Business Jet *interiors* International

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OCTOBER 2016



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FIRST VIP BBJ 787

HOW ELECTRICAL AND STRUCTURAL CHALLENGES WERE TACKLED ON THIS LANDMARK PROJECT

AIR QUALITY

Find out what's being done about TCPs, carbon monoxide, pathogens, odors and low humidity

CARBON FIBER

Experts untangle the complexities involved in working with carbon-fiber structures

PILATUS PC-24 The OEM explains how it has built flexibility into the cabin of its first jet aircraft

EXCEPTIONAL COMPETENCE IN MATERIALS LEADS TO EXCEPTIONAL INTERIOR

BASED ON THIS PRINCIPLE F/LIST DEVELOPS AND MANUFACTURES CABIN INTERIORS FOR BUSINESS & PRIVATE JETS, MEGA YACHTS AND LUXURY RESIDENCES. BREAKING GROUND BY COMBINING TRADITIONAL CRAFTSMANSHIP AND APPLIED INNOVATIVE SPIRIT. DRIVEN BY A PASSION FOR PERFECTION. ROOTED IN THE RELIABILITY OF A FAMILY-RUN AUSTRIAN COMPANY.

FLIST

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Wheels up

Head down the runway with a selection of the latest cabin designs, product launches, case study news, completion announcements and topical discussion

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Designing a cabin for Piper's new flagship, the M600, was a massive learning experience for the company's marketing team

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A joint venture between Lufthansa Technik AG and Panasonic Avionics Corporation





BBJ 787 COMPLETION The first VIP BBJ 787 design and completion took seven years of hard work to overcome challenges relating to data, electric systems and the carbonfiber fuselage



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DESIGN TRENDS

As director of interior design at Gulfstream, one of North America's business jet giants, Tray Crow is well placed to point out changes in the market



NBAA PREVIEW Exhibitors give a taste of the innovations they will present at the mammoth show, to be held in

Orlando, Florida, on November 1-3, 2016



MEBAA PREVIEW

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Cover image: Kestrel Aviation Management



SHOW AND TELL

he golden ticket at EBACE 2016 was a tour of the first VIP BBJ 787, which drew admiring glances on the static display. Unfortunately I did not manage to get on board, or even learn of anybody else who did! This is because the aircraft was being shown to potential buyers, one of whom signed on the dotted line. I spoke in great depth with Stephen Vella, CEO of Kestrel Aviation Management, who project-managed the acquisition, design, completion and sale, so even if you couldn't get on board at EBACE, you can learn all about this special aircraft now on page 60.

As this was the first VIP interior to be installed on the Boeing 787, the work was understandably complex. For one thing, it is not possible to drill holes in the carbon-fiber fuselage, so new attachment methods had to be found.

With Airbus also using carbon fiber for the A350 airframe, it is a pertinent topic for many completion centers, and is explored on page 40.

Another subject I have noticed cropping up more frequently is the quality of cabin air. On page 24 we investigate the technologies now available to remove or neutralize airborne pathogens and odors and ask what other developments might be needed.

This issue also includes details of two new OEM designs – the Pilatus PC-24 (page 32) and Piper M600 (page 54) – and, ahead of NBAA 2016, a discussion of emerging design trends (page 68), led by Gulfstream's director of interior design, Tray Crow, and three other designers based in North America. That leads into our comprehensive previews of interior products and services set to be showcased both at NBAA (page 77) and MEBAA (page 91). Hopefully, these will help you get your bearings before even arriving. I can't wait to see what the stars of those shows will be! Rest assured we will cover all the news as it happens on our website, and bring you comprehensive analysis in future issues.

Izzy Kington, editor

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PINBOARD









THE SPORTJET BY SUKHOI, A CABIN CONCEPT DESIGNED FOR PROFESSIONAL SPORTS TEAMS, BASED ON THE SUPERJET 100 REGIONAL JET A RENDERING OF A BOMBARDIER GLOBAL EXPRESS CABIN REFURBISHMENT FLYING COLOURS CORP IS WORKING ON; THE COMPANY'S FIRST PROJECT TO INCLUDE PRE-ENGINEERED COMPONENTS FROM INAIRVATION





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DETAILS IN THIS BBI 737 CONCEPT FROM GREENPOINT

DESIGN INCLUDE EXPANSIVE BEAMED ARCHITECTURE

1. ALTO AVIATION'S M1285R. A 12-TONE CHIME/TONE WARNING AMPLIFIER

2. EDELMAN HAS EXPANDED ITS ROYAL

HIDE, DREAM COW, SHAGREEN, SCOTCH GRAIN AND WHOLE GRAIN RANGES WITH MORE SHADES OF WHITE

3. A NEW APPLE AND ANDROID MOBILE APP FOR FDS AVIONICS' DO

EXPERIENCE IFEC SOLUTION

4. A CREW SEAT CUSHION AND DRESS COVER FOR DHC-8 100 AND 300 AIRCRAFT, FROM RAMM AEROSPACE

LAUNCHES



AN EMBRAER PHENOM 100 CONSTANT AVIATION REFURBISHED FOR JETSUITE; THE FIRST OF 10. THE WORK INCLUDES RECOVERING THE SEATS, DRINK RAILS AND INTERIOR PANELS





THE FIRST VIP H175, DELIVERED BY AIRBUS HELICOPTERS WITH A CABIN



EMBRAER LEGACY 650 REFURBISHED TO MATCH OTHER AIRCRAFT IN THE FLEET

In May 2016, Jet Aviation Basel completed a major refurbishment and scheduled C check on an Embraer Legacy 650. The customer tasked Jet Aviation Basel with creating an interior to match another Legacy 650 in its fleet. The company also changed the aircraft's registration from FAA to EASA and performed a pre-purchase inspection for a prospective buyer.

"Our customer was extremely happy with the work done on the interior of this Legacy 650 aircraft," said Adrian Hollenbach, technical director and continued airworthiness manager at Planair Enterprises. "The workmanship and quality is some of the best, if not the best out there at the moment. Coupled with the aircraft painting, servicing requirements and avionic upgrades, it was a very demanding project. Still, the aircraft left the facility on time and flew a faultless acceptance flight."

BELOW AND BOTTOM RIGHT: BEFORE THE REFURBISHMENT

MAIN AND BOTTOM LEFT: THE FINAL CABIN





Simon Koenig

SUPERVISOR, MAINTENANCE INTERIOR DESIGN, MAINTENANCE CENTER, JET AVIATION BASEL

What did the project scope include?

The project incorporated a scheduled C check, an FAA to EASA re-registration, exterior paint work and interior refurbishment. The latter included replacing the carpet, recovering the dado panels, wood repairs, reupholstery of seats and divan, and a non-textile flooring installation in the galley.

What was the brief for the interior?

The original owner and customer had purchased two almost identical Embraer Legacy aircraft, one of which had already been completed. The second Legacy 650 had been parked outside for quite some time and was in rather a poor condition when it came to us. We were able to use the completions specifications from the previously completed Legacy 650 to define some key elements for this one, including the carpet and seat leather.

The basic brief was for a modern and elegant business interior suitable for charter use. We had to match key materials to the first completed aircraft to maintain corporate identity, finding matching Scott Group materials for the divan, entrance non-textile flooring and dado panels. We also had to tint the wood to match the first Legacy 650, and produce and install loose equipment inserts. All this had to be achieved while keeping the budget as low as possible.

What were the most challenging aspects of the work?

With the first Legacy 650 already prefigured, we were not completely free in our choice of materials. The goal was to keep the interiors corporate and neat. The customer had extremely high expectations in terms of quality, downtime and budget. The entire project was performed in close collaboration with the customer.

What are your favorite details of the cabin?

We like the seat reupholstery and the overall ambience, which is modern and strong, but not hard. The cabin has a distinct look, which gives it high recognition value.

How did you minimize aircraft downtime?

To help reduce downtime, the refurbishment was done in conjunction with a scheduled C check. In addition, the prospective buyer took advantage of the scheduled C check to do the pre-purchase inspection. Lastly, we maintained very close contact with the customer to avoid decision delays.

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To keep the budget low, it was decided to keep the existing seat design. This enabled the upholstery shop to reuse an existing seat cover as a template for new covers, which helped reduce production hours. Manufactured by Townsend, the Taj pearlized cowhide seat leather is ligh beige with a shiny pearl finish.

The carpet was replaced with a silk and wool, loop and cut pile carpet in dark gray, made by Carter Green.

The divan material is a fabric that had already been certified as flame resistant. This meant no further flame treatment was necessary, eliminating the possibility of discoloration or structural damage. The divan fabric has a repetitive 3D structure with multiple colors. "It's a very interesting accent that contrasts nicely with the soft, plain carpet and seats," says Simon Koenig, supervisor of maintenance interior design at Jet Aviation Basel's maintenance center.

All wood veneer was tinted to match a dark, high-gloss wood veneer on another aircraft.

Given that the seat leather is light and shiny, while the wood is dark and high gloss, a key challenge was to ensure the ambience was welcoming and pleasing, rather than cold and hard.

IFEC equipment and cabin lighting was retained with no modifications.





COMPLETIONS ROUNDUP

This quarter's announcements from completion centers around the world

BASEL, SWITZERLAND

AMAC Aerospace's current projects include a cabin oxygen system upgrade on a BBJ and a C check and satcom upgrade, also on a BBJ. Recent deliveries include various aircraft in for C checks, a BBJ 747-8i in for its first annual maintenance inspection, and an ACJ320 completion. The latter was previously used as an airliner and now has a cabin with a master bedroom and lavatory, two VIP lavatories, 10 single VIP seats and four divans that convert into beds. Some original economy seats have been refurbished. All three VIP lavatories include a foot washer, developed in-house.

HAMBURG, GERMANY

Lufthansa Technik developed a mobile vacuum leak check procedure to enable inflight pressure differences to be simulated on the ground, and launched a mobile laserbased augmented reality system to support installation. Component contours are projected onto the aircraft structure, serving as a positioning aid. The company was also granted an EASA STC to install Ka-band antenna systems on an ACJ340.

MUNICH, GERMANY

RUAG Aviation opened an interiors showroom in Munich showcasing materials, finishes and accessories. Visualization technology enables customers to try potential designs virtually.

BASEL, SWITZERLAND

Jet Aviation installed its Aviation DishWasher for the first time, on an ACJ330-200ER, certified through the EASA Part-21 DOA minor modification approval process. The facility was also appointed as an authorized service center for ACJs, covering line and heavy maintenance, cabin refurbishment and cabin and system upgrades.

GENEVA, SWITZERLAND

SR Technics extended its line maintenance capabilities to the Boeing 787, offering on-call maintenance, transit checks, daily and weekly checks, cabin inspections and defect rectification. The company's sole shareholder, Mubadala, agreed to sell an 80% stake in the business to HNA Aviation, subject to anti-trust and regulatory approvals.

SINGAPORE

Jet Aviation Singapore completed its second 8C inspection in 2016 – a Bombardier Global Express XRS. The work was done in conjunction with a full interior refurbishment.

XIAMEN, CHINA HAECO Private Jet Solutions (HAECO PJS) announced it had completed maintenance work for Hongkong Jet in May and June 2016, redelivering an ACJ319 and a BBJ. In July 2016 HAECO PJS completed a 36-month check on a BBJ operated by Nanshan Jet.

PETERBOROUGH, CANADA

Rockwell Collins's Venue CMS and HD IFE system can now be retrofitted as standard on all Flying Colours Corp's CRJ ExecLiner conversions, which involve converting the Bombardier CRJ200 into a VIP format. The first installation has already taken place. A further five ExecLiners are currently

inbound to the Peterborough workshops.

KIRKLAND, WASHINGTON

Greenpoint Technologies completed a BBJ 787-8 interior for a private client represented by Kestrel Aviation Management.

CLEVELAND, OHIO

Constant Aviation received EASA approval for its Phenom 300 wi-fi STC, covering the installation of SwiftBroadband Aviator 200 and Gogo wi-fi systems on Europeanregistered aircraft. The company also recently delivered the first of 10 Phenom 100s refurbished for JetSuite. The changes include re-covered taupe and coal seats, cabin panels and leather drink rails.

DENTON, TEXAS

Greenpoint Aerospace is now an authorized distributor and installer of an air and surface purification system from Aviation Clean Air.

The system is designed to eliminate pathogens, allergens and odors, and provide surface purification throughout the cabin.

Visit businessjetinteriorsinternational.com for full news coverage



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This Airbus Corporate Jet Centre (ACJC) concept for the ACJ319 is notable for its use of Limoges porcelain, which appears where metal inlay might otherwise. For example, it is used between leather tiles on bulkheads and as a border on tables. Perhaps most surprising is its use in tiled form for the bathroom floor.

The idea came about when Sylvain Mariat, head of ACJC's Creative Design Studio, was tasked with creating unique porcelain dinnerware for a client. "I discovered this world of porcelain in Limoges, France," says Mariat. "It's where top porcelain brands make their wares. The primary raw material is kaolin, a clay mineral that is very white. The whiter the raw material, the higher the quality of the porcelain. I thought it would be interesting to play with this material on board. It's beautiful and it's a change from metal, but it's also lovely to touch because it has all these interesting ridges."

Mariat says it is fully feasible to use porcelain in certain decorative applications on an aircraft. "With materials, the first consideration is flammability, but obviously porcelain is fine in a fire – that's how it's made. The main challenge is to ensure it won't cut anyone if it breaks. You can prevent that by coating it with resin, which works like security glass in a car. When broken, it stays in one piece."

There are some limitations. Mariat says it couldn't be used for a decorative light, for example, because passengers could collide with it during turbulence, causing it to shatter. He also says the material can be heavy, so it should be applied as a veneer with an adapted backing.

Another interesting inclusion on the ACJ319 concept is a set of six mini-suites. ACJC is now offering its super-first class seat solutions to airlines, and says VIP customers often opt for them too. Whereas another recent mini-suite design by ACJC included full-height partitions, the certification of which called for clever solutions to meet emergency egress and compression requirements, on this concept half-height partitions are used. "Some customers prefer to have something that is not too closed, but sort of open and closed at the same time," says Mariat.

Other highlights include American white oak veneer, a versatile four-leaf table, a retractable bar, HD AVOD and Ka-band internet.

SINK



CURVES

The use of fluid curves extends into the bathroom, with its round shower and curved storage units, sink and lavatory.

FLOOR

0

Responding to customer requests for a non-slip and visually dynamic floor, ACJC created a design whereby randomly placed white porcelain and silver-effect tiles catch the light from LED strips mounted under the monuments, creating a dappled effect. The contrast of porcelain and silver was inspired by high-end dinnerware.

GUIDED TOUR

<u>Crew</u> rest

This area at the front of the aircraft seats five crew members.

Lounge

The lounge area comprises two sections – a dining area and a majlis. The first offers clubfour and club-two seating, while the majlis features six seats around a swiveling table inspired by a four-leafed clover. "We designed it especially for this concept," says Mariat. Leaves can be removed as desired. This area also includes a cylindrical bar that retracts from view when not required. As the concept is based on feedback from a customer based in the Middle East, some modern Arabic decorations are included on subtle backlit strips.

Mini-suites

There are six mini-suites, some facing the direction of travel and others the reverse, to create a curved corridor – a common customer request, according to Mariat. The seat is a super-first class design already offered by ACJC. It is 2m long and 84cm wide and reclines 180°. The suites also each have an ottoman, storage and IFE screen.

Master suite

This consists of the bathroom pictured left and a master bedroom featuring a queensize bed and a club seat that is integrated into the sideledge. Overall the aircraft seats 19 passengers.



flying fish

Is it a bird, is it a plane? No, it's a 23m tender limousine intended as a 'private jet of the sea', the creation of yacht designer Federico Fiorentino, and Marijana Radovic of m2atelier. "The Endeavour concept was initially developed for a potential client from the Middle East that particularly requested a very fast tender limousine with an interior inspired by private jets," says Mattia Ruocco, marine engineer and yacht designer at Federico Fiorentino. "The boat was intended to provide exclusive transfer services between private islands, airports, hotels and villas in a fast, comfortable and protected way."

The main aspect derived from private aircraft is the six-seat layout. "Large and comfortable armchairs create a cocoon environment that is luxurious, sophisticated and comfortable," says Ruocco. "The superior experience, typical of the most renowned business jets, is also achieved by the adoption of the latest technologies, high-end materials and finishes."

But boat design is not subject to the same constraints as private aircraft design. "A great advantage in designing a boat, as opposed to an aircraft, is the possibility to adopt large windows instead of portholes," says Ruocco. "This gives passengers a much wider view and underlines the sense of spaciousness on board."

Nevertheless, marine design has its own challenges. "A critical aspect is the need to create a comfortable space for passengers considering the really stunning speed that Endeavour is intended to reach," says Ruocco. "To ensure a comfortable and safe ride, the armchairs should be equipped with suspension systems."

The boat could reach a top speed exceeding 50kts, and if equipped with jet turbines and surface drives, could go even faster.

This tender is fully customizable. For example, customers can choose from different cabin floorplans tailored for meetings, entertaining and relaxing. Two interior styling concepts have been developed to showcase the possibilities, one more "opulent and luxurious", and the other more "modern and refined".

Meanwhile, Federico Fiorentino and m2atelier are continuing their partnership with the development of a 50m superyacht for Italian shipyard Rossinavi.

