable ridges is removed, meaning a thinner, lighter carpet can be specified.

NO MORE UNDERSEAT BOXES Working with seat and IFE suppliers has also enabled Airbus to solve an increasingly frustrating problem for economy passengers: the underseat boxes required to run the current generation

- 02. Airbus is considering ways in which the economy IFE sector is developing
- 03. Zuzana Hrnkova has some 20 years' experience working at Airbus
- 04. An early concept for the economy cabin. Note the flat floors and lack of IFE boxes





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thinking outside (and all around) the cabir

Making the most of the full airframe and thinking outside the cabin was a focus for Airbus back in 1999-2000, with the underfloor lavatory facilities developed for Lufthansa for the A340-600 being a prime example. At the time, Lufthansa's decisions were made by its business units, with Lufthansa Cargo in charge of cargo and Deutsche Lufthansa in charge of passenger carriage, which made the -600 stretch still the world's second-longest airliner after Boeing's 747-8i - the perfect candidate to use space outside the main deck for non-seating facilities.

Yet Hrnkova will admit that the underfloor lavatory option wasn't a big success, mainly because such options have a structural impact. She states that what airlines want is soft, not hard customization, because it maintains the residual value of the aircraft and its flexibility when the time comes to sell.

For the A350, the evolution of this tension between the customization choices made by the purchaser, lessor or first operator, and the knock-on effects for subsequent operators, is that every aircraft will be produced with the ability to install or remove the crew rest facilities in the crown of the cabin.

The aircraft has also been designed with reconfiguration flexibility in mind, particularly around seasonal reconfiguration opportunities. A350 customer Lufthansa is perhaps the bestknown airline when it comes to adjusting the balance between economy and business cabins for in-year demand, yet the idea with the A350 is that even airlines without massive maintenance, repair and overhaul subsidiaries (like Lufthansa Technik) will be able to respond more swiftly to fluctuations in demand.

of IFE and to provide power to personal electronic devices, which take up valuable foot space.

The boxes are most visible on refitted aircraft, where carriers have decided the requirement for at-seat functionality has to be met, but locations for the IFE boxes outside of the passenger footprint have yet to be enabled. But even factory-fresh cabins are being produced in which the boxes get in passengers' way.

Passengers hate the boxes, and their additional weight is an undesired consequence of the 'bread and circuses' distraction strategy that many airlines are operating to take passengers' minds off the steadily shrinking amount of personal space they have on board. With the trend toward reducing seat pitch, enabled by the extra pinch point space created by the latest generation of slimline seating, flyers are increasingly vocal about the fact that there's nowhere to put their legs (let alone their smaller carry-on items) if a box is in place and seat pitch approaches 30in. By leveraging the benefits of having a reduced list of line-fit suppliers, Airbus has been able to relocate these boxes vertically, into the weight-saving structural gaps in the underseat support frames, which jut out around 2cm either side of the triangular space. This repositioning takes the boxes out of passengers' way and will allow airlines to improve the passenger experience at higher cabin densities.

DESIGN FOR CURRENT AND FUTURE GENERATIONS It's clear that Hrnkova's experience at Airbus has given her a fundamental desire to plan for both current and future generations of A350 passengers. Even as the interiors industry innovates, the adoption of now-familiar devices such as iPhones and iPads, dating back to 2007 and 2010 respectively, is a perfect example of how the rest of the world isn't standing still either.

Apple's iOS operating system has fundamentally changed the way people expect to interact with technology







provision for future developments

The evolutionary process doesn't start or stop with the A350, of course. Airbus can build on a quarter of a century of experience producing wide-body aircraft of similar size to the A350, as well as the optimization work it has been doing on the similarly sized A330, when considering the various options for the initially mooted form of the A350.

In the first instance, that takes the form of long-overdue improvements to the A330 and A340 family cabins, such as larger overhead bins, which Hrnkova explains are one of the top things that test passengers notice on the A350. But it also includes currently produced innovations, such as the Space-Flex lavs that optimize cabin space while maintaining provisions for passengers with reduced mobility.

Airbus is also building on existing innovations. Hrnkova mentions advances in cabin lighting as an example. "Even if previous generations had mood lighting as an option, the way that the lighting transitions through various scenarios is much smoother, thanks to the full-LED capability" of the A350.

The evolution of airline seating is also a key Airbus talking point, with new

generation seats like the Recaro BL3520, B/E Aerospace Pinnacle and Zodiac Z300 highlighted as bringing over 2in of extra knee and shin clearance compared with older seats. Technological and materials advances in ultra-slimline seats like these – and updates to them based on passenger feedback as they continue in-service rollout – will filter upwards to more upmarket economy seating aimed at longer-haul missions.

Yet Hrnkova openly states that some A350 customers are continuing to go tight and bare-bones with their seating, with what she refers to as "leisure or mediumhaul operators" selecting a 3-4-3 layout

instead of the A350's standard 3-3-3. This option is an update of what's available on the A330 (and, to an extent, the A340): leisure operators like Monarch or Air Transat, and medium-haul lowcost carriers like AirAsia X, operate a 3-3-3 configuration on their Airbus wide-bodies. In some cases, carriers have operated this configuration since they operated A300s. As much as the airframer wants the Airbus Comfort Standard of having seat width at a minimum of 18in, it isn't hesitant to sell aircraft to airlines who aren't fans.



07-08. The Recaro CL3710 and BL3520 bring fresh new economy designs to this fresh new aircraft – just witness the speed at which a toddler masters the user interface of a tablet computer – and nowhere is that as true as with in-flight entertainment.

Just as seatback IFE suppliers are hamstrung with playing certification catch-up, with some looking to supplement or even supplant traditional seatback screens with commercial off-the-shelf tablets, anyone involved with constructing the rest of the cabin environment needs to consider how people who are toddlers now will interact with the cabin in their 20s and 30s, when some cabins being designed now will still be operating. (Thirty years isn't by any means an exaggeration: based on a 1960s airframe, the first Boeing 747-400 to take flight in early 1988 was later delivered to Northwest Airlines and is still flying for Delta Air Lines nearly 27 years later.)

Airbus created a 37m-long verification and validation mock-up of the A350 XWB cabins, complete with fully $\left(\frac{1}{2} \right)^{1/2}$

AIRBUS IS TAKING THE TIME TO MAKE SMART DESIGN DECISIONS IN TERMS OF IFEC operational cabin systems, and equipped with real-world cabin equipment: not just seats, but also galleys, lavatories, and rest areas. For the A350 project, six customer focus groups, which included project suppliers, tested all the different parts of the A350 cabin, including everything all the way down to the handling characteristics of the cabin equipment.

Initially, five-hour virtual flights were conducted with real airline partner pilots and cabin crew (Cathay Pacific's distinctive uniforms appear in Airbus's imagery of this part of the process), moving to full overnight flights in cooperation with Lufthansa.

Twenty-six proving flights covered 14 different airports over a total of 177 hours. By integrating mock-ups, testing and demonstration in an evolutionary, iterative way, Airbus says it can reduce the risk of more revolutionary advances affecting the A350's development. (For more information on mock-up cabins, see our feature on page 68).

Airbus is taking the time now to make smart passenger experience design decisions in terms of IFEC – and all other passenger elements – in the hope that the A350 and any further aircraft models based on it will also remain in production for nearly half a century. \boxtimes

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01. A 3D fabric that JPA has developed in collaboration collaboration with Botany Weaving 02. In a digital age, the texture and tactility of textiles such as this Bandas textile created by Patricia Uruqiola for GAN add haptic interest 03. The contrasting stitching on this leather chair by Cappellini subtly but effectively lifts a subdued leather color

materialtrends

Long lead times and cabin lifecycles mean that trends forecasting is essential for the aircraft interiors industry. Following a year of new developments, these are the trends that could influence the next generation of cabin color, material and finish schemes **NUALA MCHUGH**, MATERIALS, TREND AND BRAND SPECIALIST, JPA DESIGN

The world of trends, trend forecasting and consumer insight is at times misunderstood, with a broad perception being that of a fleeting aesthetic. Yet trends are a fundamental part of our emotional, physical and psychological landscape, and by forecasting trends the aircraft interiors industry can begin to understand what motivates consumers, as well as the impact of these stimuli on brands. Such observation enables brands to build products and experiences that truly resonate with customers and create emotional connections.

Brands that are more aware of and responsive to trends engage more successfully with consumers and increase their relevance to the future market. Trends should be pertinent to the airline brand, while also connecting with the passenger. Airlines are becoming more trend-aware with the intent of enhancing the overall customer experience. With the competitor landscape becoming increasingly sophisticated, finding ways to engage consumers and enhance their traveling experience can set an airline apart from its competitors.

Every year the team at JPA makes a strategic plan to visit relevant shows and events, including automotive shows, specialist material exhibitions, furniture fairs and of course Aircraft Interiors Expo. These shows are exciting



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05

DESIGNERS ARE GETTING CREATIVE AND ADVENTUROUS WITH THE APPLICATION AND COMBINATION OF METALLIC HUES AND TONES

gateways to future trends and a fascinating sounding board for new products and ideas, often with a number of years passing before these themes and products appear in broader markets. Many of the materials, designs and concepts presented at these shows are reflections of social and cultural shifts worldwide.

04

Research is synthesized to find relevant inspiration that can be sustained and adapted into a successful aircraft interior. Interpreting and re-evaluating the research is an ongoing process, adding new innovations, visual stimuli, design cues and inspiration to the company's design work for the coming year. The findings are then carefully curated for each project, with the passenger and airline brand in mind.

So what are some of these material trends and how have they made their way onboard aircraft cabins?

COLORED AND COMBINED METALS Metals are an exciting topic at the moment, with treatments ranging from the subtle to the sublime. Designers are getting creative and adventurous with the application and combination of metallic hues and tones. Treatments range from a small detail in the stitching that lifts a subdued leather, to extreme statement pieces such as the sculpted Masters Chair designed by Philippe Starck for Kartell, a special version of which was unveiled at Salone del Mobile 2014 in Milan, with a gold finish.

Copper, bronze and pewter have proved popular in design during the past few years, as their warm glow

creates an inviting and colorful environment. These metals can also have combined treatments such as spun or hammered effects, which add artistic character with an element of distinction.

This progression into using warmer metals was initially intended as a move away from ostentatious symbols of wealth during the economic recession. However, the warmth of copper and bronze are a welcome change, and many luxury brands are now choosing to use these metals over the more traditional gold or silver.

In reaction to this trend, JPA's design for Singapore Airline's Next Generation business class seat has a distinctive copper trim, highlighting the dynamic seat shell and reflecting the warmth of Singapore Airline's famous inflight service. The seat was recently voted the best business class product in the world by Skytrax.

INNOVATIVE CRAFT Contemporary designers and makers are reviving ancient skills with radical new technologies and forward-thinking ideas. Craft implies an attention to detail, in a world where globalization has led to countless products and experiences with little differentiation. An object with individuality and attention to detail enhances the value of the product, builds brand loyalty and is more attractive to the consumer.

Designers are increasingly taking a more hands-on, materials-driven approach to design, and several designers at Milan Design Week and the London Design Festival have been inventing unique surface treatments. These new 04. Copper, bronze and pewter are becoming popular, as used by Tom Dixon for his Form Bowls
05. A rather different application of colored metal is the golden Masters Chair, designer by Philippe Starck for Kartell







aesthetics were created in a variety of ways, combining contrasting processes, materials and treatments to create unique surfaces.