RACING STRIPES

The wide strips running down both sides of the cabin are finished with a high-tech fabric that recalls the texture of carbon fiber and reflects the boat's sporty performance

PARTITIONS

Smart glass partitions are used to divide the cockpit area from the guest lounge, giving the opportunity to maintain the view during navigation, or provide privacy when needed

GUIDED TOUR

Exterior

A light bronze/gold livery is blended with mahogany accents and stainless steel details. "The powerful exterior of Endeavour is characterized by balanced proportions, sinuous surfaces and a very aerodynamic silhouette that recalls the fuselage of an aircraft," says Ruocco.

Bow

The front part of the tender accommodates both a luggage storage compartment and a crew head with direct access from the cockpit area.

Pilot house

The pilot house layout is reminiscent of the typical aircraft's cockpit, with two seats for the crew, a chart table and a comfortable sofa if the guests want to enjoy the view from the cockpit.

Aft

At the aft of the boat is a fully functional day head and a galley with a bar.



ARMCHAIRS

The first class-inspired armchairs can recline and rotate to create a conference feel. Each handcrafted leather seat is equipped with a foldable table



HOW USEFUL IS VIRTUAL REALITY? EXPERTS FROM ACROSS THE INDUSTRY SHARE THEIR EXPERIENCES AND PREDICTIONS FOR THE FUTURE



Paulo Pires MANAGING DIRECTOR, EMBRAER ENGINEERING & TECHNOLOGY CENTER USA



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Ruth Marquardt
DIGITAL MOCK-UP INTEGRATOR, VIP
AND SPECIAL MISSION AIRCRAFT
SERVICES, LUFTHANSA TECHNIK
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Christopher Mbanefo FOUNDER AND CEO, YASAVA SOLUTIONS

How have you used virtual reality (VR)?

We first used VR internally for the development of the Super Tucano in 1997. Its use expanded to external interaction with suppliers during the joint development phase of all new jets. As the first aerospace company to adopt Canon's mixed reality technology, in 2014 we accelerated new product development through immersive design review with local and remote participants in a virtual space that comprises digital and physical components and systems.

We introduced CAVE in 2010. It was first used by project managers and engineers to review new layouts. Over the past two years, these reviews have receded in importance while marketing aspects have come more into focus. Clash monitoring and coordination between faculties are the main focuses of design engineers using CAVE, while the acquisition team uses it to give customers a very vivid impression of what is possible. We have used VR since 2012. It enables our designers and engineers to immerse themselves in a space and modify elements within it, all in 3D. We also use it to assist our clients in understanding the space. Realistic representation of form is not enough; you need to include material textures, natural and artificial light, and represent the user in real time. We have succeeded in enabling people to interact with the space while observing their own body, hands and arms. We can also simulate natural light at any point on the planet at a given time and season.

What are the advantages?

PP The first tangible benefit was real-time crossfunctional collaboration for the analysis and solution of design issues across various systems. This benefit was extended to our vendors, rendering more efficient program management and supply chain integration. RIGHT: EMBRAER USES CANON'S MIXED REALITY TECHNOLOGY, WHICH CREATES A VIRTUAL SPACE WITH DIGITAL AND PHYSICAL COMPONENTS

BELOW: DESIGN Q USES PORTABLE SMARTPHONE-BASED VR, WHICH CAN BE USED WHILE SITTING IN A CABIN MOCK-UP

BELOW RIGHT: YASAVA HAS USED VR TO PRESENT ITS DESIGNS AT AVIATION TRADESHOWS "There are amazing technological advances being made to try to trick the brain into believing it's in a virtual world," says Annika Svore Wicklund, director, Greenpoint Design. "These strides enable us to experience a proposed space better. We use VR in the concept development process; it is helpful in initial space planning and monument design. We find that augmented reality provides a better immediate tie with our current work process. In the near future, we look forward to delivering our clients' interiors months or even years before they are built!"



VIRTUAL FALCON

Dassault Aviation introduced VR in early 2000 and immersive reality in 2011. Its engineers use VR to perform design reviews and related cabin selection tasks for all Falcon models from a VR center in Saint-Cloud near Paris, France. VR also allows customers to visualize full-scale 3D digital cabin mock-ups. Meanwhile, in the Immersive Reality Lab, engineers can evaluate the practicality and ergonomy of design options and validate design configurations. "However, when it comes to the customer experience, especially with respect to physical details including the feel of upholstery and cabinet finishes, and the user-friendliness of equipment, VR has its limits," says Vadim Feldzer, head of global communications at Dassault Aviation. "To address this, the company recently opened a pair of showrooms in Paris-Le Bourget and Teterboro, New Jersey."

In addition to a central specification and design hall equipped with large HD screens, the showrooms have adjoining exhibit areas where customers can look at seats and other items. They can also be presented with partial and fullscale cabin mock-ups to allow design proposals to be compared with real-life hardware in an actual cabin setting. W It gives a very realistic, full-scale view of cabin layouts. We are also able to detect issues during the design phase that would lead to severe problems in later stages of the project.

EELS UP

It shortens internal development time greatly. It also allows clients to experience the aircraft before it is built, minimizing the element of surprise. In addition, we are now able to either send or take a design to the client, and they can spend as much time as they want interacting with the space. The days of having to fly an aircraft to a client or dragging them to a mock-up in an industrial zone are no longer necessary.

What are the current limitations?

Computer processing and wireless transmission speeds are a phase behind what is needed to implement certain features. This results in the use of cable-reliant 3D-viewing devices and a gap in image realism.

CAVE is limited to one master navigator and some co-viewers. The cost for the hardware (especially the projection walls and the beamer) and software is high. Conversion of data is a big issue as the file formats used by VR software programs are not common. A further limitation is that it is not mobile.



"It is currently the most immersive platform to showcase interiors," says Nigel Goode, director of PriestmanGoode. "Our demos allow users to freely walk around the cabin, interact with almost anything, see different seat positions, change lighting conditions and view trim, finish and other options. It is an amazing tool to explain what the final design will look like, and allow clients to make informed decisions. Ultimately, this saves our clients both time and money."





We are still grappling with computing power, as we can never have enough, and this goes hand in hand with minimizing the size of hardware for greater mobility. A few years ago I had to schlepp a stainless-steel suitcase with all the gizmos inside, which first got airport security and thereafter cabin crew excited. New technologies, partly available already, will allow us to miniaturize our equipment. Display technologies are also developing. ABOVE: LUFTHANSA TECHNIK USES CAVE FOR APPLICATIONS INCLUDING VIRTUAL FITCHECKS

TOP RIGHT: GULFSTREAM'S CAVE, WHICH IS USED FOR ENGINEERING DESIGN REVIEWS

What investment have you made in it?

PP Embraer invests 10% of its revenue in innovative new technology and process improvements, a figure that surpassed US\$550m in 2015. These investments have rendered close to 50% of our profits since 2010. This technology is key to efficient and accelerated product development. "We use headsets linked to smartphones," says Howard Guy, CEO at Design Q. "Our in-house app is installed on the phone, so color and layout changes can be made in real time without memory-intensive loading each time. This enables seamless moves from one scene to the next. A limitation is that when you are viewing through a headset that magnifies the image, pixelation can pull image quality down. However, the latest phones have high-resolution screens and phone manufacturers are constantly improving."



As a specialized firm in a very expensive part of the world, Switzerland, we have had to be very innovative and cost conscious. While others spend millions on this technology, we spend considerably less by partnering with small partners with a similar vision.

What other applications could be possible?

We have applied VR in the development of our digital factory for the planning and simulation of all production processes, as well as maintenance procedures through each aircraft's lifetime. We are also investing in the use of mixed reality with customers, in the personalization and review of interior designs.

In our product division most reviews and presentations are done with VR. We perform installation, mounting analysis and maintainability work, too. But there are a lot of other possibilities – motion and ergonomic analysis with avatars, for example. Another very interesting avenue is the simulation of light scenes or technical training of staff.

VR will become part of the end experience and possibly impact aircraft design. Do we need windows? With VR you can experience a 360° view of the scene along your flight path. Do you need to invest several hundred thousand dollars to change the color scheme? Probably not, given that we are working on solutions that allow you to change the colors according to your mood. What if I could make the whole cabin disappear and place you on a beach sipping sundowners?

How widespread will it be in five years?

P Considering the rate of computer processing power increase, the speed of wireless transmission as well as web-connected eyewear, VR will become ubiquitous.

W If the development of head-mounted devices steps forward as quickly as expected, the use of VR will become much more common. Costs will decrease. However, maybe VR will be outpaced by augmented reality; there are many possibilities with that too.

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SEVERAL TECHNOLOGIES ARE AVAILABLE TO COMBAT PATHOGENS, ODORS AND LOW HUMIDITY IN CABIN AIR SYSTEMS, BUT WHAT IS BEING DONE TO ADDRESS TCPs AND CARBON MONOXIDE? Words by Liz Moscrop. Illustration by Alicia Malesani

here's something in the air. The phrase conjures up intrigue and excitement. Unless, of course, it comes from the pilots, flight attendants and aviation industry pressure groups who are anxious over what exactly is filtering through cabin air systems. Two contaminants that raise particular concern are tricresyl phosphate (TCP), used as an additive in all aviation engine oils; and carbon monoxide, which can be formed when oils and hydraulic fluids are heated to high temperatures. TCPs are neurotoxic, meaning they can

cause brain and nerve damage. Carbon monoxide is an asphyxiant, which reduces the body's oxygen supply, already compromised by being in a pressurized cabin.

Some contend that synthetic turbine engine oils, hydraulic fluids or de-icing fluids can contaminate the air supply. In a typical cabin air recirculation system, the air changes every 3-4 minutes. The air comes from outside the aircraft, from either the engine's compressor stage (bleed air) or the auxiliary power unit and is fed into the air-conditioning packs, where it is cooled. "This air is



circulated once completely unfiltered, and then 50% of it is filtered and recirculated," says Dr Susan Michaelis, an aviation health and safety consultant, who holds a PhD on the topic of cabin air safety.

BLEED AIR

Michaelis is critical of bleed air systems, which she says allow heated and broken down engine oil fumes to escape into the airflow. One of the notable things about the Boeing 787 is that it doesn't use a bleed air system. "Business jets all use bleed air, so will be contaminated by oil fumes in the same way," says Michaelis. "The leakage of oil fumes into the cabin air at low levels is a feature of the design of engines that use pressurized air to both seal the oil chamber and provide the air supply to the cabin (unfiltered). Tests have shown exposure to heated engine oil is hazardous, and no oil company has announced tests to ensure the oils are safe to breathe."

Oil particles are not the only invisible menace. Viruses, mold and bacteria are also crawling around in the air. Many OEMs use high-efficiency particulate arresting (HEPA) air filters to improve the air quality of recirculation systems, although Michaelis comments that they are not designed to remove oil particles. HEPA filters are also used in hospitals, operating rooms and industrial clean rooms. They trap microscopic particles including bacteria and viruses and, according to the International Air Transport Association safety briefing document on the topic, "are effective at capturing greater than 99% of the airborne microbes in the filter air".

GOOD SOURCE OF ION

Other technologies include UV light and ionization. Aviation Clean Air (ACA) supplies a system based on bipolar cold plasma ionization, with STCs to install it on BBJs and the G550, and others in the works. Ionization technology is already widely used in residential and public buildings, including hospitals and airports. ACA's Aviation Ion Generator is installed in the bleed/cabin air system. Ions remove volatile organic compounds as well as unpleasant smells and allergens that have built up in the air and on surfaces. The 28V system creates both positive and negative ions, which it disperses through the cabin via the environmental control system. These ions destroy pathogens on contact, rather than working them back through a filter. By severing the hydrogen bonds that hold the pathogen's molecular

"Exposure to heated engine oil is hazardous; no oil company has announced tests to ensure the oils are safe to breathe"

ELECTRICITY VERSUS FUEL

White papers available from the More Electric Aircraft Summit, taking place in October 2016 in Hamburg, Germany, show that since jet fuel has such a high energy-to-weight ratio, it has been the only fuel able to produce the huge thrust in the heavy engines needed to lift commercial weights. The focus with MEA development is on improvements that would enable a greater emphasis on electricity. For example, integrating an advanced magnetic bearing system into the internal starter for both the main engine and auxiliary power units could allow for an oil-free, gear-free engine. This would, however, require more electrical power to be generated.

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UP IN SMOKE

A common request of completion centers is to eliminate the smell of cigarettes in the cabin. "We installed a smoke extraction system for one client, who was a heavy smoker," notes Eric Gillespie at Flying Colours Corp. "He hit a button at his seat and the air went out through the drain mount. It was a creative solution to his problem."

structure together, the pathogen is rendered inactive and is no longer a threat. The Aviation Ion Generator weighs 1.34 lb and has been tested to DO-160 standards.

CLIMATE OF CHANGE

Florent Klinger, sales engineering manager at Jet Aviation Basel, points out that increasing humidity is also important in protecting passengers. "A lack of humidity in the cabin can exacerbate jetlag, making passengers feel tired, and drying out their skin, nose and eyes," says Klinger. "When combined with the limited circulation of the air, this can lead to increased exposure to any viruses."

Klinger says the average humidity on airliners ranges from 5% in business class to 10% in economy areas, but the company usually achieves humidity levels of around 20% on VIP aircraft. "We add humidifier systems and an air cleaner based on bipolar ionization technology."

But with higher humidity in the cabin comes another issue to address. "We use a dry air system to create a barrier between the moisture and the crown area, ABOVE: FLYING COLOURS CORP INSTALLED A SMOKE EXTRACTION SYSTEM ON THIS CHALLENGER 850

BELOW: A GOLD-PLATED AIR GASPER FROM UTC AEROSPACE, WHICH PROVIDES MANY AIR MANAGEMENT SYSTEMS preventing the water vapor from coming into contact with the cold skin environment and stopping condensation forming and accumulating on the structural surface. This condensation would ultimately be absorbed into soundproofing bags, which would increase the aircraft's weight," says Klinger.

Patricio Altuna, executive vice president of sales and marketing at Associated Air Center (AAC), says humidification systems are becoming more popular. "Traditionally on ACJ/BBJ completions, AAC has installed a dualzone system," he says. "On larger aircraft completions, AAC has installed multiple units to better control the humidity levels experienced across several cabin zones. Recently, newer generation composite aircraft have incorporated this feature, in a limited fashion, to improve the comfort of flight crew." Eric Gillespie, executive vice president at Flying Colours Corp, also reports high demand: "Overall we are seeing more requests for purification systems, to be installed as loose equipment on board. Although they are not up there

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RIGHT AND INSET: THE GULFSTREAM G650ER, WHICH HAS A DUAL ENVIRONMENTAL CONTROL SYSTEM AND THREE TEMPERATURE ZONES

with the desire for something like connectivity, for example, we are certainly getting more of them."

Although there are technologies to combat germs, oil contaminants are still a concern. There are plenty of initiatives underway to reduce the emissions entering the cabin and create cleaner air. Technologies in development include more electric aircraft, which demand high power while aiming to reduce fuel consumption. Although Boeing got around the bleed air issue, the total electrical power generation on the 787 is above 1MW, while a corresponding conventional aircraft uses less than a quarter of the power. However, it, and other OEMs are devoting a great deal of resources to improving lithium-polymer battery technology in terms of fuel cell development, less resistant circuitry and reduced weight.

Could oil reformulation also lead to improvements in air quality? According to the Aerotoxic Association, French oil company NYCO is developing such oils. The Aerotoxic Association also recommends installing chemical sensors to detect contaminated air in the bleed air supplies, rather than relying on pilots' noses. "There are no warning systems on board aircraft to advise of oil and other fluid contaminants," says Michaelis. "Corporate jets fly around heads of companies, and these people will have no idea that they are taking this risk, breathing hazardous substances. This is both a serious flight safety issue and a public health issue."

A JET EXAMPLE

How does a modern business jet air system work? The G650ER, certified in October 2014, has dual environmental control systems. "Basically, hot pressurized air from the compressor section of the engine is cooled through a series of air-conditioning packs mixed with bleed air to achieve the desired temperature," says Naveed Aziz, director of completions research and development at Gulfstream. "The air is then delivered to the cabin through distribution ducts and regulated through an outflow valve."

The G650ER offers three temperature zones – one in the flight deck and two in the cabin. Aziz emphasizes that the aircraft offers 100% fresh air. "We don't recirculate the cabin air in an attempt to reduce the engine bleed requirements," he says. "The entire cabin air is replenished every two minutes. This provides a fresher, healthier cabin environment."

Cabin altitude is 3,300ft at FL410 and 4,850ft at FL510. "This is substantially lower than commercial aircraft and some other business jets that have a cabin altitude of 8,000ft," says Aziz. "The better pressurization makes it easier to breathe and reduces fatigue on long-range flights."

GATHERING DATA

Some action is being taken on cabin air – EASA has launched a preliminary cabin air quality measurement campaign, and researchers from the University of Washington and the University of Nebraska are developing biomarkers for exposure to TCP.

In the meantime, completion centers are getting ready to install equipment. "Through the years we have all read about initiatives to design, engineer, manufacture and certify UV lamps to kill airborne bacteria, which would be incorporated into the aircraft environmental control system plenums; much like the UV sterilizer technology already used in potable water systems to kill waterborne bacteria," says Altuna. "However, I am not aware if any of these have yet come to fruition." @

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NOW THAT PILATUS HAS UNVEILED THE PRODUCTION INTERIOR OF ITS UPCOMING PC-24, IT IS CLEAR THAT THE TOUTED FLEXIBILITY OF THE 'SUPER VERSATILE JET' LIES NOT ONLY IN ITS OPERATIONAL PERFORMANCE, BUT ALSO IN THE CABIN

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Words by Izzy Kington

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businessjetinteriorsinternational.com 033 OCTOBER 2016

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ISLAUE,

PILATUS PC-24



he first jet aircraft to be produced by Swiss turboprop expert Pilatus is progressing toward expected certification in October 2017. There are now three prototypes – the P01 aerodynamic proof of concept, which made a one-day appearance at EBACE 2016; P02, used to test systems and avionics; and P03, which is being used to finalize and certify the interior. A 1:1 mock-up on Pilatus's EBACE 2016 stand unveiled the production interior.