Japanese design studio Nendo stood out as an inventor of new surfaces through the use of multiple processes. The studio's particularly successful table collection consisted of glass surfaces with visible brushstrokes of paint underneath. The glossiness and smoothness of the glass contrasting with the imperfect brushstroke texture created a surprisingly soft appearance. Although visually delicate, the surface is highly durable. Similarly, Italian studio Alcarol is creating surfaces with enhanced durability by laying resin over a natural, crafted surface.

Such work is relevant for the aviation industry, as many premium seats are relatively low volume, which can increase the opportunity for bespoke materials. Putting this trend into practice, JPA has created bespoke textiles for Air China's recently launched B747-8i interior. JPA was honored to work with artist Han Meilin on this project as he created dynamic hand-drawings using traditional techniques, conveying the auspicious phoenix flying through the clouds. JPA had to use its industry expertise and experience to tackle the challenge of using weaving techniques to capture the essence of these fluid artworks.

BOLD TEXTURES Objects with texture and tactility convey tangibility and are inviting to touch. Highly tactile and engaging surfaces are emerging in response to our more interface-based, technologically led lives. Textures and surfaces with character are the opposite of the cool, flat anonymity of digital displays.

lightweight luxury

The newest development in Desso's strategy to help airlines save fuel is the launch of a lightweight carpet, made out of a special wool and nylon blend. The carpet is intended to offer the best of both products, with the luxurious look and feel of wool, combined with the durability of nylon, which together deliver a product of the highest quality that meets all industry standards. The carpet can be tailor-made to fit any aircraft interior and is part of a wider lightweight carpet range.

In this increasingly digital world, highly tactile products and interiors can be used to emanate warmth and personality, welcoming you with their colors and textures and creating a desire to use, relax and enjoy.

Applying this trend to aviation, Annette O'Toole, senior designer at JPA, created a premium three-dimensional textured fabric. Through the use of innovative weaving techniques and specialist materials, surface depth of the textile was increased. Aviation-grade yarn was used for the composition of the fabric to ensure it passed the necessary stringent tests. The resulting fabric has a tactility and surface interest that delivers on the visual promise of enhanced comfort.

SMART MATERIALS AND SECONDARY FUNCTION 'Smart materials' have the ability to sense their environment and



DURABLE MATERIALS THAT RISE TO THE CHALLENGE OF IMPROVING THE PASSENGER EXPERIENCE ARE ALWAYS OF INTEREST



the trend for 'warmer' metals, the Singapore Airlines Next Generation husiness seat has a copper trim 09. For the Brushstroke range of tables. Nendo brushed color onto a transparent glass surface, then blew another layer of colored paint on top, to create

a natural effect

08. In line with

the effects thereof, and to react to that external stimulus. The use of these materials offers a competitive advantage and aids the development of products with increasing levels of functionality. For example, materials can be enhanced to increase well-being, hygiene, durability, or to adapt to temperature and privacy needs. As technology advances, materials and surfaces are reshaping how we live our lives.

Undoubtedly the escalating power and complexity of smart materials increases the impetus for designers to drive these developments further and translate them into designs that deliver true benefits to the end user. People are engaging more with their environments, surfaces are becoming responsive, and technology is developing to enhance the function and support of products. For example, plastics and paint that conduct electricity can cleanly replace the need for wires. Self-healing materials such as concrete, composites and plastics already exist, require less maintenance and reduce waste as there is less need to replace damaged materials.

The aviation industry offers huge scope for opportunities. With such a demanding environment, durable materials that rise to the challenge of improving the passenger experience are always of interest. Materials capable of enhancing well-being and increasing customization will be the next big step in material innovations. For example, hygiene is an increasing concern for many people. One product that has been developed in response is Sharklet, a textured film product that has antibacterial properties, with a specially developed micro-texture that reportedly inhibits the growth of bacteria by approximately 90%, mitigating the need for harmful chemicals or cleaning agents.

An aircraft can be someone's home for up to 18 hours, so imagine if passengers could have true control of their immediate environment, with the ability to choose the aesthetic. Within interiors and fashion, textiles have been developed with embedded LEDs, aiming to provide the user with flexibility and choice of colors, images or

senses of style

Alcantara's new Infinito aviation collection comes with digital printing, embossing, electro welding and laser etching options, which offer a combination of sensory aesthetics. The range has also been developed for greater grip, lighter weight and improved ease of care.

The company says that to feel seats, panels and shells elegantly upholstered with Alcantara in rich textures with relaxing colors is to feel as if you are in a luxurious car.

Alcantara believes in ethical and social awareness, and has just been declared carbon neutral for the fifth year in a row.



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mix and match

An attractively designed cabin environment creates a feel-good effect, and Lantal's new Essentials Stock collection has been created to make it possible to quickly and easily implement well-balanced interior concepts. All products in the range are certified and are available off the shelf – even in smaller quantities. The collection encompasses seat cover fabrics, carpets, leathers, wall coverings and curtains – including blackout types – in elegant colors and eclectic designs that coordinate with any cabin interior concept. The idea is that, no matter how you combine the products, the result is always an appealing interior. These fully airworthy and certified products are ready to ship at a moment's notice.

10. Land Rover's DC100 Sport concept has a clever mix of materials, with the seats covered in leather, as well as a 3D mesh insert in a tribal pattern, which is repeated on the floormats, made of Ombrae panels

10

patterns that can be selected from an app on the user's smartphone.

Another example of customization through materials is Ombrae's imaging technology, which can alter images on a surface depending on lighting and the viewer's perception. An image can be created without actually transferring any graphical content, as the surface is composed of three-dimensional pixels that render the desired image or effect.

Barriers exist to the commercial exploitation of any new developments. Compared with other industries, the aviation industry can sometimes be viewed as stagnant when it comes to integrating new material technology. This can be attributed to stringent testing standards and short lead times. However, these hurdles can be overcome with the right team, a combination of in-depth industry knowledge and the support of the airline.

IN CONCLUSION Insights gained from trend observation enable brands to build products and experiences that truly



AN IMAGE CAN BE CREATED WITHOUT ACTUALLY TRANSFERRING ANY GRAPHICAL CONTENT, AS THE SURFACE IS COMPOSED OF 3D PIXELS THAT RENDER THE DESIRED IMAGE OR EFFECT

resonate with customers, creating emotional connections. Globally, one visual trend no longer dominates design, yet airlines aim to appeal to the international traveler. The question is, which trends are relevant to the brand or product in question, and which appeal to and increase passenger enjoyment and experience?

The aviation industry is unusual in that it operates on projects that can have lead times of between two and 10 years. Moreover, depending on the airline, the interior can be in service for a very long time. To reduce risk, trend analysis can help position the product to resonate with the passenger. Trend analysis is about building a credible narrative about the future, informing the decision-making process, mitigating risk and creating beautiful designs.

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brightideas

The latest cabin mood-lighting systems are changing aircraft interior design and creating new passenger experiences – but many are not being used to their full potential

MARYANN SIMSON

The latest wave of cabin mood-lighting systems has captivated us with rainbows of unimagined color, has promised painless integrations and has eagerly touted 'so easy a monkey could do it' operational controls.

It has indeed been proved that color can affect mood and that passengers prefer the ambience of a cabin with upgraded lighting. Many airlines, however, have yet to work out the best way to capitalize on their new-found mood-setting abilities, citing difficulties that include lack of training, rough scene transitions and difficulties in using various software interfaces. It almost seems that in all the excitement surrounding the capabilities of new LED technology, we may be falling into a trap of seeing too much of the forest through some troublesome trees.

SURVEYING THE SCENE Demand for aftermarket 'drop-in' LED and full 'mood-lighting' LED systems is riding a steep northbound curve, not only for wide-body long-haul aircraft, but increasingly for single-aisle jets. Companies such as Emteq, Schott and Diehl are just a few now leading the way in terms of advanced product engineering and mass component manufacturing. Some suppliers have even obtained STCs to complete installation of both fast-turnaround single accent retrofits, as well as more involved 'mood' or 'full spectrum' color retrofits. Additionally, most manufacturers have developed close working relationships to see the integration of their hardware onto new aircraft as part of line-fit cabin management systems (CMS). These complex systems today come mainly from the likes of BAE Systems (line-fit on Boeing's 737 and 777), Airbus ('CIDS' is line-fit on the A320, A318, A380 and the upcoming A350) and Panasonic Avionics (line-fit on Boeing's 787 Dreamliner).

Full mood-lighting systems are now capable of producing nearly every conceivable shade of color and combining them into beautiful custom scenes, such as Icelandair's dynamic Aurora Borealis scene created by Emteq's full-spectrum mood lighting system (see image at the bottom of page 98). But as with any new concept in the complex aircraft environment, growing pains are commonplace.

"It's a fact that LEDs are not as easy to handle as everybody thought 10 years ago. They are affected by humidity, temperature and other environmental conditions... dimming is very, very complicated with LED 01. Panasonic's LED cabin lighting systems can even create an onboard rainbow



02-03. This

Bombardier Global Express features the Emteq E Connect system. The installation was completed by FAI Technik, who customized the GUI through Emteq lights and it is difficult to deal with the power onboard because there are random changes in current and high spikes," says Olaf Schultz, senior product manager for aviation at Schott, a provider of interior illumination that is currently working closely with Lufthansa Technik in the general aviation market and on the new HelioJet SpectrumCC product.

"On the other hand, we must look at how to set up a grid that allows for the full spectrum of mood and color lighting to be used on commercial aircraft. From our experience talking to people in the business, we've learned that on at least one Boeing aircraft type, the mood-lighting system has never really been used because flight attendants think it looks too complicated."

ENHANCING THE EXPERIENCE This statement underscores a sentiment that the points of user interfaces for most mood-lighting systems, both line-fit and retrofit, have so far been somewhat of an afterthought.

In the case of a true 'drop-in' LED solution that replaces fluorescent bulbs (a technology introduced in 1938) and does not use multiple colors, but rather white plus a single accent color, control integration is fairly simple. "A typical fluorescent tube setup has three commands: bright, dim or off," explains Peter Tessmann, product marketing manager at Emteq, maker of the eFIT singleaccent-color overnight LED upgrade. "With eFIT installed, the first light could still be just white. Then the next might be white with a low blue, or all blue or white with a more intense blue, so you're getting different intensities of that accent color. These controls will be integrated into the exiting CMS touchscreen, or on an older aircraft, right into a rotary switch."

With eFIT, transition times and color temperature can be pre-selected by the airline in development meetings with Emteq. The operation of the new lights is simple for crew already familiar with the unchanged controls. Alternately, when a carrier wants an upgrade to enable scenes (sunrise and sunset, for example) which require smooth cycling through various hues, an overnight drop-in solution is not possible. "We are getting close with some new technology, but if you want mood lighting, you currently need to take the wiring out and reprogram your [CMS] touchscreen, or we have touchscreens that we sell with the product. This is not specific to Emteq mood lighting, that's the market right now."