In-house designers at Pilatus have collaborated with BMW Group DesignworksUSA – specifically, the team in Thousand Oaks, California – on the design. Pilatus has worked with the company for around 15 years, including on the PC-12. "They are design specialists," notes Oscar Schwenk, chairman of Pilatus. "We are responsible for checking the feasibility, the weight and the testing."

SELLING POINTS

The PC-24 has been marketed as the Super Versatile Jet, offering turboprop versatility, medium-light jet cabin space and light jet performance. "We have 84 customers without them flying or even sitting in the aircraft," says Schwenk. "It covers a niche – it flies fast and can land on short and unpaved runways, it is spacious and it offers Pilatus quality. We proved the quality we can produce on the PC-12. We will build a very solid and safe aircraft."

Thomas Bosshard, president and CEO at Pilatus Business Aircraft, says the flat floor



"We have 84 customers without them flying or even sitting in the aircraft"

ABOVE: EACH EXECUTIVE SEAT FEATURES A MAGAZINE RACK AND PED STORAGE

BELOW: THE PRESSURIZED BAGGAGE COMPARTMENT IS ACCESSIBLE IN FLIGHT, AND FINISHED TO THE SAME STANDARD AS THE REST OF THE CABIN and 501ft³ cabin volume are key selling points. "It is a large cabin for a jet of this size," he says. Customers include governments, private organizations and owners, and charities. Pilatus expects a variety of uses, including executive, cargo, medevac, commuter and governmental special mission.

THREE'S A CHARM

Three executive layouts will be available to start with, seating six to eight. "Others will come later, or maybe

The PC-24 requires 2,690ft to take off, and 2,525ft

to land

WEIGHT WATCHING

Oscar Schwenk has a firm eye on the potential weight penalties of interior equipment. This is currently being put to use on the definition of a medevac version. "If you have everything, it gets heavy and you lose range," he says. "If you put a steel oxygen bottle in, it's too heavy, it needs to be made from a special composite. We're also designing a very lightweight stretcher with aluminum fiber."

On the executive version of the aircraft, Schwenk says the challenge is to reduce weight without compromising the configuration, materials or overall design. "Making things lighter is a bit expensive but we have to do it; we're going through that exercise at the moment," he adds.






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by other companies producing STCs," comments Schwenk.

The standard configuration (shown at EBACE 2016) has six forward facing seats and four tables, with a wardrobe, sink and lavatory in the forward area, and a galley and storage in the aft.

For an extra US\$127,900 (and 134.9 lb weight increase), two executive seats can be added in the aft by removing the aft galley and storage. Two forward storage cabinets are added in the forward area to compensate. For US\$126,800 (plus 161.6 lb weight), customers can choose an eight-seat double-club layout with four tables, two forward storage cabinets and two center storage cabinets.

Although the six-seat option gives the most legroom, Bosshard says there is enough space in the cabin to offer a comfortable double-club arrangement. More cabin space can be taken from the aft baggage compartment if required, because the aft partition can be moved. Bosshard says it would even be possible to fit 10 seats for a commuter layout.

FAST MOVER

The seats, which are individually adjustable, are not in production yet. "The structure of the seat is more or less finalized for certification, but now we Pilatus says the unpaved runway capability gives access to 21,000 more airports



Pilatus PC-24

Cabin width: 5ft 7in Cabin height: 5ft 1in Cabin length: 23ft Seats: 2 crew + 6-10 passengers Range: 1,800 nautical miles with six passengers and NBAA IFR reserves Maximum speed: 425 kTAS Maximum altitude: 45,000ft Price: US\$8.9m (2014 base price) ABOVE: THE PC-24'S LAVATORY IS FULLY ENCLOSED AND CAN BE SERVICED EXTERNALLY

BELOW: THE SINK RECALLS THE PC-24'S CRYSTAL MOTIF

BELOW RIGHT: THE CMF PACKAGES ARE ALL NAMED AFTER SKI RESORTS – THE MOCK-UP SPORTS 'VAIL'



PC-24 TIMELINE

MAY 2013 Public launch

MAY 2014 84 orders taken

AUGUST 2014 Roll-out of first prototype

> MAY 2015 First flight

MAY 2016 Production interior unveiled

OCTOBER 2017 Expected certification and first customer deliveries

want to have three versions of it, so that's still in progress," says Schwenk.

All the commuter seats are quick-change models – Pilatus says it will be possible to install or remove them in a few minutes. "The pilot should be able to do it without any tools," says Schwenk. "Otherwise it's a nightmare."

A LA CARTE

In keeping with the focus on flexibility, there are many optional extras, although Schwenk says they will not all be available initially, and should come online after the first 20-30 aircraft. The rear galley can be extended, and two forward storage cabinets and two center storage cabinets can be added. The foldout tables are available with leather inserts, which Bosshard says provide a non-slip surface for working. He says customers go for these more often than not on the PC-12.





"We're going toward IFE on personal devices"

PED POWER

App-based IFE and CMS is offered as an option for US\$55,200 (8.8 lb). Audio and video content is stored on a hard drive on the aircraft and streamed over a wireless network to PEDs. "We're going toward IFE on personal devices," says Bosshard. "No one watches big heavy screens – PEDs provide much more flexibility."

The package also includes a 2D moving map and six USB power outlets. Two or four more power outlets can be purchased. The IFE can be enhanced with satellite XM radio, with coverage over continental USA. Internet options include Aerowave 100, which offers a 104kbps speed, and is suitable for light browsing, texting, emails and cloud services; and three Gogo systems. Gogo ATG-1000 offers email, text and VOIP services over continental USA and parts of Alaska and Canada; Gogo ATG-2000 adds light browsing; and Gogo ATG-5000 is suitable for heavier browsing and voice services.

Pilatus and BMW Designworks have created six color, material and finish (CMF) packages for customers to implemented as is or tweak. Customers ABOVE LEFT: A 2D MOVING MAP COMES AS PART OF THE APP-BASED IFE/CMS PACKAGE

ABOVE RIGHT: THE MOCK-UP SHOWCASES HOW THE LEATHER COULD BE CUSTOMIZED WITH A PERSONAL SYMBOL

There are two seats in the cockpit, but the PC-24 will be certified for single pilot operation

LEADING LIGHTS

Although there is a premium interior lighting package (US\$24,500, 9.7 Ib), LED lights are used as standard throughout. "With the LEDs nowadays we have so many more possibilities for little accents," says Bosshard. "We have LED mood lighting, with different color combinations, from warm or cold, so the customer can change the color temperature on the CMS app." can also go completely off-piste. "We have found it makes it easier for the customer to make a choice if we present them with professionally designed CMF solutions," says Bosshard. "Most of the customers tweak these, maybe changing the headrest, stitching or seat covers. They love to personalize the packages and the paint. That's our experience from the more than 1,400 PC-12s we have built, and we expect it to be similar with the PC-24."

Customers can play around with the design using an iPad app. Pilatus also has design centers in the USA and Switzerland, while its dealer network also keeps samples on hand. "People want to not only see it, they want to feel it," says Bosshard. "All senses are involved when it comes to interiors."

Bosshard says the packages incorporate materials certified for aviation. "Occasionally we have a customer who has a favorite fabric they would like to translate from their living room into the aircraft, and in most cases we're able to make it work," he says.

CASE CLOSED

The final selling point that Bosshard points out is the aft baggage compartment, which offers 51-90ft³ volume depending on the position of the aft partition. It is pressurized to enable inflight access and also has a standard pallet-sized (4ft 1in wide, 4ft 3in tall) cargo door to the exterior, as on the PC-12. "That's definitely something you don't see on other aircraft in this category," comments Bosshard. "You don't have to drag your bags through the cabin."

"The design of the cargo door was a bit of a nightmare with the engines there, but we have finalized it," adds Schwenk. Attention was also paid to how cargo items are secured. "I didn't want all the complicated fixtures I have seen in other aircraft," says Schwenk. "The pilot has to hook the straps somewhere and then the tension is too great. It should be a clever system that everybody can use easily, where you just fix items from two directions. We're working on that."



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2. Open valves on mattress & fit.



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CARBON-FIBER COMPOSITES ARE INCREASINGLY USED FOR MAJOR STRUCTURAL PARTS, SO HOW READY IS THE INDUSTRY TO WORK WITH IT? Words by Guy Bird

change

arbon-fiber composite's strength-to-weight advantage compared with various metals – it is up to 40% lighter and much stronger than aluminum – has helped usher in its introduction to the aviation industry. Carbon-fiber composites are now not only used for small parts, but also larger structural components – including the fuselage for the BBJ 787, ACJ350 and the paused Bombardier Learjet 85.

As Airbus's marketing director, David Velupillai, explains, there are advantages beyond weight and strength: "First, unlike aluminum alloy, carbon fiber is not susceptible to fatigue. This enables an aircraft such as the A350 to fly much longer between inspection intervals, delivering important maintenance savings. Secondly, unlike metals, carbon fiber does not corrode, so the structure will last longer, with less likelihood of repairs."

While the headline aircraft from Airbus and Boeing use serious amounts of carbon fiber, they are new and/or

still arriving to the market – especially in the VIP arena – and constitute only a tiny fraction of the overall jet fleet. The reasons for this are several. "As carbon fiber is a derivative of oil, it's affected by the oil price," explains Henrik Schmutzler, innovation engineer, innovation and product development at Lufthansa Technik. "It also requires a large amount of energy to make, which makes it very expensive."

The general consensus is that it's hard to put a figure on the raw material cost differences, as how the material is designed and manufactured is so relevant. "A carbonfiber seatback may cost twice as much as a metal one, but we can optimize the weight and integrate other functionality to balance the cost increase," says Gary Doy, director at Design Q. "Generally a higher material cost means a price increase, but this is almost canceled out by having fewer parts. And we can design the fixing within the part, so it can be easier to fit too."

"Carbon fiber's primary strength is along the length of its fibers"

The design of composites is a key point. "Optimal structural design is achieved when the most suitable material is used for the loads involved - which may be tension, compression, bending, shear, torsion or some combination of these," says Airbus's Velupillai. "Carbon fiber's primary strength is along the length of its fibers, so its use is most suited to structures that are loaded primarily in the plane of the material. It is thus very different from metals, which are generally isotropic they have similar strength in all directions. Carbon fiber is a relatively new material in an industry that is inherently conservative. So today, using carbon fiber is a bigger challenge than designing and manufacturing in aluminum alloy, which has been widely used in aircraft for decades."

LAYERS AND WEAVES

Design Q's Doy understands the complexity involved well: "Simulating the structural behavior of composite components is more complicated. To optimize the structure you have many options with composite construction. You can vary the number of layers, define the weave direction and combine a range of fibers (carbon, Kevlar, glass) to get the best balance between cost and weight. I can only speak for aircraft seating, but if it's harder to model the structural behavior, it's generally harder to certify."

It's also harder to make. "Carbon fiber needs to be quickly and accurately placed in molds during manufacture, because of the limited time in which



 it can be worked," says Airbus's Velupillai. "This is often done by automated tape-laying machines where the tape is more like a roll of resin-impregnated carbon fiber. The machine places strips of the tape precisely where they are needed, with the appropriate orientation, cutting off the

lengths needed, which also bring the benefit of accuracy,

ATTACHMENT THEORY

quality and repeatability."

Finally, carbon fiber is harder to alter and work with after it's been made, which is the aspect that most directly affects completion centers tasked with delivering bespoke designs. "Elements of a VIP cabin, such as walls, need to be attached to the fuselage skin and frames," says Velupillai. "Sometimes existing attachments can be used – for example, seat rails in the floor and pick-up points for overhead stowage bins – but there will always be a need for some attachments midway between these. In an aluminum-alloy fuselage, the drilling of these additional holes for attachments is well understood and relatively

ABOVE: THE FIRST BOEING 787 COMPOSITE FUSELAGE SECTION, WITH INTEGRATED LONGITUDINAL SUPPORTS (STRINGERS)

INSET: AN ACJ350 CONCEPT BY ASSOCIATED AIR CENTER

BELOW: THE A350 PRODUCTION LINE, SHOWING HOW THE FUSELAGE CONSISTS OF SEVERAL SECTIONS THAT ARE JOINED TOGETHER

CARBON FOOTPRIN

Airbus's first use of carbon fiber in airliner series production was the fin of the A310-300 in 1985. The company progressively used more in subsequent aircraft, adding carbonfiber tail planes, keel beams, rear pressure bulkheads and center wing boxes. Today, it claims the A350 uses more carbon fiber than any other airliner – featuring it in its wing and fuselage skins – in which it accounts for 53% of the structure's weight. So if carbon-fiber composite offers so many advantages, couldn't it be used in even more areas of an aircraft in the coming years? Henrik Schmutzler at Lufthansa Technik is not so sure: "With the A350 and B787, there aren't many areas left to switch to composites," he explains. "By volume, composites make up somewhere near 80% of the aircraft – so I think we've already reached a sensible limit."



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"Carbon fiber is harder to drill than aluminum"

straightforward. However, the situation is more complicated with a carbon-fiber fuselage skin, which will typically comprise many layers, often with fibers oriented in different directions. Carbon fiber is also harder to drill than aluminum alloy, so tools such as drills need to be sharpened or replaced more frequently."

NO STANDARD

These varying elements tend to make each airframe maker's material unique. "Most composites don't have the same level of standardization as metal," says Lufthansa Technik's Schmutzler. "The formulations for manufacture are very specific."

It's a factor Standard Aero's Arthur 'Chip' Fichtner, vice president of business development for Associated Air Center (AAC), was acutely aware of when the company took on its first VIP BBJ 787 interior. "Modification and repair becomes more challenging because knowledge of these design specifics is required to substantiate any changes," he says. "Interface with the OEM must happen and the growth of STCs on carbon-fiber aircraft will be related to the timeliness and availability of OEM data."

Fichtner says that AAC made stringent preparations, gaining expertise and personnel training from Boeing and the carbon-fiber manufacturers. "There are more

DRIVING FORCE

Formula 1 team and supercar maker McLaren has a long history of working with carbon-fiber composites. "Since 1981, 100% of McLaren cars designed for both road and track have been built with a carbon-fiber chassis," says Duncan Forrester, McLaren spokesman. "As volume demand increases, cost will reduce. It's unlikely that mainstream brands will be using carbon fiber in chassis construction in the next five years, as this will probably remain cost-prohibitive. But it is likely we will see an increasing amount of carbon-fiber content in cars, generally as the pressure for weight reduction increases."

Airbus's David Velupillai concurs in part: "Greater volume production will help to make carbon fiber more affordable, so everyone will benefit from more widespread use." But he's not convinced of the potential inter-industry learnings."Aerospace requirements are more rigorous than those for ground-based equipment," he explains. "Within aerospace, there are widely differing sizes of vehicles and environments. An airliner is many times the size of a satellite or fighter jet, and will generally be subject to lower g-forces. There is some potential for lessons learned in one industry to benefit those in another, but passenger-carrying aircraft are probably always going to be more demanding in terms of safety and economics."

> ABOVE: CARBON FIBER USED AS A DECORATIVE DETAIL IN THE NEW MCLAREN 570GT BY MSO CONCEPT

LEFT: THE McLAREN 570S SPRINT HAS A CARBON-FIBER CHASSIS



precautions and steps involved in performing work on carbon-fiber structure," he says. "AAC had a defect-free installation. We drilled more than 300 holes in the primary carbon-fiber structure and achieved this with a newly created in-house carbon-fiber drilling procedure, incorporating multiple verifications and proof of concept before each drilling operation."

CARBON CAREERS

Lufthansa Technik is also responding to this nascent market by increasing training and has even created new job roles with the material in mind. Tobias Adugna has worked for Lufthansa Technik for many years but became a senior composite technology expert at the firm just a

year ago. "We have to train to maintain and repair the new B787s, but as it's just entering service, we're at the beginning of a new phase," he says. "I studied composites in university ABOVE: THE BOEING 787'S CARBON-FIBER FUSELAGE NECESSITATES NEW ATTACHMENT METHODS

INSET: LUFTHANSA TECHNIK'S CONCEPT FOR THE ACJ350

BELOW LEFT: DESIGN Q HAS USED CARBON FIBER IN SEAT DESIGNS

BELOW: AN ACJ350 DESIGN BY JET AVIATION BASEL and had on-the-job training over several years so I didn't need additional special training."

According to Lufthansa Technik spokesperson Wolfgang Reinert, the company has been working for some years now on the Fiber Force research project with the Technical University of Darmstadt. This involves developing methods and concepts for the introduction of forces into the CFC fuselage structure. "The first results and insights are already flowing into the first VIP customer aircraft," says Reinert.

Airbus's approach to easing VIP installations on its ACJ350 is to pre-equip the green aircraft with several hundred Easyfit attachment points.

Ultimately, for AAC, the benefits to the customer of using carbon composite are clear, despite the obstacles. "Working with carbon fiber is more difficult and costly than metallic structures, but the ultimate pay-off is in aircraft performance and efficiency, which has a direct impact on cost for the operator over the aircraft's lifetime,"

says Fichtner. "Through innovation, our team was able to incorporate carbon fiber into our designs and deliver an interior weight of 20% less than the OEMrecommended interior weight."