Northern lights

An unusual application of the Emteq LED mood-lighting system is Icelandair's cabin upgrades for its B757 fleet. The airline has customized the system to create dynamic lighting scenes that mimic the Northern Lights and other aspects of Icelandic nature, which give a unique and tailored passenger experience.

In order to minimize integration costs and changes for cabin crew, the system uses the existing flight attendant panel for light dimming. To allow the crew to fully control the mood-lighting system, Emteq is also supplying a simple OLED control panel, which will allow the cabin crew to choose between various dynamic scenes and color presets. Virgin Atlantic worked closely with Diehl Aerospace on an innovative new lighting system interface for its B787 interiors. See our feature on p36 for more details

Where's my remote?

Perspectives on PED-controlled cabin lighting from...

The integrator:

William Barnes, senior principal software engineer, BAE: "We are working with Samsung to understand and ensure that we have a solution for this. The next part is ensuring that you have the proper firewalls in place. That is a problem and we will ensure that our solution is robust before any products come out."

The specialist:

Peter Tessmann, product marketing manager, Emteq: "It can be done and we are doing it in the business aviation market (see pictures 2 and 3). The first airline to commit will need to work through the STC and regulations, but that's why we're here, to help. No one wants to be the first in aviation, but eventually someone will be, and we will be ready when they get there."

The new contender:

Mark Jennings, executive director OEM management, Panasonic Avionics (which recently announced its intention to enter the cabin lighting market): "As with all new systems being installed on aircraft, cabin crew, like anyone else, are very familiar with the latest handheld iPhones, iPads and android device GUIs and 10-finger touch-capacitive touchscreens. A fixed crew panel will be used as the primary control for all installations, and additionally wireless control via Panasonic ToughPad or potentially wearable devices, are also part of our R&D effort. We believe form follows function, so the appealing design will always support a seamless user experience integrated into the onboard environment. There are various use cases and the right solution for each is dependent on many factors beyond just technology, such as cultural, behavioral and socio-demographic parameters."

The business aviation world:

Stephen Cooper, head of engineering at FAI Technik: "I often use iPads, and the GUI goes on the iPad as an application, but what I really prefer is creating a webpage through the wireless router. Then when the client or crew member connects to the router, they just access that webpage and control the lights there. It's proven to be far more customizable than other methods. We can even upload presentations there for a meeting. It's also possible to send and receive phone calls onboard through this portal – it all comes from controlling the lights. Naturally though, business aviation is a whole different world in terms of cost constraints."

In this scenario, and in some new line-fit applications, problems begin to emerge. The challenge is two-fold: if an airline really wants to differentiate it must move away from the preset scenes that come standard with its CMS or upgraded light system. Creating a proprietary scene can involve learning new software, lengthy discussions and approvals, design consultations, testing and uploading that new data via USB onto aircraft. Next, crew must be educated on the new control layout and inspired to actually initiate the new scene or sequence at the appropriate time during flight.

SUPPORTING THE SCENE Each mood-lighting supplier has a different working process when it comes to supporting airlines as they imagine and realize customized scenes. Emteq, for example, tends to work directly with airlines to develop new scenes for Tapestry and Quasar II, its current systems. The coding used to create scenes is proprietary to Emteq; however a PC-based software tool is in development to allow airlines to edit that code or even create their own in the future. Additionally, Emteq is deeply invested in collecting customer feedback on how airlines and flight crew interact with systems, discovering what they like and where the pain points might be.

Diehl Aerospace also supplies premium-quality cabin illumination. "In order to achieve the appearance and ambience customers are looking for, we make intensive use of our Light Verification Center in Nuremberg, Germany (Europe's largest testing facility for cabin lighting) and its mock-ups in order to define scenes," says IF AN AIRLINE WANTS TO DIFFERENTIATE, IT MUST MOVE FROM PRESET SCENES



04-05. The first retrofit of HelioJet 'white' was completed on a Lufthansa A319 in August 2013. The first retrofit installation of HelioJet SpectrumCC (color controlled white and mood light) will take off in January 2015, on an SAS A330



Halo product

Zodiac Aerospace has been working on ways to get circadian rhythms to match those of the destination timezone, as well as to offer personalization options. For example, passengers in Zodiac's Halo super-first-class concept can tell the suite's control system that they want to have six hours sleep and to wake up two hours before landing. The system will then adjust the mood lighting as appropriate for each stage of the flight, perhaps highlighting the table area for dinner, and gradually darkening as bedtime approaches. Or of course you can simply elect to have full manual control of the lighting as you see fit.

The system itself is similar to those already found in modern aircraft, but it has been applied in a new way and adds to the idea of control enhancing comfort. For customers interested in the system, it may be best suited to an enclosed suite where it won't affect other passengers. If the system were applied in a more open cabin, it would have to be at a low intensity, to avoid the first class cabin resembling the Aurora Borealis when the cabin lights are dimmed.

FULL-COLOR BENEFIT CAN TURN INTO FULL-COLOR DISASTER IF DONE WRONG

06. Zodiac Seats has reported customer interest in the lighting functions of the Halo concept Marc Renz, head of the company's cabin customization business segment. "There we can show the customer exactly what the lighting and color schemes will look like in the aircraft cabin."

BAE Systems is the provider of the CMS for Boeing's 777 and 737, both of which feature the Sky Interior. The firm recently won a contract for the new Cabin Control Panel for the B777 (expected to enter service in 2016). While BAE Systems does not manufacture LED light systems, the company does integrate control of these systems with other onboard functions into a master panel for crew. As the creators of the control mechanism, BAE Systems and not the lighting supplier (B/E Aerospace or Diehl) effectively becomes the key point of contact for airlines seeking support.