AAC is currently working on the design of an external camera installation on the fuselage of an ACJ350, which Fichtner says will enhance the passenger experience with live feeds to the entertainment system. "With the introduction of the BBJ 787 and ACJ350, operators, MRO and modification centers will need to become proficient in working with carbon-fiber structure to remain relevant in the market," he warns. ^(S)

"The pay-off is in aircraft performance and efficiency"



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CAN DEVELOPMENTS IN MATERIALS TECHNOLOGY AND LIGHTING MAKE CABINS CLEANER AND EASIER TO MAINTAIN? Words by Marisa Garcia



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assengers in a VIP jet expect the cabin to be spotless, but maintaining this perfection involves a lot of work. The issue can be particularly acute in the charter market, where cabins can be subject to more wear and tear, and may have to be ready for the next set of passengers more quickly. Could intelligent textiles make this maintenance work easier?

It's tempting to look to the commercial airlines for inspiration, but as Jerome Franier, commercial director at charter operator Privajet, points out, the two markets have completely different challenges. "The airline industry does not share the VIP aviation sector's needs: the latter is working with more delicate and luxurious materials."

NANOTECHNOLOGY

Maria Kafel-Bentkowska, color, material and finish lead at PriestmanGoode, says we can expect a lot more new material technologies to trickle down from non-aviation applications. "The contract industry is constantly developing new materials, in particular with nanotechnology and antibacterial properties," she says. "The fashion market, especially in sportswear design, develops fabrics with antimicrobial properties and applies them as standard."

Some high-tech clothing fabrics are designed to remove perspiration and repel stains. Companies have applied nanotechnology to develop special coatings for fabrics that can trap odors. Some textiles have been treated with nanoparticles or altered at the fiber level to ensure greater

Charter cleaning

"The cleanliness of the cabin, and the spotless condition of all materials – including leather, carpeting, upholstery, metal and wood surfaces – is of the highest importance to us and we spend a lot of time and effort achieving it," explains Rosina Mincheva Mollova, senior cabin crew at Comlux.

The cabin is deep-cleaned after every flight, a process that takes about two hours, according to Mincheva Mollova. "The

BELOW: THE FREQUENTLY TOUCHED PLASTIC AND METAL PARTS OF RECARO'S AIRLINE SEATS CAN NOW BE COATED WITH AN ANTIMICROBIAL FINISH challenges are when there are large groups of passengers with lots of heavy bags, which can damage the cabin, particularly the carpet. We also clean ink stains from the seats and large red wine stains from the carpet after almost every flight."

Mincheva Mollova says the cleaning crew typically uses good-quality household cleaning products. Only the carpet cleaning is outsourced, and specialist products are used for that.



softness, durability, colorfastness, and, with greater tensile strength, resistance to damage or tears.

CERTIFICATION CHALLENGES

"These types of materials have been slower to penetrate the aviation market for two reasons," says Kafel-Bentkowska. "Firstly, the safety requirements for materials used on board are incredibly stringent, which makes the certification process more complex. Secondly, as a result of the first reason, companies need to invest in research and development to get new materials certified."

PriestmanGoode has tried to advance the adoption of these materials, by raising awareness of their applications in other sectors and urging suppliers to develop materials that can be certified for aviation with the same properties. "These intelligent materials can be beneficial for airlines and VIP jets in the long term, particularly if you consider the cost

"The airline industry does not share the VIP aviation sector's needs: the latter is working with more delicate and luxurious materials"



and time that maintenance takes," says Kafel-Bentkowska. "The biggest developments in aviation so far have been fabrics with hydrophobic (water-repellent) coatings, such as Replin's Fabric Protection System."

Lauri Church, chief interior designer at Comlux, reveals the company applies an FTS protective coating to textiles on all its interior completions. "Spills will stay in a little puddle on top of the textile, rather than sinking into the fibers," says Church. "One of the greatest things about it is that it doesn't change the look or feel of the textile."

Kafel-Bentkowska is excited about a material called Fenix, developed by Arpa, which she says could be tested for onboard use. "It's an opaque material with a long list of properties, including resistance to scratches, self thermal healing of microscratches, anti-fingerprint, anti-static, hydro-repellent and suitable for contact with food. This would make it an ideal material for a variety of surfaces."

There have been several announcements recently concerning antimicrobial finishes for hard surfaces. Recaro recently started offering these for parts of its airline seats. Meanwhile, The Leather Institute is offering Jennsco's mPale antimicrobial coating. The company says mPale has 'spiked'



ABOVE: THE AIRSPACE BY AIRBUS CABIN FEATURES SOME ANTIMICROBIAL MATERIALS AND A UV LIGHT CLEANING SYSTEM

BELOW: PRIVAJET CLEANS EACH INTERIOR AFTER EVERY FLIGHT electrically charged particles that attract most microbes, and puncture the microbes' cell walls, while being imperceptible to humans.

Kafel-Bentkowska believes further innovation is only a matter of time. "While it's still early days for high-tech materials in aviation, I think these will become commonplace over time," she says. The more companies start offering them, the more this will become a competitive tool between suppliers. This will not only benefit passengers, but importantly, will have a significant impact on facilitating the maintenance process."

ULTRAVIOLET LIGHT

Other promising avenues for disinfecting hard surfaces, carpets and textiles alike include ultraviolet (UV) lighting. Boeing recently introduced a concept self-cleaning lavatory that uses UV (which the company emphasizes is not harmful to people) to kill 99.99% of germs on all the toilet's surfaces. It would be activated after every use, once the passenger has left the lavatory, and works in three seconds. Airbus has announced that similar technology will be incorporated into its new Airspace by Airbus cabin. Also, Zodiac Aerospace has patented a concept that would use LED lights and OLED light panels throughout the cabin to send out UV rays, eliminating 99% of pathogens. The UV light would only be activated between service stops, when the cabin is unoccupied; the manufacturer also proposed a safety system to ensure no one is exposed to the light.

TURN TO STONE?

Aircraft owners can now choose stone flooring throughout the aircraft. F/List, which supplies such a solution, believes it offers some key maintenance advantages. "Stone flooring is easier to clean than carpet," comments Werner Kartner, vice president of aircraft interiors at F/List. "Another disadvantage of carpet is that, after three rounds of cleaning, it needs to be fire-treated again. It's also more hygienic having a stone floor, for example in the lavatory."

F/List's solution is based on granite, with many colors and patterns available. For flooring applications, the stone layer is 0.10in thick, and the whole construction weighs 2.46 lb/ft². For other applications, including for countertops and tabletops, F/List offers a stone veneer that can be cut down to 0.03in thick and 0.66 lb/ft² in weight.





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DESIGNING A CABIN FOR PIPER'S NEW FLAGSHIP, THE M600, WAS A MASSIVE LEARNING EXPERIENCE FOR THE COMPANY'S MARKETING TEAM

> Words by Izzy Kington Photos by Jim Barrett Photography





hile Piper is 90% vertically integrated in terms of its aircraft manufacturing – even making its own seat structures – it does not have an internal interior design group. So how does it go about designing a new cabin? The answer for its new M600 single-engine six-seat turboprop was for its marketing department to work in concert with a third-party industrial design company – Blokx Design of Boston, Massachusetts. The result is a cabin featuring completely new seats, improvements to aspects including the sideledges, and the addition of equipment including USB charging ports and folding tables. With a 2016 list price of US\$2.853m, the M600 is Piper's new flagship and achieved FAA type certification in June 2016.

Jacqueline Carlon, director of marketing and corporate communications at Piper, says the focus was to see how the company's existing product could be improved. "Blokx Design specializes in taking existing tooling and using it to create something that looks new," she says. "Together we looked at every luxury car to research trends in stitching, colors and styling. Then Blokx came up with some design options that would not involve us changing the tooling for our sideledges, because that would be pretty costly and involved."

Blokx supported the interior effort with detailed drawings that expedited the engineering process. The next step was for the marketing department and Blokx to develop 'product personas' to inform the choice of colors and materials. "We looked at who buys our aircraft, what cars they drive and what their lifestyle is like," says Carlon. "We spent a lot of time sitting in cars! We wanted this interior to feel like a luxury sedan."

"We looked at who buys our aircraft, what cars they drive and what their lifestyle is like"

ABOVE: IMPROVEMENTS WERE MADE TO THE SIDELEDGES WHILE KEEPING THE SAME TOOLING

RIGHT: A WOOD LOOK WAS ACHIEVED WITH HYDRO DIPPING, TO MINIMIZE WEIGHT

> Three color palettes are available, and a fourth may be added in 2017

IN-HOUSE CRAFTS

As part of its focus on in-house manufacturing, Piper makes its own seats from scratch – from the structure to the upholstery. "People are shocked when they see we have workers sewing leather and covering side panels," says Jacqueline Carlon. "The hides come in, they are laid out and the upholsterers mark any flaws. Then we use an Eastman cutter to cut the leather exactly to our template. Then people – not machines – sew the pieces together, because depending on the interior, different threads and stitching patterns are used."



Color combinations were picked and then tweaked in line with feedback from customers and dealers, which Carlon says was particularly important in ensuring the interiors appeal to Piper's largely male customer base. "While we have men in our marketing department, it was a lot of women doing the design work," says Carlon. "This is not necessarily a bad thing, because very often a male customer's wife is closely involved in the selection of the interior."

The team finalized three color palettes – Calais, Sedona and Firenze – although the latter has a little flexibility, as it is available with vanilla or black seats. The seats are finished in real leather, supplied by Perrone. "We have worked with synthetic leathers in the past, but given the amount of wear an aircraft is subject to, our customers would much prefer to have the real thing," says Carlon.

WEIGHT CONSCIOUS

For weight reasons, the two wood-look finishes were achieved by hydro dipping, and acrylic was used instead of wool for the carpet. Each color palette has a different plating material – nickel, rose gold and brushed aluminum. One features carbon-fiber tables. "We tried hydro dipping to achieve a carbon-fiber effect, but the finish wasn't

M500 AND M600 TIMELINE

APRIL 2014 Work begins on M600 interior design

OCTOBER 2014 Work begins on translating the design to the M500

APRIL 2015 M500 interior offered as an option

MARCH 2016 M500 interior made a standard feature and second color palette added; a version offered as an option on the M350

JUNE 2016 M600 achieves FAA type certification

> JULY 2016 First M600 delivery

CABIN STATS



Piper M600

Cabin width: 4ft 1in Cabin height: 3ft 11in Cabin length: 12ft 4in Seats: 2 crew + 4 passengers Range: 1,484 nautical miles at intermediate cruise settings Maximum speed: 274kts Maximum altitude: 30,000ft Price: US\$2.853m

finish before it was installed in a customer's product."

Piper plans to build just over 20 M600s in 2016, all of which are spoken for. The company has a backlog into 2017, but Carlon says it should be able to ramp up production.

Overall Carlon is very proud of the lessons the company has taken from the project. "It's interesting because the marketing department led a lot of the design," she says. "We have a creative designer in our marketing team, but they have no experience in interiors. Given the size of our company, we had to learn how to be good at design, so this is how we did it."

quite what we wanted, so we had to go with real carbon fiber," says Carlon. "The carbon fiber was one of the biggest challenges, because when you bend and move it, if you don't do it quite right, it doesn't lie properly. You really have to pick a good-quality carbon fiber and you have to stick to the same source, because otherwise it may not look the same. We initially thought all carbon fiber looked alike, but it doesn't. Not at all."

Other subtle improvements came from a review of the company's existing products. "We basically created a list of things that we didn't like," says Carlon. "These were tiny things that the average person might not notice – for example, maybe on the sideledge one screw would be slotted and another a Phillips; they didn't match. Another example is that we had a power outlet, but it was hidden under the seat. We weren't giving ourselves credit for a really nice feature; it had to be moved."

DOG GONE

A major focus was on redesigning the seats. "We heard that passengers put their dogs on the two aft-facing seats, because they were not comfortable," says Carlon. "The seat bottom was too short and pinched your legs a little, so we set out to come up with a more comfortable seat that differently sized individuals could sit in comfortably."

The aircraft will be built and outfitted at Piper's headquarters in Vero Beach, Florida. The team there fitted the interior for the first time on the third flight test aircraft. "The mock-up was produced by a third party because our interior shop was too busy," says Carlon. "The flight test interior provided a great opportunity for us to identify where we needed to work on the fit and



TOP: USB CHARGING POINTS WERE ADDED TO CATER FOR PASSENGERS' USE OF PEDs

ABOVE: SPOTLIGHTS ARE RECESSED INTO THE CABIN CEILING

BELOW: THE M600 HAS GARMIN G3000 AVIONICS WITH AUTOPILOT AND SYNTHETIC VISION

TRANSLATING THE BENEFITS

The design created for the flagship M600 has been translated to other aircraft in Piper's range. "Our CEO challenged us by asking, 'Can you take that interior, back it off a little bit and put it into the M500?" says Jacqueline Carlon.

The M500, also a six-seat single-engine turboprop, has a lower price than its big brother – US\$1.99m to the M600's US\$2.853m.

The marketing and engineering teams collaborated to determine which elements could be translated from the M600 to the M500. "We came up with something that's not quite as ornate as the M600 interior but is still beautiful, comfortable and looks very well finished," says Carlon.

The updated M500 interior made its debut as an option in April 2015. In March 2016 a second palette was introduced and the interior became standard equipment on the aircraft. The interior was also then offered as an option (in two color palettes) on the M350, a six-seat piston aircraft. "So far in 2016 we've had a take up rate of nearly 100% for the new interior option on the M350," says Carlon. "It's very, very popular."

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THE FIRST VIP BBJ 787 DESIGN AND COMPLETION TOOK SEVEN YEARS OF HARD WORK TO OVERCOME CHALLENGES RELATING TO DATA, ELECTRIC SYSTEMS AND THE CARBON-FIBER FUSELAGE

Words by Izzy Kington

businessjetinteriorsinternational.com 061 OCTOBER 2016 BBJ 787 COMPLETION

The aircraft accommodates 40 passengers and seven cabin crew

Il the way back in 2009, a brave investor decided to buy a Boeing 787 and turn it into a VIP jet – something that had never been done before – then sell it on to someone seeking to fly 40 passengers non-stop anywhere in the world, in style.

The investor turned to Kestrel Aviation Management (KAM) to provide turnkey management of the project from airframe manufacture to entry into service. The company has similarly managed 10 other wide-body and 10 narrow-body aircraft – all Airbus and Boeing types – as well as Bombardier and Gulfstream jets. Stephen Vella, CEO at KAM, also has a lot of airline experience, and has been involved with the Boeing 787 program since its inception in 2004. This experience of the airframe and its systems proved vital on the complex seven-year project.

Vella says Airbus and Boeing projects can take two and a half years or more – including at least a year's lead time for the airframe to be built, during which time the design and engineering is finalized, and then a year and a half of installation and certification work. "This project MAIN: THE MAIN LOUNGE, LOOKING TOWARD THE AFT

ABOVE, FROM LEFT TO RIGHT: JACQUES PIERREJEAN, THE CABIN CO-DESIGNER; TOM CHATFIELD, THE TECHNICAL MANAGER; STEPHEN VELLA, CEO OF KAM, THE PROJECT MANAGER; AND STEPHAN THEIS AND HAMID SAYYAR, INSPECTORS has taken longer because the wait for the Boeing 787 is longer and we also had to develop the BBJ 787 specification with Boeing, as it didn't exist previously," he says. It was a long road that required close cooperation between KAM, Boeing,

Pierrejean Design Studio (the cabin co-designer) and Greenpoint Technologies (the completion center). Greenpoint launched a major corporate initiative in 2013 focusing on the 787 type, having recognized that these completions would be very different. The company worked with Boeing early on to gain the knowledge and information needed to win the contract with KAM.

BIG DATA

Vella says the first big challenge was obtaining data on the structure and electrical architecture. "Everything has an intellectual property stamp on it, because there are many

^{rne}overall ^{Cabin} area is 2,415ft2

LEFT: THE TEAM AIMED FOR ORGANIC, SMOOTH, ROUNDED AND FLOWING AESTHETICS, SOFT COLORS AND TACTILE SURFACES TO PRODUCE A STATE OF CALM

with Boeing to make sure that we would not cause interference with the existing electrical systems."

"Engineering faced a few challenges in developing the 787 interior, especially with regard to the

electrical system," says Bruce Kay, vice president of engineering at Greenpoint. "Our engineers conducted extensive research to learn the unique features inherent in making changes to this complex aircraft. Examples of areas posing the most challenge were integration with the power distribution system, ensuring that the current return requirements were properly addressed, defining system logic, wire routing, termination, and shielding for the thousands of wire bundles installed for the VIP interior and systems."

Greenpoint spent many hours in collaboration with its team of FAA designees to determine the correct methodology for design and substantiation of these systems. "The engineering team worked closely with interior design, fabrication and installation teams to validate the system functions requested by our client and dictated by FAA requirements," says Kay.

NO FIXED ABODE

The 787 also diverges from the norm with its fuselage, which consists of five barrels, each made from carbon fiber woven by a robot and then baked. "Each barrel has structural reinforcement inside, in most cases also made out of carbon fiber and bonded to the barrel," says Vella. Boeing insets a metallic mesh into the carbon fiber to conduct electricity. "Structural pieces are bonded together, and some are reinforced to take structural members that translate the load of the airliner equipment, including galleys, overhead baggage racks, etc," says Vella.

IFE AND CMS

All the seats have power and USB outlets, plus an inductive charging station for tablets. These 7in tablets control the CMS and IFE. "When you sit down, the tablet will show the aircraft's layout and you select your seat," says Stephen Vella of KAM. "Then you can stream music wirelessly to the wireless headphones at that seat, and you can stream videos to the tablet or the screen in front of you."

The aircraft also has a GSM phone pico network so passengers and crew can use their own cell phones to make and receive calls.

parts built by a multitude of subcontractors, which are then integrated by Boeing; it's a fundamentally different method of building an aircraft," says Vella. "When we started the project, Boeing hadn't finished the outfitters data package. There were a lot of obstacles to us accessing the information we needed."

The parties also had to work on a specification for the BBJ 787 type. "There were an awful lot of meetings where we had to develop what parts of the 787 specification would be used for the BBJ, and that took a long while," comments Vella.

ELECTRIC DREAMS

Then there are the 787's electrical systems. "The electrical complexity of this aircraft – which is almost all-electric – is challenging for cabin outfitters," says Vella. "We added kilometers of additional wiring for the wi-fi, CMS, lighting, sensors, the GSM system, etc. There was a lot of fundamental stuff to design that wasn't in the airliner specification. Every time we did this, we had to interface

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THROUGH THE ROOF

Stephen Vella of KAM is proud of the spacious feel in the cabin, and in particular the ceiling. "The 787 has very little wasted space for electrical cabling and ducting in the ceiling," he says. "We've exploited that even more by pushing the ceiling as far up and out as we can. From the floor up the sidewall panel and into the ceiling, it's totally bespoke. It's in various pieces, but to the eye it is one piece." The cabin ceiling integrates a lot of equipment – oxygen boxes, speakers, decompression slats and lighting. "There's a lot of complexity in the design and yet, as a passenger, all you see is a homogeneous ceiling with no breaks, other than the porthole-like downlighting," says Vella. "The lighting involved a lot of work to avoid generating shadows."



"These load-bearing members are only in specific areas of the aircraft, and we need to use them to distribute the load of the VIP elements we're installing. You can't drill holes or rivet things together, so we had to adapt the structural hard points to the monuments."

Greenpoint created a patent-pending floor attachment system for seats, monuments and bulkheads. The monuments are attached to pallets that are themselves attached to the seat rails. Sidewall and ceiling panels are attached to a structural grid that is fixed to the airliner's hard points.

Annika Svore Wicklund, design director at Greenpoint, says that after the chief initial challenges of decompression and floor structure attachment, other challenges surfaced, including perfecting stitching details for leather panels and removing hardwood banding on cabinetry.

WHAT'S ON BOARD?

The deckplan is the intellectual property of the original owner. Passengers enter the aircraft at Door 2, into a rotunda with wooden floors and leather-bound walls. From here, they can enter the master suite or take a right down a 'wavy' corridor into the main lounge.

The master suite is at the front of the cabin and includes a bedroom, bathroom and large dressing room. "This aircraft can

BELOW: THE AIRCRAFT FEATURES TWO VIP BATHROOMS fly for nearly 18 hours, so it is essential to provide a lot of space for clothes, shoes, bags and other sartorial accessories," says Vella. "Heads of state may also need to change from western to traditional dress."

This is the first aircraft KAM has worked on for an undefined end-user. "We had to develop a cabin that would be of interest to people of various cultures," says Vella. "It had to appeal primarily to the two major markets for large corporate aircraft – the Middle East and Asia."

CULTURAL SENSITIVITY

The master bathroom has a double-sized shower, his and her wash basins, a toilet, and is finished with lots of marble. The bathroom, bedroom and dressing room can be segregated with sliding doors, bearing in mind possible cultural preferences for men and women not to change in sight of each other.

The main lounge has two sections, the forward-most of which features a 55in screen and a translating, electrically actuated day-bed that opens into two divans. "In both Middle Eastern and Asian culture, there is a tendency to sit cross-legged with your friends or spouse, so we wanted an area where this could be done in a cozy manner," says Vella.

On each side of the cabin there are two single berthable seats that can either face forward or be moved into club-two position. The two credenzas



BELOW: AT THE ENTRANCE TO THE MAIN LOUNGE IS A MONUMENT REMINISCENT OF AN ASIAN GONG OR MIDDLE EASTERN SHIELD



in the middle of the cabin sport a finish that looks like metal. "They're actually made from a composite sprayed with a proprietary metallic coating by Metal Composites," says Vella. "There are a lot of metal-effect objects in this aircraft that are done in the same way, because it makes them incredibly light."

FINE DINING

The rear of the lounge features two four-place divans and four individual seats. There is an electrical table that raises and extends from a low coffee table into a full dining table for six, with one side unencumbered by seats, easing service.

After the lounge is a circular monument that houses a VIP rest room. Around it there is a self-service STAFF ROOM

There are pilot and crew rest cabins on board. Stephen Vella says these had to be positioned carefully – the pilot rest immediately behind the cockpit, and the crew rest tucked away to the right of the entrance – and 'solid' rather than curtained off, for acoustic reasons. "The 787 has a bowing overhead crest, so there was the potential to create noise in the master suite," he explains.

The aircraft is crewed by two pilots, six cabin staff and an engineer. The latter is catered for with a single rest behind the cockpit. "This aircraft is very complex, so this engineer is on his laptop during the flight, making sure that all the cabin and other systems are functioning, so the pilots can concentrate on flying," says Vella. "If any parts need to be replaced, he can communicate through the satcom to the ground and the part will be ready at the destination."

> refreshment and buffet area, with a refrigerator and coffee maker, plus wardrobe space. Next is the guest cabin, which has 18 lie-flat seats adapted from Zodiac Aerospace's Aura model. Kestrel brought in automotive stalwart Dräxlmaier to change the upholstery, and asked Zodiac to replace some plastic components with metal pieces. There is also one row of premium economy seats, for nannies, security guards and other staff, separated from the guest cabin by closets. Behind that is a standard galley fitted with B/E Aerospace's Essence inserts. There is another galley at the front of the aircraft.

SHARED EXPERTISE

Vella says the key to success was collaboration. "The reason we chose Pierrejean is that they have great artistic talent but they're not arrogant – they recognize what they don't know about technology and we recognize what we don't know about design; it's a true partnership," he explains. "Some other designers out there produce wonderful concepts that are totally out of touch with the reality of the 787. For example, the floor has different load-bearing strength from front to back, so there are areas that are actually quite delicate. Only by working with someone that knows the 787 can the designer steer away from those areas."

So is everybody happy with the outcome? For Greenpoint, this program was an integral part of the 787 learning process, and lessons from it are already being put to use on its second 787 completion.

Vella says the mammoth project was a little stressful, "but what I'm proud of is, we're all still friends". As for the original investor? Vella says the investment proved to be "not a bad deal".

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DECADE

HAVING HELD THE POST OF DIRECTOR OF INTERIOR DESIGN AT GULFSTREAM FOR 10 YEARS, TRAY CROW IS WELL PLACED TO REFLECT ON CHANGES IN THE MARKET

Words by Izzy Kington







LEFT AND BELOW: THE GGOO MOCK-UPS HAVE PLAYED AN IMPORTANT ROLE IN REFINING THE AIRCRAFT'S INTERIOR, DESPITE THE INCREASING USE OF VIRTUAL REALITY

BOTTOM: CAVE IS USED FOR ENGINEERING DESIGN REVIEWS AS WELL AS CUSTOMER PRESENTATIONS

ow in his 10th year as director of interior design at Gulfstream, Tray Crow came to the company as a result of its work with the local Savannah College of Art and Design, where he was chair of interior design. "I was professor of a class that worked with industrial designers at Gulfstream on a variety of design problems," says Crow. "We also sent students to do internships at Gulfstream, so I was familiar with the company. I was looking for a new and exciting creative experience; that's what brought me here."

His design background spans residential, retail, healthcare and workplace environments – the latter providing useful training in the requirements of corporate customers. His college days provided "a unique opportunity to lead young creative minds and guide them into a variety of careers".

VIRTUAL AND REAL

Crow has seen great quality improvement during his 10 years in the market, which he credits to increased focus on working with suppliers, lean manufacturing and more durable materials. He has witnessed the advent of carbon-fiber seat parts, 3D printing for rapid prototyping and the use of virtual reality for engineering and design.

"It's affecting all parts of the business," he says of the latter. "We're able to evaluate equipment under the

HOW CAVE WORKS

Gulfstream engineers use the company's automatic virtual environment, or CAVE, to conduct immersive engineering design reviews of airframes, cabins and general systems integration. CAVE is also used extensively for customerdriven cabin simulation, where layouts and materials can be changed in real time. The technology has been used in the design of the new G500 and G600 jets.

"CAVE uses an HD active stereoscopic projector to display fully immersive 3D images on the walls of a room," says Fernando Toledo, a technical specialist at Gulfstream. "Head-mounted 3D glasses with motion tracking sensors and a control device are used to enable engineers and customers to interact with life-size projections of 3D models of the aircraft."

> Toledo says there are two main benefits to the system. "It reduces the need for engineers to interact with expensive physical mock-ups and allows customers to experience the product in photorealistic three dimensions.
LUXURY TRAVELLER









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"Lighting and other technological components are getting smaller"



floorboards to ensure that there's no interference with wiring or plumbing spaces. It also enables us to look at interior elements to ensure that a closet door doesn't interfere with the headliner, for example, or that drawers and doors are operating properly – all in advance of having to build mock-ups or any other costly endeavors."

PHYSICAL PRESENCE

Some things don't change though – physical mock-ups and testing still play a vital role at Gulfstream. For example, the design for the upcoming G500 and G600 aircraft was greatly influenced by customer feedback on a mock-up launched at NBAA 2014.

The full interior is now being put through its paces on a production G500, as part of the flight test program. "My team is involved in vetting the interior, ensuring that the quality and craftsmanship is on a par with our clients' expectations," says Crow. "We will fly on the aircraft to evaluate all the interior components, ensuring that they are performing as expected."

The challenge of all designs is customers' desire to continue with their lives on the aircraft as on the ground, in comfort, says Crow. "An emerging trend is for fixed beds. ABOVE AND BELOW: THE G600 GALLEY. GULFSTREAM IS INVESTIGATING HOW BRING-ON-BOARD GALLEY EQUIPMENT CAN BE ACCOMMODATED



In terms of aesthetic preferences, Tray Crow says that Gulfsteam's clients fall into five primary categories. Clients with 'classic' taste are looking for timeless appeal. The 'opulent' look is about layering details, perhaps with complex stitching on the seats and highly customized carpets. Clients in the 'sport' category want to reflect the speed of the aircraft and are attracted to automotive styling, while 'minimalist' interiors tend to be very monochromatic and guite serene. Lastly there is the 'next generation' category. "They are the clients that are coming into the marketplace new," says Crow. "It's an area we like to focus on for future developments. These clients typically want bolder statements – maybe more complex color arrangements and a little more risk taking. Crow says that neutral schemes typically prevail. "However, we're also seeing clients expressing themselves a bit more with pops of color, maybe in hidden locations. Lining a storage box with an accent color is a trend."

Our clients travel overnight and need to be ready for business the following morning."

BRING ON-BOARD

Similarly, customers want to bring on their own equipment. "They may have a preferred espresso maker, for example, so we're exploring the possibility of providing a convenient space for them," he says.

Tablets and smartphones are another obvious example, and Crow believes that demand for installed monitors is "definitely on the decline" as the pace of improvement in the consumer market – particularly in terms of screen resolution – outstrips what is possible for equipment that must meet aviation certification requirements. "That's not to say that personal monitors are a thing of the past," says

Crow. "Certainly they will still be offered to our clients."

Lighting is another quickly moving technology. "Lighting and other technological components are getting smaller every day, so we're seeking ways to capitalize on that," says Crow.

He has noted progress with materials as well: "For example, carpet suppliers are offering unique tufting styles and

073

TREND WATCH

Ahead of NBAA 2016, three North American designers share their trend insights



Lauri Church, chief designer, Comlux America



Annika Svore Wicklund, director of the Greenpoint Design Team



Julie Mandrell, senior design coordinator, Associated Air Center

What onboard equipment is growing in demand? LC: We see more tablets replacing other types of hardwired entertainment devices. Having a tablet – whether a personal device or one provided by the flight crew – gives passengers the flexibility to stream anything they like, whenever they like.

ASW: A vast array – whatever is the latest and greatest and makes passengers' lives easier. Examples include rain showers, dishwashers, inductive stoves and OLED screens. Our task is to hide the equipment when we can, and keep the cabin clean and comfortable.

What aesthetic trends have you noticed?

LC: We are seeing fewer wood veneers being used, particularly on bulkheads. Instead we see more paints, textured fabrics and other materials. This results in a brighter interior space that feels more like a home or resort.

ASW: On top of the opportunities involved in integrating technology, we're seeing an interest in global trends and cultural appreciation. Customers want us to explore traditional techniques in modern ways. Clients want luxurious materials and details that represent their identity.

JM: Over the past four years I've noticed a movement to a more residential, less aviation aesthetic in terms of textiles, architectural styling, lighting and accessories.

How is technology impacting your work?

LC: The use of tablets affects the way we design seats and divans because it frees up the back and arms of the seat. The only drawback, albeit a minor one, is that we have to find space to store and charge these tablets. This means creating hidden compartments that maintain the streamlined look achieved by the removal of built-in entertainment.

ASW: We see an interest in technology that helps expand or adapt the space: projectors, moveable walls/panels, interactive screens and lighting. Clients want fewer wires, faster speed and simplicity of use.

What products will you be looking out for at this year's NBAA?

LC: I'm really looking forward to seeing what new galley components are available, because we don't go into the custom design of those things. I will also be looking to see how seat frames are changing because that directly affects the designs we can deliver. Finally, there's always something new happening in terms of entertainment solutions, which are really key to making flights convenient and comfortable.

JM: I'm looking for high-quality, functional cabinet hardware. I'd like to see the hardware used in the automotive industry make its way to aircraft.

patterns. We're now also seeing stone and wood flooring options, and are researching glass and mirror products."

SUPPLIER OWNERSHIP

Overall though, Crow would like to see more suppliers driving innovation. "When the specification comes out for any given part, I'd like to see suppliers take a deeper level of ownership and find ways to exceed it," he says. "For example, are there new ways in which we can experiment with flame treatment that maintain the appearance and hand of the original fabric or leather?"

In terms of aesthetics, Crow notes a continued preference for natural materials, and what he calls a layered style, exemplified by the use of gloss and matt veneers to provide contrast within a cabin. "We're also seeing new ways of laying up veneer, for example taking quarter-sawn timber, which has a very rhythmic and straight grain, and turning it on the diagonal on the bulkhead to create patterns," he says. BELOW: DESPITE GROWING DEMAND FOR PED-BASED IFE, GULFSTREAM ALSO CATERS FOR THOSE WHO WANT INSTALLED SCREENS Many of the trends noted intersect in the sales and design centers Crow helped develop in Savannah, Georgia; Dallas, Texas; Long Beach, California; and London, UK. These incorporate material showrooms, mock-ups to enable customers to try seats, and technology to visualize interiors.

Obviously not all customers travel to these showrooms, and Crow says one of his biggest challenges is "ensuring that we deliver a high-level experience to clients anywhere in the world". Part of the company's solution is its suite of apps, which can be used anywhere.

To start, a real-time cabin configuration app enables clients to see all the layout options. Then the Options app takes them through entertainment, connectivity and other equipment, showing the weight impact of everything in real time. Lastly, DesignBook is used to enable customers to try out material selections, with a 3D, 360° view. "We'll also launch some applications in 2017 that will bring in a whole new way of defining interiors," promises Crow.



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NBAA 2016

NBARZOL

NBAA'S ANNUAL BUSINESS AVIATION CONVENTION & EXHIBITION (NBAA-BACE) PROVIDES A STAGE FOR EXCITING CABIN INNOVATIONS TO BE UNVEILED – TURN THE PAGE FOR A TASTE OF WHAT TO EXPECT FROM THIS YEAR'S SHOW, TO BE HELD IN ORLANDO, FLORIDA, ON NOVEMBER 1-3, 2016

Sofa so good

The newest product from Boxmark is a sofa created with Jacques Pierrejean. Luxury Traveller has been designed to offer numerous extravagant features and an extraordinary amount of space and comfort. Another featured product is the Leather Flooring product developed with F/List. This is available with a customized tiling concept in a wide range of colors and structures. The company says it meets all applicable certification requirements, such as flammability and slip resistance. Also on display will be Boxmark's 3D leather wall panels.

There will be two static displays at NBAA 2016

SUEDE ACCENTS



Those on the lookout for suede should head to Garrett Leather's stand to see the recently introduced Allura range. The company says this European nubuck suede is a perfect companion to finished leather and

is ideal for pillows, lower sidewalls and trim. Changes in the direction of the nap create an illusion of light and dark areas on each hide. It is available in 10 colors, held in stock for immediate shipment.

The hides average 60ft², which Garrett Leather says provides superior cutting yield and value than smaller, split suedes. Allura is Greenguardcertified and may be treated to pass all FAR requirements.



NEW SIX-SEATER



Certified by the FAA in June 2016, the M600 will be the talk of Piper Aircraft's stand. The six-seat single-engine aircraft, Piper's most advanced, offers a range of 1,484 nautical miles, and 274ktas cruise speed. The maiden aircraft was delivered in July 2016 to Georgia, USA, residents Jerry and Jack Wardlaw, veteran Piper owners who will use the aircraft for business and personal travel.

The M600 costs US\$2.853m and comes with the Garmin G3000 avionics suite and an interior designed, using customer feedback, for maximum comfort. The interior sports USB charging ports, an executive folding table, workspace lighting and folding seats.