BAE Systems does have a proprietary software program – the Configuration Database Generator. This tool not only defines which cabin features an airline has selected; it also contains the definitions for the lighting scenes (colors, transition times, etc). "There is a lot of technology in this tool, presenting all the different types of light in the aircraft," reveals William Barnes, senior principal software engineer at BAE Systems. "You have ceiling lights, sidewall lights, cove lights and accent lights spread throughout the cabin. It's pretty involved. If you want to make a complex lighting scheme, you can have different colors in different areas of the aircraft." BAE has added a 'design mode' to its onboard CMS panel, which enables new scene creation directly on board. Concepts can be defined and tested against various ambient light conditions, as well as textiles. Perhaps even more importantly, this application lets the airline evaluate the aesthetic effect created when transitioning between existing flight scenes and the candidate scene.

This function is not intended for crew use. However, if a cabin attendant were to stumble across it in their daily use of the CMS, it is easy to imagine how that might contribute to his or her feeling that the system is overly complex, or it could even bring out the 'inner artist' in a crew member.

"Changing scenes should be as easy, but it should not be so flexible that flight crews start playing around with it during a flight," says Renz. "A full-color benefit can turn into a full-color disaster if it is done the wrong way."

MOVING FORWARD In the not-so-distant future, flight crew will not need to worry so much about initiating scenes manually in the midst of their other duties. It seems that every player in the lighting game is moving swiftly toward using flight data to automate these procedures.

As it develops its new full-spectrum mood lighting system, Emteq says it is looking into ways of using ARINC data to push certain light cycles as a way of minimizing interaction with flight crew. We can expect to hear more about this development and others from Emteq very soon. BAE Systems says it has already incorporated automated lighting capability based on flight status into its B777 CMS, although actual user uptake is unclear.

"The great thing is that this information exists already, it belongs to the heart of the aircraft. Using those systems in a one-way street is very acceptable," says Schott's Schultz. "It is possible and I think it's the way of the future."

The global commercial aircraft interior lighting market is valued at US\$1,469.5m and is forecast to grow to US\$2.01bn by 2020, according to data from Research and Markets

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We are all individuals. Wouldn't it be lovely to have an individual aircraft seat, too? Why should we accept uniform seats? And wouldn't it be even better if all these individual seats could still work in harmony with each other to create a consistent and stunning cabin? Isn't that what we all want?

The Rohi design team has explored a completely new approach to aircraft cabin interiors, through the creation of an innovative textile concept that allows for much more individualized passenger seat dress covers, especially in economy class. The concept is an eclectic cabin design, which is individual, inspirational and sustainable at a minimized lifecycle cost.

The innovation is an up to 6.5 yard (6m)-long design repeat, which is composed of varying patterns, textures and styles that are strung together endlessly and without transition. Pieces cut out of the roll and sewn into dress covers show random sections of the repeat, while the seat covers can be distributed throughout the cabin in any order.

The result? Each seat features an individual segment of the fabric design, allowing for infinite variants of seat dress covers. Although each seat has been given its 'own' identity and while the result cannot be anticipated, the overall cabin appearance remains harmonized.

The use of a random cutout also allows maximum application of the fabric, ensuring low wastage and reducing its environmental impact. Additionally, the random dressing of



seats with covers featuring only one part number ensures simpler logistics for airlines, which will also benefit from lower costs. This design means you can have the best of both worlds – a fantastic design at a very reasonable price that treats passengers as individuals but delivers a cabin with a clear and cohesive identity.

Rohi has more than 40 years' experience working with leading airlines from around the world, as well as over 80 years' expertise in highend domestic interiors. It has drawn upon both to create this solution. The 'next generation of eclectic' textile concept is more complex than it first appears, and it took the Rohi design team some time to fully understand the design implications and technical considerations of the concept.

Rohi mastered this new approach - the result is a product that is

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toughtests

565-RATED SHEET PRODUCTS DELIVER HIGH-IMPACT PROPERTIES AND REDUCED AIRCRAFT WEIGHT

Aircraft interior designers can specify high-strength thermoplastic alloys for the thermoforming of lighter-weight components that save fuel and look new for longer.

For example, the recently introduced FeatherWeight seat from Timco Aerosystems relies on an impactresistant thermoplastic alloy sheet from Boltaron to reportedly cut the weight of a 200-seat aircraft by more than 8,000 lb (3,629kg), yielding great long-term fuel savings.

To meet FAA flammability and heatrelease requirements, sheet products are formulated with high loadings of additives that typically incur reductions in impact resistance of 50% to 75% versus comparable non-aircraft-rated grades. It is therefore crucial for aircraft interior designers to specify sheet products that comply with FAA requirements, while exhibiting minimal adverse effect on physical properties.

There are two widely accepted methods for measuring the impact resistance of thermoplastic sheet products. With Izod testing (ASTM D-256), a pendulum held at a specific height is released, breaking the notched specimen. The distance the pendulum travels after breaking two different heavy-gauge specimens (and specimens having high impact resistance) can vary significantly, yielding meaningful test results. However, because the weight of the pendulum relative to the strength of two different thin-gauge specimens (and specimens having low impact resistance) is far greater, differences in the distance the pendulum travels beyond the specimens is far less, decreasing the accuracy of this method for evaluating sheet products typically used for thermoforming of aircraft interior parts.



thermoplast data through both Izod and Gardner imnact tests



The second ethos – Gardner Impact Testing (ASTM-D4272) – is widely used for accurately measuring differences in impact resistance between sheet products of thinner gauge and/or lower impact resistance. Alternatively, with 'falling dart' impact testing, an 'impactor' or 'dart' (of variable weight) is released from various heights onto a test specimen.

It is important to note that impact resistance expressed in terms of Izod impact strength can understate the performance difference between two different sheet products meeting the FAA 6565 standard. For example, the published Izod impact strength of one 6565-rated sheet product is 5ft-lb/in (265 J/m), versus 3ft-lb/in (159 J/m) for another 6565-rated sheet product – a performance advantage of 67%.