Pete Perera

VICE PRESIDENT, BUSINESS DEVELOPMENT, EMBRAER AERO SEATING TECHNOLOGIES (EAST)

What is your star exhibit?

We are planning to showcase our latest VVIP aircraft seat designs, with features including power assist, audio response massage, heating, wireless seat controls and air bladder cushions. EAST has developed 9g and 16g seating solutions for various aircraft platforms.

How has the 2015 acquisition by Embraer impacted AST?

We now have the opportunity to work on some of Embraer's commercial and business aircraft platforms, in addition to the solutions we are already developing for various other luxury aircraft platforms. One great example of the way Embraer has impacted our business is its investment in a new 50,000ft² manufacturing facility in Titusville, Florida. We are still designing and developing products from our headquarters in California, but we will soon start production of Embraer seats, including those for the first-class cabin of the E-Jet E2, at the new facility in Florida.

How are new technologies influencing your business?

Virtual prototyping and 3D printing are central to our design development process, helping validate seat ergonomics, kinematics and industrial design.

Can you detail any recent development programs?

We are in the certification phase for the E-Jet E2 first-class seats. Soon we will also commence development related to several new seat features, including those that guests will enjoy interacting with at NBAA 2016, which we will incorporate into our VIP seats and divans in the near future. **Come and meet us!** NBAA, Orlando, booth 4019 MEBA, Dubaï, booth 623

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Robin Butler

MANAGING PARTNER, OMNAVIA INTERIORS

What new products will you highlight at NBAA 2016?

OmnAvia will introduce carpets. upholstery and curtain fabrics and non-textile flooring. We will premiere a new category of clear coat, UV-cured finish for aircraft cabinetry, BluSky Armor. This photo-polymer finish cures in less than two minutes, and performs excellently in terms of hardness, flame resistance, adhesion and resistance to weathering. What sets it apart from other UV-cured finishes is that it contains no solvents (and therefore no VOCs), offers minimal shrinkage, and cleans up with simple isopropyl alcohol. It is the most environmentally friendly clear coat in the aircraft market today.

What aesthetic trends have you noticed this year?

We see more demand for gray tones. Additionally, more designers are opting for fabrics for lower sidewall panels and matching accent trims on cocktail tables and suchlike, primarily because of the wide range of beautiful fabrics available that can be flame treated. With carpets, there is a trend toward two-tone patterns and textures, and to patterned carpet runners that complement monotone base floor coverings.

Do you have plans to expand your range?

In addition to BluSky Armor, we have a series of complementary polishes for buffing our finish, plus a filler paste and a laminating resin that utilize the same photo-polymer chemistry. We are also developing products in the thermalacoustical insulation area that are showing promise, and will add new items in this arena in the next 12 months.

Double debut

NBAA-BACE is the best opportunity all year to visit Embraer's entire portfolio of executive jets. The company recently launched an evolution of its entrylevel Phenom 100 light jet, the Phenom 100 EV. The aircraft, showcasing a commemorative paint scheme and a refined interior with an improved aisle profile, will make its international debut at Embraer's static display, alongside the Phenom 300.

The Phenom 300 with the interior changes announced at EBACE 2016 – including a fold-out table that extends flush with the sideledge for greater surface area, aisle trim improvements and inset cupholders – will make its NBAA-BACE debut, as will the mid-light Legacy 450. Since 2008, when the Legacy 450 and Legacy 500 were launched, Embraer has brought the interior design function in-house, and worked extensively with customers on its interiors.

PED CHARGING



According to a 2015 report from SITA Air Transport Industry Insights, *The Future Is Personal*, 97% of passengers travel with mobile devices.

Astronics will highlight its EmPower range of in-seat power systems, which cater for this trend. The off-the-shelf outlets can be integrated onto any aircraft, and are currently installed in more than 900,000 seat locations.

Individual high-power USB outlets that can be directly connected to 28VDC aircraft power are new to the line-up. They come in a multitude of colors, are available in unplated metal and can be custom finished to match the interior.

To power the complete cabin and cockpit, Astronics will offer a dual frequency converter unit providing 4kVA of power to support passenger, lavatory and galley equipment.

IFE BACKBONE

The AVDS network showcased by Innovative Advantage is now supporting CMS/IFE systems on more than 550 aircraft. The product has a fiber-optic backbone and modular architecture. It interfaces with all CMS solutions and offers video tiling and 4K distribution, supporting a 72Gb data pipe.

The company says AVDS is easily scalable – up and down conversion of video signals enables OEM and completion center clients to update older IFE systems. For example, old monitors can be replaced with the AVDS backbone and live encoders, which enable live streaming of DRM-compliant content to PEDs. iOS and Android apps are available.

The company will also highlight its AVDS Client software tool, which enables completion center engineers and technicians to configure and test IFE wiring before the final CMS software is loaded. They can create and edit IFE configurations without NRE charges.

Art carpets

Carpets that benefit from Tai Ping's collaborations with designers from other disciplines will be showcased. One featured collection will be Bloom, a line of 14 handmade wool and silk rugs that the company says combine the art of rug making with the art of floral design. They were designed in collaboration with floral design specialist Jeff Leatham and launched in January 2016.

Tai Ping is also proud to announce the upcoming launch of Magnetic, an Edward Fields collection featuring 10 archival designs from the 1970s, revived and given a modern twist. Magnetic will be available from October 2016.

> More than 27,000 people attended NBAA 2015

APP-BASED IFEC



A new 55in 4K UHD IFE screen will be the centerpiece of Astronics PGA Avionics's display, drawing attention to the Carat Senses CMS, IFEC and lighting system. Passengers can access CMS functions and a variety of media in the Full IP system through a suite of apps. The system also includes full HD streaming and DRM early window content.

Astronics PGA Avionics's new Keyboard Touch Screen-4 (KTS-4) will also be on show. This version offers a flush and wide HD touchscreen and a viewing angle that is perfectly homogeneous in portrait or landscape mode. It is designed for both bulkhead and seat armrest integration.

A full range of lighting systems will also be on display – including customized reading lights, ambient lights and moodlighting systems.

CABIN CHANGES

The focus at West Star Aviation's stand will be on its MRO services. For example, the company recently reconfigured a Dassault Falcon 2000, which is normally configured for 8-10 passengers, with a personalized 13-passenger cabin. The design necessitated the fabrication of a reduced-size galley and auxiliary galley/entertainment center, shifting the forward cabin bulkhead/door forward and extending all the sideledges and window panels.

Structural modifications were made above and below the floor to accommodate the new loading. West Star also provided in-house engineering support and on-staff DER. The cabin was finished with new veneers, soft goods,

countertops, plating and switch panels for the new layout. West Star received final certification for the reconfiguration via FAA Form 337.



SHADE SOLUTIONS



The shell packages and window shade assemblies created by Lou Martin & Associates and sister company Technical Composite Corporation are available

for all types of aircraft. The solution pictured incorporates an electrical and/ or mechanical shade into all existing commercial side panels, replacing the standard shade with a decorative pleated shade. Less than 5 lb is added to the side panel, and the solution can be equipped with a manual override.

HEATED FLOORING

On its first-ever NBAA booth, F/List will premiere an integrated heating option for its Wood and Stone Flooring. The surface temperature can be individually adjusted between 74-92°F. The company will also highlight lightweight manufacturing techniques developed by Hilitech, its joint venture with the Hintsteiner Group. The company says its method reduces weight by up to 30%. Also on display will be Leather Flooring developed with Boxmark, and a new table mechanism.

CONNECTIVITY PACKAGE

Satcom Direct will showcase the SD WiFi Hub, which enables GlobalVT voice and text capabilities from individual smartphone numbers, Global One IP continuous connection between networks, and AeroV voice over IP calling – on aircraft of all sizes. The company says it is a small and light solution for regional missions where passengers require e-mail access and text messaging. It also adds functionality



to the Satcom Direct Router on larger aircraft, supporting HD media products.



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Mike Gueringer and Paul Reesnes

CO-OWNERS, CUSTOM AIRCRAFT CABINETS (CAC)

What skills will you highlight?

PR: We have crafted a unique meeting area for our booth that highlights our capabilities in woodwork, upholstery and fabrication. Our attention to detail is especially evident in the conference table and the welcome podium. All the precision components used in creating this booth were created in-house, whether in our CNC department or in our metal fabrication shop. We will also display our AeroProtect range of low-VOC, water-based products that are easily applied to guard against damage to woodwork, polycarbonates, plating and so on during cabin installations.

What investments have you made recently?

MG: CAC has invested several million dollars in facilities and equipment since 2011. Our goal has been to lead our market, and so our 146,000ft² facility has been outfitted with the finest equipment available. In 2015 we opened a metal fabrication facility, which allowed us to manufacture the precision metal parts required for our cabinetry and upholstery projects, as well as external customers.

Have customer requirements changed over the years?

MG: Our customers have always had high quality expectations. They also expect projects to flow efficiently and on time. That is why our focus must be on unrivaled customer satisfaction.

What are you looking forward to at the show?

PR: Developing new customer relationships and presenting expanded opportunities to our existing customers.

There were more than 1,100 exhibitors at NBAA 2015

Combined downtime

Its ability to complete heavy maintenance and interior services concurrently will be highlighted by Jet Aviation St. Louis. The company recently reached its milestone 35th 120-month inspection. The Global 5000 was also fitted with avionics upgrades including Rockwell Collins's Venue CMS and iPad electronic flight bags, and left with a new paint job and a full softgoods modification.

The Global 5000's interior was completely renovated. The new seats and carpet in a stylized pattern serve as the focal points in shades of blue and gray. The seats are the Ultra Comfort Technology seats manufactured by B/E



Aerospace. The two VIP seats are electronic, operated by a touchpad on the armrest. New seats were also installed in the cockpit.

All metal pieces in the cabin were replated in a polished champagne gold finish. All the wood veneer was replaced with eucalyptus stained slightly darker than the original color. The left-hand galley was extended into the space that had been the galley annex. New quartz countertops in sparkled cream and gray tones were also installed.

HOLD FIRM

MSB Design has created a collection of new cabin stowage products for fragile items, which it will showcase on its stand. It will also show a range of china, crystal and flatware inserts designed to prevent drinking and dining ware from being damaged during flight.

Also on display will be examples of MSB's expanding range of hi-lo conference tables. OEMs, completion houses and design centers are implementing these with slim pedestals, refined carpet pinch beauty rings, and Bluetooth-operated electric mechanisms, says the company. MSB will also promote its ability to produce one-off pieces.



FLEXIBLE SWITCH

The new Cadence Switch System (CSS), from Alto Aviation is a series of switches allowing customizable panel dimensions and functionality through discrete logic and no software. The final switch panel may consist of several modules, with options including headphones, USB charging, HDMI ports, Bluetooth interface and ordinance signage. These modules have predefined harness configurations and no overlays. The CSS is fit-compatible with former CMS/IFE switch offerings. By defining a cover bezel that fits an existing cutout, Alto may be able to provide a CMS/IFE upgrade solution without changing the woodwork.



Foiled suede

The new Shimmering Suede collection shown by Townsend Leather consists of genuine split suedes that have been finished with several foil applications. These foiled patterns are offered in matt or high-sheen options on 18-20ft² split suedes. Standard patterns are available but can be offered on any custom-colored suede. The company says it is coordinating these decorative leathers with aniline-dyed, soft cowhide split suede brushed to a luxurious nap. There are natural variations in color, tone and texture.

There will be more than 50 education sessions at NBAA 2016

Alexander a

CONNECTED CABIN HARD FINISHES

Launched in September 2016, TrueNorth Avionics's latest cabin communications system – Simphonē Pro, with an upgrade program for legacy Simphonē product owners – will be featured at the company's stand. "All that most owners will have to do is pull out the old system and plug in the new one – no additional wiring or configuration is required," says Mark van Berkel, CEO at TrueNorth.

Building on the Optelity Cabin Gateway, Simphonē Pro has advanced processing power and updated wi-fi capabilities. It is a 4MCU system offering wi-fi, telephony, a full-featured VoIP PBX, enterprise email and connectivity for the latest PEDs. The system has two variants: with and without dual iridium voice and data channels. Owners can also buy Optelity Care support program membership and receive complimentary access to a bandwidth maximizing service. "This new system is backed by STCs and is even more configurable than our previous systems," says Steve Newell, chief commercial officer at TrueNorth.

CEO Juan Pablo Camargo explains that Techno Aerospace tries to accommodate nearly any request in terms of artistic hard-surface finishing. The company can provide full assemblies with its finishes, including CNC machined panels, certification, hardware and monuments ready for installation. A new 60,000ft² facility provides room for expansion, as well as the workforce and ability to focus on multiple projects.

Techno Aerospace has produced original artwork, crackled ceramics, 3D metalized surfaces, hydrographic patterns and proprietary metal plating techniques for any substrate. It has sold

many Cupinserts beverage holders, and designer loose equipment. "We wouldn't have the knowledge and capabilities we have today if it weren't for the challenge and support from designers and customers from around the world," adds Camargo.



SEAT DISPLAY



Attendees will have the opportunity to experience the new Gulfstream G500 and G600

seats. A seat display area will feature three distinct seat styles geared toward particular missions. Varying degrees of bolstering are used to support sitting, leisure and sleeping applications. "Through customer feedback, industry collaboration, comfort studies and historical data, our new design platform provides a tailoring experience for each seat," says Tray Crow, director of interior design, Gulfstream.

The seats feature more foam contouring, a new layering technique designed to improve the longevity of the cushions and reduce pressure points, ergonomically enhanced armrests, flexible frames to accommodate multiple foam contours and variability in terms of seat depth.

INTEGRATED INSTALLATION



Having signed the first customer for Inairvation's preengineered retrofit cabin solution for

Bombardier Global types earlier in 2016, Flying Colours Corp will showcase the benefits of combining this solution with bespoke interiors.

The company will also highlight its cabin connectivity expertise. The company has installed the Satcom Direct Router on a number of aircraft, and has made Rockwell Collins's Venue product a standard fit on its ExecLiner aircraft. Flying Colours plans to use NBAA as an opportunity to establish other potential partners in this sector. The company also continues to outfit ADS-B Out tracking systems on Challenger 300, 350, 604, 605 and 650 airframes. Flying Colours will also showcase new customer reception offices and a VIP lounge that recently opened at its facility in Ontario, Canada.





SLOW JUST GOT FAST

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About 100 aircraft were on display at NBAA 2015

Wireless charging

Pentastar Aviation will highlight its ability to equip business aircraft with wireless charging units from Cobalt Aerospace. It says the units are a lightweight solution, accept aircraft power and provide contained wireless charging, eliminating the need for cords and adaptors. "As manufacturers of mobile technology continue to introduce devices with wireless charging capabilities, we want to make sure we are able to offer our customers the most current wireless technology in their aircraft cabin," says Jesse Beard, avionics and engineering manager at Pentastar Aviation. "The Cobalt charging solution allows us to seamlessly integrate wireless charging into virtually any aircraft cabin."

CMS AND IFEC

The Venue HD CMS/IFE system, Stage content services, smart cabin router and Inmarsat's JetConneX (JX) connectivity service will all be the focus on Rockwell Collins's stand. JX is now ready for service, offering connection speeds starting at up to 10 times faster than SwiftBroadband. Rockwell Collins says that paired with the ARINCDirect router, this service is poised to take business jet connectivity into the future, and it is also a perfect complement to Venue.

In May 2016, Bombardier announced that it had chosen Venue for its Global 5000 and Global 6000 programs.



HAPPY BIRTHDAY

In the company's 60th year, experts from Duncan Aviation will discuss services including aircraft consignment/ acquisition, airframe inspection, engine MPI, interior refurbishment, exterior paint, engineering/certification and avionics installation, including wi-fi and NextGen mandate requirements and options. A Citation CJ3 retrofitted with Rockwell Collins's Pro Line Fusion flight deck upgrade will be on static display.

Duncan Aviation recently announced plans to build a 220,000ft² business jet maintenance, modification and paint complex at its location in Provo, Utah. It will include a 166,000ft² maintenance and modifications center.



FAST-CURING COAT

BluSky Armor 1027, a new clear coat finish for cabinets and trims developed by MSI Coatings, will be highlighted by OmnAvia Interiors. "The curing reaction is catalyzed with low-intensity light at the high end of the UV range, and cures tack-free within 120 seconds," says Robin Butler, managing partner of OmnAvia Interiors. "This can remove days of processing time."

OmnAvia Interiors adds that there are zero solvents in the formulation, and that the elimination of off-gassing means there is no orange peel to be sanded off between applications.

AIRLINE OVERLAP

Greenpoint's Azure BBJ 787-9 VIP interior will be shown in 1/20th scale. Parent company Zodiac Aerospace will also showcase various products. One display will feature a cockpit mock-up and associated systems. The company says its vast commercial interior offerings provide the VIP and business aviation industry with expansive alternatives. For example, Zodiac Aerospace is supplying various systems and seats on Greenpoint's wide-body programs.

WIRELESS ACCESS

A new wireless access point (nMAP2) with dual radios and embedded wireless optimization algorithm Cognitive Hotspot Technology (CHT) will be promoted by VT Miltope. "Business jets are typically set at installation with the default static wireless configuration with no optimization for the intended passenger services," says Robert Guidetti, vice president of commercial products at VT Miltope. "nMAP2 with CHT alleviates having to initially figure out the best configuration because it adapts the wireless network continuously." @

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MEBAA 2016

Held once every two years, the Middle East Business Aviation Association (MEBAA) Show will take place on December 6-8, 2016 in Dubai, UAE. Read on to discover the latest developments from some of the interior suppliers and service providers attending!