However, Gardner impact testing of the same two sheet grades in 60mm thickness determined mean failure height of the first grade to be 70in (177.8cm) versus 24in (60.96cm) for the second grade, a performance advantage of 192%, illustrating the importance of this test method to specifiers of aircraft-rated sheet.

It is incumbent on the specifier of thermoformed interior components to identify significant differences in available sheet products by evaluating reliable test data obtained not only through Izod impact strength testing, but also Gardner impact testing.

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CLEVER LIGHTING SYSTEMS CAN ENHANCE CABIN AMBIENCE AND IMPROVE PERFORMANCE, AT REDUCED COST

Every airline is seeking ways to enhance the passenger experience and reduce costs. But can you do both? By addressing the entire cabin lighting environment holistically, and leveraging pioneering next-generation lighting technologies, the team at STG Aerospace is proving it can be done.

With more than 9,000 aircraft from 300 airlines flying with STG Aerospace products installed, the company knows about lighting aircraft interiors.

There was a time when cabin lighting was purely functional. Light is just light – right? Not any longer. With the advent of versatile, controllable, lightweight LED technology, lighting systems are now being put to a wide variety of imaginative uses – from creating dramatic first impressions, to achieving brand differentiation, to providing passengers with aesthetic but subliminal 'cues' that can mark the various stages of a flight and help alleviate jetlag.

Based on the latest research into the effect of ambient lighting on everything from eating patterns to sleep quality, liTeMood from STG Aerospace is a true plug-and-play, programmable, LED cabin lighting system that can be easily retrofitted to enhance the cabin ambience and improve the operational metrics of any airline.

In fact, STG Aerospace carried out the industry's first-ever 'swap-out/ swap-in' LED lighting project when it replaced the fluorescent lighting on Swiss International Air Lines' fleet of Avro RJ100s. György Filep, the airline's aircraft systems engineer, described the company's innovative LED technology as, "a real breakthrough in cabin lighting for us. We carried out a thorough evaluation of all available systems and were impressed by the reduction in maintenance burden and



improved cabin appearance delivered by STG Aerospace's new product."

Then in April of this year, ArkeFly, a Dutch charter airline and member of TUI group, awarded STG Aerospace the contract to retrofit its B737-800 fleet with liTeMood. In the words of Freek van der Pal, ArkeFly's maintenance and engineering manager, "STG Aerospace's liTeMood system offered the product benefits, low cost and technical advantages we were looking for to enhance our cabin interiors, and simultaneously provided our customers with the best cabin ambience experience."

STG Aerospace's safTglo is the market-leading photoluminescent emergency floorpath marking system and can be easily installed by an OEM or retrofitted by an airline. With its unique design and a long-standing 100% reliability record, safTglo can reduce maintenance costs by up to 80% compared with other systems. safTglo is greener, too. Since no power source is involved, the number of battery packs required on board (for providing conventional emergency lighting with back-up power) can be dramatically reduced. This helps to minimize weight, reduce complexity and increase the aircraft's fuel and electrical efficiencies.

safTglo products have been endorsed by a number of customers with specific operational requirements. For example, Thomas Cook Airlines had some problems with its electrical floorpath marking systems, which required a costly maintenance regime, including carpet cutting, fitting and binding, which often resulted in considerable carpet wastage. By selecting the safTglo OverCarpet option – a polycarbonate housing with a unique hinged-wing extension that hides, protects and grips carpet edges - the airline was able to dramatically reduce its maintenance costs at the same time as enhancing its brand image with STG Aerospace's photoluminescent colormatching service.

The pioneering research undertaken by the company and, indeed, its commercial success, continue to reaffirm an important truth for STG Aerospace. From minimizing maintenance costs to reducing the onboard weight of an aircraft's fixtures and fittings, and from transforming the passenger experience to enhancing brand identity, carefully choosing the right lighting solution can make a major contribution to any airline's competitive edge.

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artwork

MEET MONALISA, DEVELOPED BY AVIOINTERIORS AND BEING USED FOR AN AIRLINE'S B747-8 FIRST CLASS

Aviointeriors was recently selected by a premium airline to furnish the first class section on a B747-8. The company selected Monalisa, a passenger pod that offers luxury and privacy in a selfcontained space, making the air travel experience far more enjoyable.

Monalisa is a seat-pod complex intended for the first class cabins of premium airlines. The seat is designed to offer a spacious environment for the occupant, and to form a wide and comfortable bed for night flights.

With this seat, the passenger is cocooned in a hand-crafted environment, with upholstery made of the finest leather, trimmed with computer precision but sewn with proper care and attention by experienced craftsmen. Craftsmen also work with precious veneer inserts and polished metal frames to give the furniture a sense of luxury and exclusivity for the traveler.

Monalisa offers independent controls for the transition and the backrest; the motion system can be controlled using a dedicated control panel or with a special software run through the IFE system, according to the customer's preference.

The seat turns into a full-size single bed by joining with the ottoman on the front of the pod, which can also serve as a temporary guest seat. When in bed mode, both the armrests align with the bed surface to make it wider, and the bottom seat makes an upward movement during the final inches of the transition run: this is in order to have a continuous and flat mattress surface without any gaps.

In the areas that come into contact with the passenger the most, the leather's soft surface is microperforated in an elegant pattern that helps to reduce perspiration. A choice of the finest fabrics is also available for these parts.

The seat is wide and cozy, with an exclusive cradling movement that has been engineered to offer the best comfort in the reclined relaxing positions, for passengers of all physiques. The seat also provides a lumbar support adjustable in both height and depth, and an integrated massage system.

Mood lights are provided to create a soothing lighting around the main elements of the passenger environment, and the personal reading lights and spotlights make it easier to read or to find personal belongings without disturbing other guests in the cabin.

The center seats feature an elegant and electrically operated privacy shield.

The customized Monalisa that will soon be flying will be different from the standard model. This is because, when it comes to first-class products, a high level of customization is requested by the airlines in order to make the flying experience unique and the brand clearly recognizable.

Aviointeriors is happy to work with airlines to achieve a high level of customization of Monalisa Note that the pictures shown here are of the standard 2015 Monalisa model





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<u>Aerolux has developed a comprehensive range of products to offer a full kitchen in the air</u>

Founded in 1988 on the northwest coast of the UK, Aerolux has become well known for producing quality custom-engineered galley inserts for commercial and corporate/ business aircraft.

Standards of air travel have become increasingly demanding, with customers being especially discerning about onboard experiences such as the quality of food and beverages served. For breakfast, lunch or dinner, galley equipment is essential to meeting the needs of customers. From Nespresso coffee to chilled chardonnay, from the perfect slice of toast to ice cream, the range of equipment has to be right for the job.

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 awardwinning espresso coffee maker, a toaster, a skillet, a rice cooker, warming ovens and fridge/freezers.

Wherever possible, Aerolux has designed its galley equipment to meet industry standard configurations such as 'Atlas galley'. Key features of all Aerolux galley products include 115/200V AC, 400Hz aircraft power, safe and hygienic operation, and ease of cleaning.

The Aerolux coffee maker is a selfcontained unit specifically designed for inflight preparation of espresso coffee. 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 help prepare toast or even a toasted





sandwich in the galley. Just like at home, the Aerolux toaster will toast two or four slices of bread, lightly toasted or dark. The unit has been designed and built from food-grade materials. It enables easy cleaning for hygiene purposes and minimises crumbs with its removable crumb tray.

For the complete breakfast in the air, Aerolux has developed the Aero-Skillet

 a safe and easy-to-use hot plate, which is suitable for cooking eggs or hash browns.

Initially designed for the preparation of rice on Asian routes, the rice cooker unit has also been adapted for heating liquid food such as consommé. The unit has been designed and built to maintain hygiene and be easy to clean, especially in an aircraft environment.

Designed to warm bread rolls or plates, the warming oven is adaptable to suit the particular requirements of the airline. A range of ovens is also available to heat prepared food, from high-speed convection ovens to steam ovens.

To keep food chilled or liquids cold before serving, the fridge units have also been adapted to keep medical supplies cold for long-term use. To keep ice cream frozen or to stop ice from melting, Aerolux's freezer products have been designed to meet the exacting requirements of airlines the world over.

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The AirChair, now in use with 56 airlines and VIP users, is proving very popular. Special features of the seat include the rearward-folding backrest, as recommended by the UKDPTAC guidelines. The idea behind this feature is to allow a carer to lift the occupant with a straight back. The four 4in-diameter swiveling castors with rubber tires contribute to the excellent maneuverability of the AirChair, especially when negotiating aircraft toilets.

Models from 14in (356mm) to 18in (457mm) in width are available. The most popular sizes are the 14in for regional aircraft and the 15in for international carriers. The standard color is blue, but other colors are available, and there are further options, such as having embroidered logos in the leather seating.

The basic construction is high-strength, powder-coated aluminum alloy with fasteners in stainless steel. The castors are made of glass-filled polyamide and have sealed-for-life ball bearings in the swivel and wheel.

The seat and backrest are in high-quality leather assemblies, which can be easily removed for cleaning. All materials meet stringent FAA and EASA fire-resistance requirements, and the release is on a Certificate of Conformity, as no higher release is necessary.

The AirChair weighs 6.1kg (13.4 lb) and is rated at a capacity of 170kg (374 lb). Type testing was conducted to a load of 460kg (1,012 lb) without permanent deflection.

For comfort, there is a fold-out footrest and retractable side restraints. Additional straps can be fitted in addition to the adjustable waist strap.



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1957:palomar unitized seat

If you've read our feature on future PSU design, you may have pondered the idea of relocating the PSU panel from the overhead stowage and incorporating its features into the seat. However, as Marie Antoinette once said, "There is nothing new except what has been forgotten." Indeed perhaps the Palomar Unitized Seat has been forgotten, since it was launched back in 1957.

Customers for the Douglas Aircraft DC-8, the company's first jet airliner, weren't overwhelmed with seating options, with the only option being the Palomar seat, designed and manufactured in-house. But what a seat it was. Douglas had listened to customers' wishes to have a flexible seating solution that would enable quick cabin reconfiguration, but found that moving overhead PSUs was problematic in a quick turnaround.

The solution was to incorporate the passenger features into a unit located to the side of the headrest, with the gasper, oxygen mask, tray table light and attendant call button at the rear of the unit to serve the passenger behind. The seat occupant benefited from an inbuilt reading light that projected over their shoulder (incandescent, then later fluorescent), together with an attendant call light.

The Palomar's innovative design removed the problem of overhead units, but the in-seat units still needed to be fed with air, oxygen and electricity. The solution was to route air, oxygen and power cables through to a sidewall duct that ran the length of the cabin and which fed each row of seats through an umbilical connection. Cunningly, this duct did not deprive passengers of space, as it also served as the outboard armrest.

As IFE became more popular, some versions even received a modification whereby the reading light was replaced with a headphone outlet and channel selector. The Palomar was a brilliant solution, and many remember it fondly as one of the first true aircraft seat innovations. Sadly, Douglas reverted to a more conventional overhead PSU design for the DC-8 in the early 1960s, and its seats became more conventional.

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