EXPANSION IN EUROPE

Boutsen Design will highlight its recent expansions in Europe. Through a partnership with Sky Valet, business aviation passengers can now shop for Boutsen Design products in business aviation terminals at Cannes, Saint-Tropez, Paris-Le Bourget, Barcelona, Ibiza, Palma de Mallorca and Faro. The company has also just renovated its concept store at the Nice Côte d'Azur general aviation terminal (GAT) with new product lines and collections including a wide range of specialized items for private aircraft, and a variety of gifts from Lalique, Baccarat, Christofle, Ralph Lauren and Loro Piana Interiors. Additionally, the concept store offers a selection of Fendi Casa accessories including decorative candles, leather cushions, trays, photo frames, and even eco-friendly coffee capsules from partner company and local supplier Monte Carlo Espresso.

Simultaneously, Boutsen Design has initiated a partnership with Luxury Living Group and Signature Flight Support for the styling and decoration of the VIP lounge at Nice Côte d'Azur GAT. The partnership between the three companies has enabled a complete restyling of the lounge. Boutsen Design looks forward to new exciting opportunities for expansion in the business aviation industry.

END

EDWs and AVOD

The latest version of Vision Systems' electronically dimmable windows (EDW) will be on display. The company says these provide variable shading from clear to very dark (UV and light blockage of more than 99.9%), instantly. They default to their darkest possible state when the aircraft is on the ground, the aim being to keep the interior cool and minimize the need for airconditioning. They also include noise barriers to keep the cabin quieter.

The EDWs interface with any CMS, and can be controlled with a touch panel directly on the window, a personal tablet, or automatically with integrated light sensors. The range also includes privacy solutions. These solutions have no moving parts and are suitable for flat or curved surfaces, plastic or composite glass.

Vision Systems' EDWs can be combined with tailor-made motorized shades – for one or two windows and with smooth or pleated fabrics, single or dual screens.

Vision Systems will also exhibit its wireless AVOD IFE system for PEDs, which includes DRM-approved streaming. The connectivity option enables internet access, email, video conferencing and personal smartphone usage over VoIP. Other options include cabin management and an interactive moving map. The solution is customizable both in terms of functionalities and the graphic user interface. Content and software upgrades can be downloaded via USB or an on-ground 3G/4G connection.





8,314 people from 80 countries attended MEBAA 2014

Completions expertise

A recent ACJ320 completion project – delivered on-time and within budget to a new customer – is just one of many milestones that will be showcased by AMAC Aerospace. Highlights of the cabin include custom furniture, decorative inlays, handmade VIP carpet and high-end technical support systems.

AMAC also developed its fourth STC for the installation of a fuselagemounted Ka-band antenna on a BBJ 3. AMAC is currently developing Ka-band antenna system STCs for the B777, A340 and BBJ 737.



Meanwhile, a new cabin design concept was developed by AMAC's design organization, and applied to the interior of a privately owned Bombardier Global Express 5000. The seats, divans, carpet and VIP lavatory were refurbished. In addition, the aircraft underwent an 8C check and various cockpit and satcom upgrades.

In May 2016, AMAC acquired JCB Aero, a French leader in the design and installation of civil and VIP aircraft interiors, leading to the development of lightweight composite technology.

In other news, AMAC is further expanding its presence in Turkey with a new hangar in Bodrum. The building work is underway and the hangar is scheduled to become operational in the first quarter of 2017. Additionally, AMAC has sold three PC-12 aircraft to the Middle East region – two of the aircraft to a customer in the UAE and one to a customer in Turkey.

BBJ 747 MODEL

displayed at MEBAA 2014

> A 1/20th scale VIP BBJ 747-8 model featuring an interior design concept by Greenpoint's design team will be a major focus at the company's stand. The BBJ 747-8 interior concept is designed to achieve both a corporate and personal atmosphere. The model highlights two of Greenpoint's patented products – the Aerolift, an elevator that permits access from the ground to the main deck, and the Aeroloft, which provides additional passenger sleeping suites above the main deck. To date, Greenpoint has sold four Aeroloft kits for BBJ 747-8 aircraft.

This will be Greenpoint's second consecutive year exhibiting at MEBAA, and members from both the sales and design teams will be present. Greenpoint's parent company, Zodiac Aerospace, recently opened an aftermarket support facility at Dubai South, providing repair and logistics support to local customers. The Zodiac Aerospace team in Dubai focuses on seats, oxygen equipment, avionics and electronics, fuel systems, emergency equipment and galley inserts.

Greenpoint is currently completing its second VVIP BBJ 787-8, scheduled to deliver in 2017. In addition, the company inducted its first BBJ 777-200LR in 2016.

BOMBARDIER MILESTONE

MRO provider RUAG Aviation is celebrating its 35th anniversary as a Bombardier-authorized service center. The company says it has maintained its status by continually satisfying the OEM's quality standards and dedicating resources to meet evolving requirements as new aircraft types emerge. The latter involves developing new capabilities as well as securing the necessary infrastructure, tools and approvals.

The company provides one-stop-shop solutions, performing all required services within a single downtime, adapted to suit individual schedules. These services include MRO, cabin interiors, aircraft painting, system upgrades, FBO, and support and consulting.

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FULL SERVICE

A recent Bombardier Challenger 850 project demonstrates RUAG Aviation's abilities to make the most of downtime by offering a raft of capabilities

ecently, RUAG Aviation completed a 96-month check on a Russia-registered Bombardier Challenger 850. In keeping with its focus on maximizing aircraft availability, and therefore profit for its customers, the maintenance downtime was combined with interior work.

The company's one-stop-shop services include maintenance, refurbishment, cabin design, system upgrades, IFE system installations and paint work. It holds DOA status, multiple OEM certifications and has experience going back almost 60 years.

The Challenger 850 project was completed fully on schedule despite challenges that could have had a big impact – including unanticipated irregularities on structural elements, unique and complex cabin interior features, and out-of-production cabin interior replacement parts.

Finding solutions to these issues presented an excellent opportunity for the team to prove the advantages of the one-stop-shop concept. Additional documentation and replacement parts were sourced in-house, sheet metal specialists put their expertise to work repairing structural elements, and the cabin interior design specialists mobilized their suppliers to weave new carpeting in an exact replica of the aircraft's highly personalized pattern.

This project also served to highlight RUAG Aviation's language capabilities. Documentation for the unique cabin features was only available in Russian, but the company resolved this thanks to its in-house linguistics specialists.

"This 96-month check was an achievement for us on several levels," says André Ebach, general manager, business jets, RUAG Aviation. "The customer required strict adherence to the



delivery date and full on-site representation throughout the entire project. We responded with complete transparency, using it to create a very satisfying dialog and establishing a pattern of trust between our team and our customer."

It is RUAG Aviation's practice to appoint a project oversight team for every customer, to ensure their individual requirements are met. The company says quality, reliability, flexibility and exacting control over budgetary and time constraints were the essential elements contributing to the success of this project. "Our dedicated aircraft project team was able to constructively resolve all these challenges," says Ebach. "We provide one-stop-shop solutions, which allowed the team to manage the full scope of the MRO and all extenuating issues successfully, within the scheduling constraints. To ensure timely delivery, we also implemented double shifts."

This aircraft also represents RUAG Aviation's first official application of its unlimited certification rights for Russiaregistered civil aircraft. The company announced in May 2016 that it had been granted full approvals by the Russian Federal Air Transport Agency.

RUAG Aviation is also an authorized service center for Bombardier, Dassault, Embraer and Pilatus aircraft, as well as a service center for Rolls-Royce and General Electric engines and the Gulfstream G550.

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PERSONAL ITEMS

Aircraft owners can add a real personal touch to their cabins through carefully selected, customized or bespoke flatware, crystal, china, linen and other amenities

hirty years ago, Jim Dahlgren and Allan Duck established a business to meet the unusual and eclectic demands of a niche market. Today Dahlgren Duck & Associates (DDA) of Dallas, Texas, supplies leading aviation companies with top-end crystal, china, flatware, linens and amenities. It also offers customization and bespoke design services, to help VIP aircraft owners encapsulate their style in their amenities.

Perhaps the need is for functional dinnerware for a busy corporate fleet. "In this instance we would recommend a brand that delivers high quality combined with longevity," says Scott Ritter, CEO at DDA. "The proposal to a private owner may be very different. The interior is likely to reflect their luxurious lifestyle. We would suggest a collection from a luxury brand with customization, perhaps incorporating their initials or family crest."

DDA also has a bespoke design division, run by a dedicated team with years of experience and making use of a network of project consultants, artisans and boutique craftspeople. The company notes that deep knowledge, imagination and understanding of the client are needed to create a rare piece. "Sometimes a customer will come to us with a very specific idea, or they'll have seen a pattern in nature they want replicated in their china or flatware," says Ritter. "Others will come with very broad specifications that require us to research, design and reiterate concepts."

Recent projects include a triangular china and crystal set created to represent three brothers, a flatware design inspired by a shell, and a dinner service inspired by a Moroccan mosque. Fulfilling these requests requires energy, time and obsessive attention to detail. "We seek





out experts for every project," says Ritter. "In some cases there may be one person in the world with the necessary skills."

DDA fosters strong and long relationships with its customers and manufacturers. "We like to think of ourselves as the client's strategic partner in creating an onboard lifestyle," says Ritter. "It is this that has ensured we remain preferred partners with the globe's finest luxury producers and favored suppliers to the world's elite."

Looking to the future, DDA continues to invest in developing its product knowledge, as well as enhancing the client specification, selection, ordering and reordering processes. The company has introduced technology that enables customers to follow their projects in real time, no matter where they are. "We are staying true to our origins but we recognize that we need to respond to changing market expectations, to modernize luxury," says Ritter. "Today's audience is increasingly made up of digital natives, so we have adjusted our technology to support the delivery of a brand that people want to do business with. We can showcase our product portfolio, capabilities and expertise through technology, and it enables us to interact with clients in a completely new way."

And the cost to personalize your jet? "Typically our clients are more concerned with the quality and the end product rather than the cost," says Ritter. "The value is in the service, expertise and ability to fulfill even the wildest interior dreams. That's priceless for many customers." @

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SKY HIGH

Passengers' expectations of aircraft seats will only grow, driven by progress in the automotive sector, contends RCO

apid advances in the automotive seating market over the past few years have increased expectations of VIP aircraft seats, notes RCO Aerospace Products. "Seats not only need to be comfortable, they also need to accommodate many different postures and purposes in a single structure," explains Norm Starr, general manager, sales and quality, RCO Aerospace Products. "Passengers expect entertainment equipment, massage functionality, heating, cooling and adjustability, because most mid-range luxury automobiles offer these innovations as standard."

Creating a VIP aircraft seat that is comfortable, lightweight, offers numerous options and meets aviation certification requirements is no simple task. RCO Aerospace Products reports it has met some challenging customer demands by using lightweight materials to save space and weight, which it was then able to give over for the integration of IFE and activecomfort-focused technologies.

A further challenge is that the definition of comfort varies from person to person. "Creating seats that accommodate many different passengers' perception of comfort for short- and long-haul flights is difficult to achieve," says Starr.

RCO's response to this challenge was to develop Comfort Mat technology, which is installed between the seat cushion and frame. It enables the firmness of the seat to be changed quickly between flights to suit passenger preferences. "This flexibility is especially useful in a corporate or shared jet," says Starr.

For picky passengers the company can deploy its Robostand system to tailor comfort for individual seats. "We don't like to claim we can create comfort, but we can certainly provide usable comfort data for a seat," says Starr.



Clients supply a seat they find comfortable, either from home or their car. RCO then uses Robostand, a software program mated to a robotic arm, to map the contours and firmness of the specified seat. This data is used to replicate the foam as closely as possible when it makes the aircraft seat.

The ultimate goal is one seat that meets many different needs. Today, seats are used as office chairs, for dining and for sleeping. RCO has developed the CloudRocker collection of concept seats to give passengers the flexibility to assume all of these postures in the same seat.

"There is a lot of work ahead to meet the growing needs of VIP and business jet clientele," says Starr. "If the automotive sector is an indicator, aerospace seat designers and manufacturers will be busy cooking up new ways to incorporate these technologies for years to come." @

RIGHT: THE ROBOSTAND SYSTEM



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LEVEL BEST

As VIP expectations of cabin noise levels continue to grow, Aerocon Engineering pushes for continual improvements with its soundproofing solutions

enny Younesi, president and CEO of Aerocon Engineering, reports that the business and VIP aircraft industry is evolving daily both in terms of technologies and customer/end-user expectations. "Cabin comfort is among the highest of requirements, and sound levels are a key part of this," he says. "Soundproofing the cabin is essential for customers who plan to use the aircraft as a flying office or home. We are always requested to improve the weight and performance of our noise reduction system, especially with newer aircraft types, for example the BBJ777, BBJ787, BBJ747-8 and ACJ350, which feature new systems and materials that are unlike old designs."

For a current project, Aerocon has teamed with GDC Technics on the design and installation of cabin interior noise reduction systems for a BBJ787 and a BBJ777, both for VVIP customers. Younesi is highly confident the team will realize cabin sound levels lower than any previously achieved in the VVIP market.

Aerocon has installed its noise reduction kits and achieved FAA STC and EASA certification on most narrow- and wide-body BBJ and ACJ types, and many mid-size corporate jets. The company develops a custom acoustic treatment plan for each aircraft and then creates an installation kit addressing specific noise sources or areas of the aircraft. In addition to insulation blankets, the noise reduction systems include special treatments for the air distribution system, interior monuments and cabin periphery.

Aerocon handles all aspects of the certification process, including the project application and certification plan, data approval/submittal, conformity inspections, testing and test witnessing, instructions for continued airworthiness and acoustic testing/analysis. The



company holds FAA Parts Manufacturer Approval, AS9100C and FAA Radiant Panel Test Facility (CFR 25.856a) accreditations. Aerocon works with EASA to validate FAA STCs when required.

Younesi credits the company's success to its personnel, who he says have strong backgrounds in applied aircraft interior acoustics and in working with customers to provide the best performance for the latest aircraft designs. "Constant field presence keeps Aerocon up-to-date, both in terms of technology and the issues facing completion centers," says Younesi. "Experience enables us to provide readyto-install solutions – we don't experiment on the aircraft. We compare each installed system with previous designs to improve efficiency and performance."

Younesi says Aerocon faces new challenges on almost every project.

"These challenges range from customers' expectations to discovering the latest material technologies," he reveals. "Implementing new and novel techniques and designs into new aircraft models impacts the design and certification requirements and ultimately the cost of the overall system. As an FAA-certified lab, Aerocon conducts the required flammability testing on new materials. Aerocon always absorbs non-recurring engineering costs for the development and certification of new designs. maintaining ownership of these designs. This way, our customers receive the best possible pricing."

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SOLVER SERVICE

With 15 years' experience in the decorative plating industry, Signature Plating sees itself not just as a plater, but as a problem-solver for its customers

ecently, a challenging galley latch plating project was brought to Signature Plating. "The customer had already gone down several avenues with no success," says Frank McKnight, co-owner and chief financial officer at the company. "We identified the key issues in a couple of days and within a day were completing the parts without any restrictions."

The company says this kind of problem-solving is a Signature specialty. "We have the plating part down; we see our role as a solution provider for our customers – our expertise goes way beyond the physical work," says Randy Gordon, director of business development at Signature.

The company has 15 years' experience on VVIP aircraft ranging from the Beechjet 400 to the ACJ340 and BBJ 747. Larry Donoho, president, says that when it was the new plater on the block, the company did not have much product in the marketplace, so it obtained work by custom-matching others' finishes. This capability has been retained, despite the company now having more than 100 of its own finishes, with Donoho also revealing more will soon be introduced.

McKnight says one of the biggest challenges on a big project can be identifying a true cost and adhering to it. "In this industry, it is not uncommon to see a project come in 50-75% over budget," he explains. "Signature works at the front end with customers, getting involved in meetings, reviewing drawings and providing a broken down estimated list of parts and cost to calculate the budget. Then we communicate with the customer throughout the rest of the project, so if there are any deviances, they are not a surprise at the end. If the end





cost is greater than the projected one, it is usually only around 3-5%, and never more than 10%."

Paul Sahanek, vice president and head of production, Signature, says everything the company does is geared to the customer. "We operate on a simple principle: to achieve long-term relationships, there must be mutual benefits," he says. "If we are successful in being more than just a plater, our customers will come to believe in and rely on us. One customer was flabbergasted when we showed them that every part on their shipping list is entered into our system with the names the customer uses. He said that this has saved his team countless hours when processing the parts, but he wondered how we were profitable applying this to all customers."

To further reduce the customer's reconciliation effort, each package within a consignment is labeled with the customer's name for the part and the quantity. "This is a great help when a customer is looking for a specific package, because they don't have to open package after package to find it," says Sahanek. "This is what we do day in and day out, because we are committed to exceeding customers' expectations."

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ART NOUVEAU

With its wide range of interior finishes, Techno Aerospace is aiming to give designers new opportunities while still meeting certification requirements

ichard Roseman, founder and director of Richard Roseman Airborne Design, says client expectations continue to push designers' creativity. "We live in a world today where simply covering bulkheads with a beautiful veneer is below the mark in terms of current design paradigms – not to mention the expectations of sophisticated clients," he says.

The evolution of cabin design, and the increasing demand for more elaborate offerings, is pushing the limits of suppliers providing products for business and VIP interiors in terms of creativity, stringent airworthiness certifications and the ability to produce quickly and efficiently. "Today, as designers, we are looking for fresh, alternative treatments for bulkheads," says Roseman. "One of the most evocative new trends is for 3D wall treatments; modern textures and patterns that dramatically expand the freshness and overall aesthetic of a cabin. In this new arena, the possibilities truly are boundless."

Can producers of these products and finishes meet today's elaborate requirements? Yes, says Roseman: "For us, it has become a fresh new playground and the cool part is that cutting-edge vendors are answering the call. A prime example is Techno Aerospace [formerly Techno Coatings], which has developed an entire platform for custom 3D finishes for bulkheads and other monuments. We can collaborate with Techno Aerospace by mapping out concepts and asking them to generate samples until we have the look we want. As designers, we have imaginations that can move us in the directions we need – but finding vendors out there that can achieve these ideas while meeting certifications and weight constraints is not always easy. In this regard, Techno Aerospace has become an



exciting new resource, going well beyond its core capability of electroplating."

Another trend is the integration of custom artwork, especially in VVIP interiors. "New custom metal artwork is a refreshing option for our programs," says Madeline Tuesley, design associate for Greenpoint Technologies. "Working directly with Techno Aerospace's chief artist in residence, Dianár, is inspiring, as concepts and ideas are brought to life; the outcome is truly unique and innovative. Techno Aerospace also continues to stay in line with the trends and colors that we are seeing in design today and their mixed metal pairings give a fresh perspective to aircraft plating."

"New textures and colors are another design trend," says Warja Borges, owner of Unique Aircraft. "One thing is for sure: we are going away from interiors being wooden boxes and playing more with different hard top surfaces, paint and film – whatever is on the market. As designers continue to search for certifiable, durable and nice-looking materials, it is a pleasure to work with a company that has such a wide range of materials and textures, especially when you have to fulfill 65/65 requirements. Not being limited by minimum quantity orders makes it even easier to design unique looks with Techno Aerospace."

In the end, Techno Aerospace says its offering is intended to mitigate risk, while allowing designers to express their creativity. "Like all passionate artists, I continually learn and improve, and Techno Aerospace serves as a resource for me as it is continually creating new and sophisticated surfaces and finishes," says Jeannine Ohrmundt, owner of Ascending Designs. "Its compositions are designed to work within the aviation biosphere, eliminating potential risk that typically goes along with new products. The possibilities are endless!" @

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TAKE CHARGE

With PED use on the rise, True Blue Power is seeing increasing demand for its onboard charging solutions

ith passengers bringing PEDs including tablets, smartphones and noise-canceling headsets on board, there is a growing market for power solutions, says True Blue Power.

One of the company's solutions is TA102, a compact dual USB charging port that can be installed on seats and elsewhere in the cabin or cockpit. It is engineered to provide 2.1A of power to each charging port, simultaneously, powering up any consumer product requiring a USB interface. "Passengers and pilots can charge two high-powered devices at the same time," says Tom Genovese, account manager at True Blue Power. "Some other dual-charging devices are built with one low-power and one high-power port."

The company recently launched a higher powered model, the TA202 Series High Power USB Charging Port, which provides 3A per port simultaneously. Whereas the TA102 is compatible with Type-A USB configurations, the TA202 also supports Type-C USB configurations, meaning it can power current- and nextgeneration electronic devices. Both products were designed and made specifically for aviation applications by True Blue Power's parent company, Mid-Continent Instrument Company.

FAA TSO and EASA ETSO certified, the intelligent power sources protect themselves and the charging devices from potential short-circuiting, power surges and over-current. They feature aluminum cases designed to withstand aircraft vibrations, shock and humidity, while offering a compact size that enables installation within an armrest, interior cabin wall or instrument panel.

A long list of options – including lit and non-lit (hermetically sealed connector) units – provides flexibility in installation. The power connection can be positioned The TA102 and TA202 USB charging ports are charging onts and EASA FAA TSO and EASA ETSO certified

> ABOVE: A USB CHARGING PORT IN A CUSTOM INSTALLATION

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LIGHT

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PHONE

MIC

LEFT: THE TA202 HIGH POWER USB CHARGING PORT, WHICH IS COMPATIBLE WITH BOTH TYPE-A AND TYPE-C USB CONFIGURATIONS

RIGHT: THE TA102 DUAL USB CHARGING PORT

on the back or the bottom of the unit for a tight fit, and four mounting options are available: rear, circular, an instrument hole adapter, or a cosmetic bezel, which can be plated to match the interior design.

"As demand for support of personal electronics and portable technology continues to grow, commercial and private aircraft look to reliable products such as these to ensure non-stop entertainment and business productivity," says Genovese. "These small, economical, easy-to-install charging ports deliver just that. They offer an economical alternative to installing digital media equipment in each seat, providing passengers with access to uninterrupted IFE via their PEDs." As well as USB charging ports, the True Blue Power product line includes converters, inverters, emergency power supplies and lithium-ion batteries. Select products feature proprietary nanophosphate lithium-ion cells, which the company says offers stable chemistry, faster charging, consistent output, excellent lifecycle and superior cost performance. "All this translates into smaller, lighter products that can be less than half the size and weight of some existing solutions," says Genovese. @

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READY TO GO

The new Pinnacle Cowhide range illustrates Townsend Leather's increased focus on in-stock programs

oday, Townsend Leather is known for its custom coloring capabilities and typical lead times of four weeks for most leathers. For years the company's business was based on making every lot to order, but with the demands and realities of the market today, Townsend Leather reports it has become increasingly important to also offer a wide range of in-stock and ready-to-ship leathers. It says that although some projects are longer term, more projects require quick solutions and ready-to-ship materials, for the short time an aircraft may be on the ground or available to be refurbished.

To this end, the company has committed to producing and holding stock in a range of popular and widely used aviation colors and leather qualities. Townsend Leather holds stock of its most popular leather, Classic Cowhide, in popular neutral colors and also stocks a variety of specialty and decorative leathers, including woven, embossed and foiled leathers, as well as suede.

The newest stock program offered by the company is based on a newly developed leather called Pinnacle Cowhide. This is available in seven in-stock colors as well as made-to-order colors. The aniline-dyed cowhide has a protective finish and will generally be 1.1-1.3mm in thickness. It also features an embossed rounded grain designed for outstanding wear and great cutting yield, both of great importance to the aviation market. The leather supplier says the finished product meets the aviation industry's flammability standards and test requirements.

Townsend Leather understands that its customers are working on projects with demanding schedules. As a supplier of a key interior component, flexibility and the ability to offer a variety of solutions

The hides used for the new pinnacle Cowhide nage average 55-60ft²

THE NEW PINNACLE COWHIDE RANGE IS AVAILABLE IN SEVEN STOCK COLORS AND FURTHER COLORS CAN BE MADE TO ORDER with immediate availability are very important. Committing to stock programs is one way in which the company tries to cater to the demands of its clients and their customers.

Townsend Leather is a USA-based, third-generation family business and manufacturer of upholstery hides and decorative leathers, supplying the retail, residential, commercial, hospitality, home furnishings, aviation, motorcoach and yachting markets. The company prides itself on pushing the boundaries of what is possible from the perspectives of color, texture, pattern and cutting-edge design and technological opportunities.

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GLASS CEILING

Real glass is making a breakthrough in the business aircraft interior market, says Air-Craftglass

n July 2016, Air-Craftglass made the first commercial order run of its real mirror product for aircraft interiors. The run was for 500 mirrors, for an undisclosed client. "The mirrors were partly for their stock program and some are installed already," says Frans van Hapert, president and CEO of Air-Craftglass. "We can make approximately 2,500 mirrors a day."

For van Hapert, the order run signals a turning point for the acceptance of real glass in the aviation industry. "The market is ready to install real glass solutions because of the big advantages they offer compared with other materials," he says. "Firstly, the optical quality is superior because of the traditional mirror manufacturing technique we are using. Secondly, our products are lighter than all other materials on sale. Thirdly, the cost of ownership is lower: we work with real scratch-resistant glass that lasts a lot longer before replacement is needed, compared with traditional materials. Last but not least, due to our efficient production process we can offer these high-quality products for very competitive prices."

The company will present its complete collection of mirrors, lenses and wood veneers at NBAA, in Orlando, Florida, from November 1-3, 2016. "We will present our ultra-thin anti-reflecting glass, which can be used for lenses and dust panels – this is an absolute novelty for the aircraft industry."

Air-Craftglass's success is due in part to its development of a patented procedure to laminate glass without flammable films. The company says its products satisfy all fire and other regulations, including the 65/65 heat release test.

The company can supply large lenses to cover two, three or more windows with



a transparent glass film. RGB/LED lighting and touchscreen technologies can be integrated into these lenses. Meanwhile, the company says its mirrors can be 0.02in thick and weigh 2.5 times less than polycarbonate. The glass is tempered chemically to make it five times stronger, and then applied to a subsurface, often a type of honeycomb. The product can also be supplied with a self-adhesive backing, installation-ready.

There are also many opportunities for customization. "All mirrors are produced to the specifications of our clients, including cut-outs and the radius," says van Hapert. "In the mirror itself, we can integrate OLED lighting systems, logos and other prints."

Air-Craftglass's next goal is to offer a 0.2mm-thick wood veneer sandwiched between glass sheets to withstand fire and other tests; van Hapert says this will greatly expand the range of wood veneers that can be integrated in aircraft cabins. The company expects to launch this Natural Collection in mid-2017, and aims to offer 500+ certified wood varieties.

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SWIFT SWITCH

The deadline is approaching for customers to upgrade from mini-M Aero to SwiftBroadband – but Cobham Satcom has a solution that enables some existing hardware to be reused

n just a few months' time, on December 30, 2016, Inmarsat's legacy mini-M Aero service reaches its end-of-life date, presenting hundreds of operators and owners with the opportunity to upgrade and take advantage of the increased functionality of the company's recommended replacement service, SwiftBroadband.

New activations of mini-M Aero were halted two years ago, but it is estimated there are still 500 aircraft operating the system, with many more likely to have the hardware installed. "By capitalizing on the availability of SwiftBroadband, these customers will add value for themselves and their passengers, enabling them to take advantage of an extensive range of applications facilitated by modern satcom services, as well as adding value to the aircraft," says Scott Beutel, regional sales manager for aeronautical products at Cobham Satcom.

Cobham Satcom is highlighting its Aviator 300 system as an upgrade path for legacy mini-M Aero installations. It says the system is a natural solution to support the hardware upgrade as it allows for the retention of the existing intermediate gain antenna used by these aircraft, reducing the time and cost involved in upgrading to SwiftBroadband. The procedure to migrate to the more powerful connectivity solution involves the installation of a new diplexer and SwiftBroadband unit, with existing RF cabling reused.





"As the end-of-life date for mini-M Aero approaches, we are highlighting this opportunity for mini-M Aero customers to make the simple upgrade and take advantage of real-time satellite communications services including voice, email, web browsing and video streaming for a variety of applications," explains Beutel. "The innovative design of our products means that we are able to offer a cost-effective migration path to support increasing demand for highspeed connectivity on board. By utilizing the existing mini-M Aero antenna, Aviator 300 can be installed cost-effectively to provide an extensive range of modern satcom services."

Cobham Satcom describes the Aviator 300 solution as a compact, lightweight system built with a full range of features and options. The company says it offers cost-effective SwiftBroadband capabilities, including satcom services including fast data connectivity, wi-fi and high-quality voice calling. It can be installed on a wide range of airframes.

Cobham Satcom is devoted to providing dependable communications and internet access anywhere in the world, under the most demanding conditions. Its satellite and radio communication terminals perform in challenging and remote environments on land, at sea and in the air. The company designs and manufactures these products under the Aviator, Explorer, Sailor and Sea Tel brands. 🚿

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AIR BRUSH

The new air and surface purification system from Aviation Clean Air is designed to eliminate odors and allergens, to provide a clean, safe and healthy interior atmosphere

Developed specifically to purify the air and surfaces in aircraft cabins, Aviation Clean Air's (ACA) new system works by creating cold plasma. In the process, positive and negative ions attach to hydrogen and oxygen molecules in the water vapor present in the air. These ions cluster around airborne mold spores, viruses and bacteria, and a chemical reaction takes place on the cell membrane surface transforming the ion into an OH radical, which severs the hydrogen bonds that bind pathogens together. The cells are inactivated by severing the proteins on the cell membrane, allowing the OH radicals to penetrate the membrane and bond with the hydrogen of the cell. As a result, the cell will not be able to reproduce, will guickly die, and the threat is eliminated.

"It is important to note that this process replicates one found in nature,



therefore, it is reasonable to conclude that there are no adverse effects to humans beyond what occurs in the natural process," says Howard Hackney, partner at ACA.

The ACA component is also used to control gases, odors and volatile organic compounds (VOC). In the same way, the ions surround pathogens and deactivate them, the plasma also surrounds gas molecules. As the gas molecules interact with the ions, the covalent bonds of the gas are broken down. "These gases are reduced to harmless trace elements that are part of the composition of the natural air we breathe," says Hackney. "For example, ammonia, which is quite pungent, is broken down into nitrogen and hydrogen.

In summary, ACA says the system kills the H5N1 bird flu virus, the H1N1 swine flu virus, SARS bacteria, staph bacteria, mold spores, MRSA, E.coli, TB, C.diff and more; it controls allergens, gases and VOCs; removes pet, cooking, cigar, cigarette and moisture odors; and neutralizes static electricity. ©

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TAILOR MADE

The leather projects carried out by Boxmark are as unique as the company's customers

Each and every piece created by Boxmark is inspired by the desire to create something unique. The company offers a full range of leather refining and processing services for VIP, business and commercial aircraft, supplying hides and leather-covered components, working on prototypes, serial products and customized workpieces.

Boxmark says it can offer almost infinite possibilities in terms of the visual design of the materials. The company refines leather and fabric in different ways upon request – punching, embossing, perforating, printing, embroidering and lasering, according to the customer's wishes.



For example, there are more than 3,000 options in the Emotions range of structural embossments. Unique effects are created on the embossed surface by additional processing of the surface using special dyes and gloss techniques. The company has an in-house sewing room and saddlery, where the many single parts of a leather piece are brought together into the final product.

Pieces can be finished with functional, ornamental or exclusive, special seams. As well as design-orientated demands, functional requirements – for example concerning ergonomics, special performance characteristics and international industry standards – are taken into account.

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THE RIGHT TOOLS

The AVDS Client, software used by OEMs and completion centers to configure IFE systems, has proved a popular product for Innovative Advantage

> LEFT: THE AVDS CLIENT USER INTERFACE

Soon after establishing itself in the business/VIP market, Innovative Advantage decided to create a software tool to help OEMs and completion centers when installing CMS/IFE networks. Starting as a simple way to label inputs and outputs, the AVDS Client is now used to configure, test and monitor an aircraft's IFE backbone.

The graphical interface is designed to enable engineers and aircraft technicians to create and edit inputs and outputs easily. "IFE configuration changes that used to take weeks and cost tens of thousands of dollars are made in minutes," says Richard Morris, president of Innovative Advantage. "All the audio preamp settings can be made quickly with the AVDS Client software as well."

During the checkout stage of the completion, engineers and technicians on the floor use the AVDS Client to verify signal routing and view the resolution, frame rate and status of all the aircraft's audio and video sources, in real time.



"Even before the final CMS software has been installed, all the input and output wiring can be checked and verified using the AVDS Client," says Morris.

Built-in test code monitors the AVDS backbone and fiber connection between nodes. Error logs and debug messages can be examined or emailed to Innovative Advantage for analysis.

"The AVDS Client continues to evolve – whether in response to customer input or

with exciting new features including streaming, 4K and video tiling," comments Morris. "Innovative Advantage continues to invest in the tools our aircraft OEM and completion center customers count on."

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THIS PRIVATE RESIDENCE IN THE USA TAKES ITS CUES FROM THE ORNATE OPULENCE OF HISTORIC PALACES IN EUROPE

Worth US\$159m, Le Palais Royal in Hillsboro Beach, Florida, was created for a businessman by designer and developer Joseph Leone, who has also designed and implemented the extension of the client's yacht. Work on Le Palais Royal began in 2007 and is due for completion in January 2017.

"The vision is to create a real chateau in the USA, with the same workmanship and detail as those created more than 400 years ago in Europe," says Leone.

The drama begins in the main entrance lobby, where the 30ft-high interior dome is finished with a *trompe l'oeil*. Other highlights include the mansion's spectacular main staircase, a disappearing sliding door on the ocean side and an IMAX movie theater. The interior makes extensive use of detailed custom plaster work and 22-karat gold leaf worth more than US\$7m.

Leone says the most challenging aspect was putting together the right team. "We needed to find expert craftspeople who could produce the same level of quality and detail as the Palace of Versailles or Buckingham Palace," he explains. @





OTHER EYE-CATCHING DESIGNS FROM VARIOUS INDUSTRIES ...



United Airlines' long-haul business class, United Polaris, is part of a lounge-to-landing rebrand realized with PriestmanGoode. The seat is based on a patented concept and layout by Acumen. PriestmanGoode led its development into a United product.



This seafront penthouse in Tel Aviv, Israel, makes great use of contrasting blue and copper tones, sweeping glass walls and luxurious marble flooring. It is part of the Royal Beach Tel Aviv Hotel and Residence, the creation of Oranim Art Estates.



This studio was opened at Lamborghini's headquarters in Sant'Agata Bolognese, Italy, to support the Ad Personam customization program. Huracán and Aventador customers can pick from the leathers and other materials, colors, seats and rims on view.

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